



Bushfire Assessment

for the Lorne Strategy Review

Report prepared for
the Surf Coast Shire Council

June 2019

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Terramatrix project code: SurfCoastSC-2019-01 Lorne Strategy Review-Bushfire Assessment

Cover image: Looking north along the Lorne foreshore and beach towards the main township area.

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Version Control

Version	Date issued	Comments	Issued by
1.0	2019-03-25	Bushfire Development Report (BDR) to client	Hamish Allan
2.0	2019-05-10	Amended BDR to client incorporating client feedback received on v1.0	Hamish Allan
3.0	2019-06-02	Amended BDR to client incorporating client feedback received on v2.0	Hamish Allan
3.1	2019-06-27	Amended BDR to client incorporating minor client changes to v3.0	Hamish Allan

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Glossary

BAL	<i>Bushfire Attack Level</i> - A means of measuring the severity of a building’s potential exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kilowatts per metre squared, and the basis for establishing the requirements for construction to improve protection of building elements from attack by bushfire e.g. a building constructed to a BAL-12.5 standard is expected to be exposed to radiant heat not exceeding 12.5 kW/m ² .
BMO	<i>Bushfire Management Overlay</i> - A planning scheme provision used to guide the development of land in areas of high bushfire hazard. The BMO applies to areas where there is potential for extreme bushfire behaviour, such as a crown fire and extreme ember attack and radiant heat
BPA	<i>Bushfire Prone Area</i> - An area that is subject to, or likely to be subject to, bushfire attack as determined by the Minister for Planning.
Bushfire	An unplanned fire burning in vegetation; sometimes referred to as wildfire. A generic term which includes grass fires, forest fires and scrub fires.
Bushfire attack	Attack by wind, burning embers, radiant heat or flame generated by a bushfire.
Bushfire hazard	A specific source of potential damage or harm, typically consisting of three key elements; vegetation, weather and topography.
Bushfire risk	The chance or probability of damage or harm if exposed to a bushfire hazard and the severity of the impact i.e. consideration of the likelihood and consequences of impacts from bushfire.
Classified vegetation	Vegetation deemed to be a bushfire hazard in accordance with AS 3959-2018 <i>Construction of building in bushfire prone areas</i> .
Defendable space	An area of land around a building where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire.
DELWP	<i>Department of Environment, Land Water and Planning</i>
Effective slope	The slope of the land (gradient, measured in degrees) under the classified vegetation which most influences the bushfire attack. The slope is determined on the basis of the fire moving towards the building and the rate of spread of the fire and not solely on the basis of the relative elevation of the vegetation.
Ember attack	Attack by smouldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.
EVC	<i>Ecological Vegetation Class</i> - The standard unit for classifying vegetation types in Victoria. EVCs are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating.
FFDI	<i>Forest Fire Danger Index</i> - The chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression, according to various combinations of air temperature, relative humidity, wind speed and both the long- and short-term drought effects.

Flame temperature	The assumed effective flame temperature sustained for a 2 minute period over a fire front width of 100 m.
Flame zone	The highest level of bushfire attack as a consequence of direct exposure to flames from the fire front in addition to radiant heat flux and ember attack.
RHF	<i>Radiant heat flux</i> - The heat transfer rate per unit area from thermal (electromagnetic) radiation, expressed as kilowatts per metre squared. Calculated or measured for a specific surface to determine the radiant heat received by that surface from flames associated with a bushfire.

Executive Summary

Study overview

Surf Coast Shire Council (SCSC) issued a consultant brief to prepare a strategic bushfire report to inform the Lorne Strategy Review (LSR).

The study area has been defined by SCSC as comprising the main township area and fourteen additional site specific investigation areas either within the township, on the periphery of the township or some distance from the township. Eight sites are identified as Special Investigation Areas (SIAs) in the Lorne Strategy on Map 2 of Clause 21.10 (two of the SIAs have been split into north and south sites for the purposes of this assessment). A further six sites were nominated for investigation as part of this study by SCSC and/or third-party stakeholders.

This bushfire assessment has been undertaken in response to the brief, which specified a range of tasks including:

'Settlement Planning

...assess the bushfire context of the township and subsequently, the role and importance of the existing settlement boundary as a bushfire risk-based planning management tool'.

Site Specific Investigations

'Undertake a strategic assessment of the sites identified on Map 2 of Clause 21.10 - Investigation Areas for their suitability for low density residential development (e.g. lots greater than 0.4ha) or sustainable tourist accommodation (e.g. group accommodation). The assessment should consider the strategic merit for the retention of these sites within the Surf Coast Planning Scheme... under the spectrum of bushfire risk'.

'Undertake a strategic assessment of sites... that have been identified by third-party stakeholders... the suitability of these site for residential or sustainable tourisms accommodation should be considered under the spectrum of bushfire risk. The purpose of this task will be to inform Council of the strategic merit, if any, in identifying these sites for land uses that can assist in providing alternative forms of accommodation to cater for permanent or seasonal demand'.

Accordingly, this assessment identifies how any future development in the township and additional investigation sites, might respond to the bushfire risk pursuant to the applicable Victorian planning and building controls that relate to bushfire. Specifically, the objective and applicable strategies of the Planning Policy Framework (PPF) at Clause 13.02 *Bushfire* in the Victoria Planning Provisions, the *Bushfire Management Overlay (BMO)* and schedules to the BMO at Clause 44.06 and associated Clause 53.02 *Bushfire Planning*.

It should be noted that this assessment has been undertaken at the strategic scale for settlement planning purposes only. *The findings should not be used or relied upon for the purposes of statutory planning or building regulation compliance (e.g. BMO permit applications or BAL assessments).*

This report provides:

- A description of the landscape-scale bushfire risk and an assessment of its potential impact;
- The identification of applicable bushfire planning and building controls;
- An analysis of vegetation within and around the study area, and its classification pursuant to the BMO/AS 3959 methodology;
- An analysis of topography within and around the study area, and its classification pursuant to BMO/AS 3959 methodology;
- An analysis of potential fire weather on days of severe or higher fire danger;
- An assessment of the appropriateness the BMO/AS 3959 default inputs and assumptions about fire behaviour and conditions (the ‘design fire’);
- The determination of BAL setbacks for each site based on likely BMO requirements for defendable space for infill development and/or potential new development;
- Planning and design considerations for future development; and
- A summary response to the objective and strategies of Clause 13.02 *Bushfire* in the Victoria Planning Provisions.

Bushfire planning and building controls

Clause 71.02-3 *Integrated Decision Making* states that planning and responsible authorities should endeavour to integrate policies and balance conflicting objectives in favour of net community benefit and sustainable development. However, in bushfire affected areas, the protection of human life must be prioritised over all other policy considerations.

Clause 13.02 *Bushfire* requires priority to be given to the protection of human life by:

- *‘Prioritising the protection of human life over all other policy considerations.*
- *Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.*
- *Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process’.*

This report assesses the hazard to the study area in accordance with Clause 13.02, to identify if future development of the sites can appropriately prioritise the protection of human life, and meet the objective of Clause 13.02, including by ensuring future dwellings and other development will not be exposed to radiant heat flux (RHF) above 12.5kW/m², which is commensurate with a BAL-12.5 construction standard. A BAL (Bushfire Attack Level) is a building construction standard in response to the severity of a building’s potential exposure to ember attack, radiant heat and flame contact from bushfire.

Additionally, as all of the sites and the surrounding landscape for approximately 10km, are covered by the BMO or a BMO schedule, this study includes a bushfire hazard landscape assessment and a bushfire hazard site assessment of the vegetation and topography within 150m around each site, or hypothetical development envelope within each site, in accordance with the BMO application requirements.

Hazard assessment

All of the study area and land within approximately 10km around it, is covered by the BMO. All land for approximately 45km by road is also designated as a Bushfire Prone Area (BPA).

The Otway Ranges occur to the north, west and southwest of the township and are one of the most hazardous bushfire landscapes in Victoria. It is credible, and arguably likely on days of severe or higher fire danger, for bushfire behaviour to exceed the presumptions and design characteristics underpinning the BMO/AS 3959 model.

The type and extent of (hazardous) vegetation within, and up to 400m around, the study area has been identified and classified, based on Department of Environment, Land, Water and Planning (DELWP) extant Ecological Vegetation Class (EVC) mapping, aerial imagery and site investigation. The vegetation is dominated by higher fuel Shrubby Foothill Forest and Shrubby Wet Forest EVCs (62% and 16% of the study area and 400m neighbourhood assessment zone respectively). Forest vegetation is therefore, for almost all of the study area sites, the determinant of BALs and defensible space, except where small patches of Scrub and Shrubland occur.

Modified vegetation also occurs throughout Lorne, where 'bush gardens', with a high component of native shrubs, grasses and/or groundcovers, cover a relatively high proportion of the non-building area of a lot. This type of vegetation may not produce a 100m wide fire front moving at a quasi-steady state rate of forward spread, as presumed in the BMO/AS 3959 methodology, but can generate radiant heat and localised flame contact that needs to be fully considered.

The elevation within the study area ranges from sea level to 380m. There are a variety of aspects created by gullies extending in various directions, in addition to the predominantly southeast aspect of the Ranges as a whole. The system of ridges and valleys creates complex and steep terrain conducive to extreme bushfire behaviour. The topography was analysed by creating an elevation model for the study area and the land 400m around it, using a GIS (Geographic Information System) TIN (Triangulated Irregular Network) generated from SCSC supplied 2.5m contour data. 36% of the study area and 400m neighbourhood assessment zone around it, is very steep, with a gradient exceeding the 20° upper limit for applying default defensible space distances. 19% of the study area has a gradient in the >15° to 20° slope class.

Climatic conditions and fire weather, including the applicability of the BMO/AS 3959 default Forest Fire Danger Index (FFDI) 100 benchmark, have been analysed using Aireys Inlet weather data (as the closest representative Bureau of Meteorology Automatic Weather Station (AWS)). Although it was

noted that the FFDI 100 benchmark has been exceeded previously (e.g. FFDI 194 on Black Saturday 2009) this has also occurred at many other locations across Victoria.

The results of the FFDI analysis reveal that the FFDI 100 threshold is likely to occur approximately every 6 years at Lorne/Aireys Inlet. If the more conservative recurrence interval of a 1-in-50 year or in 1-in-100 year event was adopted, a significantly higher FFDI would be applicable. However, the CFA has no published policy on FFDI recurrence intervals and the results of the FFDI analysis are not necessarily evidence a higher FFDI value and, hence, increased defensible space, should be applied in the study area. The analysis does, however, support the need to adopt a precautionary approach when assessing development applications in the study area, particularly for vulnerable developments and those in higher risk locations.

Additionally, it should be noted that, under various climate change scenarios, the frequency and severity of elevated fire danger days across south-east Australia is forecast to increase. Especially in eastern and southern Australia, there has been an increase in the length of the fire weather season and a greater number of higher risk days.

Analysis of wind data and creation of a wind rose, from the Aireys Inlet AWS data, was undertaken to show the frequency of wind speed and direction on days of elevated fire danger (i.e. when calculated FFDI was ≥ 50) during the extended fire danger period (1st October – 31st April). The results show the prevalence of northwesterly winds on days of elevated fire danger (40% of wind records when FFDI ≥ 50 during the extended fire danger period), with strong winds also likely to be experienced from the west-northwest and north.

Site analysis and findings

Each of the sites in the study area was analysed to identify the effective slopes, vegetation classification and other factors that will influence future development potential *from a bushfire safety and compliance perspective only*. The assessment criteria applied are based on BMO compliance requirements and key strategies in Clause 13.02, being:

- Hazard exposure (vegetation and topography);
- RHF (Radiant Heat Flux)/BAL analysis (setbacks for 10kW/m², 12.5kW/m² and 29kW/m²); and
- Distance to an established BAL-12.5 area (i.e. proximity to a place of 'relative safety').

Main Township Area

The Lorne township is an area of significant bushfire risk and therefore, not an appropriate location for intensification of development or settlement growth, in accordance with the objective and strategies of Clause 13.02. However, infill development within the township is appropriate if it can comply with the BMO and/or BMO Schedule requirements. This is more appropriate in the southern township area (i.e. south of the Erskine River) which has better access to established BAL-12.5 locations and is somewhat less exposed to modified or other classified vegetation. The topography around the southern township area, whilst still steep, is also somewhat less hazardous than the northern part of the township.

Development that significantly extends the length of the township perimeter should generally be avoided, especially 'finger shaped' development that may result in exposure of development to hazardous vegetation on more than one aspect/direction.

However, opportunities to consolidate (simplify) the township edge should be investigated, especially where they can provide a 'hard edge' to the township that may increase the safety of existing development near the current township perimeter, which may not have been built to any BAL. The creation of non-vegetated land and/or defensible space with BAL-29 dwellings, may provide a 'buffer' between classified vegetation around the township and existing non-BAL rated buildings, thus increasing the setback of existing vulnerable buildings from hazardous vegetation and potential bushfire impacts.

In principle, the development of sites 3-11, in or on the township periphery, may help achieve this, although it is noted that these sites have particular characteristics that may mean they cannot or should not be developed.

Special Investigation Areas

All of the special investigation areas are in a landscape of significant bushfire risk, where bushfire behavior may exceed the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, from a bushfire safety and compliance perspective in response to Clause 13.02 Bushfire, *it is considered that there is little or no strategic merit for the identification of these sites within the Surf Coast Planning Scheme as being suitable for low density residential development or sustainable tourist accommodation.*

Sites 1 and 2: Deans Marsh Road – North and South

Neither site is well-suited to intensified development. The southernmost existing cleared or semi-cleared area within Site 2 may be able to support a small scale sustainable tourism development, but it cannot likely achieve the required 'Table 3' defensible space without significant vegetation removal and only a small area appears able to achieve a BAL-12.5 development envelope.

The relatively remote location of these sites, their position in an extreme risk landscape surrounded by Forest on steep topography, and the likely amount of native vegetation removal that would be required to create defensible space, means they are not well suited to development.

Site 3: Northwest of Muir and Duncan Streets

This site may be able to provide for some development, but it would require significant vegetation removal including on steep slopes in the north of the site. Development of the site in a low threat state could provide risk reduction benefits for adjacent and nearby lots.

Site 8: Northwest of Gardner and Heath Streets

Some of this site could potentially provide for BAL-29 development, subject to the modified vegetation to the north, west and south being able to achieve defensible space standards. Whilst a

small BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the position of the site on the edge of the township close to classified Forest on steep slopes. Further site specific investigation and consultation would be needed to confirm the development potential. The steep downslope to the south is a significant constraint to development near the southern end of the site.

Site 9: Erskine Falls Road, west of Polwarth Street

BAL-29 development may be achievable on this site, but development would be constrained to a relatively small area. The site has the advantage of being buffered (protected) to a large degree from a bushfire approach from the north, by the industrial development immediately to the north of the site across Erskine Falls Road. More detailed site investigation of the slopes and vegetation may increase the size of the 'potentially developable' BAL-29 area.

Site 10: West of Fletcher Street

The site could potentially provide for some BAL-29 development, subject to the amount and location of vegetation removal that can be achieved to create defensible space. It is important to note the constraints imposed by the steep topography and that greater distances for defensible space than the default distances in Tables 2 or 3 to Clause 53.02-5, would likely be required due to downslopes exceeding 20°.

Sites 12 and 13: Allenvale North and South

The distance of these sites from the township, their position in an extreme risk landscape surrounded by Forest on steep topography, and the likely amount of native vegetation removal that would be required to create defensible space, means they are not well suited to development. A very small part of the existing cleared or semi-cleared area within Site 13 may be able to support small scale sustainable tourism development with 'Table 3' defensible space. A larger area may provide for BAL-12.5 development, however both scenarios require vegetation removal for defensible space. Due to the landscape risk it is considered BAL-29 construction should be the minimum proposed.

3rd Party Sites

Site 4: Lascelles Avenue

If able to be managed to defensible space standards, the whole site could provide for BAL-29 development, but this would require extensive vegetation removal. Development of this site would remove an area of classified vegetation within the township that poses a hazard to existing development.

Site 5: Former Quarry

It is unlikely that this site could provide a viable development area, even for BAL-29 development, due to the constraints imposed by the steep topography. Additionally, as development would likely require a rezoning, the Settlement Planning strategy in Clause 13.02 would be invoked, which requires any planning scheme amendment to result in a development area capable of BAL-12.5. BAL-

12.5 development is not considered appropriate on this site due to its exposure to modified vegetation and proximity to classified Forest.

Sites 6 and 7: Waverley Avenue and Erskine Avenue

The steepness of the sites is likely to significantly constrain development and vegetation removal to create the requisite defensible space. Due to the occurrence of modified vegetation, only BAL-29 (or higher) development would be possible, although Site 7 can 'theoretically' achieve a viable BAL-12.5 setback area.

Site 11: Slaughterhouse Site

The site would be viable for BAL-29 development and, theoretically, could achieve a BAL-12.5 and 'Table 3' development area, subject to the extent of exposure to modified vegetation. The development setbacks shown may be able to be reduced (i.e. the developable area increased) subject to development of an alternative measure (under the BMO) that recognises the reduced risk from the east due to the short slopes and small areas of Scrub/Shrubland that occur in this direction.

Site 14: 2530 Great Ocean Road

Whilst the site is large enough to provide for BAL-12.5 development, if the required area of vegetation can be managed as defensible space, the significant landscape risk and relatively isolated setting of the site means it is not well-suited to development. Any development would likely be required to have minimum BAL-29 buildings with increased defensible space as an additional protective measure, e.g. BAL-29 buildings with BAL-12.5 defensible space.

Strategic justification for development

Due to the significant landscape risk with potential for extreme fire behavior, and the requirement for native vegetation removal on often very steep slopes, none of the sites has strong strategic justification for intensification of development under Clause 13.02. However, some sites have more potential than others to be developed in compliance with the BMO.

Sites 1, 2, 12, 13 and 14 are beyond the main township area and have less ability to access the comparatively lesser risk BAL-12.5 areas and NSP locations within the township. They cannot, therefore, be considered low risk locations with safe access to areas where human life can be better protected from the effects of bushfire.

Sites 3, 5, 6, 7, 8, 9 and 10 have reasonable access to the comparatively lesser risk BAL-12.5 areas and NSP locations within the township. However, as they are located generally on the western edge of the township, they could also be exposed to potentially extreme bushfire behavior. Any proposed development of these sites should be carefully considered and aim to have a minimum BAL-29 construction standard with maximum defensible space. A significant constraint for these sites, however, is that they would require vegetation removal on steep slopes. Due to the existing modification of vegetation to the west and northwest of Site 8, this factor may be less of a constraint for this site.

Development of Site 4 would comprise infill development in a location within the township boundary and this site is therefore, more suited than any other to residential or other development. Development of this site would, however, require vegetation removal that may result in unacceptable biodiversity impacts.

Site 11 has reasonable access to the comparatively lesser risk BAL-12.5 area and NSP in the south of the township. It has potential for BAL-29 development and, due its proximity to the coast and the township, is comparatively less exposed to hazardous vegetation.

It is important to note that if a rezoning is required to facilitate development of any site (e.g. sites 5 and 11, which are in the Public Conservation and Resource Zone (PCRZ)), it would invoke the settlement planning strategies in Clause 13.02, including:

- *'Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).*
- *'Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).'*

Whilst a BAL-12.5 area may be achievable on some sites, it is considered that BAL-12.5 development is not appropriate on any site due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on a site, however this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

1 Introduction

1.1 Study purpose

The Surf Coast Shire Council (SCSC) is undertaking a review of the Lorne Strategy 2003 (revised 2004) with the intention of preparing a strategic land use framework for the township (SCSC, 2018).

SCSC recognise that bushfire is a key constraint that must be considered in accordance with Clause 71.02 *Operation of the Planning Policy Framework* (Surf Coast Planning Scheme, 2018a) and that many of the residential areas, both within and on the periphery of the township, are subject to extreme bushfire risk. Accordingly, Lorne is not identified as a growth area in the Surf Coast Planning Scheme (SCSC, 2018).

A consultant brief was issued to prepare a strategic bushfire report to inform the Lorne Strategy Review (LSR). The brief stipulated that *'The report needs to consider the strategic considerations in settlement planning for the township but also consider a number of sites that have been nominated for investigation either in the Planning Scheme or by third parties for residential or tourist accommodation. Fundamentally, the report should be undertaken under the spectrum of the objective of Clause 13.02 of the Surf Coast planning Scheme, which states: "To strengthen the resilience of settlements and communities to bushfire through risk-based planning that prioritises the protection of human life"'* (SCSC, 2018).

Specific tasks stipulated in the brief included that the assessment should *'...consider the best practice approach adopted by the CFA in considering strategic planning projects along the lines of the following framework:*

- *Landscape bushfire considerations*
- *Alternative locations for development*
- *Availability of safe areas*
- *The views of the relevant fire authority*
- *Site based exposure*
- *Areas of high biodiversity conservation value*
- *No net increase in risk'* (SCSC, 2018).

Specific tasks under the heading of Settlement Planning include:

- *'Having regard to the strategies outlined in Clause 13.02 for settlement planning, assess the bushfire context of the township and subsequently the role and importance of the existing settlement boundary as a bushfire risk-based planning management tool'* (SCSC, 2018).

Specific tasks under the heading of Site Specific Investigations include:

- *Undertake a strategic assessment of the sites identified on Map 2 of Clause 21.10- Investigation Areas for their suitability for low density residential development (e.g. lots greater than 0.4ha) or sustainable tourist accommodation (e.g. group accommodation). The assessment should consider the strategic merit for the retention of these sites within the Surf*

Coast Planning Scheme as suitable for low density residential development or sustainable tourist accommodation under the spectrum of bushfire risk.

Third Party Site Specific Investigations

- *Undertake a strategic assessment of sites identified in section 1.0 of this RFQ that have been identified by third party stakeholders. As with the assessment of the sites identified in Map 2 of Clause 21.10 of the Surf Coast Planning Scheme, the suitability of these sites for residential or sustainable tourism accommodation should be considered under the spectrum of bushfire risk. The purpose of this task will be to inform Council of the strategic merit, if any, in identifying these sites for land uses that can assist in providing alternative forms of accommodation to cater for permanent or seasonal demand’(SCSC, 2018).*

1.2 Overview

This bushfire assessment has been undertaken in response to the brief, to inform the LSR and identify how any future development in the township and additional sites nominated by SCSC, might respond to the bushfire risk pursuant to the applicable Victorian planning and building controls that relate to bushfire. Specifically, the objective and applicable strategies of the Planning Policy Framework (PPF) at Clause 13.02 *Bushfire* in the Victoria Planning Provisions (Surf Coast Planning Scheme, 2018b), the *Bushfire Management Overlay (BMO)* and schedules to the BMO at Clause 44.06 (Surf Coast Planning Scheme, 2018c) and associated Clause 53.02 *Bushfire Planning* (Surf Coast Planning Scheme, 2018d).

The study area has been defined in the brief and subsequently by SCSC, as comprising the main township area and fourteen additional site specific investigation areas either within the township, on the periphery of the township or some distance from the township. Eight sites are identified as Special Investigation Areas (SIAs) in the Lorne Strategy on Map 2 of Clause 21.10 (two of the SIAs have been split into north and south sites for the purposes of this assessment). A further six sites were nominated for investigation as part of this study, by SCSC and/or third-party stakeholders.

This report assesses the bushfire hazard and identifies the ability of future development to respond to the bushfire risk in accordance with the applicable bushfire planning and building controls. It has been prepared in accordance with guidance for the assessment of, and response to, bushfire risk provided in:

- *Bushfire State Planning Policy Amendment VC140*, Planning Advisory Note 68 (DELWP, 2018a);
- *Local planning for bushfire protection*, Planning Practice Note 64 (DELWP, 2015);
- *Planning Permit Applications Bushfire Management Overlay Technical Guide* (DELWP, 2017);
- *AS 3959-2018 Construction of buildings in bushfire prone areas* (Standards Australia, 2018); and
- Country Fire Authority (CFA) guidelines for bushfire hazard landscape assessment (CFA, 2018) and strategic land use planning (CFA, 2015).

It should be noted that this assessment has been undertaken at the strategic scale for settlement planning purposes only. The findings should not be used or relied upon for the purposes of statutory planning or building regulation compliance (e.g. BMO permit applications or BAL assessments).

This report provides:

- A description of the landscape-scale bushfire risk, and assessment of its potential impact;
- The identification of applicable bushfire planning and building controls;
- An analysis of vegetation within and around the study area, and its classification pursuant to the BMO/AS 3959 methodology;
- An analysis of topography within and around the study area, and its classification pursuant to BMO/AS 3959 methodology;
- An analysis of potential fire weather on days of severe or higher fire danger;
- An assessment of the appropriateness the BMO/AS 3959 default inputs and assumptions about fire behaviour and conditions (the 'design fire');
- The determination of BAL setbacks for each site based on likely BMO requirements for defensible space for infill development and/or potential new development;
- Planning and design considerations for future development; and
- A summary response to the objective and strategies of Clause 13.02 Bushfire in the Victoria Planning Provisions.

2 Methodology

2.1 Study approach

The study methodology has followed the risk assessment process of determining the credible consequences of a bushfire and the likelihood of those consequences being realised. A description of potential bushfire behaviour was used to examine the potential for a severe fire to impact the study area.

In the context of describing the risk of bushfire to the Lorne township and site around or beyond the township boundary, the consequence can be defined as loss of life and houses during a bushfire. The likelihood is determined by:

- The probability of weather conditions occurring that could result in a fire of sufficient intensity to destroy homes and claim lives;
- The probability of an ignition on that day;
- The potential for a fire to develop to a level of severity such that homes are destroyed and lives could be lost;
- The vulnerability of assets to the level of bushfire attack to which they are exposed; and
- The presence and efficacy of risk controls.

In this study a description of potential bushfire behaviour was used to examine the potential for a severe fire to impact the study area. This description considered a range of inputs, some of which were site-specific data analysed at a local scale (such as fuel, vegetation, topography and length of fire run) and others which were assumptions (such as the weather conditions that might occur on the day of the hypothetical fire, and that an ignition could occur).

The potential impact of a bushfire depends upon the severity of the hazard (i.e. the fire behaviour), the number of assets exposed to the fire, and the vulnerability of those assets to the fire severity predicted. In the case of houses, vulnerability can be usefully considered in terms of the level of flame, radiant heat and ember attack they are likely to be exposed to versus their ability to withstand that level of attack.

The bushfire characteristics considered include:

Hazard

- Vegetation and fuel – landscape, neighbourhood and site scales
- Topography – landscape, neighbourhood and site scales
- Weather – Wind direction and speed and Forest Fire Danger Index (FFDI)
- Potential fire behaviour – landscape and site scale
- History of bushfire

Exposure

- Location of potential development sites and 'hypothetical development areas' within them
- Proximity to Classified or modified vegetation

Vulnerability

- Distance of the study site from a safer area and landscape through which evacuation would occur
- Constraints to new development meeting BMO requirements and implementing Clause 13.02 strategies

The description of the bushfire characteristics of the study sites was based on:

- Analysis of publicly available spatial data and spatial data and aerial imagery provided by the Surf Coast Shire Council (SCSC);
- Field inspection and assessment of the study area;
- Bushfire history in the landscape; and
- The professional expertise of Terramatrix.

2.2 Study area

The overall study area comprises fourteen individual sites in addition to the main township area, covering a total area of almost 540ha. The sites have been defined in the brief, and subsequently by SCSC, as follows.

Main Township Area

The main township area is generally, the settlement boundary in the Lorne Strategy Framework Map (Map 1 in Clause 21.10) (Surf Coast Planning Scheme, 2018e).

Special Investigation Areas (SIA)

Sites that may have potential for low density residential development or sustainable tourist accommodation, as identified in the Lorne Strategy on Map 2 of Clause 21.10 – Investigation Areas (Surf Coast Planning Scheme, 2018e). The brief stipulated that *'The assessment should consider the strategic merit for the retention of these sites within the Surf Coast Planning Scheme as suitable for low density residential development or sustainable tourist accommodation under the spectrum of bushfire risk'* (SCSC, 2018).

The SIAs identified in the Lorne Strategy on Map 2 of Clause 21.10 total eight sites (two of the SIAs, Allenvale and Deans Marsh Road, have been split into north and south sites for the purposes of this assessment). The SIAs were identified in the Lorne Strategy Plan 1991, as areas to be investigated for limited residential expansion, and were subsequently designated as Special Investigation Areas (SIA) in the Lorne Strategy Plan Review (LSPR) (SCSC, 2008), which is a reference document of the Surf Coast Planning Scheme.

Third Party Sites

A further six sites were nominated for investigation as part of the study, by SCSC and/or third-party stakeholders.

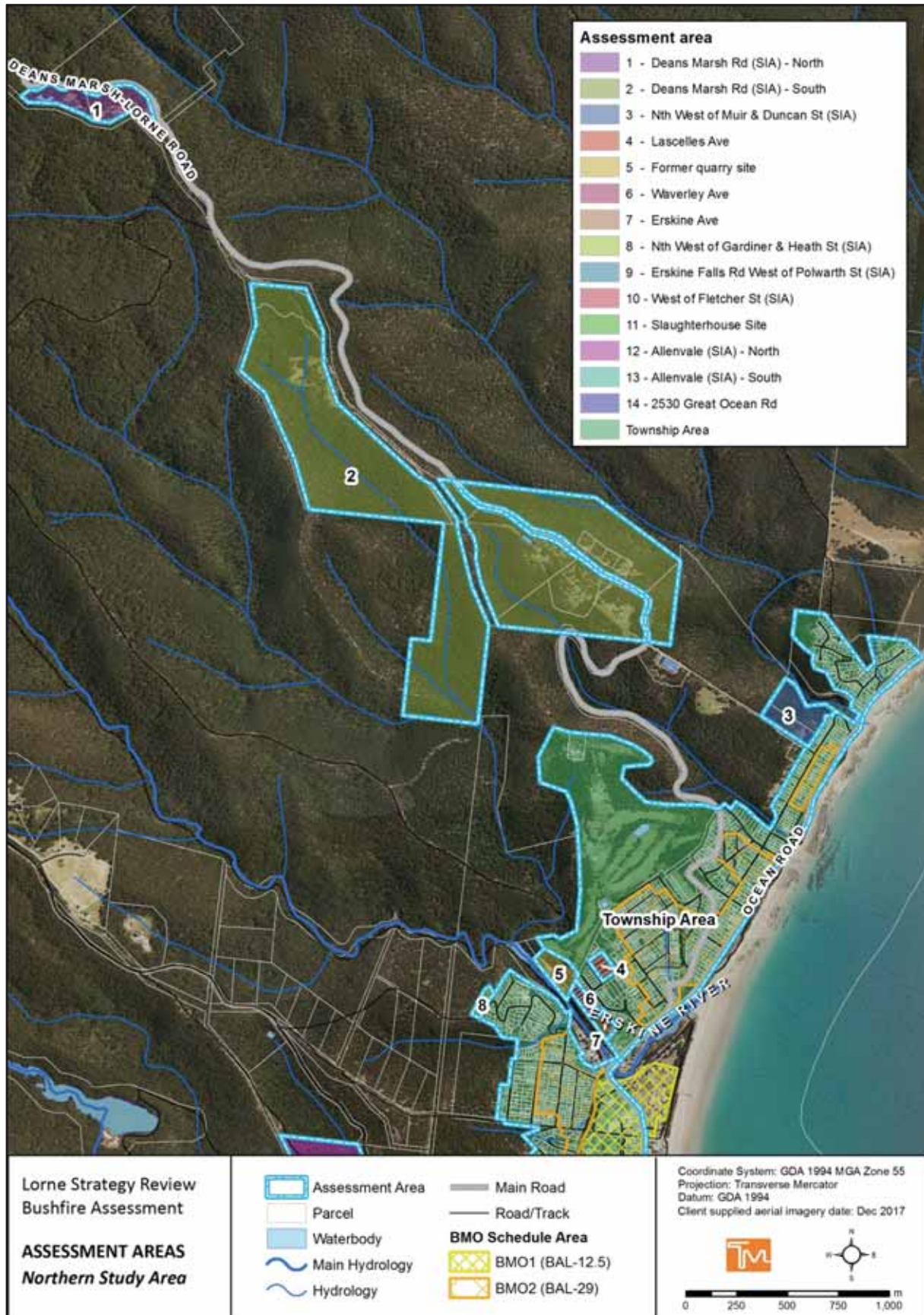
The sites are shown in Map 1 and Map 2 following and are summarised in Table 1 below.

Table 1 - Study area sites summary.

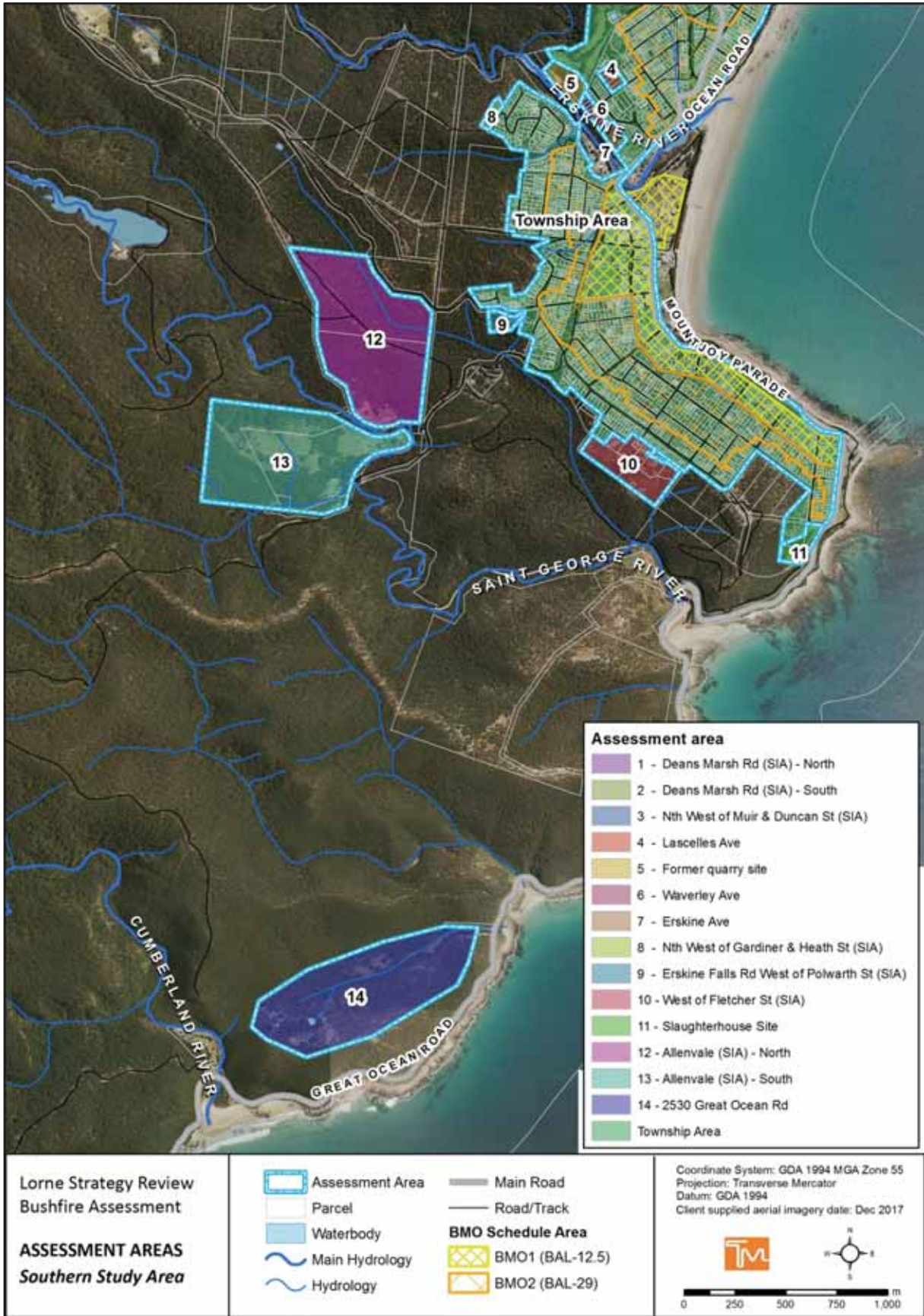
Site No.	Site name	Area (ha)	Zoning	Comments
-	Main township area	260.22	GRZ (mainly)	
1	Deans Marsh Road - North	7.20	RCZ	Map 2 to Clause 21.10 identifies these sites for investigation for sustainable tourism. (SIA 1 in the Lorne Strategy Plan 2003 (Amended 2004)). For the purposes of this study they have been split into a northern and southern site, shown as site 1 and 2 respectively in the maps).
2	Deans Marsh Road - South	133.81	RCZ	
3	Northwest of Muir and Duncan Streets	5.65	RCZ	Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable tourism (SIA 3 in the LSP 2003).
4	Lascelles Avenue	1.00	GRZ	Third party nominated site.
5	Former quarry site	2.57	PCRZ	Third party nominated site. This site is not identified in Map 2 of Clause 21.10 but is largely shown as SIA 4 in the LSP 2003.
6	Waverley Avenue	1.06	GRZ	Third party nominated site.
7	Erskine Avenue	0.90	GRZ	Third party nominated site.
8	Northwest of Gardiner and Heath Streets	0.69	RCZ	Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable Tourism (part of SIA 5 in the LSP 2003).
9	Erskine Falls Road, west of Polwarth Street	1.20	RCZ	Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable Tourism (SIA 6 in the LSP 2003).
10	West of Fletcher Street	8.41	RCZ	Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable Tourism (SIA 7 in the LSP 2003).
11	Slaughterhouse site	2.03	PCRZ	Third party nominated site.
12	Allenvale - North	37.40	RCZ	Map 2 to Clause 21.10 identifies these sites for investigation for Low Density Residential/Sustainable Tourism (SIA 8 in
13	Allenvale - South	37.79	RCZ	

				the LSP 2003). For purposes of this study, they have been split into a northern and southern site, shown as site 12 and 13 respectively, in the maps. The northern half of site 12 is identified as an investigation area for Sustainable Tourism. The balance of site 12 and all of site 13 is identified as an investigation area for Low Density Residential/Sustainable Tourism.
14	2530 Great Ocean Road	38.81	RCZ	Third party nominated site.

Total area 538.74 (based on SCSC supplied boundaries)



Map 1 - Northern study area.



Map 2 - Southern study area.

3 Bushfire planning and building controls

This section summarises the applicable planning and building controls that relate to bushfire. Sections 5 Site analysis and 6 Planning and design considerations identify the ability of site to respond to and comply with the controls.

3.1 Clause 71.02-3 Integrated Decision Making

Clause 71.02-3 states that planning and responsible authorities should endeavour to integrate policies and balance conflicting objectives in favour of net community benefit and sustainable development. However, in bushfire affected areas, ***the protection of human life must be prioritised over all other policy considerations*** (Surf Coast Planning Scheme, 2018b).

3.2 Clause 13.02 Bushfire

Clause 13.02 has the objective '*To strengthen the resilience of settlements and communities to bushfire through risk based planning that prioritises the protection of human life*' (Surf Coast Planning Scheme, 2018b). The policy must be applied to all planning and decision making under the Planning and Environment Act 1987, relating to land which is:

- Within a designated Bushfire Prone Area;
- Subject to a Bushfire Management Overlay; or
- Proposed to be used or developed in a way that may create a bushfire hazard.

Clause 13.02 requires priority to be given to the protection of human life by:

- '*Prioritising the protection of human life over all other policy considerations.*
- '*Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.*
- '*Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process*' (Surf Coast Planning Scheme, 2018b).

Clause 13.02 stipulates key strategies, which require that strategic planning documents, planning scheme amendments and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures. This also applies to planning permit applications for:

- Subdivisions of more than 10 lots;
- Accommodation;
- Child care centre;
- Education centre;
- Emergency services facility;
- Hospital;
- Indoor recreation facility;
- Major sports and recreation facility;

- Place of assembly; and
- Any application for development that will result in people congregating in large numbers.

Clause 13.02 states that development should not be approved where ‘...a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented’ (Surf Coast Planning Scheme, 2018b).

This study assesses the hazard to the study area in accordance with Clause 13.02 (and Clause 44.06 BMO) to identify if future development of the sites can appropriately prioritise the protection of human life, and meet the objective of Clause 13.02, by ensuring future dwellings and other development will not be exposed to radiant heat flux (RHF) above $12.5\text{kW}/\text{m}^2$, which is commensurate with a BAL-12.5 construction standard.

The maximum $12.5\text{kW}/\text{m}^2$ RHF safety threshold is invoked by Clause 13.02 as a key strategy for settlement planning and the upper limit for acceptable risk. Responsible authorities must ‘*Not approve any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL- 12.5 rating under AS 3959-2009¹*’ (Surf Coast Planning Scheme, 2018b).

This study also identifies the potential for development of the sites to comply with the likely applicable approved measures for defensible space and construction in Clause 53.02 *Bushfire Planning*, which is invoked by the BMO coverage. The default requirement for defensible space for ‘vulnerable uses’ such as tourism developments with an accommodation component, is to achieve RHF that will not exceed $10\text{kW}/\text{m}^2$. This lower, and therefore more precautionary, RHF threshold is what the defensible space distances in Table 3 to Clause 53.02-5 are based on.

Because an alternative measure for vulnerable uses may propose a higher $29\text{kW}/\text{m}^2$ RHF threshold (i.e. commensurate with a BAL-29 construction standard), and this standard is typically appropriate for residential dwellings, the sites have also been assessed against this higher threshold.

The three RHF safety thresholds above, and their commensurate defensible space distances are identified in Section 6.1.1 BALs and vegetation management.

¹ AS 3959-2009 was superseded by AS 3959-2018 in November 2018, which was invoked in the National Construction Code on 1 May 2019. Therefore, all quoted references in this report to AS-3959-2009 should be read as references to the 2018 version of the standard.

3.3 Local Planning Policy Framework (LPPF²)

The Municipal Strategic Statement (MSS) at Clause 21 in the Surf Coast Planning Scheme, acknowledges that the Shire has an extensive fire history with many settlements at high risk from bushfire or grassfire. The threat of bushfire on coastal and hinterland towns within close proximity to forested land is identified as a key issue and influence. One of the key strategic directions for sustainable land use and development in the Municipal Framework Plan is *'To direct population growth and development to low bushfire risk locations'* (Surf Coast Planning Scheme, 2018e). A key strategic direction for environmental management is *'To avoid development in areas of biodiversity and landscape significance where bushfire mitigation measures will compromise those assets'* (Surf Coast Planning Scheme, 2018e).

3.3.1 Clause 21.03 Environmental Management

Bushfire is identified as a risk and relevant strategies are to:

- *Direct new urban growth areas and subdivision away from the bushfire hazard.*
- *Avoid development intensification in areas at risk from bushfire including close to or abutting the national park/urban settlement interface.*
- *Ensure development is only permitted where the risk to life, property and community infrastructure from bushfire can be reduced to an acceptable level and bushfire protection measures can be readily implemented* (Surf Coast Planning Scheme, 2018f).

3.3.2 Clause 21.04 Tourism

This clause states that the benefits of tourism need to be balanced against potential negative impacts, including the pressure for tourism development in areas of very high and extreme bushfire risk. It also identifies that increasing traffic volumes on the Great Ocean Road (especially during the bushfire season) is resulting in congestion, traffic hazards and emergency response difficulties. One of the tourism development strategies is to:

'Limit non-agricultural based tourism development to the Lorne coastal hinterland and other selected rural areas. Such developments to be small scale, nature and adventure based tourist activities and accommodation that are compatible with natural processes and have regard to minimising exposure and risk to bushfire' (Surf Coast Planning Scheme, 2018g).

3.3.3 Clause 21.10 Lorne Strategy

The Lorne Strategy notes that residential areas within the town and on the periphery, are subject to extreme bushfire risk. Relevant identified 'key issues and influences' are:

- *'Growth is constrained by the Great Otway National Park, highly significant remnant vegetation and extreme bushfire risk providing barriers to the expansion of the town.'*

² It is noted that the LPPF will be translated into the PPF as the Municipal Planning Strategy, as proposed by VC148 (DELWP, 2018b). However, at the time of preparing this report the LPPF and MSS are components of the Surf Coast Planning Scheme.

- *Managing development within the settlement boundary on lots that have a direct interface with (or are within close proximity to) the bushfire hazard generated by the Great Otway National Park.*
- *There is an ongoing risk of a landscape scale bushfire penetrating and spreading throughout the town having severe impacts on the community and the towns infrastructure*
- *The Lorne hinterland contains a number of small scale tourist establishments in a highly valued and attractive environment, some of which are located on steep terrain, have hazardous access and all have a direct interface with the bushfire hazard generated by the Great Otway National Park’ (Surf Coast Planning Scheme, 2018h).*

One of the objectives for settlement, built environment and heritage is *‘To support sustainable urban development in Lorne in a manner that enhances the distinctive, vegetated, low density coastal character of the town whilst addressing risks associated with bushfire’.*

Relevant strategies are to:

- *‘Avoid development intensification within close proximity to the Great Otway National Park bushfire hazard or in other areas assessed as being of high bushfire risk’;*
- *‘Apply minimum subdivision lot sizes based on proximity to services or environmental and bushfire constraints’; and*
- *‘Encourage the establishment of sustainable tourism activities in the hinterland where risks to persons and property from bushfire will not be increased and where environmental assets identified through the ‘Biodiversity Mapping Project’ 2014 will not be significantly impacted’ (Surf Coast Planning Scheme, 2018h).*

The strategies will be implemented by *‘Avoiding the intensification of development in areas identified as containing significant biodiversity assets and/or being at extreme risk from bushfire’.*

3.4 Bushfire Management Overlay

The purposes of Clause 44.06 *Bushfire Management Overlay (BMO)* are:

- *‘To implement the Municipal Planning Strategy and the Planning Policy Framework.*
- *To ensure that the development of land prioritises the protection of human life and strengthens community resilience to bushfire.*
- *To identify areas where the bushfire hazard warrants bushfire protection measures to be implemented.*
- *To ensure development is only permitted where the risk to life and property from bushfire can be reduced to an acceptable level’ (Surf Coast Planning Scheme, 2018c).*

The BMO largely applies to patches of treed vegetation greater than 4ha in size, where head fire intensity has been modelled to be 30,000kW/m or more i.e. potential for extreme bushfire behaviour. It also extends over land 150m around those areas, based on research into house loss from bushfires which has found that 92% of house loss occurs within 150m of the bushfire hazard (DTPLI, 2013).

All of the sites and the surrounding landscape for approximately 10km, are covered by the BMO or a BMO schedule (see BMO coverage of the landscape shown in Map 3, and coverage of the sites by BMO schedules in Map 1 and Map 2). The BMO coverage reflects statewide BMO hazard mapping introduced into the Surf Coast Planning Scheme by amendment GC13, which was gazetted on 3rd October 2017.

The BMO requires a planning permit for all subdivision of land, and buildings and works associated with the following uses (some exemptions apply):

- Accommodation (including a dependent person's unit)
- Child care or Education centre
- Hospital
- Industry
- Leisure and Recreation
- Office
- Place of assembly
- Retail premises
- Service station
- Timber production
- Warehouse.

A BMO application must be accompanied by:

- A *Bushfire hazard site assessment*, including a plan that describes the bushfire hazard within 150m of the site in accordance with the site assessment methodology of AS 3959-2009 *Construction of buildings in bushfire-prone areas* and Clause 44.06;
- A *Bushfire hazard landscape assessment*, including a plan that describes the bushfire hazard of the general locality more than 150m from the site; and
- A *Bushfire management statement*, detailing how the development responds to the bushfire risk and the requirements and objectives of Clauses 44.06 and 53.02.

Section 4 of this report includes a bushfire hazard landscape assessment in accordance with the BMO application requirements and Section 5 includes a bushfire hazard site assessment (see also Map 3 and Map 12 to Map 25).

Clause 53.02 Bushfire Planning applies to BMO applications and contains:

- **Objectives:** An objective describes the outcome that must be achieved in a completed development.
- **Approved measures:** An approved measure meets the objective.
- **Alternative measures:** An alternative measure may be considered where the responsible authority is satisfied that the objective can be met. The responsible authority may consider other unspecified alternative measures.
- **Decision guidelines:** The decision guidelines set out the matters that the responsible authority must consider before deciding on an application, including whether any proposed alternative measure is appropriate.

A schedule to the BMO may specify substitute approved measures, additional alternative measures and additional or substitute decision guidelines (Surf Coast Planning Scheme, 2018d).

Schedule 1 to the BMO (BMO1) applies to township areas that are sufficiently distant from modified or classified vegetation (see Section 4.2.2) such that a BAL-12.5 construction standard is appropriate. This is based on the lesser levels of ember attack that can be expected, that radiant heat from a fire front is unlikely to exceed 12.5kW/m² and that flame contact from classified vegetation is not credible (see Map 1 and Map 2). Accordingly, the BMO1 bushfire protection measures include BAL-12.5 for the construction of or extension to one dwelling on a lot, with defensible space for 30m or to the property boundary, whichever is the lesser distance (Surf Coast Planning Scheme, 2017a).

Schedule 2 to the BMO (BMO2) applies to township areas that may be exposed to modified vegetation but are sufficiently distant from classified vegetation, such that a BAL-29 construction standard is appropriate. This is based on radiant heat from a fire front being unlikely to exceed 29kW/m² and that flame contact from classified vegetation is unlikely (see Map 1 and Map 2). Accordingly, the BMO2 bushfire protection measures include BAL-29 for the construction of or extension to one dwelling on a lot, with defensible space for 30m or to the property boundary, whichever is the lesser distance (Surf Coast Planning Scheme, 2017b).

3.5 Bushfire Prone Area (BPA)

All sites and the surrounding land for more than 25km around them, are in a Bushfire Prone Area (BPA). BPAs are those areas subject to or likely to be subject to bushfire, as determined by the Minister for Planning³. The nearest non-BPA land is located in a small area of Birregurra, approximately 40km by road to the northwest; or at Jan Juc, 44km by road to the northeast; or at Apollo Bay, 45km by road to the southwest (see Figure 1).

In a BPA, the Building Act 1993 and associated Building Regulations 2018, through application of the National Construction Code (NCC), require bushfire protection standards for class 1, 2 and 3⁴ buildings, 'Specific Use Bushfire Protected Buildings'⁵ and associated class 10A buildings⁶ or decks. The applicable performance requirement in the NCC is:

'A building that is constructed in a designated bushfire prone area must, to the degree necessary, be designed and constructed to reduce the risk of ignition from a bushfire, appropriate to the —

- (a) *potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and*
- (b) *intensity of the bushfire attack on the building'* (ABCB, 2016).

³ BMO areas are the higher hazard locations within a BPA, where there is potential for extreme bushfire behaviour.

⁴ Class 1, 2 and 3 buildings are defined in the Building Code of Australia (BCA), and are generally those used for residential accommodation, including houses and other dwellings, apartments, hotels and other buildings with a similar function or use.

⁵ Specific Use Bushfire Protected Buildings are defined in the Victorian *Building Regulations 2018*, they generally comprise 'vulnerable' uses and include schools, kindergartens, childcare facilities, aged care facilities and hospitals.

⁶ Class 10a buildings are defined in the BCA as non-habitable buildings including sheds, carports, and private garages.

Compliance with AS 3959-2018 *Construction of buildings in bushfire prone areas* is 'deemed-to-satisfy' the performance requirement (ABCB, 2016).

The Victorian Building Regulations (2018) require that applicable buildings be constructed to a minimum Bushfire Attack Level (BAL)-12.5, or higher as determined by a site assessment or planning scheme requirement. A BAL is a means of measuring the severity of a building's potential exposure to ember attack, radiant heat and direct flame contact. There are six BALs defined in AS 3959-2018, which range from BAL-LOW, which has no bushfire construction requirements to BAL-FZ (Flame Zone) where flame contact with a building is expected (see Table 2).

In a BPA, larger developments and certain vulnerable uses (see Section 3.2) are also required by Clause 13.02 *Bushfire* to:

- *'Consider the risk of bushfire to people, property and community infrastructure.*
- *Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.*
- *Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts'* (Surf Coast Planning Scheme, 2018b).

Table 2 - BALs explained (adapted from AS 3959-2018; Standards Australia, 2018).

Bushfire Attack Level (BAL)	Risk Level	Construction elements are expected to be exposed to...	Comment
BAL-LOW	VERY LOW: There is insufficient risk to warrant any specific construction requirements but there is still some risk.	No specification.	At 4kW/m ² pain to humans after 10 to 20 seconds exposure. Critical conditions at 10kW/m ² and pain to humans after 3 seconds. Considered to be life threatening within 1 minute exposure in protective equipment.
BAL-12.5	LOW: There is risk of ember attack.	A radiant heat flux not greater than 12.5 kW/m ²	At 12.5kW/m ² standard float glass could fail and some timbers can ignite with prolonged exposure and piloted ignition.
BAL-19	MODERATE: There is a risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to radiant heat.	A radiant heat flux not greater than 19 kW/m ²	At 19kW/m ² screened float glass could fail.
BAL-29	HIGH: There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.	A radiant heat flux not greater than 29 kW/m ²	At 29kW/m ² ignition of most timbers without piloted ignition after 3 minutes exposure. Toughened glass could fail.

Bushfire Attack Level (BAL)	Risk Level	Construction elements are expected to be exposed to...	Comment
BAL-40	VERY HIGH: There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.	A radiant heat flux not greater than 40 kW/m ²	At 42kW/m ² ignition of cotton fabric after 5 seconds exposure (without piloted ignition).
BAL- FZ (i.e. Flame Zone)	EXTREME: There is an extremely high risk of ember attack and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.	A radiant heat flux greater than 40 kW/m ²	At 45kW/m ² ignition of timber in 20 seconds (without piloted ignition).

3.6 Other controls

3.6.1 Zoning

Most of the township study area is in the General Residential Zone (GRZ), as are three of the additional sites (see Table 1). Two of the additional sites are in the Public Conservation and Resource Zone (PCRZ) with the remaining nine sites being in the Rural Conservation Zone (RCZ). It is important to note that the respective zones may enable or prohibit the potential development of sites assessed by this study. For example, with the GRZ there is an underlying assumption that land will be used for residential purposes. With the RCZ there are limitations in terms of subdivision and development which may rule out some of the sites assessed as part of this study. Therefore, a rezoning of land may be required to enable development.

Whilst the zoning itself does not have any intrinsic bushfire risk implications, any proposal to rezone land requires a response to Clause 13.02. This includes the strategies requiring future development to be located where RHF will not exceed 12.5kW/m² (indicative 12.5kW/m² setback distances from classified vegetation have been determined for each site and are shown in the analysis maps in Section 5)⁷.

⁷ Note that a key Clause 13.02 settlement planning strategy directs population growth and development to locations assessed as having RHF of less than 12.5kW/m² (author's emphasis). However, another strategy stipulates a maximum BAL-12.5 construction standard (which requires RHF to not exceed 12.5kW/m²). This study considers the intent of the strategies in Cl 13.02 is to ensure that BAL-12.5 is a maximum construction standard for settlement planning, which is consistent with the wording of the latter strategy and the criteria for BAL-12.5 in AS 3959-2018 (see Table 2 above).

In the BMO via Clause 53.02-1, simpler, less onerous application requirements apply in residential zones, to applications for the construction of a single dwelling or an extension to a single dwelling, which can meet specified approved measures. These are known as 'Pathway 1' applications and are provided for in the following zones:

- Neighbourhood Residential Zone
- General Residential Zone
- Residential Growth Zone
- Urban Growth Zone
- Low Density Residential Zone
- Township Zone
- Rural Living Zone

A BMO pathway 1 application in these zones must demonstrate it can meet all the approved measures at Clause 53.02-3.

3.6.2 Overlays

In addition to the BMO, the main overlay controls that apply are summarised as follows.

The Significant Landscape Overlay - Schedule 4 (SLO4) applies to most of the township area, and the SLO1 applies to all other sites except for Sites 1, 5, 7 and 11.

The Neighbourhood Character Overlay - Schedule 2 (NCO2) and the Design and Development Overlay and associated schedules (DDO) apply to most of the township area.

The Vegetation Protection Overlay -Schedule 1 (VPO1) applies to site 1.

Whilst these planning overlays do not of themselves have significant bushfire risk implications, they do impose constraints to, or considerations for, the siting and design of future development and vegetation removal that may be required to create and maintain defensible space. Consideration of the role of these overlays in future development outcomes is beyond the scope of this assessment.

4 Bushfire hazard assessment

One of the bushfire hazard identification and assessment strategies in Clause 13.02 is to use the best available science to identify the hazard posed by vegetation, topographic and climatic conditions.

The basis for the hazard assessment should be:

- *‘Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;*
- *Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;*
- *Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and*
- *The site for the development’* (Surf Coast Planning Scheme, 2018b).

This section includes a bushfire assessment at:

- The wider landscape scale, for more than 20km around the site (see Figure 1 and Map 3);
- The local landscape scale extending up to 1km from the site and the neighbourhood scale up to 400m around the study area boundary, to identify any risk arising around the site beyond the BMO site assessment zone; and
- The site scale, for 150m around the study areas to assist in determining future development potential based on RHF thresholds for:
 - Vulnerable development to achieve Table 3 setbacks in accordance with the BMO, such that RHF can be expected to not exceed 10kW/m²;
 - BAL-12.5 development in accordance with the settlement planning strategies in Clause 13.02 for RHF to not exceed 12.5kW/m²; and
 - BAL-29 development to achieve Table 1 or 2 to Clause 53.02-5 setbacks in accordance with the BMO, such that RHF can be expected to not exceed 29kW/m².

4.1 Wider landscape assessment

4.1.1 Location

Lorne is an established coastal township, located on the Great Ocean Road, approximately half way between Torquay (to the northeast) and Apollo Bay (to the southwest).

The Otway Ranges occur to the north, west and southwest of the township (see Figure 1) and are one of the most hazardous bushfire landscapes in Victoria, combining large tracts of forest on steep and rugged terrain and a number of small settlements located along the coast and in the ranges.

The Great Otway National Park extends along the coastline and covers 103,000ha incorporating the former Otway National Park and Angahook-Lorne, Carlisle and Melba Gully State Parks (DPCD, 2012).

Beyond the National Park to the north and northwest is predominantly agricultural land on gently undulating terrain leading up to the Colac - Winchelsea plains (DPCD, 2012).

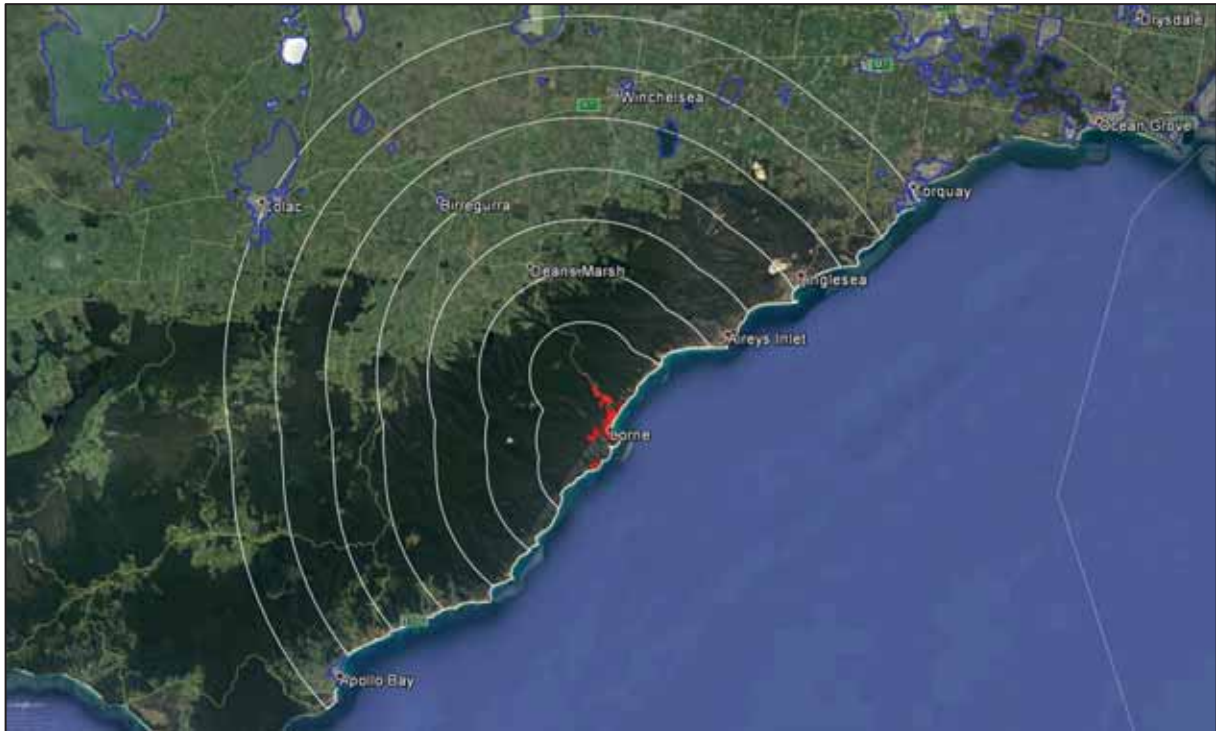


Figure 1 – The wider landscape setting of Lorne, with the study area (in red) and 5km buffers shown in white outline, extending to 35km. Non-BPA land is shown in blue outline (© 2018 Google, Image © CNES/Airbus).

4.1.2 Environment

Lorne and surrounds fall within the Otway Ranges bioregion, which includes the Otway Ranges from Moonlight Head in the west, to Bambra in the northeast, and extending south to the coast (Duffy et al., 2002).

This bioregion is characterised by the following features:

- Lower Cretaceous sandstones and mudstones;
- Deeply dissected into a rugged series of valleys and ridges;
- Generally cool and wet climate with rainfall varying from 800-2000mm per annum, with a strong seasonal peak in winter;
- Highest rainfall levels close to the main ridge (elevation 500-700m);
- Warmest months are January and February, coastal area is milder with less seasonal variation in temperatures (Duffy et al., 2002).

The Otways area contains a range of vegetation types including tall wet forest, rainforest, dry forest, woodland and heathland. EVCs occurring within 400m of the study area (see Map 6 and Map 7) are:

- Estuarine Wetland
- Riparian Forest
- Grassy Dry Forest
- Herb-rich Foothill Forest
- Damp Sands Herb-rich Woodland

- Wet Forest
- Shrubby Foothill Forest
- Coastal Headland Scrub
- Shrubby Wet Forest

DELWP mapping also identifies a Coastal Dune Scrub/Coastal Dune Grassland Mosaic as occurring in narrow patches to the east of the township between the beach and the Great Ocean Road.

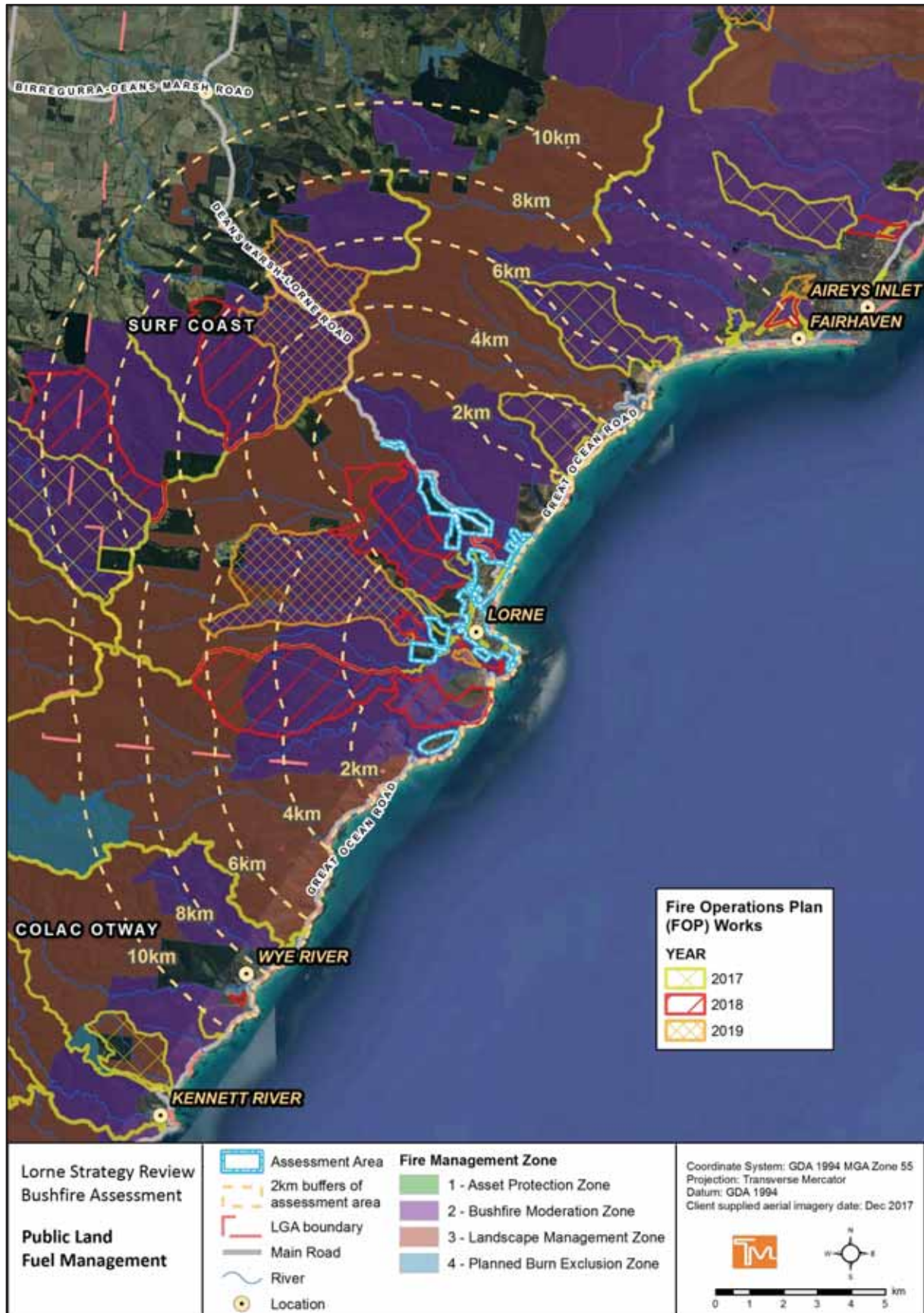
Wet Forest and Shrubby Wet Forest are found in areas of high rainfall, predominantly along the top of the Otways and sheltered gullies and creek lines. They have a tall eucalypt overstorey, to 30m, with scattered understorey trees over a tall broad-leaved shrubby understorey and a moist, shaded, fern-rich ground layer usually dominated by tree-ferns (DSE, 2003a, 2003b). Wet Forest is characterised by *Eucalyptus regnans* (Mountain Ash) (DSE, 2003a), whilst Shrubby Wet Forest is characterised by *Eucalyptus obliqua* (Messmate Stringybark) and *Eucalyptus cypellocarpa* (Mountain Grey Gum) with a more abundant herbaceous layer where gaps in the canopy allow for light to penetrate (DSE, 2003b). Fuel loads are inherently high, but the wet forest requires an extended period of below-average rainfall to dry out sufficiently to carry severe fire, and then typically only late in the summer.

Drier eucalypt Forest and Woodland occurs on the more exposed slopes and in coastal areas, including Grassy Dry Forest, Herb-rich Foothill Forest, Shrubby Foothill Forest and Damp Sands Herb-rich Woodland around Lorne. These vegetation types have may have lower fuel loads than the wetter forest but, being inherently drier, are more often in a combustible state that could sustain a bushfire.

Coastal Headland Scrub occurs on steep, rocky headlands exposed to salt-laden on-shore winds, as a low shrubland (<2m tall) with emergent eucalypts (DSE, 2004c). Fires in Scrub and Shrubland are heavily influenced by wind speed and, due to the large amount of dead material held within the fuel stratum, will burn under strong winds even if other fire weather conditions are not severe (see wind analysis in Section 4.3.2).



Map 3 - Bushfire hazard landscape assessment.



Map 4 - Public land fuel management.

4.1.3 Bushfire scenarios

Under the BMO weather conditions (FFDI 100, see Section 4.3.1) it is likely that an ignition in the farming land to the north of the National Park, or within the forest itself, would develop rapidly and grow to a significant size. The forest extends between 10 and 50km in width (i.e. northwest to southeast) and is approximately 100km long (i.e. from Johanna in the southwest to Bells Beach in the northeast) (see Figure 1). There is ample space for a large fire to develop.

The Lorne township could be impacted by bushfire from the north or northwest under the wind direction typical of extreme fire weather, or from the southwest following the wind change typically associated with the passage of a cold front following a period of hot weather (Long, 2006).

The large area of forest and steep, rugged terrain could support the development of a bushfire with a towering convection column that influences the local weather system, resulting in extremely intense and erratic fire behaviour.

It is considered that the assumptions of the BMO in regard to bushfire development are valid in this landscape and, indeed, if a convection column-driven bushfire were to develop, fire behaviour might be beyond the assumptions of the BMO/AS 3959 model.

The Otways and surrounding landscape have a significant bushfire history (see Map 3), with large areas being burnt on Black Friday 1939 and Ash Wednesday 1983. More recently, 116 homes were lost in Wye River and Separation Creek on 25th December 2015 (Leonard *et al.*, 2016).

The accounts for Ash Wednesday are considered a relevant description of potential fire behaviour in medium-long unburnt areas under extended drought and Code Red fire weather conditions.

On Ash Wednesday, the FFDI at Cape Otway peaked in the 90s, whilst it exceeded 100 further west at Warrnambool and inland at Ballarat and Melbourne Airport (CFA, 1983) and at Forrest (Billing, 1983) (see FFDI analysis in Section 4.3.1).

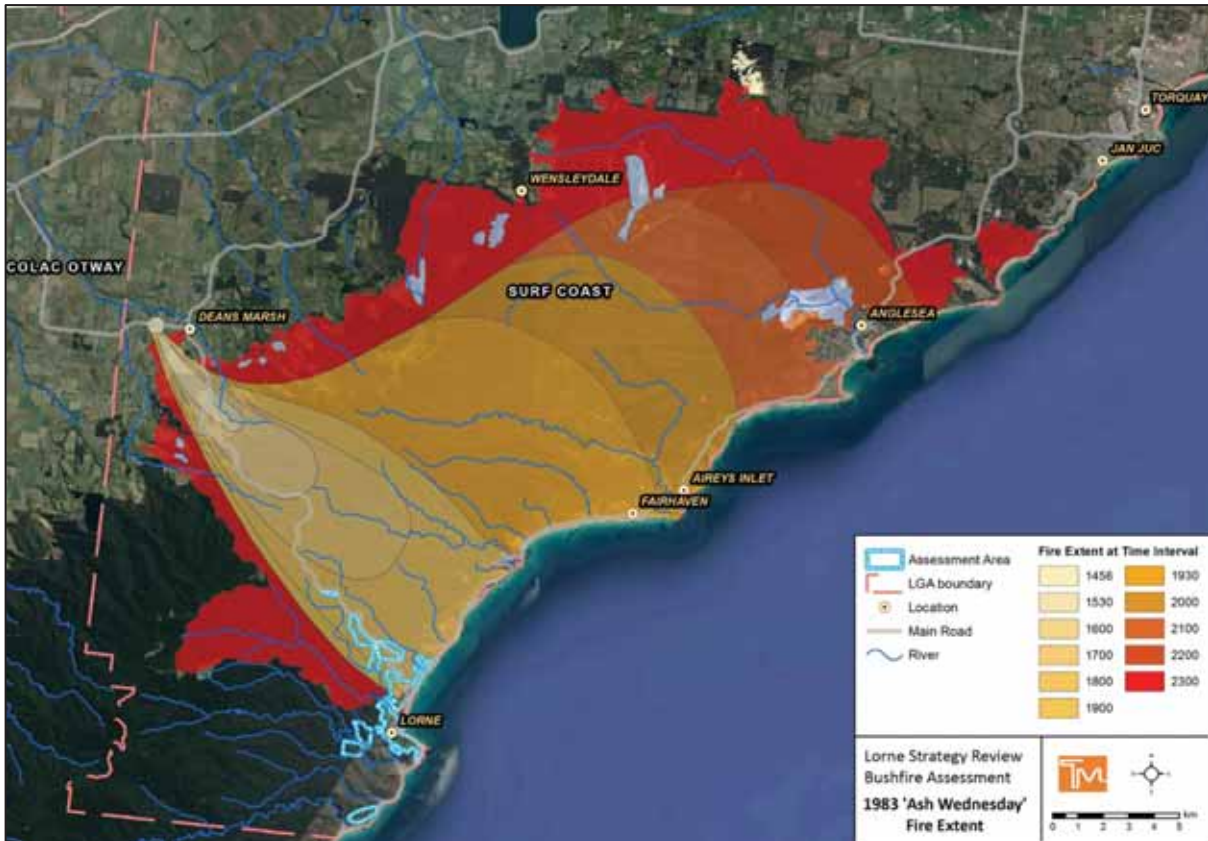
The fire began just before 3pm at Deans Marsh to the north of the Otway Ranges (see Map 5). It spread rapidly through grassland and entered the forest about 3.30pm. Fuel loads in the forest were estimated to be in excess of 20t/ha (CFA, 1983) whilst Billing (1983) predicted 30-35 t/ha in the denser forest types. Fire intensity increased dramatically and crowning and long distance spotting (approx. 10km) began to occur (Billing, 1983). The rate of spread through the forest remained fairly constant at approximately 7km/h. Poor access and extreme fire behaviour prevented effective fire suppression.

There was significant spotting early in the fire into the Lorne and Big Hill Creek areas, with fire being reported on the coast near Reedy Creek by 4.20pm (Billing, 1983) and burning on both sides of the Great Ocean Road at Big Hill Creek by 5.10pm (CFA, 1983). The fire was reported to be burning in many tongues in the bush and spotting heavily. Spot fires and house losses were reported in North Lorne from 5.22pm, and by 6.30pm 30 houses had been lost in this area (CFA, 1983).

At 6.40pm the wind swung to the west and the fire began heavy spotting to the east along its entire length. At around 7pm a gale force south-westerly (100 km/h gusting to 160km/h) reached the fire area and approximately 15km of the eastern flank became the head of the fire (Billing, 1983). The fire caused extensive damage in Eastern View and Fairhaven with gale force winds destroying many houses before the fire arrived (CFA, 1983).

At 7.20pm the fire spotted into the creek flat at Airey’s Inlet and developed very quickly destroying 217 houses. By 8pm the fire had reached Urquhart Bluff and began spotting into Anglesea. The rate of spread during this period was approximately 10 km/h. The main fire front reached Anglesea at 9pm and burnt around the west and north of the town. The fire was finally contained in the Forest Road-Jarosite Road area around 11pm (CFA, 1983).

Recent fuel reduction burning was credited with reducing losses in both Lorne and Anglesea whilst strips of unmanaged vegetation were considered to have carried the fire into the township areas (Rawson et al., 1985).



Map 5 - Spread and final perimeter of the Otways Fire, 16th February 1983 (data supplied by CFA).

4.1.4 Public land fuel management

Much of the forest in the Otways is on public land and subject to a FFMV Fire Operations Plan (FOP) (see Map 3 and Map 4).

The DELWP Strategic Bushfire Management Plan (DELWP, 2014) identifies Lorne as a priority township for bushfire protection. The plan states that planned burning on the northern slopes of the Otway ranges reduces the likelihood of the fire-sensitive wet forest and rainforest, inland of Lorne, being burnt in a bushfire, and that at the time when the plan was released there was only a 5% chance that a bushfire burning under an FFDI 130 (i.e. Black Saturday-type conditions) would burn a large amount of the landscape's wet forest and rainforest.

DELWP zones public land to inform decisions about land management, in particular use of prescribed fire, to meet fire management objectives. The area immediately surrounding Lorne is predominantly Bushfire Moderation Zone with large areas of Landscape Management Zone beyond this. The Code of Practice for Fire Management on Public Land (DSE, 2012) define these zones as:

Bushfire Moderation Zone - This zone aims to reduce the speed and intensity of bushfires. The use of planned burning in the BMZ is designed to protect nearby assets, particularly from ember spotting during a bushfire. Where practicable, the BMZ will aim to achieve ecologically desirable fire regimes, provided bushfire protection objectives can still be met. This may include using other fuel management methods.

Landscape Management Zone - Within this zone, planned burning has three broad aims:

- *'Bushfire protection outcomes by reducing the overall bushfire fuel and bushfire hazard in the landscape;*
- *Ecological resilience through appropriate fire regimes;*
- *Management of the land for particular values including forest regeneration and protection of water catchments at a landscape level.*
- *Other fuel reduction methods will be used within this zone as appropriate' (DELWP, 2012).*

Map 4 shows prescribed burns and mechanical works for the three year period 2017-2019 that were, or are, scheduled in the surrounding landscape.

A number of the dominant canopy species in the forest surrounding Lorne are stringybarks (e.g. *Eucalyptus obliqua*) that will develop Extreme bark hazard if long unburnt and can generate massive quantities of embers and short distance spotting (Hines et al., 2010). There are also ribbon or candle barked species present (e.g. *E. globulus*, *E. viminalis*, *E. cypellocarpa* and *E. ovata*) that can develop Very High bark hazard conducive to longer distance, as well as short distance, spotting (Hines et al., 2010). One of the longest enduring benefits of prescribed burning is a reduction in bark fuel hazard.

However, whilst there has been and continues to be, considerable fuel reduction burning in the landscape which may assist to moderate the bushfire attack, the potential for a large and intense bushfire will persist.


4.1.5 BMO landscape typologies

To assist in defining the risk arising from characteristics beyond the site scale, four 'broader landscape types', representing different landscape risk levels, are described in the DELWP technical guide *Planning Applications Bushfire Management Overlay* (DELWP, 2017). These are intended to streamline decision-making and support more consistent decisions based on the landscape risk.

The four types range from low risk landscapes where there is little hazardous vegetation beyond 150m of the site and extreme bushfire behaviour is not credible, to extreme risk landscapes with limited or no evacuation options and where fire behaviour could exceed BMO presumptions.

The surrounding landscape best accords with Broader Landscape Type 4 (see Table 3).

Table 3 - Landscape risk typologies (from DELWP, 2017).

Broader Landscape Type 1	Broader Landscape Type 2	Broader Landscape Type 3	Broader Landscape Type 4
<ul style="list-style-type: none"> • There is little vegetation beyond 150 metres of the site (except grasslands and low-threat vegetation). • Extreme bushfire behaviour is not possible. • The type and extent of vegetation is unlikely to result in neighbourhood- scale destruction of property. • Immediate access is available to a place that provides shelter from bushfire. 	<ul style="list-style-type: none"> • The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site. • Bushfire can only approach from one aspect and the site is located in a suburban, township or urban area managed in a minimum fuel condition. • Access is readily available to a place that provides shelter from bushfire. This will often be the surrounding developed area. 	<ul style="list-style-type: none"> • The type and extent of vegetation located more than 150 metres from the site may result in neighbourhood-scale destruction as it interacts with the bushfire hazard on and close to a site. • Bushfire can approach from more than one aspect. • The site is located in an area that is not managed in a minimum fuel condition. • Access to an appropriate place that provides shelter from bushfire is not certain. 	<ul style="list-style-type: none"> • The broader landscape presents an extreme risk. • Fires have hours or days to grow and develop before impacting. • Evacuation options are limited or not available.
			

4.2 Local and neighbourhood assessment

4.2.1 Regional Bushfire Planning Assessment

As part of the response to the 2009 Victorian Bushfires Royal Commission, Regional Bushfire Planning Assessments (RBPAs) were undertaken across six regions that covered the whole of Victoria. The RBPAs provide information about ‘identified areas’ where a range of land use planning matters intersect with a bushfire hazard to influence the level of risk to life and property from bushfire. The RBPAs state that *‘This information should be addressed as part of strategic land use and settlement planning at the regional, municipal and local levels’* (DPCD, 2012).

The Regional Bushfire Planning Assessment for the Barwon South-west Region covers the study area and identifies a number of issues in relation to the township. These are:

- *Multiple bushfire matters including:*
 - *Cluster of small and medium size lots in excess of 0.4ha located along the Great Ocean Road in or in close proximity to bushfire hazard areas;*
 - *Lots have direct interface with Great Otway National Park and associated bushfire hazard areas;*
 - *Scattered vegetation throughout the settlements extends the interface between the Great Otway National Park and urban areas;*
 - *Grassland and coastal scrub provide additional interfaces between the Great Otway National Park and settlement boundaries;*
 - *Extensive areas are mapped as containing vegetation of high and very high conservation significance;*
 - *Strategy for Lorne identifies potential for urban growth (Identified area code 65-002);*
- *The Lorne Framework Plan identifies potential low density residential areas north and west of the township for investigation in a vegetated area of bushfire hazard (Identified area code 65-011);*
- *The settlement of Lorne directly interfaces with the Great Otway National Park and surrounding environs. Development penetrates vegetated areas containing significant landscapes of high and very high conservation value (Identified area code 65-013) (DPCD, 2012).*

4.2.2 Vegetation

Lorne is a well-established township and the boundary between the classifiable vegetation and township area is well defined in most parts of Lorne (see Map 12 and Map 13). Some exceptions include areas such as Lascelles Terrace/Waverley Avenue where residential allotments abut or are in close proximity to Forest vegetation and surrounding properties contain bush/semi-bush gardens that comprise modified vegetation (see below).

Developed residential allotments within the more established parts of the township, mostly contain low threat vegetation as defined by clause 2.2.3.2 of AS 3959-2018 (see below), although in many

places this includes remnant Eucalypts within a garden setting which contribute to tree canopy cover throughout the residential area.

The BMO/AS 3959 method requires the assessment and classification of vegetation according to its bushfire hazard for determining defensible space distances and BAL construction standards for buildings.

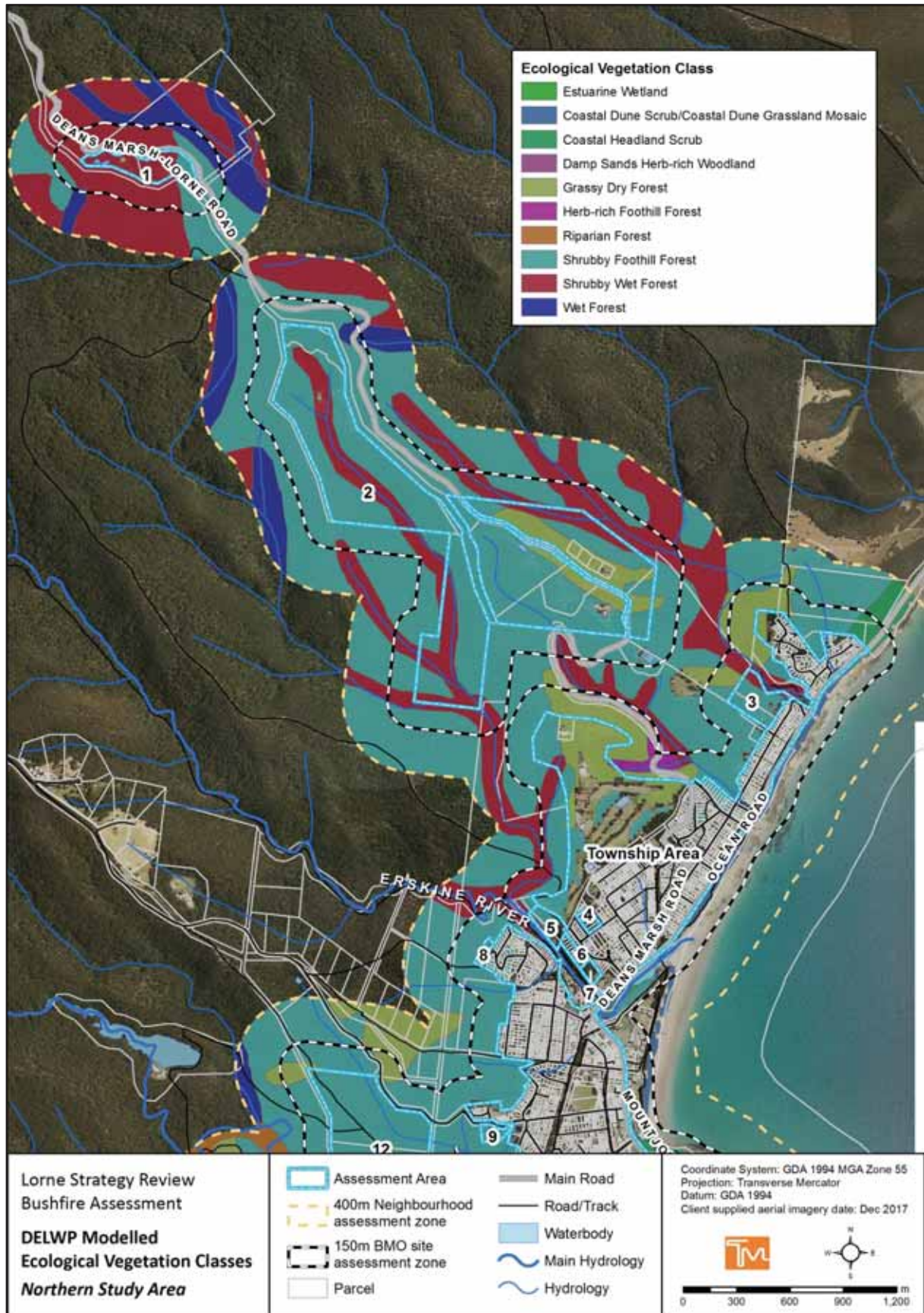
The classification system is not directly analogous to Ecological Vegetation Classes (EVCs) but uses a generalised description of vegetation based on the AUSLIG (Australian Natural Resources Atlas: No. 7 - Native Vegetation) classification system. If more than one vegetation type is present the 'worst case scenario' is applied - the predominant vegetation type present is not necessarily the worst case scenario.

The methodology to assess classified vegetation in this study has been to;

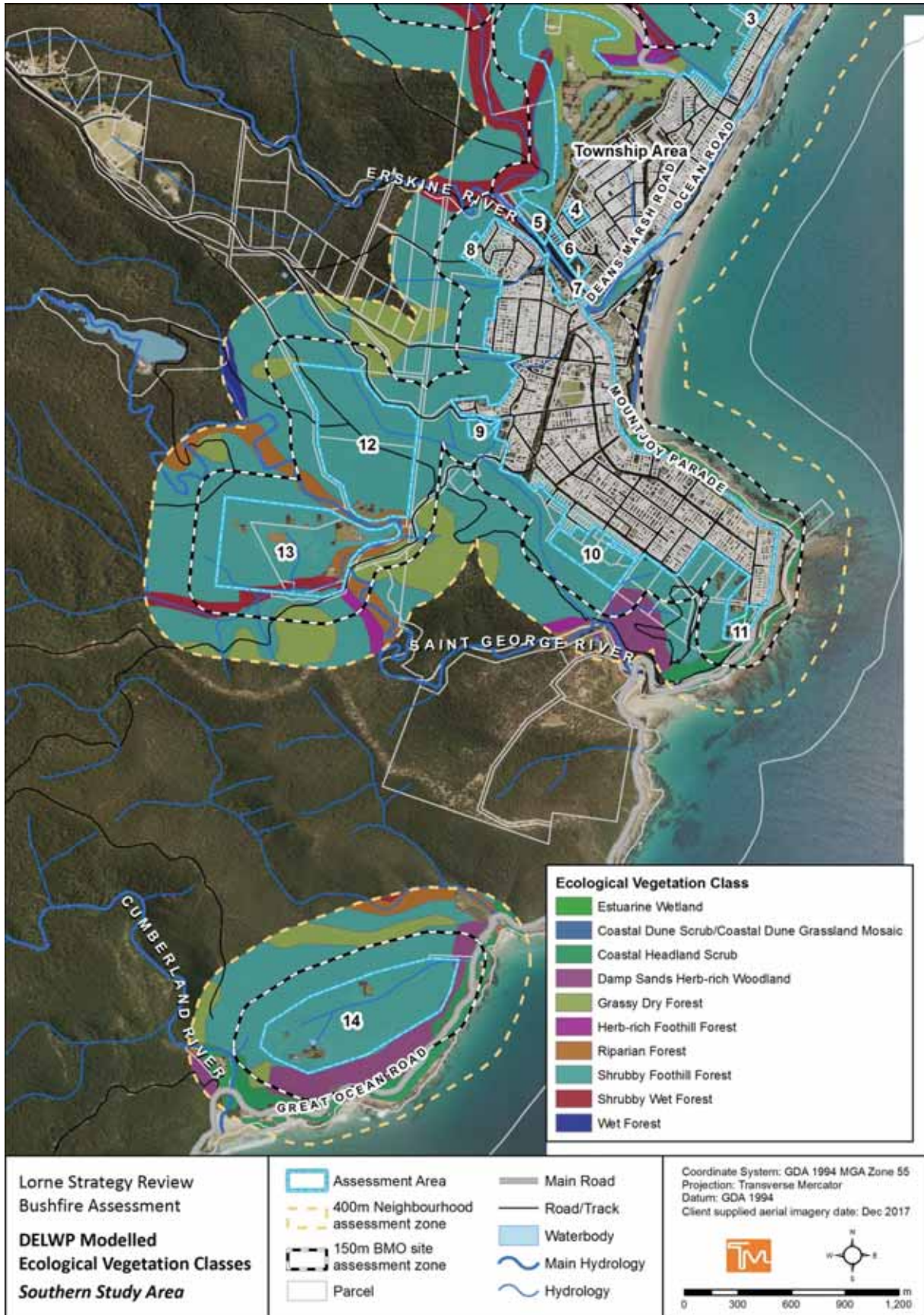
1. Determine extent of simplified native vegetation groups and EVCs present from DELWP data and mapping, within the 400m local assessment area around the study area sites;
2. Assign the EVCs/native vegetation groups present, to one of the BMO/AS 3959 vegetation groups;
3. Map each vegetation group and the BMO defined 'modified vegetation' areas, within the 150m BMO site hazard assessment zone in and around each the site or potential development area within each site, based on EVC/Native vegetation group mapping and aerial photography interpretation; and
4. Check and refine the vegetation assessment and mapping by ground truthing.

Map 6 and Map 7 show the extent of EVCs on and around the study sites within the 400m and 150m assessment zones. Table 4 delineates the EVCs into BMO/AS 3959 vegetation groups and Map 12 to Map 25 show the extent of modified and classified vegetation within the 150m BMO site hazard assessment area in and around each the site, or potential development area within each site.

Note that EVC descriptors or names do not necessarily directly correlate with the corresponding BMO/AS 3959 group of the same name. For example, a Woodland EVC may more closely accord with Forest or even Tall Scrub under AS 3959. In classifying vegetation, the most important determinant is the likely fire behavior the vegetation will generate.



Map 6 - EVCs present within the local assessment zone around northern study sites.



Map 7 - EVCs present within the local assessment zone around southern study sites.

Table 4 - Extant native vegetation in the 400m assessment zone around the study area sites, by EVC Group, Sub-group, EVC and corresponding AS 3959-2018 group/vegetation type.

Group No.	Ecological Vegetation Class (EVC)		AS 3959-2018 Vegetation Group	Comment
	Sub-group No.	Group - Sub-group Name		
1	1.1	Coastal Scrubs, Grasslands and Woodlands	EVC 161 - Coastal Headland Scrub	Scrub comprises vegetation over 2m tall, with an average assumed height of 3m, whilst Shrubland comprises vegetation less than 2m tall with a presumed average height of 1.5m ⁸ .
			Coastal Dune Scrub/Coastal Grassland Mosaic	Occurs as narrow patches to the east of the township between the beach and the Great Ocean Road. Shrubland and Grassland have almost exactly the same defensible space setbacks.
6	6.1	Dry Forests - Exposed and/or lower altitude	Forest	May be classifiable as Woodland if only sparse shrub cover and lesser understory fuels are present.
	6.2	Dry Forests - Sheltered and/or higher altitude	Forest	
7	7.1	Wet or Damp Forests - Wet	EVC 23 - Herb-rich Foothill Forest	Dominant vegetation (62% of EVC area in 400m zone)
			EVC 45 - Shrubby Foothill Forest	
8	8.2	Riparian Forest - Riparian Scrubs and/or Swampy Scrubs and Woodlands	EVC 30 - Wet Forest	
			EVC 201 - Shrubby Wet Forest	Covers 16% of EVC area in the 400m zone.
15	15.2	Herb-rich Woodlands - Damp Sands	Woodland	Douglas (2011) assesses this EVC sub-group as being equivalent to 'Woodland', which accords with the bioregional benchmark descriptor for this EVC.

See Figure 2 showing the proportional area of each EVC within the 400m neighbourhood assessment zone.

⁸ Scrub also has an assumed overall fuel load of 25t/ha whilst Shrubland has an assumed overall fuel load of 15t/ha (Standards Australia, 2018).

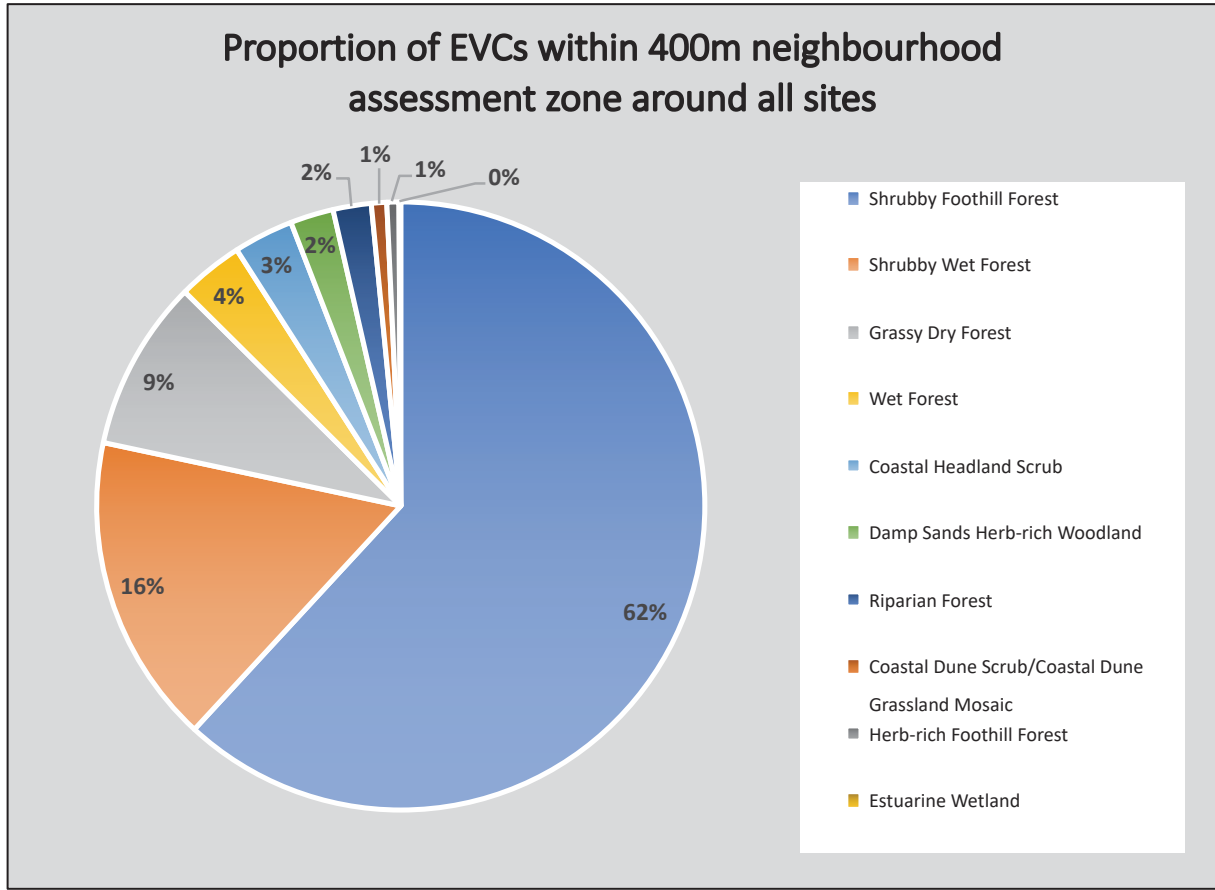


Figure 2 – Proportion of EVCs in the 400m neighbourhood assessment zone.

Forest

Forest vegetation comprises areas with trees to 30m high or taller at maturity, typically dominated by eucalypts, with 30–70% foliage cover (may include understorey ranging from rainforest species and tree ferns to sclerophyllous low trees or shrubs). Includes pine and eucalypt plantations (Standards Australia, 2018).

This vegetation dominates the landscape and for almost all of the study area sites, except Sites 14 and 11, is the determinant for identifying BALs and defendable space (RHF setbacks). As identified in Table 4, the following EVCs have been assigned to the Forest group.

EVC 22 - Grassy Dry Forest (30% tree canopy cover)

‘Occurs on a variety of gradients and altitudes and on a range of geologies. The overstorey is dominated by a low to medium height forest of eucalypts to 20 m tall, sometimes resembling an open woodland. The understorey usually consists of a sparse shrub layer of medium height and a ground layer dominated by a high diversity of drought-tolerant grasses and herbs’ (DSE, 2004d).

EVC 23 - Herb-rich Foothill Forest (40% tree canopy cover)

Occurs on relatively fertile, moderately well-drained soils on an extremely wide range of geological types and in areas of moderate to high rainfall. Occupies easterly and southerly aspects mainly on lower slopes and in gullies. A medium to tall open forest or woodland to 25 m

tall with a small tree layer over a sparse to dense shrub layer. A high cover and diversity of herbs and grasses in the ground layer characterise this EVC' (DSE, 2004e).

EVC 45 - Shrubby Foothill Forest (40% tree canopy cover)

Occurs on ridges and exposed aspects on moderately fertile soils and at a range of elevations. The overstorey is a medium eucalypt forest to 25 m tall over an understorey characterised by a distinctive middle stratum dominated by a diversity of narrow-leaved shrubs and a paucity of ferns, graminoids and herbs in the ground stratum. (DSE, 2004f).

EVC 30 - Wet Forest (40% tree canopy cover)

Grows on fertile, well-drained loamy soils on a range of geologies and elevation levels. It is largely restricted to protected sites in gullies and on southern aspects of hills and mountains where rainfall is high and cloud cover at ground level is frequent. Characterised by a tall eucalypt overstorey to 30 m tall with scattered understorey trees over a tall broad-leaved shrubby understorey and a moist, shaded, fern-rich ground layer that is usually dominated by tree-ferns' (DSE, 2004a).

EVC 201 - Shrubby Wet Forest (40% tree canopy cover)

Tall eucalypt forest to 30 m tall with scattered understorey trees over a tall broad-leaved shrubby understorey and a moist, shaded, fern-rich ground layer that is usually dominated by tree-ferns. Herbs may also be abundant where light penetrates the ground layer. Largely restricted to western and northern aspects and ridgelines in areas of higher rainfall in the Otway Ranges' (DSE, 2004b).

EVC 18 - Riparian Forest (40% tree canopy cover)

'A tall forest to 30 m tall along river banks and associated alluvial terraces with occasional occurrences in the heads of gullies leading into creeks and rivers. Soils are fertile alluvium, regularly inundated and permanently moist. Dominated by tall eucalypts, but also has an open to sparse secondary tree layer of wattles and scattered dense patches of shrubs, ferns, grasses and herbs' (DSE, 2004g).



Figure 3 - Forest to the west of the southern township area.



Figure 4 - Forest on steep slope to the southwest of Site 8.



Figure 5 - Forest on steep topography to west of southern township area.



Figure 6 - Looking northwest across Site 3, at Forest identified by DELWP mapping as Shrubby Foothill Forest.

Woodland

Woodland vegetation is defined by AS 3959-2018 as vegetation comprising trees 10-30m tall, 10–30% foliage cover dominated by eucalypts (and/or callitris) with a prominent grassy understorey that may contain isolated shrubs (Standards Australia, 2018).

Woodland is only an influence on BALs and defensible space (RHF setbacks) at Site 14, where it occurs on the steep slope to the south of the site, above the Great Ocean Road (see Map 7 and Map 25). As identified in Table 4, the following EVC has been assigned to the Woodland group.

EVC 3 - Damp Sands Herb-rich Woodland (20% tree canopy cover)

‘A low, grassy or bracken-dominated eucalypt forest or open woodland to 15 m tall with a large shrub layer and ground layer rich in herbs, grasses, and orchids. Occurs mainly on flat or undulating areas on moderately fertile, relatively well-drained, deep sandy or loamy topsoils over heavier subsoils (duplex soils)’ (DSE, 2004h).

Scrub/Shrubland

The Scrub group of AS 3959-2018 comprises areas with shrubs that have an average height of >2m, with 10 - >30% foliage cover. Typical of coastal areas and tall heaths up to 6 metres in height. May be dominated by Banksia, Melaleuca or Leptospermum with heights of up to 6 metres (Standards Australia, 2018).

Shrubland comprises areas with shrubs that are on average <2m tall, with >30% foliage cover. Understorey may contain grasses (Standards Australia, 2018).

Most of the Coastal Headland Scrub EVC is best classified as Shrubland, however where it grows taller than 2m high, it may be classifiable as Scrub. The only site where it is only an influence on BALS and defensible space (RHF setbacks) is at Site 11, where Shrubland occurs on the slope to the south of the site, and below the Great Ocean Road. The Shrubland grades up to the taller Scrub classification above the walking track, and eventually into Forest vegetation at higher elevations.

EVC 161 – Coastal Headland Scrub

‘Wind-pruned scrub or shrubland to 2 m tall with emergent eucalypts on steep, rocky coastal headlands often associated with cliffs exposed to the stresses of extreme salt-laden winds and salt spray from the south-west. Occurs on shallow sands along rocky sections of the coast’ (DSE, 2004c).



Figure 7 - Shrubland below Site 11.



Figure 8 - Looking south towards Site 14, southwest of Site 11, showing Shrubland below the Great Ocean Road, which grades up into Scrub and then Woodland/Forest where a tree canopy develops at higher elevations.

EVC 10: Estuarine Wetland

*‘Grows on anaerobic peat-rich muds on the edges of estuarine waterbodies such as creeks, rivers and lagoons with intermediate salinity conditions. Vegetation is determined by fluctuating salinity, which varies in time from occasionally fresh to brackish or occasionally saline according to river flood and marine tide events. Dominated by graminoids and halophytic herbs and often fringed by a tall scrub layer of Woolly Tea-tree *Leptospermum lanigerum* at the landward edge’ (DSE, 2004i).*

Vegetation fringing estuarine wetland (e.g. near the outfall of the Erskine River) is likely to be classifiable as Scrub or Shrubland, depending on its height, area and distance from buildings. However, if the vegetation is small in area, more than 20m from a building, or periodically inundated and reliably moist, it may comprise excluded vegetation or modified vegetation (see following).

Modified Vegetation

‘Modified vegetation is vegetation that doesn’t fit into the vegetation classifications in AS 3959-2018 Construction of buildings in bushfire prone areas (the standard) because it:

- has been modified, altered or is managed due to urban development, or gardening,*
- has different fuel loads from those assumed in the standard,*
- has limited or no understorey vegetation, or*
- is not low-threat or low-risk vegetation as defined in the standard’ (Surf Coast Planning Scheme, 2018d).*

Modified vegetation may occur where fuel loads are higher than typical residential gardens and therefore the vegetation cannot be excluded as low-threat. However, because of the amount of

disturbance and modification that has occurred and/or the pattern and configuration of the vegetation (e.g. small, fragmented patches and/or reduced or no understorey/surface vegetation), the fuel load and anticipated fire behaviour is likely to be different from that presumed in the BMO/AS 3959 methodology.

This type of vegetation may not produce a 100m wide fire front moving at a quasi-steady state rate of forward spread, as presumed in the BMO/AS 3959 methodology, but may generate radiant heat and localised flame contact that needs to be fully considered (DELWP, 2017).

Modified vegetation occurs throughout Lorne, where ‘bush gardens’, with a high component of native shrubs, grasses and/or groundcovers, cover a relatively high proportion of the non-building area of a lot. These areas tend to coincide with those that retain a higher proportion of remnant tree canopy cover.

Lots with less tree cover, more non-permeable surfaces, lawn, or other less dense and/or flammable gardens can be deemed to be low threat, or non-vegetated in accordance with the criteria for excluded vegetation (see below).

It must be recognised that the definition of, and boundary between, modified vegetation and low threat vegetation is somewhat subjective and difficult to clearly identify. Notwithstanding, this study has delineated areas of modified vegetation, based largely on aerial imagery provided by SCSC and limited ground truthing. However, the assessment of modified and low threat vegetation has been undertaken at the strategic scale only, to indicate comparatively higher hazard areas from generally lower hazard areas. It should be seen as broadly indicative only, rather than a clear and definitive demarcation of these areas, especially as typically, modified vegetation grades into low threat vegetation and vice versa (see Map 12 and Map 13).

Note that for compliance with Clause 53.02, the presence of modified vegetation within 30m-50m of a building or site, will typically require a minimum BAL-29 construction standard for the building. Areas of modified vegetation within the township, that are sufficiently distant from classified vegetation, are typically those areas covered by the BMO2 schedule.

Excluded vegetation and non-vegetated areas

Areas of low threat vegetation and non-vegetated areas can be excluded from classification in accordance with Section 2.2.3.2 of AS 3959-2018, if they meet one or more of the following criteria:

- a) *Vegetation of any type that is more than 100m⁹ from the site (or a building).*
- b) *Single areas of vegetation less than 1 ha in area and not within 100m of other areas of vegetation being classified vegetation.*
- c) *Multiple areas of vegetation less than 0.25ha in area and not within 20m of the site, or each other, or of other areas of vegetation being classified vegetation.*

⁹ 150m in BMO areas

- d) *Strips of vegetation less than 20m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20m of the site or each other, or other areas of vegetation being classified vegetation.*
- e) *Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.*
- f) *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks' (Standards Australia, 2018).*

Areas comprising excluded vegetation or non-vegetated land are those not shown as modified or classified vegetation, shown in the site assessment maps in Section 5

All land within the BAL-12.5, BMO1 area, has been deemed to be, and is shown as, a low threat or non-vegetated area.

4.2.3 Topography

Lorne is sited on the foreshore, a narrow strip of flat land beyond it, and then the eastern slopes and valleys of the Otway Ranges. The system of steep ridges and valleys creates complex terrain.

The elevation within the study area ranges from sea level to 380m (see Map 8 and Map 9). Slopes are steep. In many places they exceed the 20° upper threshold for determining BALs using the simple 'Method 1' procedure in AS 3959-2018 and the approved measures in the BMO (see Map 10, Map 11 and Figure 9). There are a variety of aspects created by gullies extending in various directions, in addition to the predominantly southeast aspect of the Ranges as a whole.

Many lots within the township area and other sites have both steep upslopes and steep downslopes within the 400m of them. The 'effective slope' used in determining defendable space distances and BALs, will be that slope within 150m of a development that will not become defendable space, but will comprise classified vegetation.

The 'effective slope' determines the BAL and applicable vegetation setback (defendable space distance). This is the slope of the land under the classified vegetation¹⁰ that will most significantly influence the bushfire attack on a building. Two broad types apply:

- Flat and/or Upslope - land that is flat or on which a bushfire will be burning downhill in relation to the development. Fires burning downhill (i.e. on an upslope) will generally be moving more slowly with a reduced intensity.
- Downslope - land under the classified vegetation on which a bushfire will be burning uphill in

¹⁰ The slope of the land between the classified vegetation and the building is called the site slope, which in the BMO/AS 3959-2018, methodology is presumed to be the same as the effective slope.

relation to the development. As the rate of spread of a bushfire burning on a downslope (i.e. burning uphill towards a development) is significantly influenced by increases in slope, downslopes are grouped into five classes in 5° increments from 0° up to 20°.

The topography was analysed by creating an elevation model for the study area and the land 400m around it, using a GIS TIN (Triangulated Irregular Network) generated from SCSC supplied 2.5m contour data.

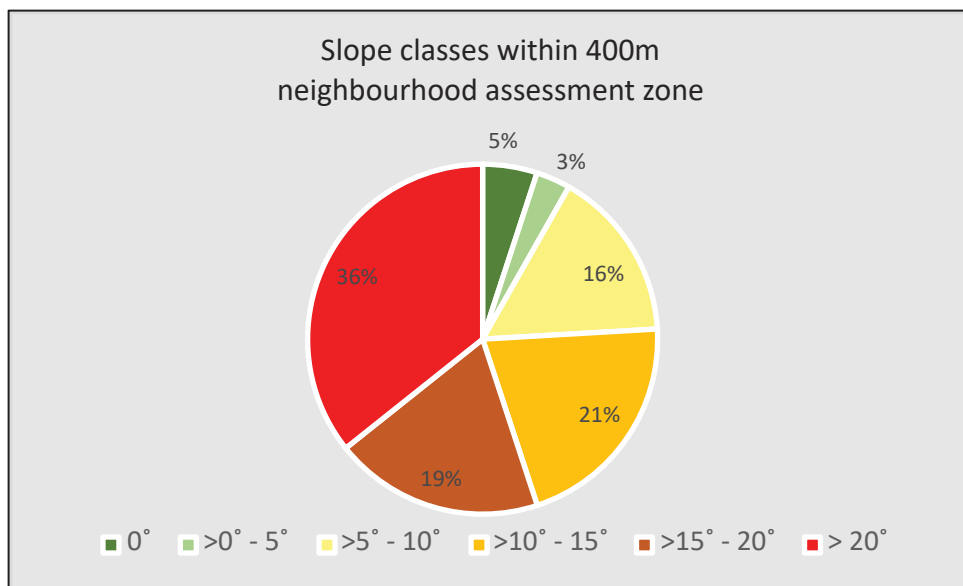
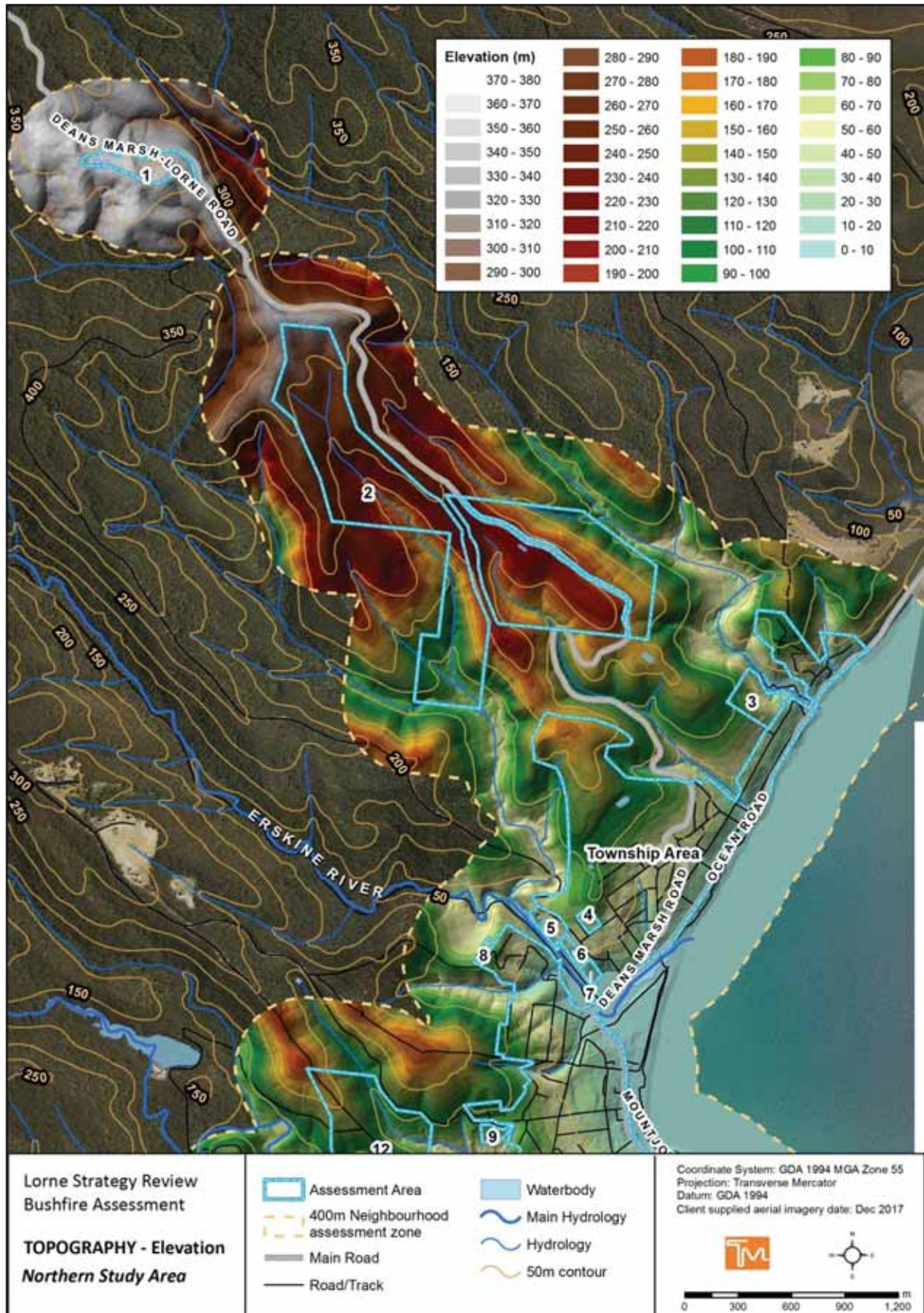
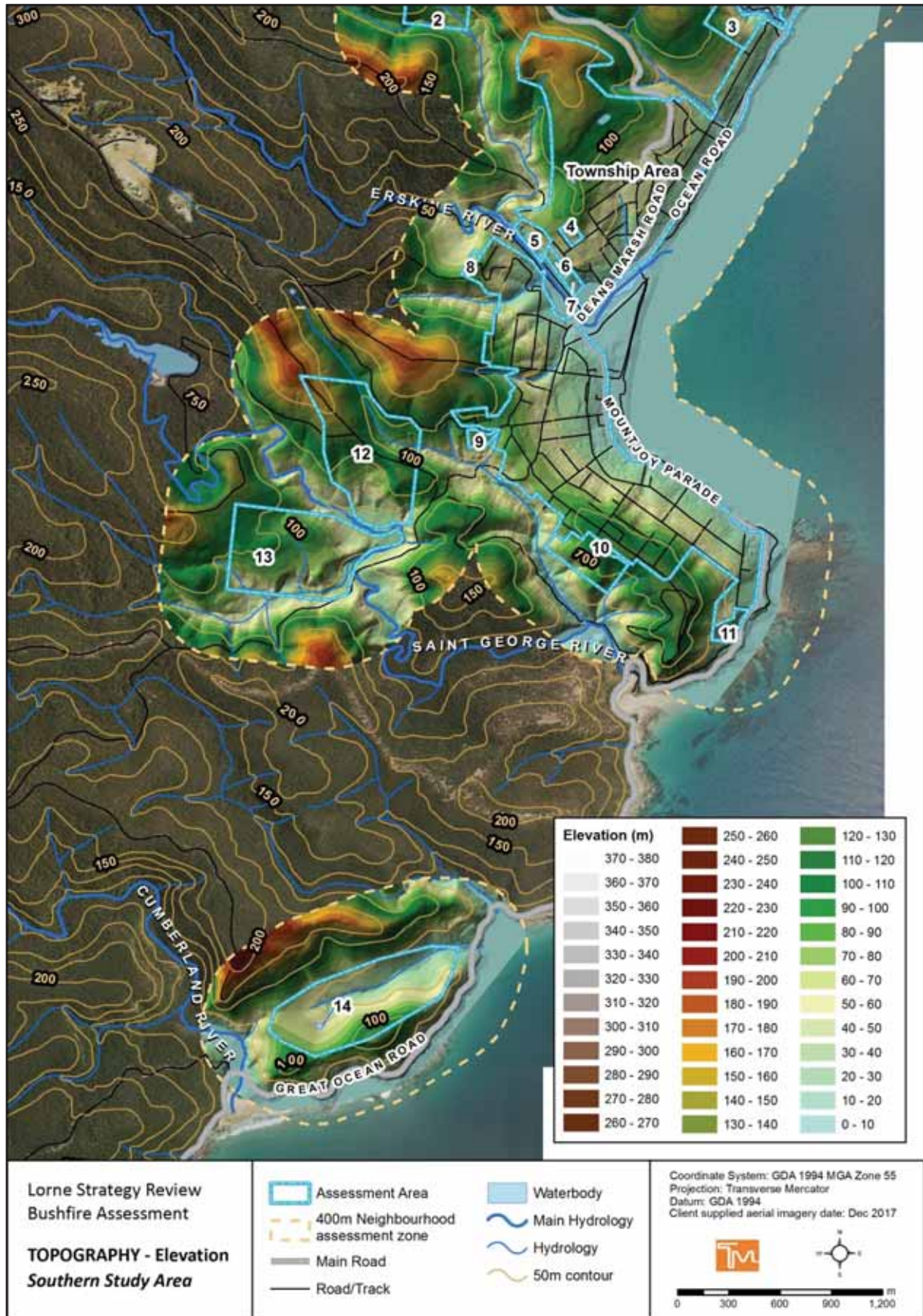


Figure 9 - Slope classes within the 400m assessment area (n.b. these slope classes do not differentiate between upslopes and downslopes).

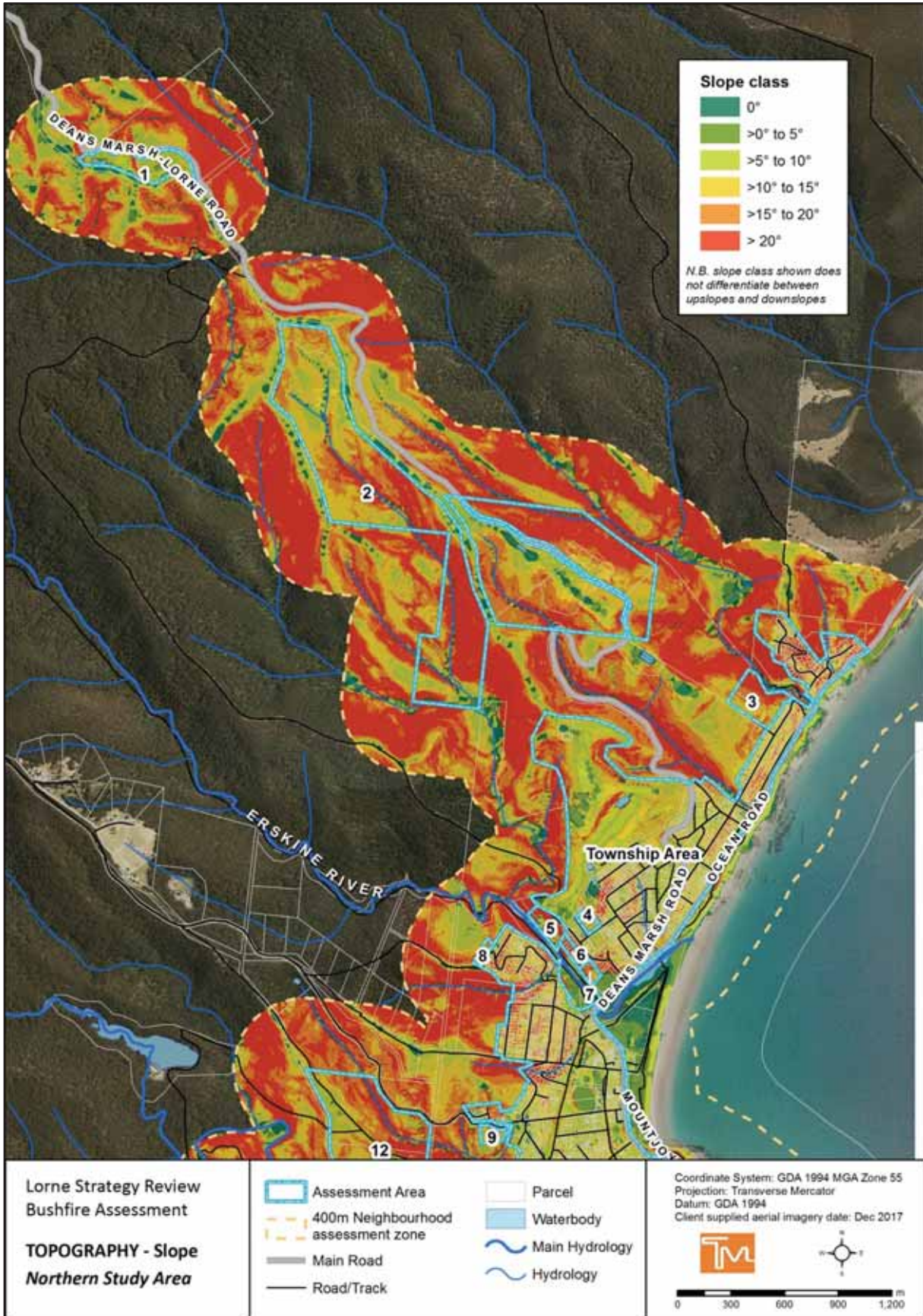
Figure 9 and the following maps shows the steep and variable topography that occurs within and around the study area, extending out to the 400m neighbourhood assessment zone. Over 36% of the land area has a gradient exceeding the 20° upper limit for applying default defendable space distances. See further analysis of upslopes and downslopes in the site assessment maps and analysis in Section 5.



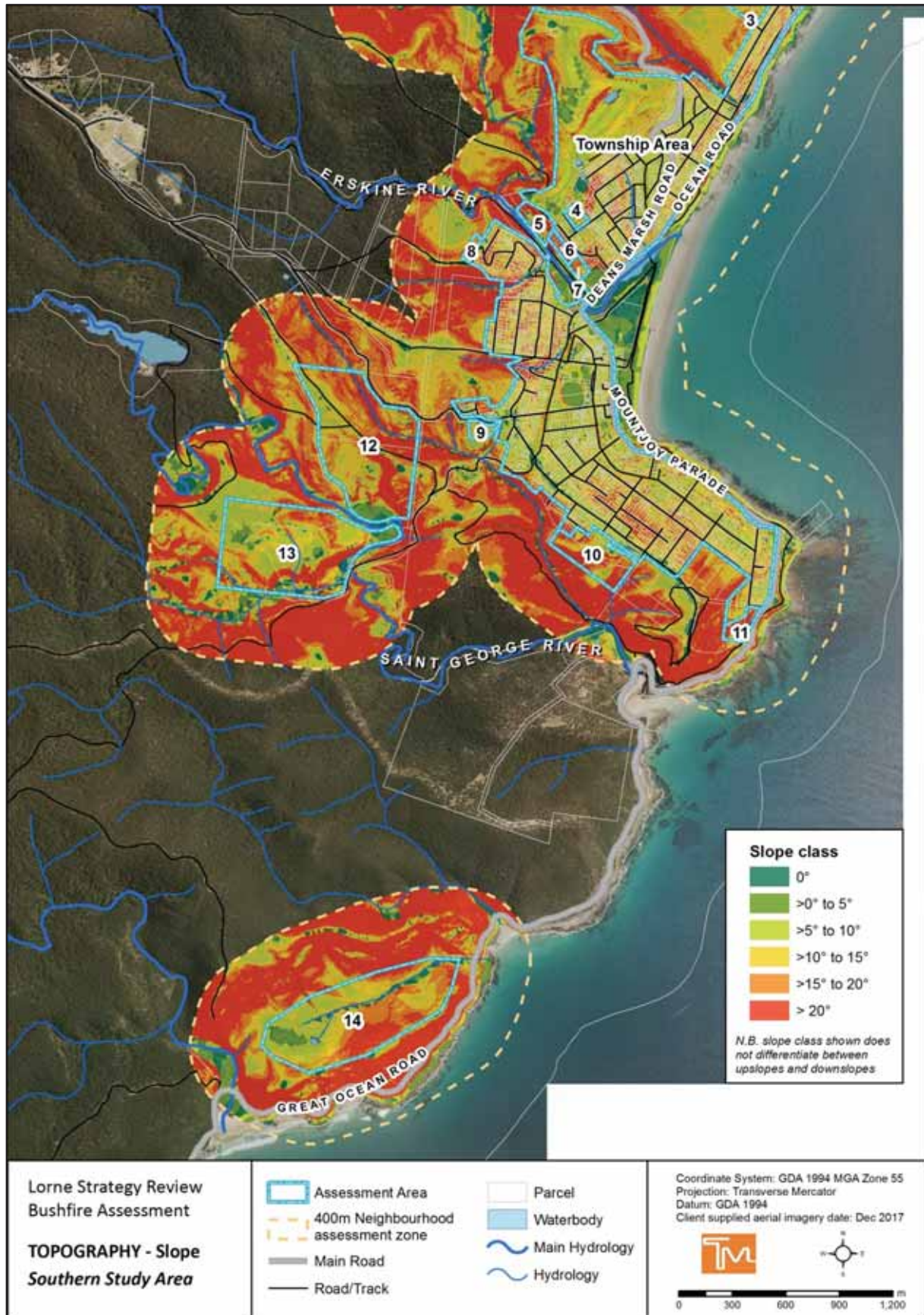
Map 8 - Elevation Map of northern study area and neighbourhood assessment zone.



Map 9 - Elevation map of southern study area and neighbourhood assessment zone.



Map 10 - Slope analysis of northern study area and neighbourhood assessment zone.



Map 11 - Slope analysis map of southern study area and neighbourhood assessment zone.

4.2.4 Neighbourhood fire behaviour

The BMO assumes that a bushfire impacting upon a dwelling will be fully developed, i.e. that it has had the time and space to develop to a size that sustains a 100m wide flame front moving at a quasi-steady state rate of forward spread under FFDI 100 conditions.

There is clear potential for a fully developed, high intensity forest fire of this scale to impact upon the Lorne township. Thus, the fire behaviour modelling assumptions of the BMO in regard to fire development are considered valid.

There is the potential for the residential part of the study area to be impacted significantly by ember attack. The degree of ember attack will depend on fire intensity and the bark fuel hazard at the time of the fire, which will be determined by the tree species present and time since the area was last burnt. It is reasonable to expect spot fires to ignite throughout the residential area, the size of which will depend upon the type and continuity of vegetation in the vicinity of each ignition and the effectiveness of fire suppression activities.

It should also be noted that given the current level of vegetation within the study area (particularly in the areas north of the Erskine River), and in the absence of effective fire suppression, it is feasible for bushfire to spread through the residential area via patches of available fuel such as vacant blocks, 'bush' gardens, creeklines and road reserves. Even low intensity fire burning across dry lawns and in garden beds, or igniting heavy fuels close to houses, can destroy undefended houses through direct flame contact or high levels of radiant heat. Burning bark and leaves from trees and shrubs in gardens and road reserves can contribute to short distance ember attack. Burning homes and other heavy 'urban' fuels produce significant amounts of radiant heat for a long period of time, which may compromise neighbouring homes. This is the scenario that resulted in substantial house loss from the Wye River-Separation Creek fire on 25th December 2015 (Leonard et. al., 2016).

4.2.5 Bushfire attack on buildings

Buildings close to hazardous vegetation (i.e. vegetation not deemed low threat) may be exposed to significant levels of radiant heat and potentially flame contact, particularly where Forest or modified vegetation occurs on steep downslopes in respect to the residential area or a study site.

Ember attack is statistically the most common mechanism of building ignition during bushfire. The impact of embers extends much further from the unmanaged fuel than flame contact and radiant heat, and can continue to pose a risk many hours after the fire front has passed. Embers start small fires on or near the structure that get larger and, in the absence of effective suppression, will spread to destroy the building.

There is the potential for the study sites to be impacted significantly by ember attack. The degree of ember attack at any particular location will depend on:

- Fire intensity;
- Wind speed and direction;

- Vegetation type, especially the bark fuel hazard at the time of the fire (determined by the tree species present and time since the area was last burnt); and
- Distance of the asset from the ember generating vegetation.

Some tree species in the forest surrounding Lorne are stringybarks (e.g. *Eucalyptus obliqua*) that will develop Extreme bark hazard if long unburnt and can generate massive quantities of embers and short distance spotting (Hines et al., 2010). There are also ribbon or candle barked species present (e.g. *E. globulus*, *E. viminalis*, *E. cypellocarpa* and *E. ovata*) that can develop a Very High bark hazard conducive to longer distance, as well as short distance, spotting (Hines et al., 2010).

It is reasonable to expect spot fires to ignite throughout the residential area, the size of which will depend upon the continuity of vegetation in the vicinity of each ignition and effectiveness of fire suppression activities. The amount and nature of ‘garden’ vegetation varies through the township. In a previous hazard assessment of Lorne, Terramatrix (2012) identified three groupings of residential properties:

- Lots close to the forest;
- Lots some distance from the forest but containing dense garden vegetation which is best defined as modified vegetation under the BMO schema; and
- Lots further away and surrounded by low threat vegetation.

Whilst house loss from ember attack has been reported up to 700m from Forest (Chen and McAneney, 2010), these are statistical outliers and extremely uncommon. Chen and McAneney (2010) analysed house loss in a number of major forest fires that impacted on peri-urban areas in southeastern Australia (see Figure 10). They identified that:

- 50% of houses lost were located within 50m of bushland;
- 80-90% of house lost were located within 100m of bushland; and
- 100% of houses lost were located within 700m of bushland.

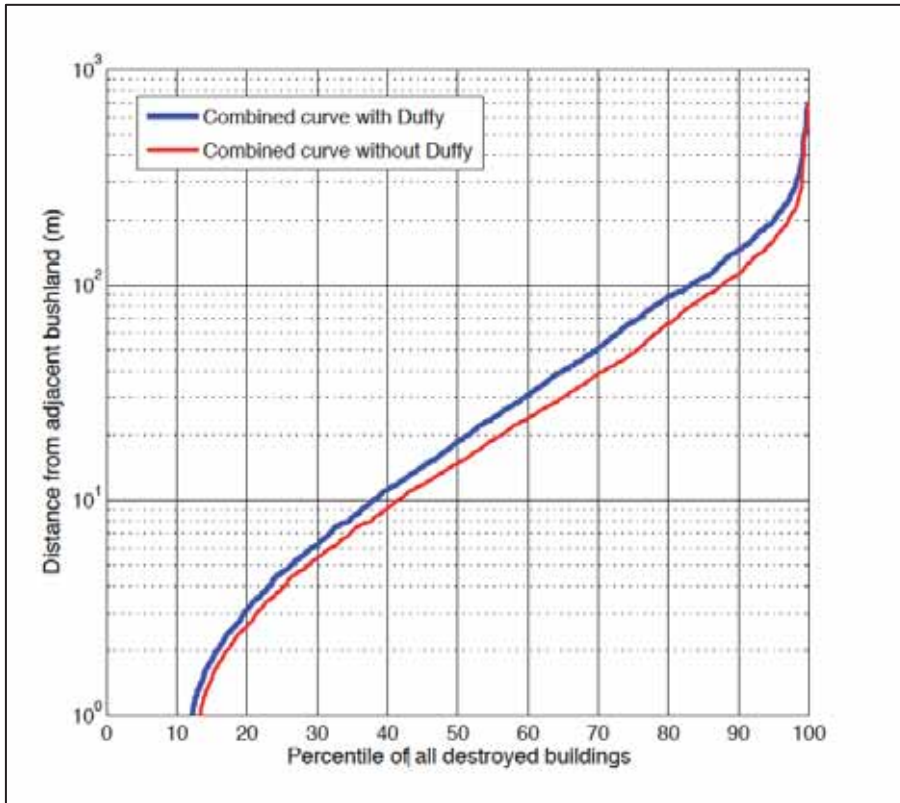


Figure 10 - House loss in relation to proximity to bushland, from Chen and McAneney (2010).

A study of house loss in the 2015 Wye River/Separation Creek bushfire highlighted the impact of ember attack and surface fire spread through dry grass and a leaf litter bed from the established canopy cover. House loss was heavily linked to the ignition of heavy ‘urban’ fuels such as wooden retaining walls, decking and stairs, and vehicles and other combustible items stored beneath elevated parts of a building in igniting dwellings through radiant heat/flame contact beyond that which they had been designed to withstand (Leonard et al., 2016).

4.3 Fire weather

The Forest Fire Danger Index (FFDI) and the Grassland Fire Danger Index (GFDI) represent the level of bushfire threat based on weather (and fuel) conditions. An FFDI 100/GFDI 130 is applied in non-alpine areas of Victoria by the building system, to establish building setback/defendable space distances from classified vegetation in accordance with AS 3959-2018 and the BMO.

The indices are also used for predicting fire behaviour including the difficulty of suppression, forecasting Fire Danger Ratings (FDRs) and determining an appropriate level of preparedness for emergency services. Table 5 displays the FDRs, their FFDI/GFDI range¹¹ and the description of conditions for each FDR.

¹¹ The GFDI ranges for each FDR in Table 5 may vary in some jurisdictions.

Table 5 - Fire Danger Ratings (Source: AFAC, 2017; CFA 2017).

Forest Fire Danger Index	Grassland Fire Danger Index	Fire Danger Rating (FDR)	Description of conditions
100+	150+	Code Red	The worst conditions for a bush or grass fire. Homes are not designed or constructed to withstand fires in these conditions. The safest place to be is away from high risk bushfire areas.
75-99	100-149	Extreme	Expect extremely hot, dry and windy conditions. Fires will be uncontrollable, unpredictable and fast moving. Spot fires will start, move quickly and will come from many directions. Homes that are situated and constructed or modified to withstand a bushfire, that are well prepared and actively defended, may provide safety. You must be physically and mentally prepared to defend in these conditions.
50-74	50-99	Severe	Expect hot, dry and possibly windy conditions. If a fire starts and takes hold, it may be uncontrollable. Well prepared homes that are actively defended can provide safety. You must be physically and mentally prepared to defend in these conditions.
25-49		Very High	
12-24		High	If a fire starts, it can most likely be controlled in these conditions and homes can provide safety. Be aware of how fires can start and minimise the risk. Controlled burning off may occur in these conditions if it is safe – check to see if permits apply.
0-11		Low – Moderate	

4.3.1 FFDI analysis

Analysis of weather data was undertaken to determine the wind speed and direction on days of elevated fire danger (to inform analysis of risk to each site associated with the direction of approach of a possible bushfire) and indicate the appropriateness to the study area of the FFDI 100 threshold applied by the planning and building system in non-alpine areas¹² of Victoria.

The analysis is based on a calculated FFDI, using data obtained for the closest Bureau of Meteorology (BOM) automatic weather station (AWS) considered representative of Lorne weather conditions. This is the station at Aireys Inlet, which is located approximately 15.7km to the northeast of the study area¹³. The analysis is based on synoptic weather data records available for all days during an extended fire danger period (October-April), using records that had all the required relative humidity, temperature, wind speed and drought factor¹⁴ inputs required for calculating the FFDI. Table 6 summarises the attributes of the station and data.

¹² In alpine areas of Victoria an FFDI 50 applies for determining BALs using Method 1 of AS 3959-2018.

¹³ Four other BOM AWS sites in proximity to Lorne, at Cape Otway, Weeaprounah, Geelong Airport and Colac Airport, were considered too distant from and/or not likely to be representative of weather conditions for the study area.

¹⁴ The drought factor (DF) is a numerical scale from 1-10, which represents an estimate of the proportion of fine fuels available to be consumed in a fire, based on seasonal weather conditions and time since last rainfall. DF=10 means driest fuel conditions with 100% of fine fuels available to be burnt.

Table 6 - Summary of BOM AWS station and data attributes.

Attribute	Aireys Inlet
Distance and direction from Lorne	15.7km to northeast
Elevation	105m
BOM Station No.	090180
BOM district name	Western Coast
Date station opened (beginning of data period)	27 th July 1990
Date of oldest record with all inputs*	21 st January 1994
Date of most recent record with all inputs*	14 th March 2019
No. of records with all inputs*	462,184
No. of years of data	25

*Record with all inputs = a data record that has recorded values for all four attributes required to calculate FFDI i.e. drought factor, relative humidity, temperature and wind speed.

The data was sorted to retain only those records for which all four inputs were available to calculate the FFDI i.e. drought factor, relative humidity (%), temperature (°C) and wind speed (km/h at 10m above ground level, averaged for the 10min period before the reading). Only those records for days during an extended fire season period (1st October – 30th April, i.e. summer and two months either side) were used. Based on the FFDI calculations, Generalised Extreme Value (GEV) analysis using annual maximum FFDIs was undertaken, to determine the FFDI return period (recurrence interval) for various FFDI thresholds (Douglas, 2013; Douglas *et al.*, 2015).

Note that the FFDI analysis has been undertaken to assist in analysing the hazard posed by the weather and assess the appropriateness of the BMO/AS 3959 fire weather inputs to the study area. It does not necessarily equal the actual FFDI or fire weather conditions that may have occurred¹⁵.

Further, the benchmark of an FFDI 100 represents a 'one size fits all' model of extreme fire weather conditions applied across the state, but which has been exceeded for periods of time during significant fire events and at some locations (e.g. Black Saturday 2009) including at Aireys Inlet. Therefore, it is important to note that this is not necessarily the *worst-case* conditions for any particular location, including the study area.

Table 7 - Five years in the data period (1994-2019) with the highest FFDI.

Date	Time	Temperature (°C)	Relative humidity (%)	Wind speed (km/h)	Drought factor	FFDI
2009/02/07	2:32 pm	44.7	9	68	9.6	194
2013/03/27	12:35 pm	35.3	13	55	10.0	94
1998/03/22	12:54 pm	35.8	11	55	9.0	93
2018/01/06	1:45 pm	38.7	11	54	8.1	90
2003/01/25	12:33 pm	42.4	9	46	7.6	85

¹⁵ Uncertainty values associated with *forecast* FFDIs are significant, reflecting the imprecision of the input values, and may cross a number of FDR classes (Yeo *et al.*, 2014; AFAC, 2017).

Table 8 - GEV recurrence intervals for FFDI/FDR thresholds.

Fire weather threshold (FFDI)	Recurrence interval (years)
Severe fire danger (FFDI 50)	1.4
Extreme fire danger (FFDI 75)	2.9
Code Red fire danger (FFDI 100)	6.0
175	50
199	100

Table 7 and Table 8 show the results of the FFDI analysis. They reveal that the FFDI 100 threshold for building protection in the BMO/AS 3959 methodology is likely to occur approximately every 6 years at Lorne/Aireys Inlet. If the more conservative recurrence interval of a 1-in-50 year or in 1-in-100 year event was adopted, a significantly higher, more conservative FFDI would be applicable¹⁶.

Currently the CFA has no published policy on FFDI recurrence intervals and the FFDI 100 threshold is applied throughout Victoria in the planning and building systems (except for in Alpine areas where an FFDI 50 applies) for determining BALs in the planning and building systems. The results of the FFDI analysis are not necessarily evidence a higher FFDI value, and hence, increased defensible space, should be applied in the study area, but they support the need to adopt a precautionary approach when assessing development in the study area, particularly for vulnerable developments and those in higher risk locations.

It should also be noted that under various climate change scenarios, the frequency and severity of elevated fire danger days across south-east Australia is forecast to increase (Lucas *et al.*, 2007). Especially in eastern and southern Australia, there has been an increase in the length of the fire weather season and a greater number of higher risk days (CSIRO/Bureau of Meteorology (BOM), 2018). There is a 'high confidence' that climate change will result in a harsher fire weather climate for the Southern Slopes Victoria West sub-region that the study area is in; with a 'low confidence' in the magnitude (size) of the expected change¹⁷ (CSIRO/BOM, 2019) i.e.

4.3.2 Wind analysis

Wind speed and direction is a major influence on fire behaviour, especially in shrub and heath fuels. Analysis of wind data and creation of a wind rose, from the Aireys Inlet AWS data, was undertaken to show the frequency of wind speed and direction on days of elevated fire danger (i.e. when calculated FFDI was > or = 50) during the extended fire danger period (1st October – 31st April). The results are shown in Figure 11.

¹⁶ e.g. the NSW Rural Fire Service applies a 1:50 recurrence interval for residential development.

¹⁷ Confidence in a climate projection statement represents the authors' assessment of its reliability from multiple lines of evidence including physical theory, past climate changes and climate model simulations. Confidence is expressed using the qualifiers 'very high', 'high', 'medium', 'low' and 'very low' (CSIRO, 2015).

The results show the prevalence of northwesterly winds on days of elevated fire danger (40% of wind records when FFDI > or = 50 during the extended fire danger period), with strong winds also likely to be experienced from the west-northwest and north.

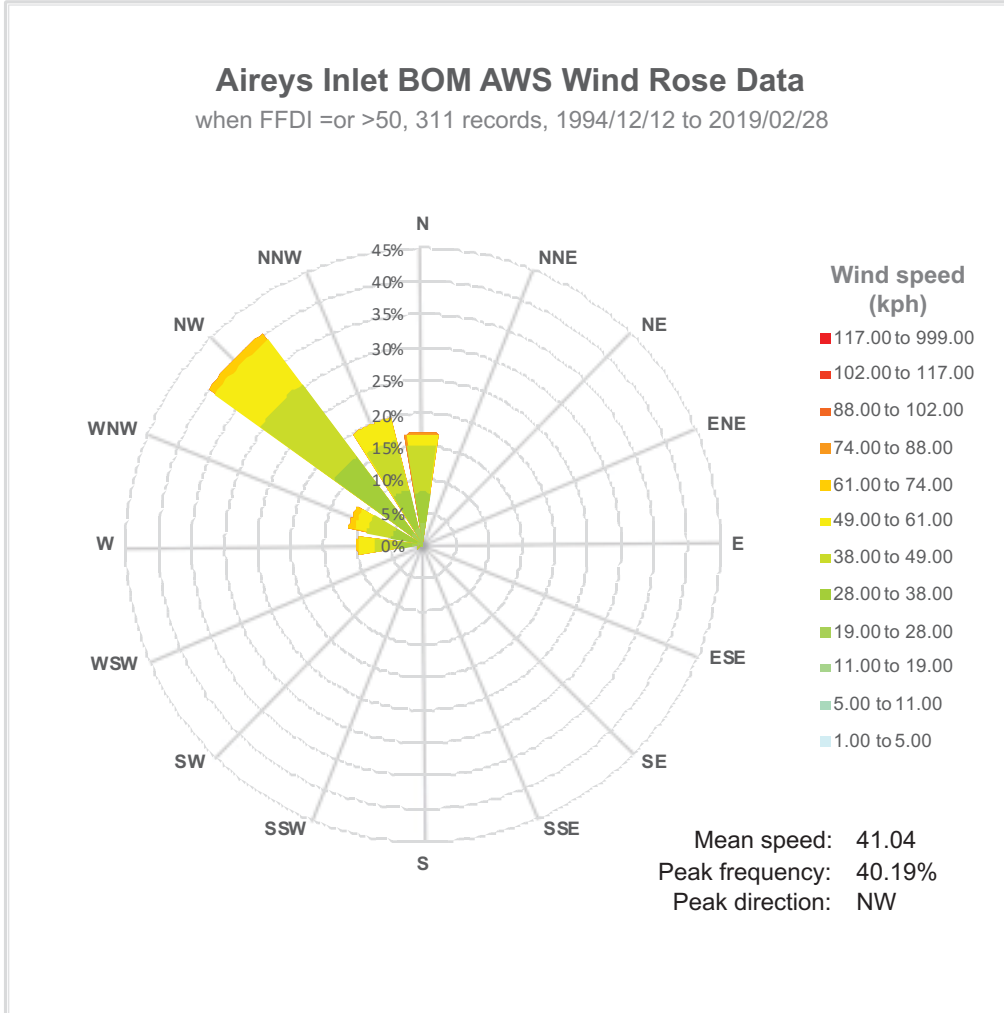


Figure 11 - Wind Rose for Aireys Inlet.

5 Site analysis

This section identifies the hazard for each site, represented by the vegetation and topography; analyses the potential of each site to provide a development envelope based on three key RHF/BAL safety thresholds; and, identifies the approximate shortest distance by road to a BAL-12.5 area considered to be relatively safe. A discussion about the merits of future development of each site is also provided in this section, along with the hazard assessment and RHF mapping.

5.1 Method

Each of the component sites of the study area has been analysed to identify at the site scale, the effective slopes, vegetation classification and other factors that are an influence on future development potential. The analysis and discussion are from a bushfire safety and compliance perspective only, i.e. other planning controls that would play a role in deciding whether development could be achieved on a site (such as other overlays, biodiversity values etc.) are not explicitly considered. SCSC will need to balance competing objectives in addition to considering the ability of the land to be developed from a bushfire safety perspective.

The assessment criteria applied, as explained in the following sections, are based on BMO compliance requirements and key strategies in Clause 13.02 (for further assessment under Clause 13.02 (see Section 6.3 Summary response to Clause 13.02 Bushfire):

- Hazard exposure (vegetation and topography);
- RHF/BAL analysis (setbacks for 10kW/m², 12.5kW/m² and 29kW/m²); and
- Distance to an established BAL-12.5 area (proximity to a place of ‘relative safety’).

The analysis includes the standard site hazard assessment methodology of the BMO, which requires that the slope and topography is analysed within a 150m Site Assessment Zone (SAZ) around a potential building or development site, to determine the applicable BAL and commensurate defensible space according to RHF setback distances from classified vegetation.

5.1.1 Assumptions

Assumptions about the location and size of a potential development envelope on each site have been required to define the 150m SAZ, identify the applicable vegetation classification(s), effective upslopes and downslopes within the SAZ, and a boundary or edge of classified (unmanaged) vegetation from which RHF setbacks can be applied and, hence, determine what defensible space might be created and what BALs could apply.

For larger sites, a ‘hypothetical development envelope’ has been applied, largely focussed on existing cleared or least vegetated land, within which it has been assumed all vegetation will be managed at the defensible space standards as required by Table 6 to Clause 53.02 (see Table 10). For smaller sites, it has been assumed that the whole site will be managed as defensible space.

5.1.2 Radiant heat flux thresholds

Each site was assessed for its ability to meet the defensible space and construction objective at Clause 53.02-4.2 and the settlement planning strategies in Clause 13.02, by providing an area of land within the site where RHF would not exceed three key safety thresholds, being:

- 10kW/m²; as per Approved measure 3.1 for a building used for accommodation (other than a dwelling or dependent person's unit), a child care centre, an education centre, a hospital, leisure and recreation or a place of assembly in accordance with Table 3 to Clause 53.02-5.
- 12.5kW/m²; as per the RHF and BAL-12.5 threshold for settlement planning in Clause 13.02¹⁸
- 29kW/m²; equivalent to a BAL-29 construction standard, which is the minimum BAL requirement for a site exposed to modified vegetation (and/or in the BMO2 area of Lorne). BAL-29 construction (with commensurate defensible space from Table 2 to Clause 53.02-5) is also the maximum allowed by Alternative measure 3.6 for a building used for accommodation (other than a dwelling or dependent person's unit), a child care centre, an education centre, a hospital, leisure and recreation or a place of assembly.

Maps 12 to 25 show the results of the analysis. Note that the BAL boundaries shown, delineate areas beyond which (within a site) the applicable BAL may apply.

5.1.3 Access and egress

The BMO at Clause 53.02-4 requires that '*Development is sited to provide safe access for vehicles, including emergency vehicles*' and that '*Vehicle access is designed and constructed to enhance safety in the event of a bushfire*' (Surf Coast Planning Scheme, 2018d).

A settlement planning strategy of Clause 13.02 is to strengthen the resilience of settlements and communities and prioritise protection of human life by '*Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire*' (Surf Coast Planning Scheme, 2018b). Note that the nearest *lowest* risk locations where BAL-LOW can apply are distant from the study area, located approximately 45km away in Apollo Bay and Jan Juc, where land is not in a BPA (see Figure 1). Travel to them is through an extreme risk landscape. As the study area is in a BPA and covered by the BMO, BAL-LOW cannot apply in the study area and the minimum BAL for applicable buildings is BAL-12.5

Accordingly, each site has been assessed for the distance by road to the nearest BAL-12.5 area, which can be deemed a place of 'relative safety', and the bushfire hazard of the route that would be

¹⁸ As noted earlier, a key Clause 13.02 settlement planning strategy directs population growth and development to locations assessed as having RHF of less than 12.5kW/m² (author's emphasis). However, another strategy stipulates a maximum BAL-12.5 construction standard (which requires RHF to not exceed 12.5kW/m²). This study considers the intent of the strategies in Cl 13.02 is to ensure that BAL-12.5 is a maximum construction standard for settlement planning, which is consistent with the wording of the latter strategy and the criteria for BAL-12.5 in AS 3959-2018, which is to ensure that RHF not exceed 12.5kW/m²

travelled to get there. The existing BMO1 (BAL-12.5) schedule has been used to denote BAL-12.5 locations of 'relative safety'.

The two 'Neighborhood Safer Places - Places of Last Resort' (NSPs) for Lorne, located at the Foreshore and the Point Grey Picnic Area and Carpark (see Map 13), are arguably the safest places in the township to move to prior to a bushfire threatening, in the absence of a suitable building being available. Note however, that survival is not guaranteed at an NSP and they are places of relative safety only, which may not provide shelter from smoke or embers (CFA and SCSC, 2017).

5.1.4 Important considerations

Setbacks shown are *indicative only*, based on a hypothetical development area, and indicate *potential RHF setbacks and possible BAL outcomes*. It should be recognised that the assessment has been undertaken at the strategic scale for settlement planning purposes only, to inform the review of the Lorne Strategy. *The findings should not be used for the purpose of statutory planning or building regulation compliance* (e.g. BMO permit applications or BAL assessments) which would require a more site-based assessment and field investigation.

Where effective slopes within the 150m assessment zone are shown as exceeding a 20° downslope, a site-specific effective slope would need to be determined by field investigation, and a 'Method 2' calculation undertaken to determine the extent of increased defendable space that would be required. This is beyond the scope of this study and, therefore, where slopes exceed 20°, the maximum 20° 'default' distances in the defendable space tables in Clause 53.02-5 have been applied. *Consequently, for sites exposed to large areas of downslope greater than 20°, the setbacks shown may underestimate the setbacks required for each BAL threshold.*

Whilst a site or sites may (or may not) be able to be developed in compliance with the BMO, it does not necessarily follow that the development is safe and appropriate in accordance with Clause 13.02. That is, just because development can comply with the BMO and associated Clause 53.02, the significant landscape risk may mean that development is not appropriate when assessed against the state planning policy at Clause 13.02.

5.2 Main township area

Hazard exposure

As identified in Section 4.1 Wider landscape assessment and Section 4.2 Local and neighbourhood assessment, the township is in a significant risk landscape, exposed to long fire runs of many kilometres through high fuel forest vegetation often on very steep and complex topography. At the site scale, within the 150m SAZ around the township boundary, the township is exposed almost wholly to Forest vegetation with some small areas of Scrub and Shrubland to the north and south. Some areas of modified vegetation also occur within the 150m SAZ.

A third of the land under the classified vegetation is on a Downslope greater than 20°. These steeper slopes are mainly around the northern township area, the Erskine River, Golf Course and the Summerhills Avenue area, including the Lilypond Bushland Reserve. 28% of classified vegetation is on a Downslope >10° to 20°, whilst 39% of classified vegetation is either upslope or on a Downslope less than 10° (see Map 12 and Map 13).

RHF/BAL analysis

Map 12 and Map 13 show RHF setback distances from classified vegetation (Forest), beyond which BAL-12.5 development and 'Table 3' development may be appropriate. However, it is important to note that these setbacks do not account for the presence of modified vegetation throughout much of the township (shown indicatively mapped in semi-transparent blue shading). Note that all vegetation within the BMO1 (BAL-12.5) area has been assumed to be low threat and, therefore, no modified vegetation is shown as occurring within the BMO1 area.

Theoretically, the approved measures in Clause 53.02 for meeting the defensible space objective, require a BAL-29 construction standard (or BAL-40 in higher risk settings) in response to modified vegetation within the 150m site assessment zone (SAZ). Tables 1 and 2 to Clause 53.02-5 stipulate that defensible space in response to modified vegetation should be for 50m or to the property boundary. Therefore, once development is at least 50m from modified vegetation, a lower BAL such as BAL-12.5 may be appropriate within the township – noting that a 48m setback from Forest in the All upslopes and flat land class enables BAL-12.5 development. Note also that the BMO2 schedule for Surf Coast requires BAL-29 and defensible space for 30m or to the property boundary, whichever is the lesser distance.

Given the continuing prevalence of modified vegetation throughout the BMO2 area in the township, as well as between the classified vegetation and the BMO2 area, a minimum BAL-29 construction standard for these areas is appropriate, i.e. no large new areas are identified where BAL-12.5 development is appropriate.

However, the BMO2 schedule should be allowed to work as intended, whereby if a particular site is assessed as being sufficiently distant (e.g. at least 50m) from modified vegetation and from classified Forest, then BAL-12.5 could be considered via a standard pathway 1 or 2 BMO application, i.e. applications that depart from the schedule should be assessed on their merits.

It is reiterated though, that as identified in Section 4 Bushfire hazard assessment, the township could be subjected to significant ember attack and localised ignitions in patches of modified vegetation. The BAL-29 standard provides greater resistance to higher levels of ember attack and radiant heat associated with local flaming sources, than lower BALs and also affords higher protection from house to house ignitions.

Distance to an established BAL-12.5 area

The BAL-12.5 BMO1 schedule only applies in the southern part of the township. Due to its length and position between the beach and areas of modified vegetation to the west, it is readily accessible from at least the southern township area with the travel distance to it from most lots less than approximately 500m. Easy access to a BAL-12.5 location from the northern township area is slightly less reliable. Note also, that any travel to a NSP or BAL-12.5 area would almost certainly involve some exposure to modified vegetation.

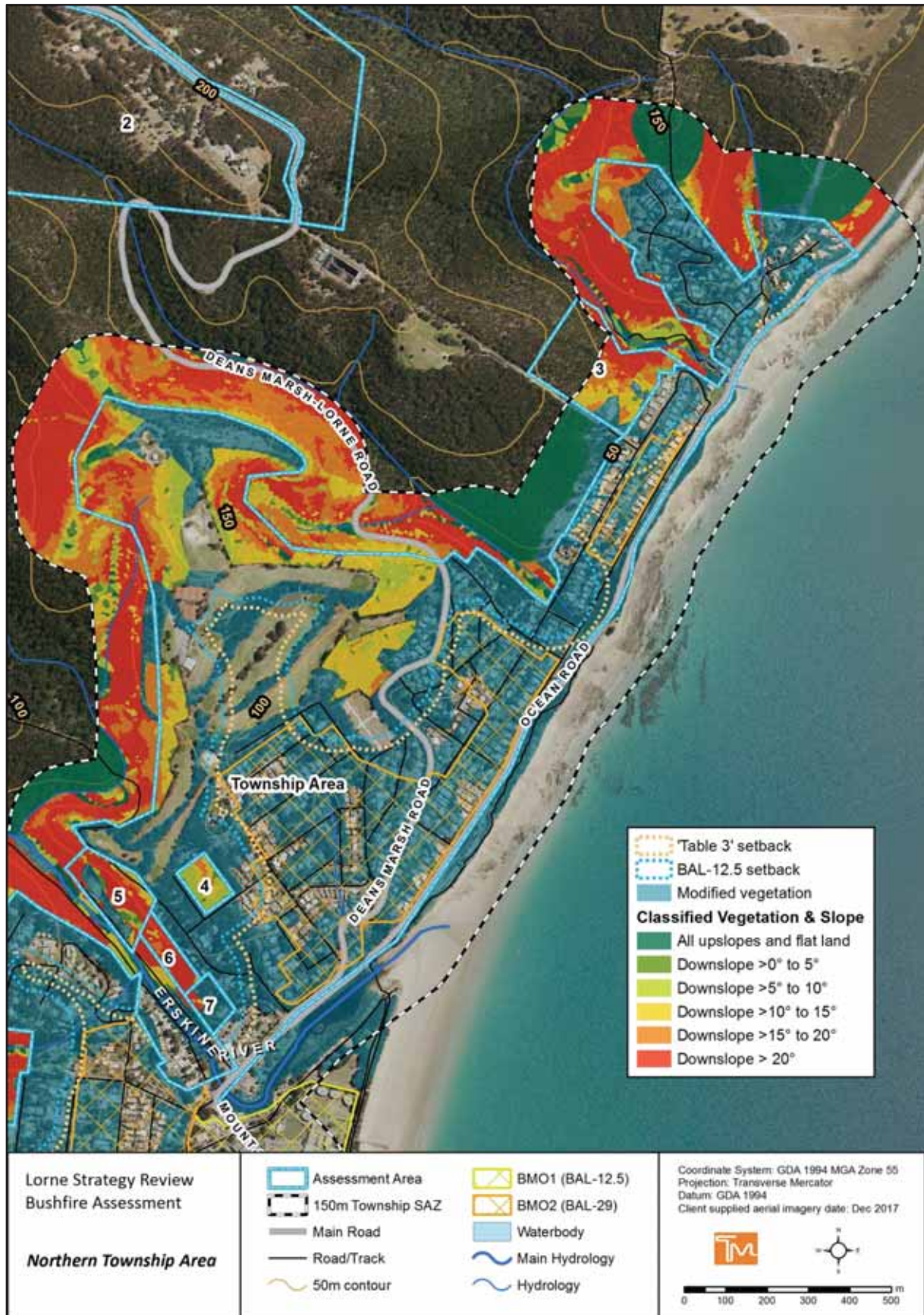
Summary conclusion

The Lorne township is an area of significant bushfire risk and therefore not a suitable location for intensification of development, or settlement growth, in accordance with the objective and strategies of Clause 13.02. However, infill development within the township is appropriate if it can comply with the BMO and BMO Schedule requirements. This is more appropriate in the southern township area (i.e. south of the Erskine River) which has better access to established BAL-12.5 locations, and somewhat less exposure to modified or other classified vegetation. The topography around the southern township area, whilst still steep, is also moderately less hazardous than the northern part of the township.

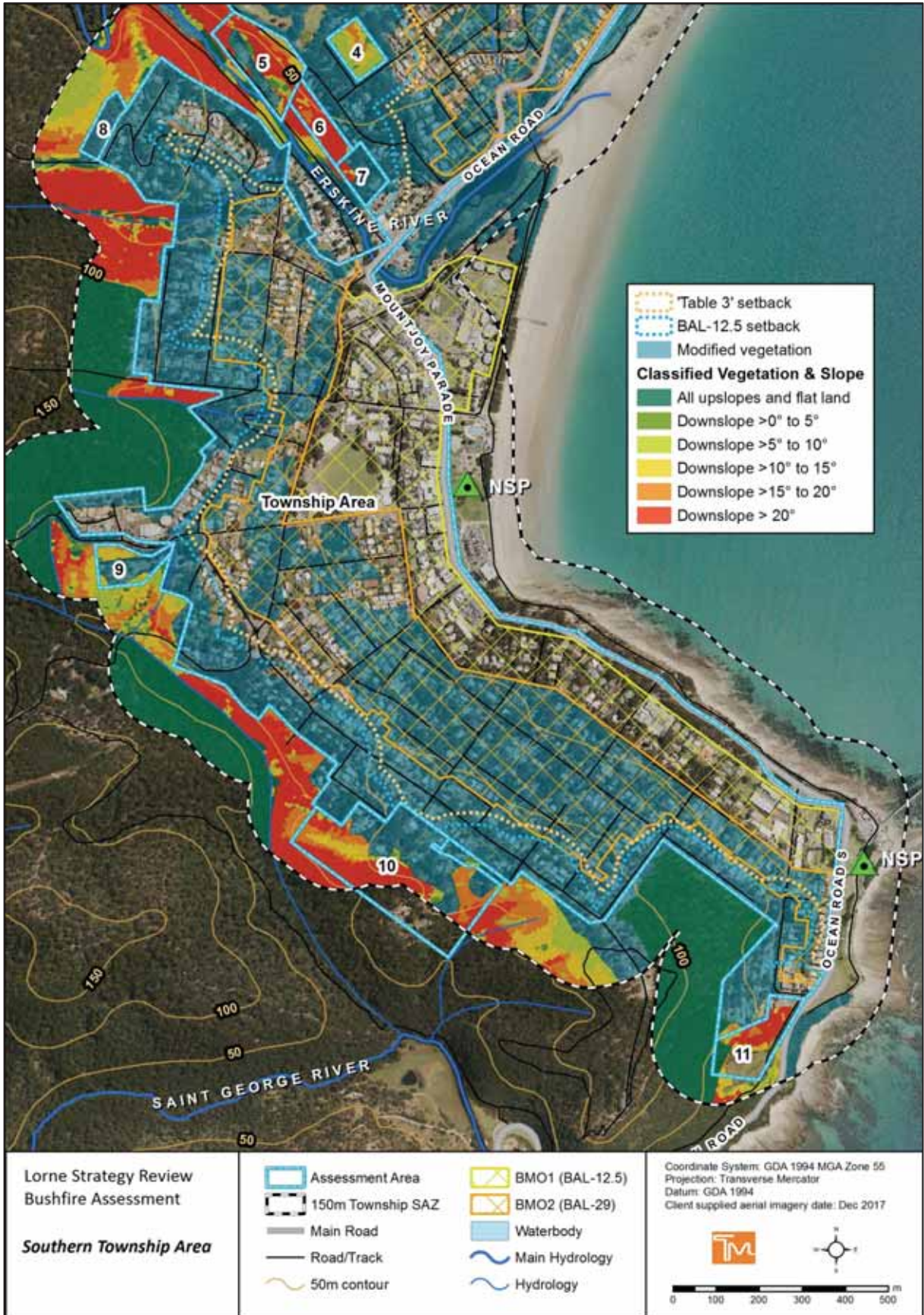
Development that extends the length of the township perimeter should generally be avoided, especially 'finger shaped' development that may result in exposure of development to hazardous vegetation on more than one aspect/direction.

However, opportunities to consolidate (simplify) the township edge should be investigated, especially where they can provide a 'hard edge' to the township that may increase the safety of existing buildings and development on or near the current township perimeter, which may not have been built to any BAL. The creation of non-vegetated land or defensible space with BAL-29 dwellings, may provide a 'buffer' between classified vegetation around the township and existing more vulnerable non-BAL rated buildings, thus increasing the setback of those buildings from hazardous vegetation and potential bushfire impacts.

In principle, the development of sites 3-11, in or on the township periphery, may help achieve this, although it is noted that these sites have particular characteristics that may mean they cannot or should not be developed (see the site analyses following).



Map 12 – Township area – north.



Map 13 – Township area – south.

5.3 Special investigation areas

All of the special investigation areas are in a landscape of significant bushfire risk, where bushfire behavior may exceed the presumptions underpinning the BMO/AS 3959 methodology. ***Accordingly, from a bushfire safety and compliance perspective in response to Clause 13.02 Bushfire, it is considered that there is little or no strategic merit for the identification of these sites within the Surf Coast Planning Scheme as being suitable for low density residential development or sustainable tourist accommodation.***

5.3.1 Site 1: Deans Marsh Road – North and Site 2: Deans Marsh Road - South

Map 2 to Clause 21.10 identifies these sites for investigation for sustainable tourism (SIA 1 in the Lorne Strategy Plan 2003 (Amended 2004)). For the purposes of this study, they have been split into a northern and southern site, shown as Site 1 and 2 respectively in the maps). Both sites are in the RCZ.

Hazard exposure

Site 1 to the north, is a relatively small area (7.2ha) surrounded by classified Forest (80% of the 150m site assessment zone), with approximately one third of that being on Downslopes exceeding 20° and another third being on Downslopes >10° - 20° (see Map 14).

Site 2 to the south is much larger (133.8ha) but is similarly surrounded by classified Forest (71% of the 150m site assessment zone), with approximately 23% being on Downslopes exceeding 20° and 50% on Downslopes >10° - 20°.

Both sites are exposed in all directions to high hazard forest on steep topography, with long fire runs possible from multiple directions.

RHF/BAL analysis

The northern site is unable to achieve a viable BAL-12.5 or 'Table 3' development envelope. It could potentially provide for BAL-29 development; however, this is a relatively small and constrained area within the middle of the site and would require vegetation removal to create defensible space.

Two hypothetical development areas were identified for the southern site, both focussed on existing cleared areas, one in the northwest and one in the southeast of the site (see Map 15). The site appears not to be able to achieve a viable 'Table 3' development envelope (without extensive vegetation removal) but could achieve a small BAL-12.5 area. It could potentially provide for BAL-29 development, but significant vegetation removal would be required to create defensible space.

Distance to an established BAL-12.5 area

The northern Site 1 is remote from and to the northwest of the township, approximately 7.8km by road from a BAL-12.5 area, with 76% of that travel route through Forest outside the township boundary. The southern Site 2 is closer to, but still some distance from, and to the northwest of the

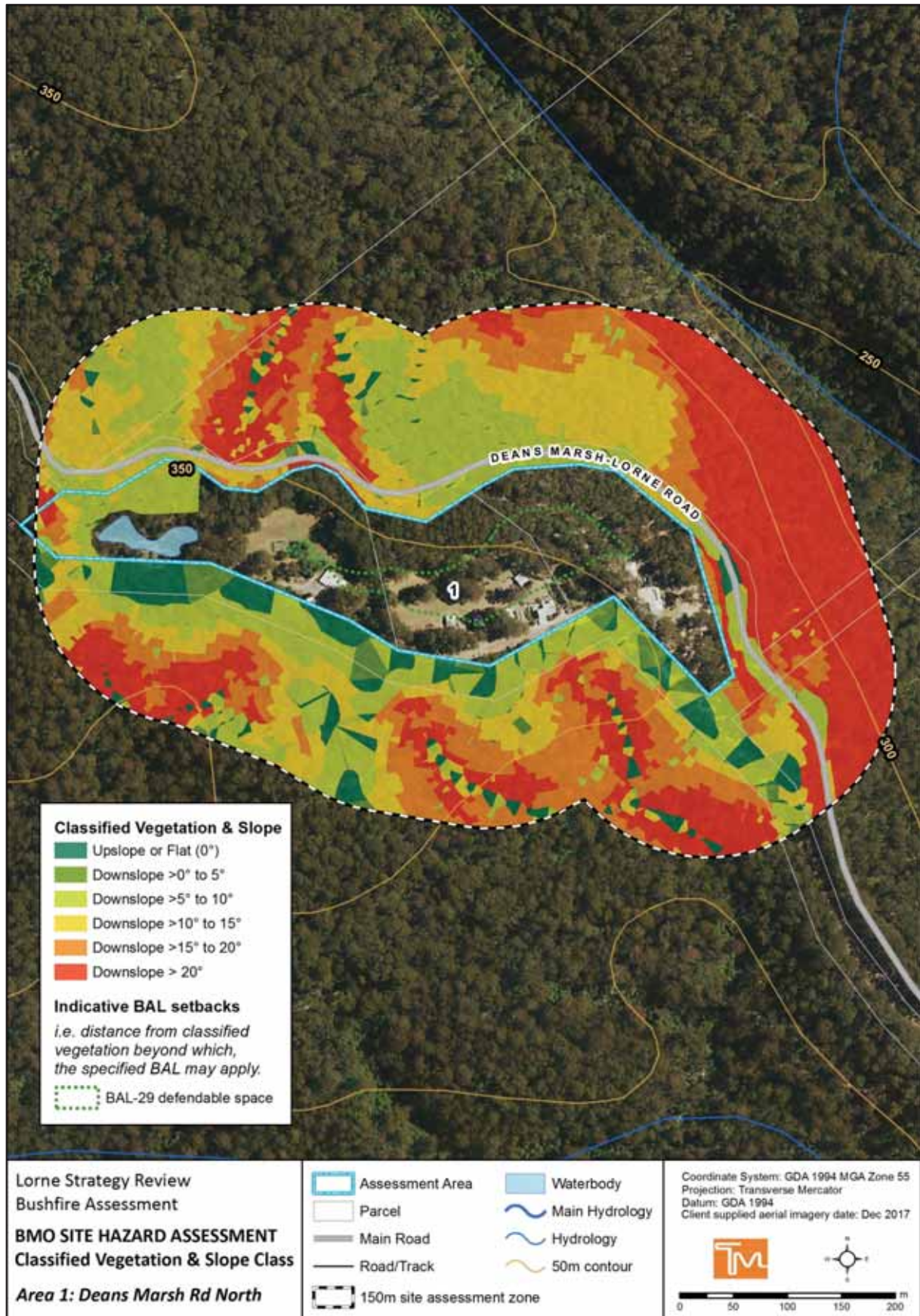
township. A 3.8km travel route by road is required to reach a BAL-12.5 area, with more than half of the route through Forest beyond the township boundary.

Summary conclusion

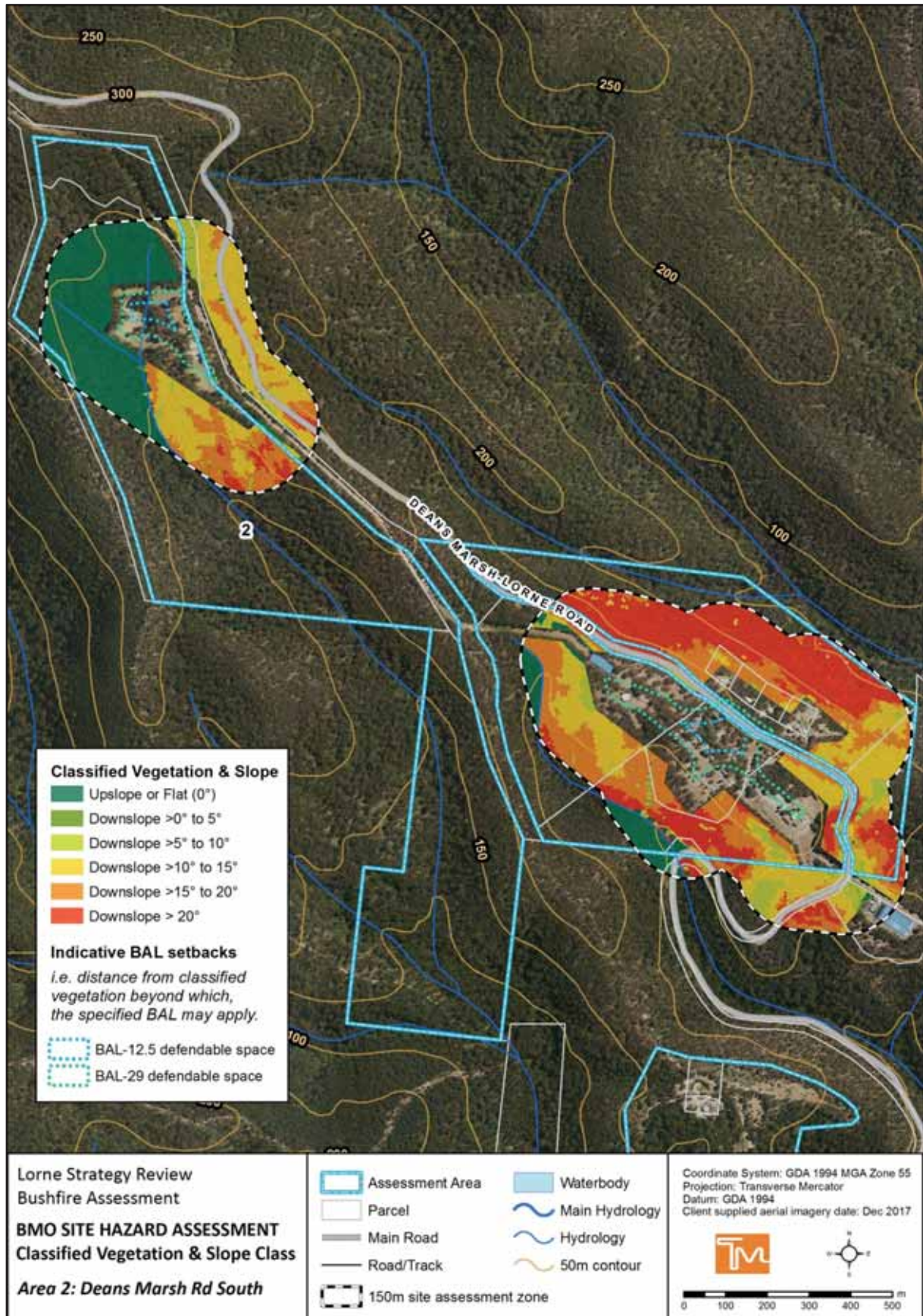
Neither site is well-suited to intensified development. The southernmost existing cleared or semi-cleared area within Site 2 may be able to support a small scale sustainable tourism development, but it is unlikely to achieve the required 'Table 3' defendable space without significant vegetation removal and only a small area appears able to achieve a BAL-12.5 development envelope.

Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome is contrary to that stipulated in the settlement planning strategies of Clause 13.02.

The relatively remote locations of these sites, their position in an extreme risk landscape surrounded by Forest on steep topography, and the likely amount of native vegetation removal that would be required to create defendable space, means they are not well suited to development.



Map 14 - Site 1: Deans Marsh Road – north.



Map 15 - Site 2: Deans Marsh Road – south.

5.3.2 Site 3: Northwest of Muir and Duncan Streets

Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable tourism (SIA 3 in the Lorne Strategy Plan 2003 (Amended 2004)). The site comprises approximately 5.65ha of land and is zoned RCZ.

Hazard exposure

This site is surrounded by classified Forest on three sides, comprising half of the 150m site assessment zone. However, depending on where future development would be located within the site, all of the Forest is arguably either upslope or flat in relation to the site.

RHF/BAL analysis

The site can achieve viable 'Table 3' and BAL-12.5 development envelopes, although it is exposed to some relatively small areas of modified vegetation in or adjacent to the township which means a minimum BAL-29 construction standard would likely be required. It could provide for BAL-29 development, and this higher standard is appropriate given the location of the site on the northwest edge of the township and its exposure to classified vegetation on three sides.

The analysis assumes the whole site could be managed as defensible space; however, it is recognised that this would require significant vegetation removal.

Distance to an established BAL-12.5 area

This site is located adjacent to the northern township area. A 2.2km travel route by road is required to reach a BAL-12.5 area, however the route is not high risk, being through either modified or low threat vegetation within the township boundary.

Summary conclusion

This site may be able to provide for some intensified development, but it would require significant vegetation removal including on steep slopes in the north of the site.

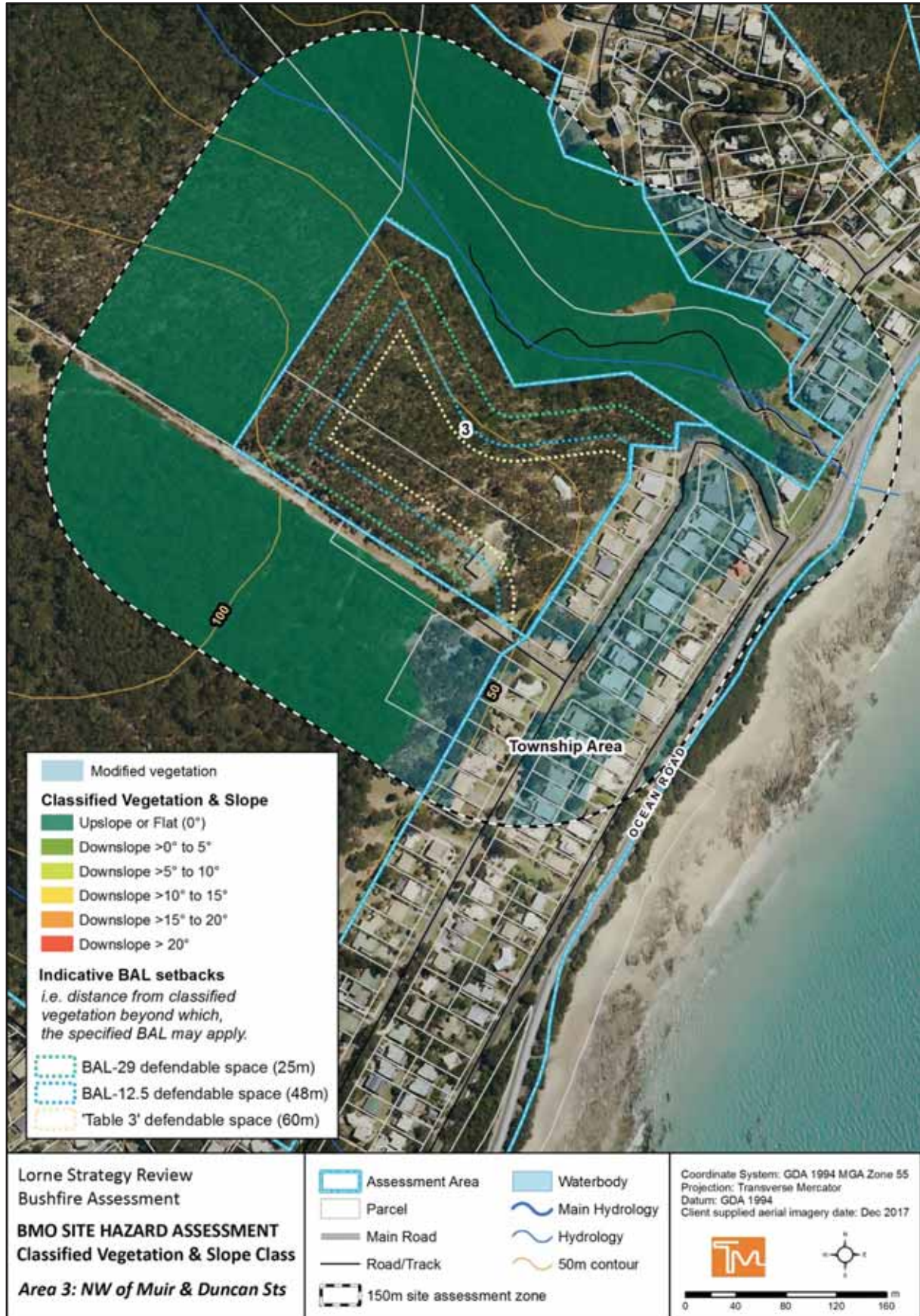
Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

Development of the site in a low threat state could provide risk reduction benefits for adjacent and nearby lots.

Refer to Map 16 and Table 9.



Figure 12 - Looking northwest across Site 3.



Map 16 - Site 3: Northwest of Muir and Duncan Streets.

5.3.3 Site 8: Northwest of Gardner and Heath Streets

This site comprises approximately 0.69ha of land abutting the western township boundary and is zoned RCZ. Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable Tourism (part of SIA 5 in the LSP 2003).

Hazard exposure

The site is exposed to classified Forest on very steep slopes exceeding 20° to the south and some similarly steep slopes above the Erskine River to the north. Relatively large areas of land to the west, southwest, north and northwest contain modified vegetation, with retained tree canopy but a more or less slashed understorey (see Figure 13). Accordingly, Map 17 shows modified vegetation extending for a 61m arc around the site from the north and west. 61m corresponds to the setback from Forest in the Downslope >15°-20° slope class, required for BAL-29 development. It appears however, that the modified vegetation may extend beyond this 61m area, further to the west, but this would need to be confirmed by more detailed site investigation.

RHF/BAL analysis

Theoretically, a small portion of the site may be able to achieve BAL-12.5, however, as with many other sites, the existence of modified vegetation invokes a minimum BAL-29 standard (which is considered appropriate given the significant bushfire hazard exposure). Note that further vegetation management would be required to enable BAL-29 development on the site, to ensure the setback from classified vegetation to the west, north and south (shown as the 61m area of modified vegetation) can meet the defensible space standards in Table 6 to Clause 53.02-5 (see Table 10). Additionally, increased defensible space may be required due to some downslopes exceeding 20°.

Distance to an established BAL-12.5 area

This site is located immediately adjacent to the western edge of the township area. The site is approximately 1km by road from the nearest BAL-12.5 area, with the route through modified and low threat vegetation within the township.

Summary conclusion

Some of this site could potentially provide for BAL-29 development, subject to the modified vegetation to the north, west and south being able to achieve defensible space standards.

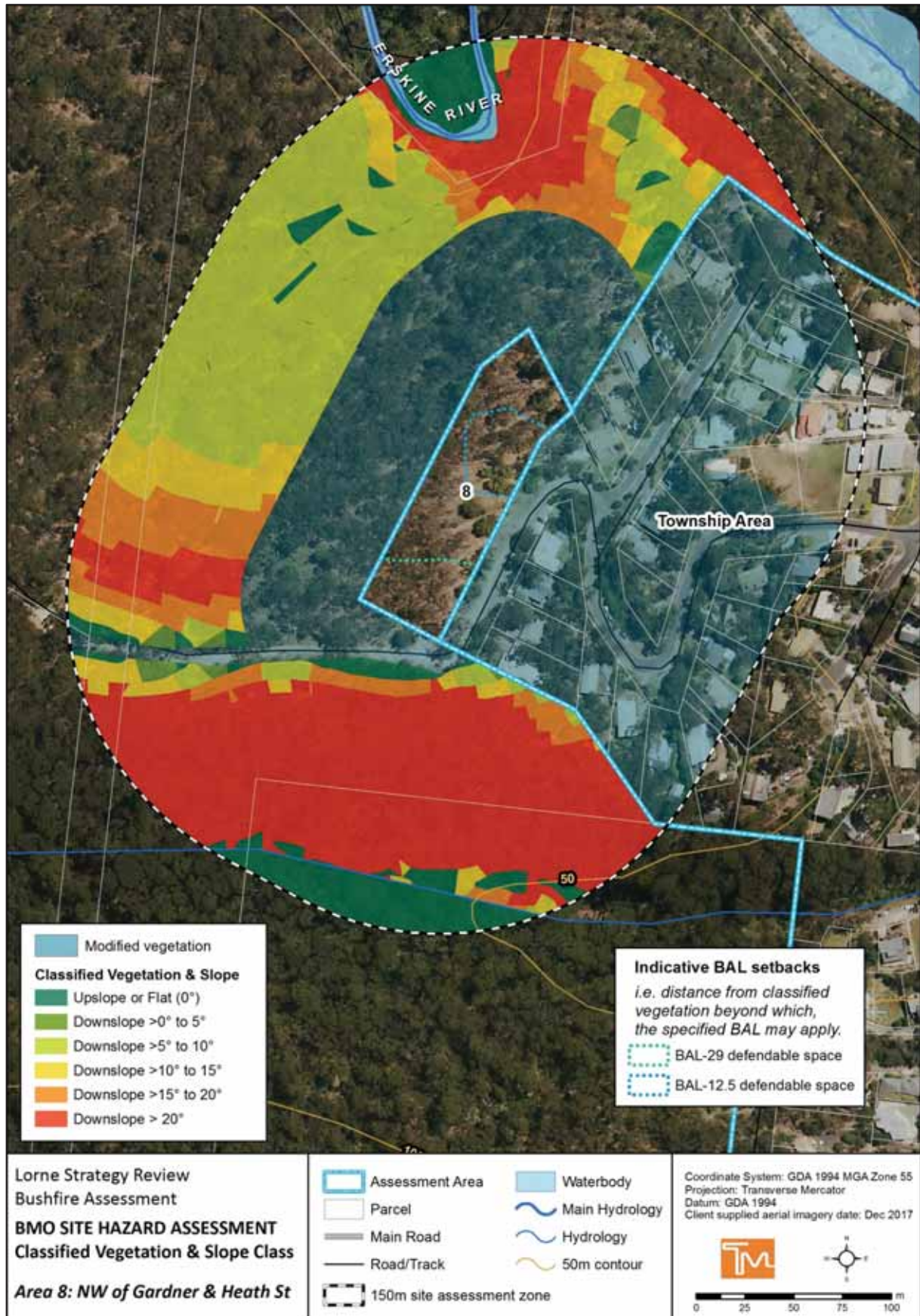
Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

Further site-specific investigation and consultation would be needed to confirm if this site has any development potential. The steep downslope to the south is a significant constraint to development near the southern end of the site.

Refer to Map 17 and Table 9.



Figure 13 - Looking northwest below Site 8 at modified vegetation.



Map 17 - Site 8: Northwest of Gardner and Heath Streets.

5.3.4 Site 9: Erskine Falls Road, west of Polwarth Street

This site comprises approximately 1.20ha of RCZ land abutting the western edge of the southern township area. Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable Tourism (SIA 6 in the LSP 2003).

Hazard exposure

The site is exposed to classified Forest to the west and south, and to modified vegetation in the road reserve to the north and in the township area to the east.

RHF/BAL analysis

The relatively small size of the site, and proximity of Forest on a downslope in two or more directions, means no part of the site is able to achieve a viable BAL-12.5 envelope or 'Table 3' defendable space area. Additionally, the exposure of the site to modified vegetation invokes a minimum BAL-29 standard. Only a small part of this site is shown as potentially enabling BAL-29 development.

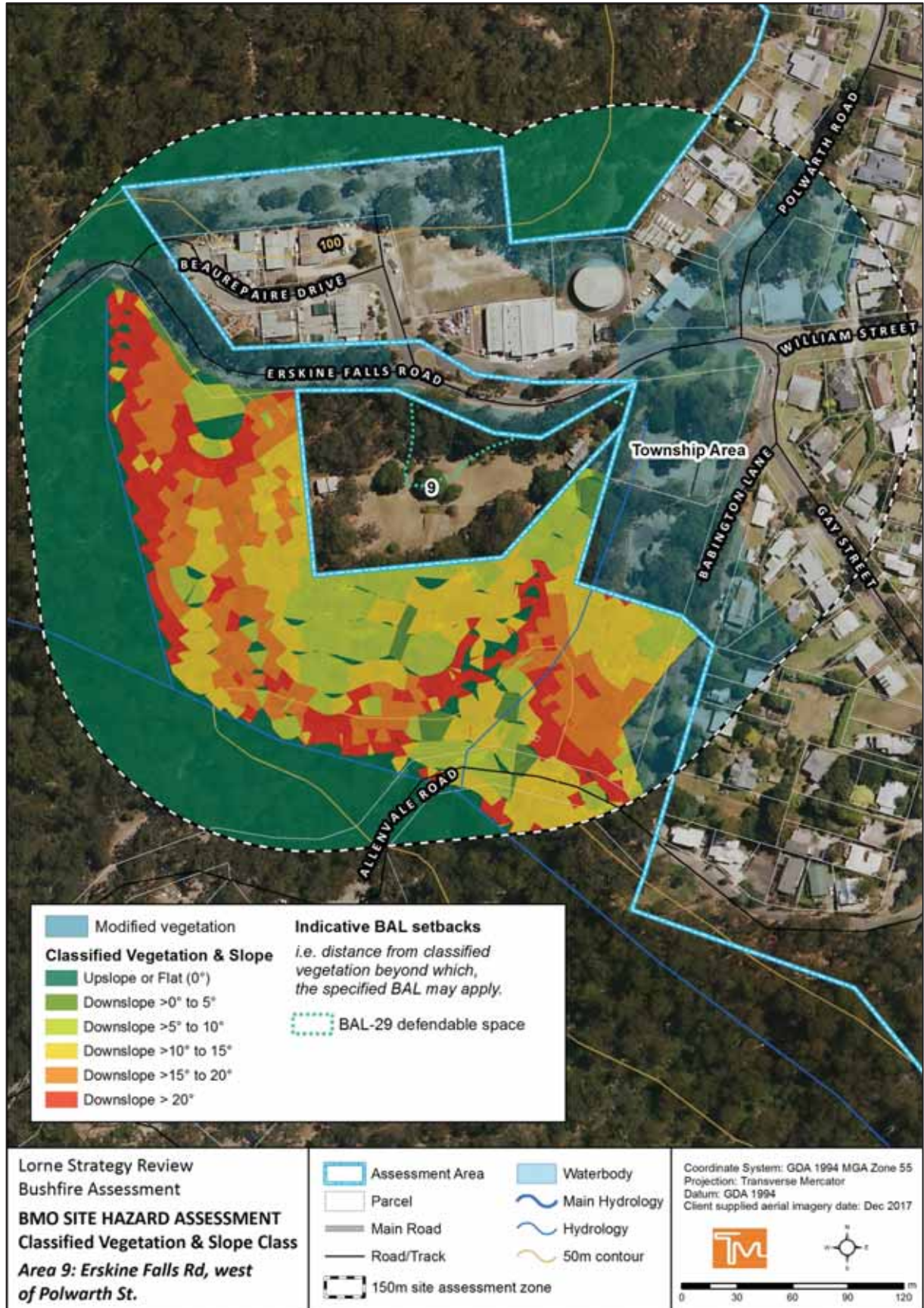
Distance to an established BAL-12.5 area

The site is only approximately 325m from the BAL-12.5 schedule area, with the route largely through low threat vegetation in the township.

Summary conclusion

BAL-29 development may be able to be achieved on this site, but development would be constrained to a relatively small area. The site has the advantage of being buffered (protected) to a large degree from a bushfire approach from the north, by the industrial development immediately to the north of the site across Erskine Falls Road. More detailed site investigation of the slopes and vegetation may result in an increase in the size of the 'potentially developable' BAL-29 area shown. However, a BAL-29 outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

Refer to Map 18 and Table 9.



Map 18 - Site 9: Erskine Falls Road, west of Polwarth Street.

5.3.5 Site 10: West of Fletcher Street

This site is located on the southwestern edge of the southern township area. Map 2 to Clause 21.10 identifies this site for investigation for Low Density Residential/Sustainable Tourism (SIA 7 in the LSP 2003). It comprises approximately 8.41ha of RCZ land.

Hazard exposure

The site is exposed to classified Forest on three sides, including on very steep downslopes exceeding 20° to the south and west-northwest. 51% of the classified Forest in the site assessment zone is on a downslope exceeding 20°.

RHF/BAL analysis

Theoretically, some of the site can achieve BAL-12.5 or Table 3 setbacks as shown, but for the presence of modified vegetation to the north which invokes a minimum BAL-29. Some of this site could potentially provide for BAL-29 development, which it is considered should be the minimum standard to apply to any future development on the perimeter of the town. However, substantial vegetation management would be required for BAL-29, including on very steep slopes, to ensure the setbacks from classified vegetation to the west, northwest, south and southwest can meet the defensible space standards in Table 6 to Clause 53.02-5 (see Table 10).

Distance to an established BAL-12.5 area

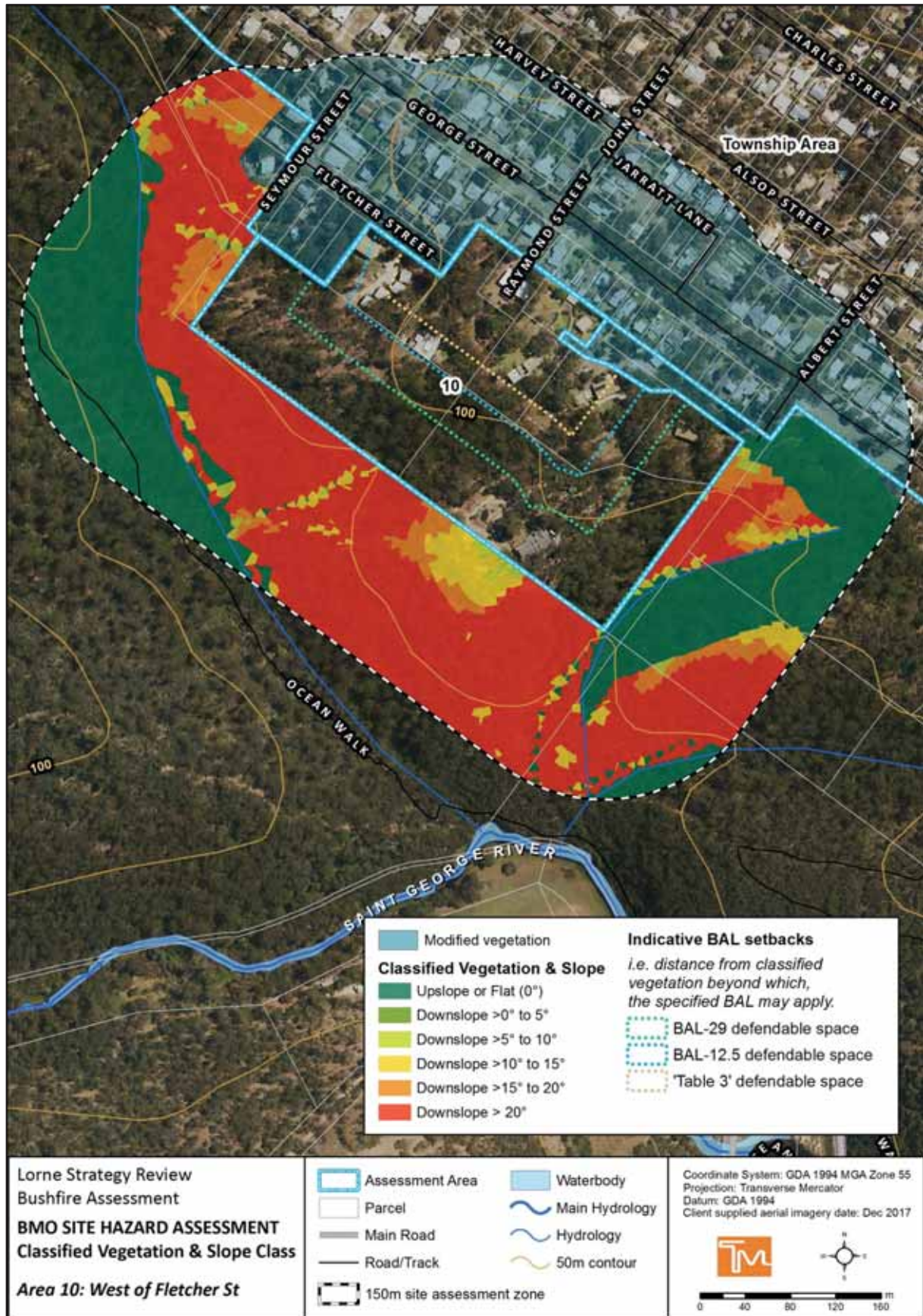
The site is only 385m from the BAL-12.5 area, with the route through modified or low threat vegetation within the township.

Summary conclusion

The site could potentially provide for some BAL-29 development, subject to the amount and location of vegetation removal that can be achieved to create defensible space. It is important to note the constraints imposed by the steep topography and that greater distances for defensible space would likely be required due to downslopes exceeding 20°.

Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

Refer to Map 19 and Table 9.



Map 19 - Site 10: West of Fletcher Street.

5.3.6 Sites 12-13: Allenvale North and South

Map 2 to Clause 21.10 identifies these sites for investigation for Low Density Residential/Sustainable Tourism (SIA 8 in the LSP 2003). For purposes of this study, they have been split into a northern and southern site, shown as Site 12 and 13 respectively in the maps. The northern half of Site 12 is identified as an investigation area for Sustainable Tourism. The balance of Site 12 and all of Site 13 is identified as an investigation area for Low Density Residential/Sustainable Tourism. Each site comprises an area of approximately 37ha of land in the RCZ. Two existing, largely cleared areas are identified as 'hypothetical development areas', a smaller area within the southern boundary of Site 12 and a larger more centrally located area within Site 13.

Hazard exposure

Both sites are surrounded by extensive areas of classified Forest (66% of the 150m site assessment zone), however much of the Forest is upslope or flat in relation to the sites.

RHF/BAL analysis

The analysis shows a very small part of the site may be able to achieve a 'Table 3' development envelope, with two larger areas potentially able to achieve BAL-12.5 and also, therefore, provide for BAL-29 development.

Distance to an established BAL-12.5 area

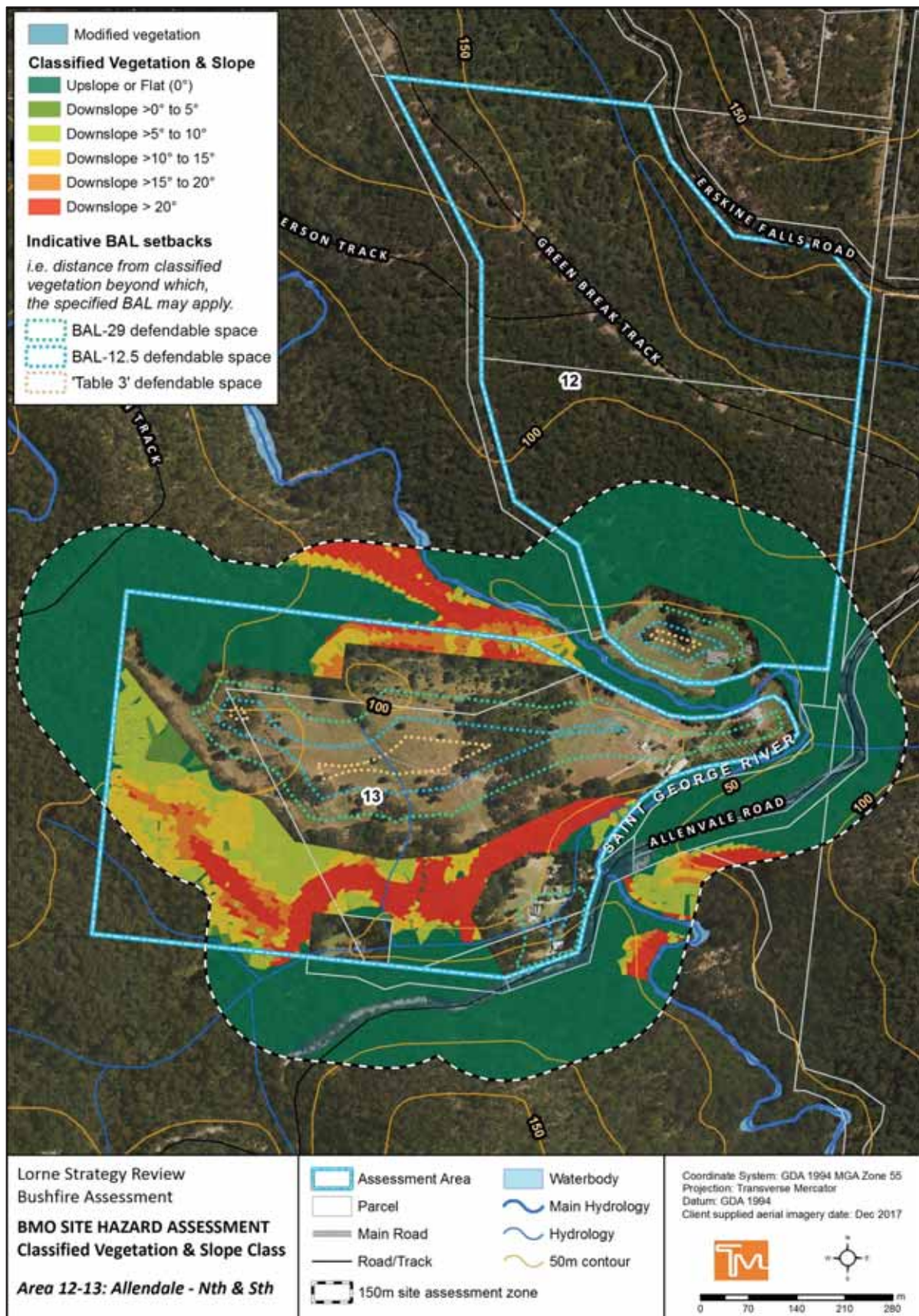
The location of these sites is over 1.5km to the southwest of the southern township area, with approx. 65% of that travel to reach a BAL-12.5 area being by one road only and through Forest outside the township boundary.

Summary conclusion

The distance of these sites from the township, their position in an extreme risk landscape surrounded by Forest vegetation on steep topography, and the likely amount of native vegetation removal that would be required to create defensible space, means they are not well suited to development under the strategies stated in Clause 13.02. A very small part of the existing cleared or semi-cleared area within Site 13 may be able to support small scale sustainable tourism development with 'Table 3' defensible space.

A larger area may provide for BAL-12.5 development, however both scenarios require vegetation removal for defensible space. Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

Refer to Map 20 and Table 9.



Map 20 - Sites 12-13: Allendale North and South.

5.4 Third party nominated sites

5.4.1 Site 4: Lascelles Avenue

This site comprises approximately 1ha of GRZ land located within the northern township area, east of the golf course.

Hazard exposure

The site is exposed to classified Forest on Sites 5 and 6, with 68% of the Forest on a Downslope exceeding 20°. However, all of the Forest is relatively distant from the site and only short runs are possible through the Forest on Sites 5 and 6. Therefore, an alternative measure may be able to be developed to reduce the 'default' setbacks shown from this vegetation. The site itself, however, also comprises Forest vegetation that would need to be managed as defensible space in any development scenario.

RHF/BAL analysis

This site could provide for intensified development, with much of the site, at least 'theoretically', able to achieve 'Table 3' setbacks, and almost all of the site able to achieve BAL-12.5 setbacks. A key constraint, however, is that the defensible space distances for these BAL outcomes are on land outside the site boundary, over modified vegetation that does not meet defensible space standards. The site is therefore suitable only for BAL-29 development; however, this would require vegetation removal across the site.

Distance to an established BAL-12.5 area

The site is only 776m from the BAL-12.5 area, most of the route is through modified vegetation within the township boundary.

Summary conclusion

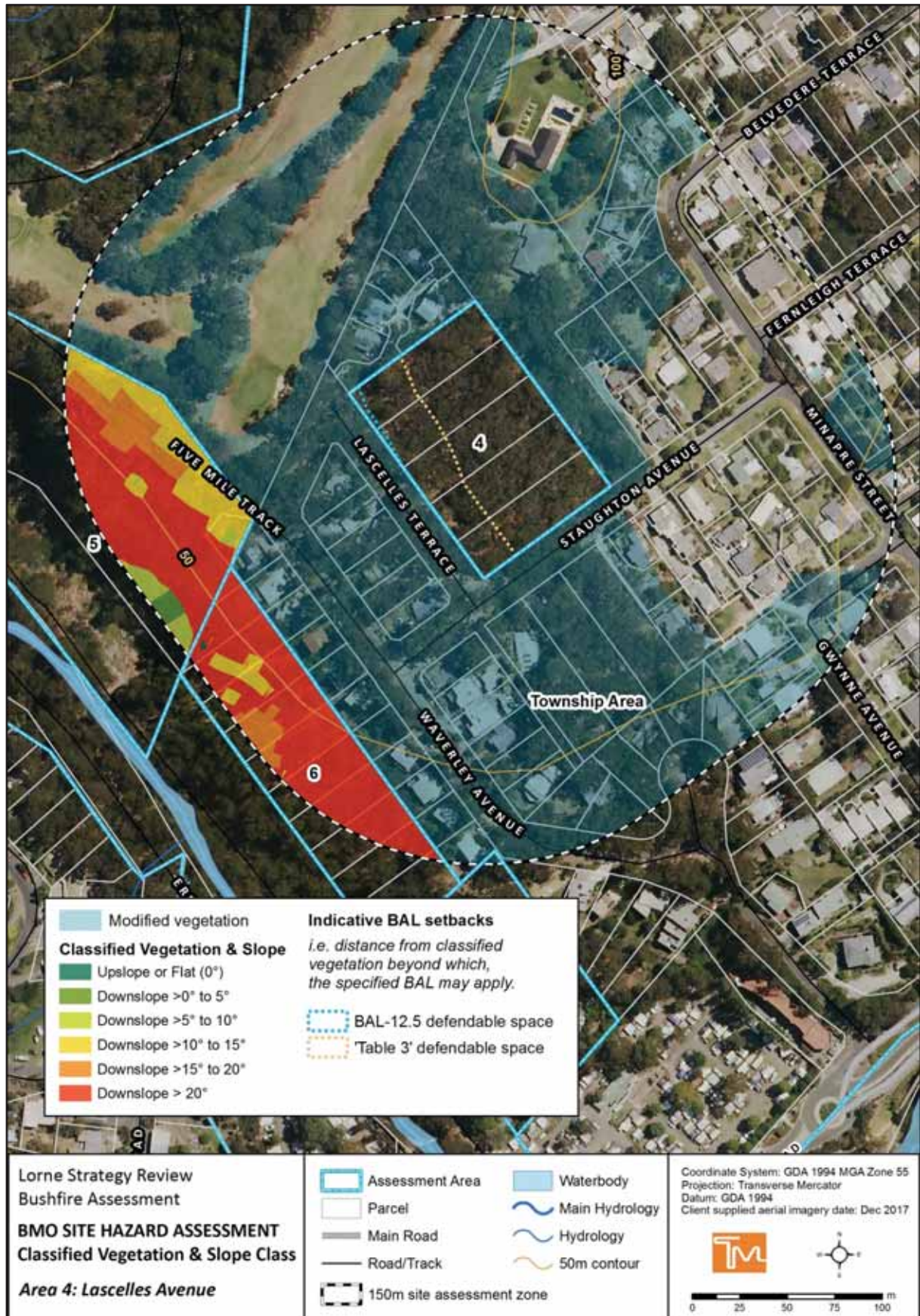
If able to be managed to defensible space standards (which would require extensive vegetation removal), the whole site could provide for BAL-29 development. Development of this site would also remove an area of classified vegetation within the township that poses a hazard to existing development.

Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

Refer to Figure 14, Map 21 and Table 9.



Figure 14 - Looking northwest across Site 4.



Map 21 - Site 4: Lascelles Avenue.

5.4.2 Site 5: Former quarry

This site comprises approximately 2.57ha of PCRZ land to the south of, and abutting, the Lorne Country Club and Golf Course. It is not identified in Map 2 of Clause 21.10 but is shown as SIA 4 in the LSP 2003.

Hazard exposure

The site is extremely steep, especially the northern half which has a gradient exceeding 20°. It is located on land above and to the northeast of the Erskine River. Given the short lengths of downslope below the site and to the east, on sites 6 and 7 above the Erskine River, for the purposes of this study these areas have been assigned the 'All upslopes and flat land' slope class. However, this would need further analysis if any development were to occur and may result in a decrease in the developable area.

The site is exposed for Forest vegetation to the northwest, west, south and southwest. However, except to the west, the length of fire runs possible in the other directions is relatively short, due to the township development that occurs just further to south and southwest (see Map 22).

The future development of Site 6 (which was nominated for investigation by third parties) is an influence on this site. Currently, it comprises classified vegetation and therefore constrains the development potential of the site to the southeast. Site 4 is distant enough not to be a constraint.

RHF/BAL analysis

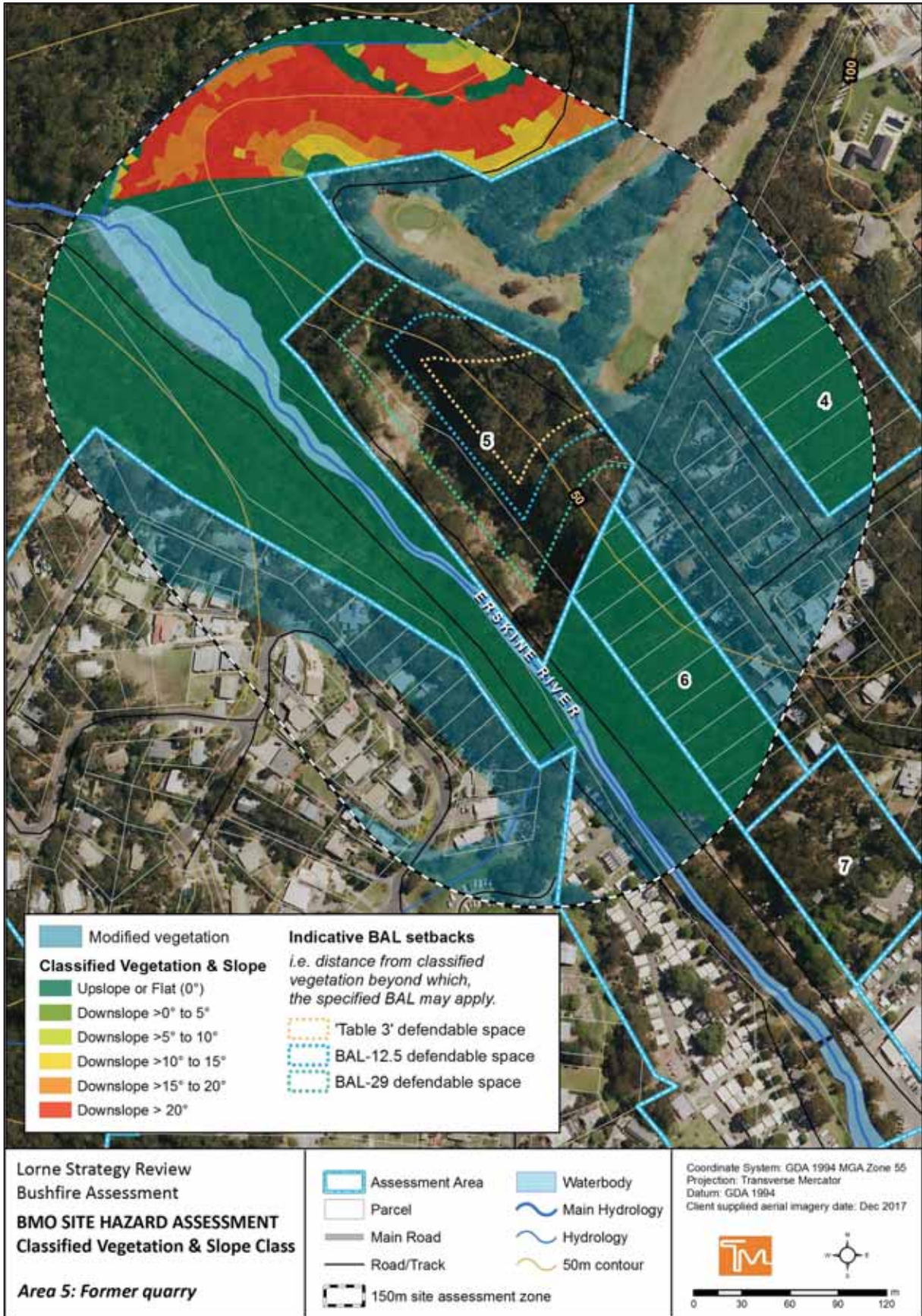
It appears able to achieve a viable Table 3 and BAL-12.5 setback from classified vegetation, however the defendable space for these BAL outcomes is on land outside the site boundary, over modified vegetation in the Country Club and township, which does not meet defendable space standards. The site may be suitable for some BAL-29 development, however the zoning, narrowness and steepness of the site are significant constraints.

Distance to an established BAL-12.5 area

Site 5 is only just over 0.5 km from a BAL-12.5 area.

Summary conclusion

It is unlikely that this site could provide a viable development area, even for BAL-29 development due to the constraints imposed by the steep topography. Whilst a BAL-12.5 area may in theory be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02, and these would be invoked if a planning scheme amendment was required to rezone the site to enable development. Refer to Map 22 and Table 9.



Map 22 - Site 5: Former Quarry.

5.4.3 Sites 6 & 7: Waverley Avenue and Erskine Avenue

These sites are located on very steep land above and to the northeast of the Erskine River. The sites either abut or are within the northern township area boundary. Both sites are zoned GRZ, with Site 6 just over 1ha in size and Site 7 just under 1ha. To the northwest Site 6 abuts Site 5, the former quarry (see Map 23).

Hazard exposure

Both sites are exposed to Forest vegetation between their southwest boundaries and the Erskine River below the sites. They are also exposed to modified vegetation on lots to northeast and southwest, and in the golf course to the north.

RHF/BAL analysis

As they are contiguous to each other, they have been assessed together. The former quarry, Site 5, currently comprises mainly classified Forest with some small areas of modified vegetation. The sites may be suitable for some BAL-29 development if vegetation can be managed, however this would require vegetation removal on very steep slopes.

The narrowness of the sites, especially Site 6, is also a constraint. It is possible that this site cannot provide a large enough viable development area for a BAL-29 outcome, even if Site 5 were to be developed and managed as defensible space.

Site 7 appears to be able to provide a viable BAL-29 development area.

Given the short lengths of slope up from the Erskine River, for the purposes of this study they have been deemed to be in the 'All upslopes and flat land' slope class. However, this would need further analysis if any development were to occur and may result in a decrease in the developable area.

Distance to an established BAL-12.5 area

The furthest of the sites, Site 6, is less than 0.5 km from a BAL-12.5 area.

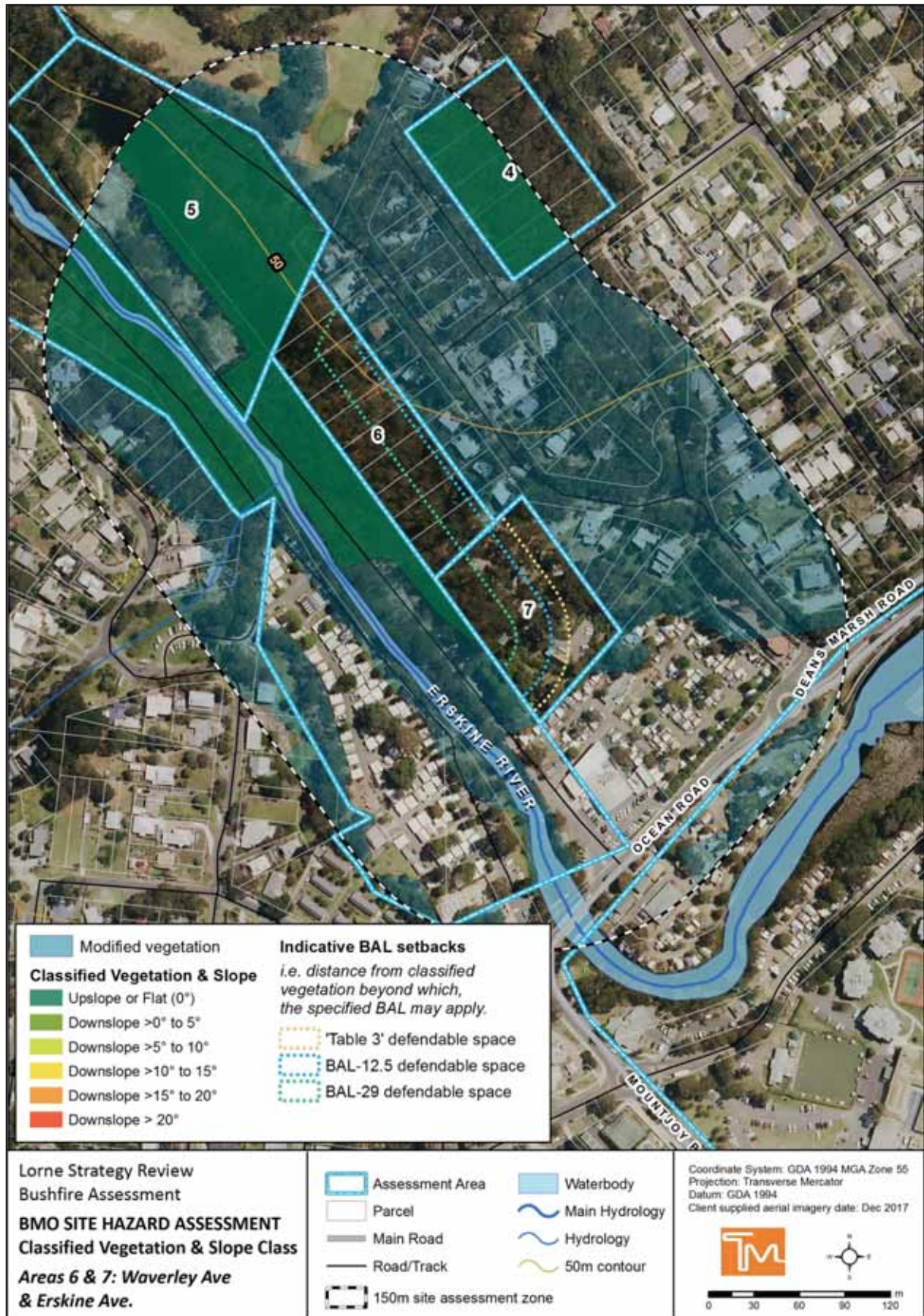
Summary conclusion

The steepness of the sites is a likely significant constraint to development and vegetation removal to create defensible space. Due to the occurrence of modified vegetation, only BAL-29 (or higher) development would be possible, although Site 7 can 'theoretically' achieve a viable BAL-12.5 setback area. Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

Refer to Figure 15, Map 23 and Table 9.



Figure 15 - Looking northwest along the track northeast of the Erskine River, below Site 6.



Map 23 - Sites 6 and 7: Waverley and Erskine Avenues.

5.4.4 Site 11: Slaughterhouse site

This site is located on PCRZ land abutting the southeasternmost boundary of the township (see Map 24 and Figure 16).

Hazard exposure

To the east and southeast, the site is exposed to Shrubland on steep but short slopes below the Great Ocean Road, which grades up into Scrub vegetation above the road and then into taller Forest above the tramway walking track to the west and north of the site. Some small areas of substantially modified vegetation occur in the township to the north.

RHF/BAL analysis

The site can provide a viable, but small, area towards the centre and northern end of the site that achieves Table 3 and BAL-12.5 setbacks from classified vegetation. However, modified vegetation to the northwest may (or may not, subject to further investigation) necessitate BAL-29 development. Relatively large parts of the site may achieve BAL-29, but any rezoning would invoke the BAL-12.5 settlement planning strategy in Clause 13.02.

Distance to an established BAL-12.5 area

The site is approximately 330m from a BAL-12.5 area and the NSP located at the southern end of the township.

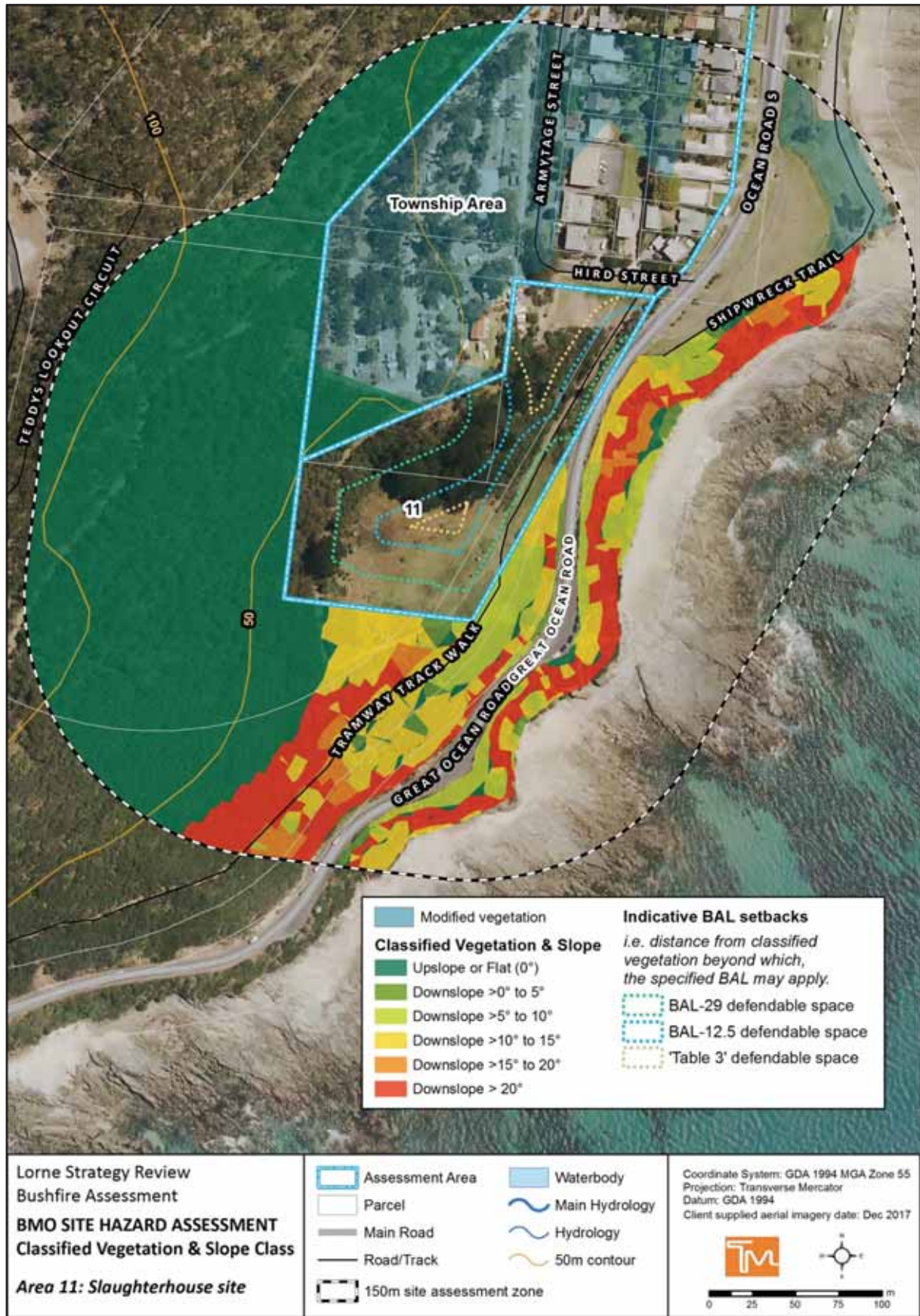
Summary conclusion

The site would be viable for BAL-29 development, and theoretically could achieve a BAL-12.5 and 'Table 3' development area, subject to the extent of exposure to modified vegetation. The development setbacks shown may be able to be reduced (i.e. the developable area increased) subject to development of an alternative measure that recognises the reduced risk from the east due to the short slopes and small areas of Scrub/Shrubland that occur in this direction.

Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on the site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02, and these would be invoked if a planning scheme amendment was required to rezone the site to enable development.



Figure 16 – Looking west at the site from the Great Ocean Road, showing Shrubland along the eastern boundary.



Map 24 - Site 11: Slaughterhouse site.

5.4.5 Site 14: 2530 Great Ocean Road

This site is in the RCZ and relatively remote from the township, in a valley approximately 4.5km to the southwest of Lorne (see Map 9 and Map 25).

Hazard exposure

The site is surrounded by classified Forest and Woodland (75% of the 150m site assessment zone), but much of it (68%) is upslope or flat in relation to the site.

RHF/BAL analysis

The analysis shows the site could achieve a viable BAL-12.5 or 'Table 3' development envelope if the required surrounding areas of defendable space within the site can be created and managed at the standards in Table 6 to Clause 53.02-5. Similarly, the site could provide for BAL-29 development.

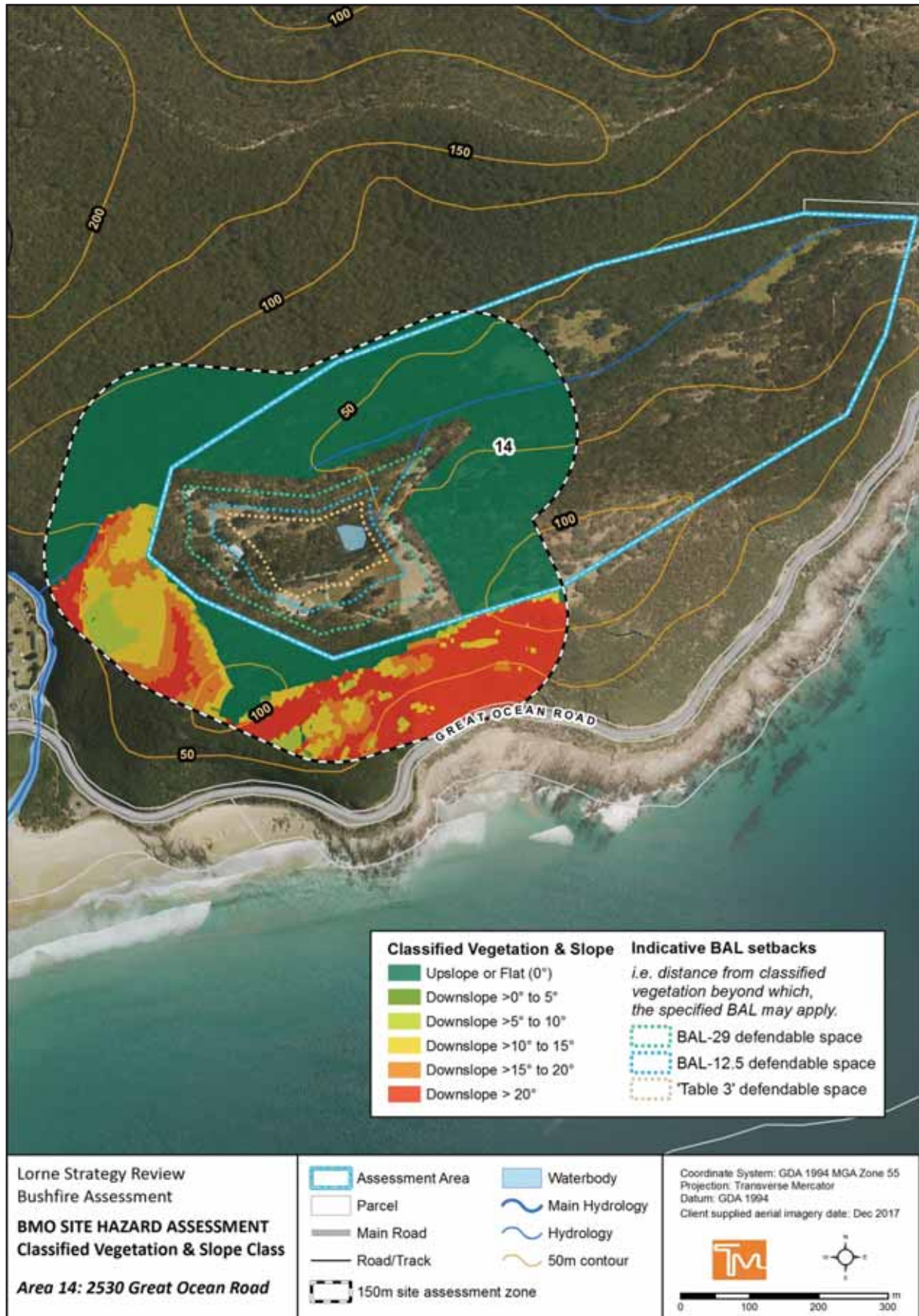
Distance to an established BAL-12.5 area

The site is approximately 4.8km by road to a BAL-12.5 area, with 94% of that travel route through Forest and Scrub vegetation outside the township boundary.

Summary conclusion

Whilst the site is large enough to provide for BAL-12.5 development, if the required area of vegetation can be removed and managed as defendable space, the significant landscape risk and relatively isolated setting of the site, means it is not well-suited to intensified development.

Whilst a BAL-12.5 area may be achievable, it is considered that BAL-12.5 development is not appropriate due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Any development would likely be required to have minimum BAL-29 buildings with increased defendable space as an additional protective measure, e.g. BAL-29 buildings with BAL-12.5 defendable space. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.



Map 25 - Site 14: 2530 Great Ocean Road.

Table 9 - Summary attributes of sites additional to the Township area.

Site No.	Site Name	Proportion of slope classes under classified vegetation in the 150m site assessment zone (SAZ)			Vegetation		BALs			Travel distance to BAL-12.5 schedule area		
		Upslope or Downslope to 10°	Downslope >10° - 20°	Downslope >20°	Type(s) of classified vegetation in 150m SAZ	% area of 150m SAZ comprising classified vegetation	% area of 150m SAZ comprising modified vegetation	Viability Table 3' defendable space area	Viability BAL-12.5 defendable space area	Viability BAL-29 defendable space area	Distance by road (m)	% of distance that is beyond the township area
1	Deans Marsh Road – North (SIA)	31%	30%	30%	Forest	80%	0%	No	No	Yes	7,812	76%
2	Deans Marsh Road – South (SIA)	27%	50%	23%	Forest	71%	0%	No	Yes, small	Yes	3,820	53%
3	Northwest of Muir and Duncan Streets (SIA)	100%	0%	0%	Forest	49%	17%	Yes, but exposed to modified vegetation	Yes, but exposed to modified vegetation	Yes	2,177	0%
4	Lascelles Avenue	4%	27%	68%	Forest	11%	56%	Yes, but exposed to modified vegetation	Yes, but exposed to modified vegetation	Yes	776	0%
5	Former quarry site (SIA)							Yes, but exposed to modified vegetation	Yes, but exposed to modified vegetation	Yes	570	0%
6	Waverley Avenue	78%	8%	14%	Forest	25%	40%	No	No	Yes	440	0%
7	Erskine Avenue							No	Yes, but exposed to modified vegetation	Yes	340	0%
8	Northwest of Gardiner and Heath Streets (SIA)	38%	20%	42%	Forest	52%	40%	No	Yes, but very small and exposed to modified vegetation	Yes	1,050	0%
9	Erskine Falls Road, west of Polwarth Street (SIA)	62%	28%	10%	Forest	48%	23%	No	No	Yes, very small	325	0%
10	West of Fletcher Street (SIA)	37%	12%	51%	Forest	48%	28%	Yes	Yes	Yes	385	0%
11	Slaughterhouse site	75%	13%	12%	Forest, Scrub & Shrubland	45%	15%	Yes, northern end but possibly exposed to modified vegetation	Yes, northern end but possibly exposed to modified vegetation	Yes	330	0%
12-13	Allenvale North & South (SIA)	79%	10%	11%	Forest	66%	3%	Yes, very small	Yes, small	Yes	1,550	65%
14	2530 Great Ocean Road	68%	15%	17%	Forest & Woodland	75%	0%	Yes	Yes	Yes	4,815	94%

6 Planning and design considerations

This section identifies design and planning compliance considerations for any future development in the study area, including a response to Clause 13.02 and published CFA guidance.

6.1 Design considerations

6.1.1 BALs and vegetation management

To satisfy key settlement planning strategies of Clause 13.02, for any rezoning proposal or development that triggers the Clause 13.02 use and development control, future dwellings and other buildings requiring a BAL (see Section 3.4), should be sufficiently setback from classified vegetation to enable a BAL-12.5 construction standard. In the BMO, the setback is the defensible space, which is defined in Clause 73.01 as *‘An area of land around a building where vegetation is modified and managed to reduce the effects of flame contact and radiant heat associated with bushfire’* (Surf Coast Planning Scheme, 2018i).

The vegetation management requirements for the defensible space are stipulated in Table 6 to Clause 53.05-5.

Table 10 – Vegetation management requirements for the defensible space as per Table 6 to Clause 53.02-5 (Surf Coast Planning Scheme, 2018d).

Vegetation management requirement
<p>Defensible space is provided and is managed in accordance with the following requirements:</p> <ul style="list-style-type: none"> • Grass must be short cropped and maintained during the declared fire danger period. • All leaves and vegetation debris must be removed at regular intervals during the declared fire danger period. • Within 10 metres of a building, flammable objects must not be located close to the vulnerable parts of the building. • Plants greater than 10 centimetres in height must not be placed within 3m of a window or glass feature of the building. • Shrubs must not be located under the canopy of trees. • Individual and clumps of shrubs must not exceed 5 sq. metres in area and must be separated by at least 5 metres. • Trees must not overhang or touch any elements of the building. • The canopy of trees must be separated by at least 5 metres. • There must be a clearance of at least 2 metres between the lowest tree branches and ground level <p>Unless specified in a schedule or otherwise agreed in writing to the satisfaction of the relevant fire authority</p>

These standards are onerous and, for heavily vegetated sites, would likely require significant vegetation removal. This may be problematic, especially on steep sites where an erosion risk may

exist. The CFA typically consider that defensible space on slopes greater than 20° is not feasible, due to the practical constraints of managing vegetation on a very steep slope.

The defensible space setback is measured from the edge of the classified vegetation to the external wall of a building, excluding eaves, roof overhangs and some other building appurtenances¹⁹ (Standards Australia, 2018) (see Figure 17).

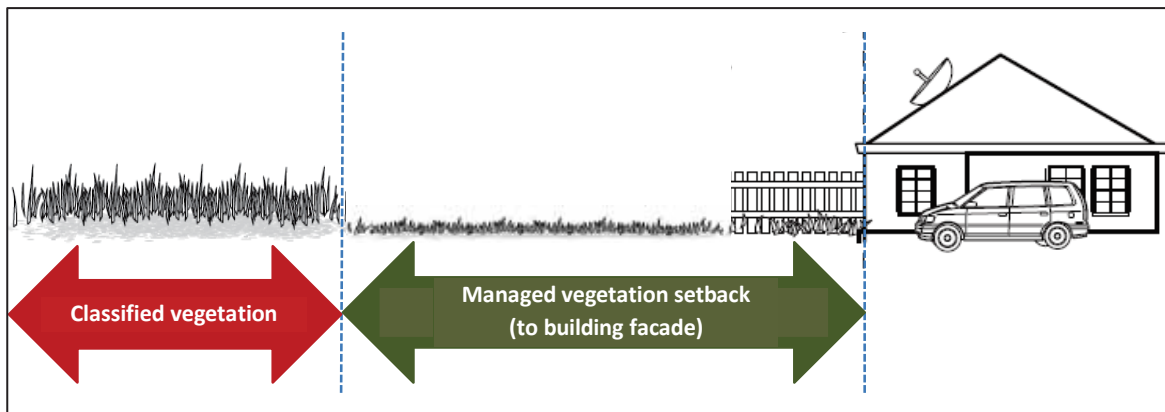


Figure 17 - Example of building-classified vegetation setback (adapted from CFA, 2013).

The applicable setbacks for both BAL-12.5 and BAL-29 in accordance with Tables 1 and 2 to Clause 53.02-5, and the greater 'Table 3' distances required for vulnerable uses (including accommodation other than a dwelling), in response to Forest in all slope classes, are provided in Table 11 below.

Note that Site 11 has some exposure to Scrub and Shrubland, and Site 14 has exposure to Woodland, which have lesser setback requirements. For simplicity, only Forest setbacks are shown in Table 11.

Note that whilst BAL-12.5 may theoretically be achievable on some sites, it is considered that BAL-12.5 development is not appropriate on any site, due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Additionally, many sites are exposed to modified vegetation which requires a minimum BAL-29 outcome.

Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on a site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

¹⁹ The setback distance is measured from the edge of the classified vegetation to the external wall of the building, or for parts of the building that do not have external walls (including carports, verandas, decks, landings, steps and ramps), to the supporting posts or columns. The following parts of a building are excluded:

- a) Eaves and roof overhangs.
- b) Rainwater and domestic fuel tanks.
- c) Chimneys, pipes, cooling or heating appliances or other services.
- d) Unroofed pergolas.
- e) Sun blinds (Standards Australia, 2018).

Table 11 – Defendable space distances in response to Forest, for BAL-12.5 (as per Table 1 and 2²⁰ to Clause 53.02-5) and BAL-12.5 (as per Table 3²¹ to Clause 53.02-5) (Surf Coast Planning Scheme, 2018d).

Slope class	Defendable space distance (m)		
	Table 1 and 2		Table 3
	BAL-29	BAL-12.5	BAL-12.5
All upslopes and flat land	25	48	60
Downslope >0° - 5°	32	57	70
Downslope >5° - 10°	39	69	85
Downslope >10° - 15°	49	82	105
Downslope >15° - 20°	61	98	125

It is important to note that those sites that are exposed to classified vegetation on a downslope exceeding 20°, would require increased development setbacks and defendable space calculated using 'Method 2' of AS 3959.

The defendable space should be wholly contained within the boundaries of the property the development is located on. Adjoining land may only be included within the defendable space, where that land meets the defendable space standards (see Table 10) and there is a reasonable assurance that the land will remain in that state in perpetuity.

6.1.2 Setbacks between buildings

In the 2015 fire that resulted on the loss of over 100 homes at Wye River and Separation Creek, house to house fire spread was a key factor in the ignition and loss of buildings. The combustion of other heavy fuel elements in close proximity to buildings was also a significant factor, including treated pine retaining walls, plastic water tanks, and building materials and other combustible items stored under or near buildings (Leonard *et al.*, 2016). Surface and near-surface fine fuels were extensive and provided a near continuous flammable fuel bed, which facilitated the fire spreading through the settlement, however, the built elements represented the majority of the fuel loads and these heavy fuels were a key factor in the house to house spread (Leonard *et al.*, 2016).

The Wye River/Separation Creek settlement has similar characteristics to many areas in the Lorne study area, including:

- Dwellings adjacent to or amongst native forest;
- Dwellings on steep, generally southeast facing slopes;
- Elevated sub-floor spaces;
- Narrow roads constrained by vegetation and steep topography; and
- Large areas of modified vegetation in close proximity to dwellings.

²⁰ For a dwelling, a dependent person's unit, industry, office or retail building.

²¹ For accommodation (other than a dwelling or dependent person's unit), a child care centre, an education centre, a hospital, leisure and recreation or a place of assembly.

In response to the Wye River/Separation Creek fire, guidelines for rebuilding were produced as a set of voluntary, integrated bushfire protection measures for those rebuilding (see Figure 18), to increase the bushfire resistance of rebuilt houses and hence, increase community resilience (Leonard and Short, 2016).

Some, or all of the voluntary bushfire protection measures, could be applied for new development in the Lorne Study Area, with particular consideration to:

- Using non-combustible fences and retaining walls;
- Keeping/storing exposed heavy fuel items at least 6m away from houses, or fully enclosing them within the house, or a shed built to the same BAL as the house;
- Separating adjacent houses from each other by at least 12m or, if both houses are BAL-29 compliant, 8m.
- Ensuring exposed sub-floor construction elements are non-combustible or enclosed by non-combustible cladding.

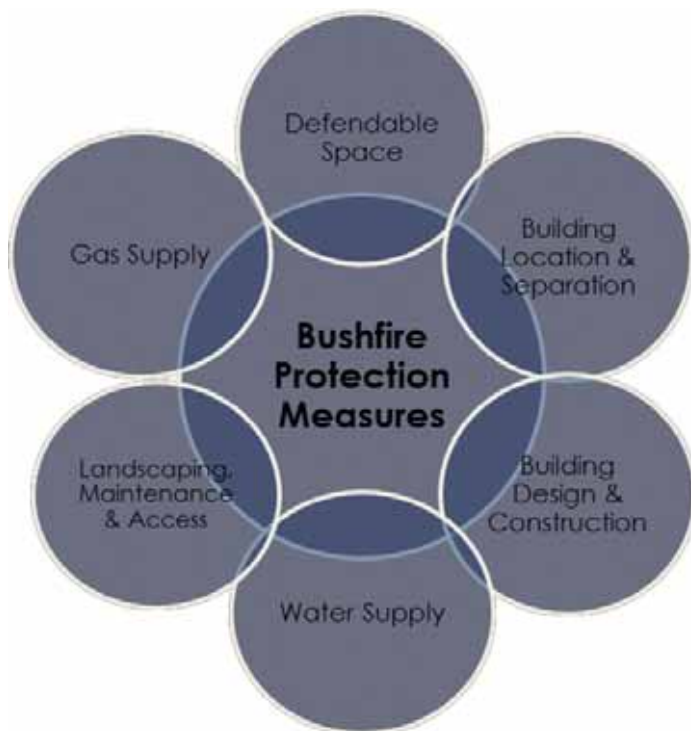


Figure 18 – Bushfire protection measures (Source: Figure 1 in Leonard and Short, 2016).

6.1.3 Perimeter roads

Perimeter roads are a highly desirable design feature in larger new developments; to achieve, or contribute to, BAL setbacks, separate future development from hazardous vegetation with a ‘hard’ non-vegetated edge, facilitate access/egress and property protection and fire fighting (see Figure 19).

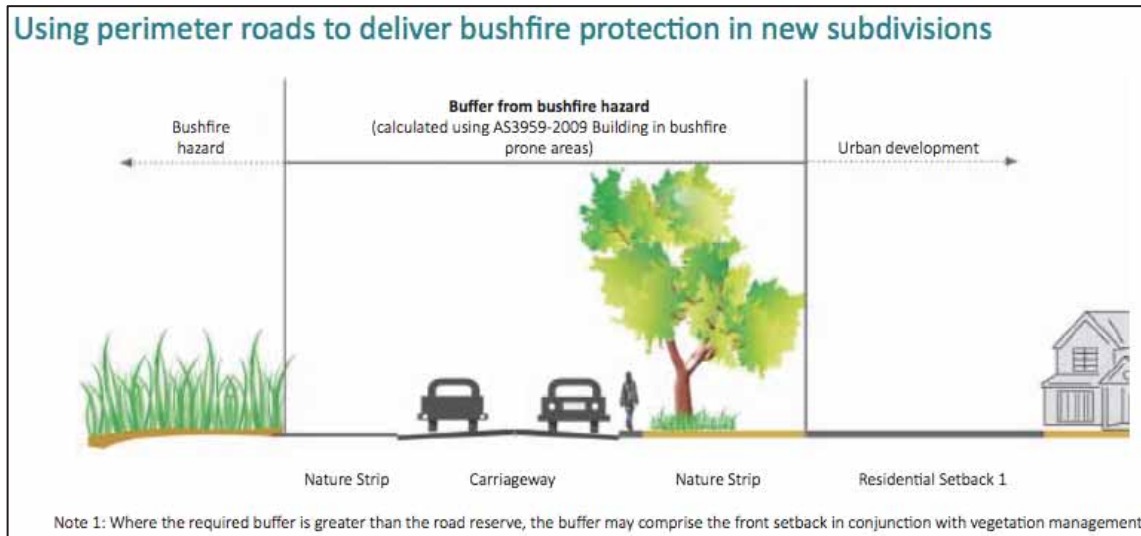


Figure 19 - Illustration of a perimeter road to provide required development setbacks (DELWP, 2015a).

6.2 Emergency Management Planning

Certain developments, such as those associated with tourism, could have large numbers of overnight and/or day visitors on a site during the fire danger period. For such developments an appropriate Bushfire Emergency Management Plan (BEMP) should be developed and implemented.

A BEMP should address a range of issues including:

- Triggers for closure and/or evacuation of the site, including closure on days of forecast elevated fire danger e.g. Total Fire Ban or Code Red days.
- Limiting the numbers of people on-site on other higher-risk days (e.g. days with a severe or extreme fire danger rating to the capacity of any designated shelter-in-place (SIP) buildings.
- Procedures for when, how, and to where, site occupants might be evacuated in the event of a bushfire that has potential to impact the site.
- Procedures for when and how a SIP response would be activated to ensure all site occupants can be moved to the comparative safety of a designated SIP buildings.
- Provision of appropriate bushfire safety information for visitors prior to, and in the event of, a bushfire.
- Staffing and resource arrangements to ensure BEMP measures will be able to be implemented, including monitoring of conditions, appropriate training, communications and equipment.

6.3 Summary response to Clause 13.02 Bushfire

The strategies stipulated in Clause 13.02 are detailed in the following sub-sections, and a summary response is provided about how development in the study area can potentially respond to the strategies.

6.3.1 Protection of human life strategies

Priority must be given to the protection of human life.

Prioritising the protection of human life over all other policy considerations

The study area is in a very high to extreme bushfire risk location. However, within the established township area, the protection of human life can be prioritised by ensuring future dwellings and other developments comply with the approved or alternative measures in the BMO.

The prevalence of modified vegetation in some parts of the established township area (e.g. many of those areas covered by BMO2) means that whilst BAL-12.5 construction is theoretically possible, as the properties are well setback from the Forest beyond the town boundary, in practice many are likely to remain exposed to modified vegetation on private property that will require a BAL-29 or higher response.

Any significant expansion of Lorne (other than infill) would require a strategic approach to managing Forest fuels on the periphery of the town, such as through the creation of substantial asset protection zones that meet or exceed the BMO standards for vegetation within defensible space areas.

The Joint Fuel Management Program that covers public land in the Otways is also critical to the bushfire protection of Lorne. The program aims to strategically reduce fuel hazard in areas where bushfires are likely to start, develop or travel through on route to the town. This means the program is planned, monitored and reported on, at a landscape scale (in terms of percentage risk reduction) and many of the burns contributing to the safety of the town occur in the hinterland remote from the town boundary.

Whilst DELWP and CFA guidance on assessing landscape scale bushfire risk includes consideration of public land fuel management, there is no quantitative method to account for its impact in reducing the likelihood of a locality being impacted by a 'BMO-style' large, intense bushfire. As the level of 'direct' protection provided to an individual property on the edge of Lorne will depend on when and where fuel reduction has occurred, this level of protection will vary over the lifespan of a dwelling. Thus, land use planning tends to focus on the concept of defensible space (i.e. intensive fuel management in the immediate surrounds of a building to reduce likelihood of flame and radiant heat ignition) rather than strategic broad-acre fuel management.

In more remote sites, or sites abutting the forest, development may not be achievable, or may require additional bushfire protection measures to be provided, including consideration of:

- An enhanced combination of BAL and defensible space, i.e. higher BAL and/or more defensible space e.g. BAL-29 construction with BAL-12.5 defensible space;
- Use of private fire shelters; and

- Appropriate emergency management planning to ensure the site will be vacant in the event of severe or higher fire danger conditions.

Directing population growth and development to low risk locations and ensuring the availability of, and safe access to, areas where human life can be better protected from the effects of bushfire.

As identified in Sections 4.1 and 4.2, the study area is in a significant risk landscape and there are no low risk locations identified. Arguably therefore, none of the sites has strategic justification for intensified development. The nearest *least* risk locations are areas that are not in the BPA, however these areas are distant to the study area, approximately 45km away (see Figure 1), and travel to them is through an extreme risk landscape.

Comparatively lesser risk areas within the main township area are the two designated Neighbourhood Safer Places (NSPs) and the BMO1 (BAL-12.5) area (see Map 1, Map 2, Map 12 and Map 13).

Sites 1, 2, 12, 13 and 14 are beyond the main township area and therefore have less ability to access the comparatively lesser risk BAL-12.5 areas and NSP locations. Development on them would be exposed to potentially extreme bushfire behaviour. They cannot therefore be considered low risk locations with safe access to areas where human life can be better protected from the effects of bushfire.

Sites 3, 5, 6, 7, 8, 9 and 10 have reasonable access to the comparatively lesser risk BAL-12.5 areas and NSP locations in the township. However, as they are located generally on the western edge of the township, they could also be exposed to potentially extreme bushfire behavior. Any proposed development of these sites should be carefully considered and aim to have a minimum BAL-29 construction standard with maximum defensible space. A significant constraint for these sites, however, is that they would require vegetation removal on steep slopes. Due to the existing extent of modification of vegetation to the west and northwest of Site 8, this factor may be less of a constraint for this site.

Development of Site 4 would comprise infill development in a location within the township boundary and this site is, therefore, more suited than any other site to residential or other development. Development of this site would, however, require vegetation removal that may result in unacceptable biodiversity impacts (see 'Section 6.3.4 Areas of high biodiversity conservation value').

Site 11 has reasonable access to the comparatively lesser risk BAL-12.5 area and NSP location in the south of the township. It has potential for BAL-29 development and, due to its proximity to the coast and the township, is comparatively less exposed to hazardous vegetation. However, its PCRZ zoning may be an obstacle to development.

Reducing the vulnerability of communities to bushfire through consideration of bushfire risk in decision-making at all stages of the planning process

This report provides the basis for incorporating bushfire risk into decision making associated with planning development in the study area.

The CFA consider that community resilience to bushfire will be strengthened (and hence, presumably, vulnerability to bushfire will be reduced) when a strategic planning proposal demonstrates that Clause 13.02 strategies have been applied, and where a proposal takes advantage of existing settlement patterns so that new development will not expose the community to increased risk from bushfire.

The CFA provide principles to respond to Clause 13.02 including that settlement planning decisions should;

- *'Direct development to locations of lower bushfire risk.*
- *Carefully consider development in locations where there is significant bushfire risk that cannot be avoided.*
- *Avoid development in locations of extreme bushfire risk.*
- *Avoid development in areas where planned bushfire protection measures may be incompatible with other environmental objectives'* (CFA, 2015).

The Otways are an extreme bushfire risk landscape and development of some sites cannot meet the settlement planning objective in Clause 13.02 that RHF not exceed 12.5kW/m², nor satisfy the CFA strategic planning principles for bushfire.

Some of the investigation sites examined in this study have, however, been found capable of providing areas where BAL-29 (or lower) construction could occur. The ability to construct a dwelling to the BAL indicated by a BMO/AS 3959 site assessment does not necessarily make the site a safe place to be during a bushfire. Experience has shown that residents will respond to bushfire in a multitude of ways, but which can be broadly summarised as leaving early well before they are in direct danger, leaving late when the bushfire is active in the area, staying and passively sheltering or staying and actively defending. The rationale behind planned and actual actions is complex and influenced by a range of personal factors and the external environment.

The BMO and AS 3959-2018 provide a well-established process for assessing the survivability of a building, based on an assessment of potential bushfire behaviour in the immediate vicinity of the building and providing a commensurate BAL/defendable space response. The safety of people is not, however, necessarily assured by the survival of the building, as many people will chose to leave if threatened by fire. Settlement planning should consider how easily people could re-locate to an area of relative safety, such as to the BAL-12.5 area of Lorne, through consideration of the distance they need to travel and the landscape through which they would be passing. This study has commented on these

factors in relation to the investigation sites, but there are no established criteria for quantifying ‘acceptable’ landscape setting.

6.3.2 Bushfire hazard identification and assessment strategies

The bushfire hazard must be identified, and an appropriate risk assessment be undertaken.

Applying the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard.

This report identifies the hazard in accordance with the commonly accepted methodologies of the BMO/AS 3959 and, as appropriate, additional guidance provided in *Planning Practice Note 64 Local planning for bushfire protection* (DEWLP, 2015), *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018a) and *Planning Permit Applications Bushfire Management Overlay Technical Guide* (DELWP, 2017).

The type and extent of (hazardous) vegetation within, and up to 400m around, the study area has been identified and classified into BMO/AS 3959 vegetation groups. Classification was based on the anticipated long-term state of the vegetation, EVC mapping, aerial imagery, site assessment, published guidance on vegetation assessment for bushfire purposes and experience with the fuel hazard posed by the vegetation types that occur within the region.

GIS analysis of 2.5m contour data supplied by SCSC was undertaken, including creating a Digital Elevation Model (DEM) of the topography (see Map 8 and Map 9) and determining slopes, extending to 400m around the study area (see Map 10 and Map 11). Within 150m around all sites or ‘hypothetical development areas’ within sites, vegetation has been classified and upslopes and downslopes have been differentiated (see Map 12 to Map 25)

In relation to climatic conditions and fire weather, the applicability of the BMO/AS 3959 default FFDI 100 benchmark used in the Victorian planning and building system, has been analysed in Section 4.3.

Considering the best available information about bushfire hazard including the map of designated bushfire prone areas prepared under the Building Act 1993 or regulations made under that Act.

The extent of BPA and BMO coverage of the study area and surrounding landscape has been considered and (see Sections 3.4 and 3.5) and is shown in Figure 1, Map 1, Map 2 and Map 3. This is based on the most recent BPA mapping, which was gazetted 4th April 2019, and the most recent BMO mapping, gazetted on 3rd October 2017.

Applying the Bushfire Management Overlay in planning schemes to areas where the extent of vegetation can create an extreme bushfire hazard.

As identified in Map 3, the whole study area and surrounding landscape for approximately 10km is covered by the BMO or a schedule to the BMO. This is considered appropriate and reflects the most recent statewide BMO mapping introduced into the Surf Coast Planning Scheme by amendment GC13 on 3rd October 2017.

Considering and assessing the bushfire hazard on the basis of:

- ***Landscape conditions - meaning the conditions in the landscape within 20 kilometres and potentially up to 75 kilometres from a site;***
- ***Local conditions - meaning conditions in the area within approximately 1 kilometre from a site;***
- ***Neighbourhood conditions - meaning conditions in the area within 400 metres of a site; and***
- ***The site for the development.***

The hazard has been assessed and described at the landscape, local, neighbourhood and site scale.

At the broader landscape and neighbourhood scale, the hazard, including vegetation topography and fire weather, has been assessed (see Section 4 and Map 3 to Map 11) in accordance with guidance in Planning Practice Note 64 (DEWLP, 2015) Planning Advisory Note 68 (DEWLP, 2018a) and the BMO technical guide (DELWP, 2017).

At the site scale, the assessment follows the BMO methodology, of classifying vegetation and topography within 150m of a site (see Section 5 and Map 12 to Map 25).

Consulting with emergency management agencies and the relevant fire authority early in the process to receive their recommendations and implement appropriate bushfire protection measures.

The author is not aware of any consultation that may have occurred to date, but the CFA will be provided with a copy of this report and their feedback incorporated into the report and/or the Lorne Strategy.

Ensuring that strategic planning documents, planning scheme amendments, planning permit applications and development plan approvals properly assess bushfire risk and include appropriate bushfire protection measures.

DELWP advisory and practice notes, Clause 13.02, and the building regulations invoked by the BPA coverage, specify the general requirements and standards for assessing the risk, and the bushfire hazard landscape assessment has been considered.

Not approving development where a landowner or proponent has not satisfactorily demonstrated that the relevant policies have been addressed, performance measures satisfied or bushfire protection measures can be adequately implemented.

If the objective and applicable strategies of Clause 13.02 cannot be successfully implemented, then development will not be appropriate, as the risk cannot be deemed to be acceptably mitigated.

The CFA specify that areas where development should not proceed could include:

- *'Isolated settlements where the size and/or configuration of the settlements will be insufficient to modify fire behaviour and provide protection from a bushfire.*
- *Where bushfire protection measures will not reduce the risk to an acceptable level.*
- *Where evacuation (access) is severely restricted.*
- *Where the extent and potential impact of required bushfire protection measures may be incompatible with other environmental objectives or issues, e.g. vegetation protection, land subject to erosion or landslip' (CFA, 2015).*

Some or all of these criteria and characteristics are variously applicable to sites in the study area (see 'Section 5 Site analysis' and Summary Table 9). The CFA criteria are especially pertinent to Sites 1, 2, 12, 13 and 14, which are beyond the main township area and subject to potentially extreme bushfire behaviour. The last CFA dot point above is relevant to all or most sites, as they would all require vegetation removal and all, except perhaps Site 4, involve very steep slopes.

6.3.3 Settlement planning strategies

Settlement planning must strengthen the resilience of settlements and communities and prioritise protection of human life.

Directing population growth and development to low risk locations, being those locations assessed as having a radiant heat flux of less than 12.5 kilowatts/square metre under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009).

As identified above, none of the locations are considered low risk. The applicable distances for dwellings or other buildings to be setback from classifiable vegetation, such that RHF is calculated to equal or below 12.5kW/m², and BAL 12.5 dwellings could therefore potentially be sited, are provided in Table 11 in Section 6.1.1, and for each site, are shown in Map 12 to Map 25. However, as discussed previously, due to the significant landscape risk, and risk of exposure to modified vegetation, future development on any of the sites should have a minimum BAL-29 construction standard with maximum defensible space.

Ensuring the availability of, and safe access to, areas assessed as a BAL-LOW rating under AS 3959-2009 Construction of Buildings in Bushfire-prone Areas (Standards Australia, 2009) where human life can be better protected from the effects of bushfire.

None of the sites has safe access to a BAL-LOW area. The nearest lowest risk locations where BAL-LOW can apply are distant from the study area, located approximately 45km away in Apollo Bay and Jan Juc, where land is not in a BPA (see Figure 1). Travel to them is through an extreme risk landscape.

Ensuring the bushfire risk to existing and future residents, property and community infrastructure will not increase as a result of future land use and development.

Achieving no net increase in risk to existing and future residents, property and community infrastructure, through the implementation of bushfire protection measures and where possible reduce bushfire risk overall.

The risk to existing residents within the township may be reduced by the development of additional residential areas and associated low threat or non-vegetated land on sites that are on the edge of, or within, the township (see site analysis in Section 5).

Assessing and addressing the bushfire hazard posed to the settlement and the likely bushfire behaviour it will produce at a landscape, settlement, local, neighbourhood and site scale, including the potential for neighbourhood-scale destruction.

This report appropriately assesses and addresses the risk at a range of scales.

Assessing alternative low risk locations for settlement growth on a regional, municipal, settlement, local and neighbourhood basis.

No alternative low risk development locations have been identified or assessed as part of this study.

Not approving any strategic planning document, local planning policy, or planning scheme amendment that will result in the introduction or intensification of development in an area that has, or will on completion have, more than a BAL-12.5 rating under AS 3959-2009'

A number of sites are not able to achieve BAL-12.5 defensible space setbacks, and for those that may, the higher BAL-29 construction standard is recommended as an additional protective measure due to the potential for significant fire behaviour that may exceed the assumptions underpinning the BMO/AS 3959 model.

6.3.4 Areas of high biodiversity conservation value

Ensure settlement growth and development approvals can implement bushfire protection measures without unacceptable biodiversity impacts by discouraging settlement growth and development in bushfire affected areas that are of high biodiversity conservation value

Most, if not all, sites would require extensive vegetation removal to achieve the required defensible space, which is likely to have appreciable biodiversity impacts.

6.3.5 Use and development control in a Bushfire Prone Area

Clause 13.02 requires that *'In a bushfire prone area designated in accordance with regulations made under the Building Act 1993, bushfire risk should be considered when assessing planning applications for the following uses and development:*

- *Subdivisions of more than 10 lots.*
- *Accommodation.*
- *Child care centre.*
- *Education centre.*
- *Emergency services facility.*
- *Hospital.*
- *Indoor recreation facility.*
- *Major sports and recreation facility.*
- *Place of assembly.*
- *Any application for development that will result in people congregating in large numbers'* (Surf Coast Planning Scheme, 2018b).

It further states that:

'When assessing a planning permit application for the above uses and development:

- *Consider the risk of bushfire to people, property and community infrastructure.*
- *Require the implementation of appropriate bushfire protection measures to address the identified bushfire risk.*
- *Ensure new development can implement bushfire protection measures without unacceptable biodiversity impacts'* (Surf Coast Planning Scheme, 2018b).

It is noted that if a planning permit is required for the use or development under Clause 44.06 - BMO, then the use and development control strategy is addressed through the relevant application requirements and decision guidelines in Clause 53.02 (DELWP, 2018a). However, in higher risk landscapes such as the study area, where there is potential for significant fire behaviour resulting from characteristics that may exceed the assumptions underpinning the BMO/AS 3959 model, compliance with BMO approved measures may not provide acceptable safety.

7 Conclusion

This report has assessed the bushfire hazard in and around the Lorne study area, in accordance with Clause 13.02 in the Surf Coast Planning Scheme, the BMO methodology invoked by the BMO coverage of the area, and additional guidance provided in *Planning Practice Note 64 Local planning for bushfire protection* (DEWLP, 2015), *Planning Advisory Note 68 Bushfire State Planning Policy Amendment VC140* (DEWLP, 2018a) and the DELWP technical guide *Planning Permit Applications Bushfire Management Overlay* (DELWP, 2017a).

Whilst a planning scheme amendment is not currently being prepared, it is considered that this assessment also fulfills the requirements of *Ministerial Direction 11 Strategic Assessment of Amendments*, which requires that planning scheme amendments address any relevant bushfire risk as appropriate (Direction No. 11, 2013).

All of the study area, and land within approximately 10km around it, is covered by the BMO. All land for approximately 45km by road is also designated as a BPA.

The Otway Ranges occur to the north, west and southwest of the township and are one of the most hazardous bushfire landscapes in Victoria. It is credible, and arguably likely on days of severe or higher fire danger, for bushfire behaviour to exceed the presumptions and design characteristics underpinning the BMO/AS 3959 model.

Climatic conditions and fire weather, including the applicability of the BMO/AS 3959 default FFDI 100 benchmark have been analysed. Although it was noted that the FFDI 100 benchmark has been exceeded previously (e.g. FFDI 194 on Black Saturday 2009) this has also occurred at many other locations across Victoria.

The type and extent of (hazardous) vegetation within, and up to 400m around the study area, has been identified and classified, based on DELWP extant EVC mapping, aerial imagery and site investigation. The vegetation is dominated by higher fuel Shrubby Foothill Forest and Shrubby Wet Forest EVCs (62% and 16% of the study area and 400m neighbourhood assessment zone, respectively).

The terrain in the study area and the surrounding landscape is steep and conducive to extreme fire behaviour, with 36% of the study area and 400m neighbourhood assessment zone around it, exceeding a 20° slope and 19% in the >15° to 20° slope class.

Accordingly, for sites beyond or on the periphery of the main township area, for the risk to be mitigated to an acceptable level, future development may need to provide bushfire protection measures above and beyond the default approved or alternative measures in the BMO, including consideration of:

- Appropriate emergency management planning to ensure a site will be vacant in the event of severe or higher fire danger conditions;

- An enhanced combination of BAL and defensible space e.g. higher BAL and/or more defensible space;
- Using non-combustible fences and retaining walls;
- Keeping/storing exposed heavy fuel items at least 6m away from buildings, or fully enclosing them within the building, or an outbuilding built to the appropriate BAL;
- Separating adjacent buildings from each other by at least 12m, or, if both buildings are BAL-29 compliant, 8m;
- Ensuring exposed sub-floor construction elements are non-combustible or enclosed by non-combustible cladding; and
- Use of private fire shelters.

Due to the significant landscape risk with potential for fire behavior above and beyond the assumptions in the BMO/AS 3959 model and requirement for native vegetation removal on often very steep slopes, none of the sites has strong strategic justification under Clause 13.02 for intensification of development. Accordingly, from a bushfire safety and compliance perspective there is little or no strategic merit for the identification of any site within the Surf Coast Planning Scheme as being potentially suitable for development. Notwithstanding, some sites have more potential than others to be developed in compliance with the BMO.

Sites 1, 2, 12, 13 and 14 are beyond the main township area and, therefore, have less ability to access the comparatively lesser risk BAL-12.5 areas and NSP locations. Development on them would be exposed to potentially extreme bushfire behaviour. They cannot, therefore, be considered low risk locations with safe access to areas where human life can be better protected from the effects of bushfire.

Sites 3, 5, 6, 7, 8, 9 and 10 have reasonable access to the comparatively lesser risk BAL-12.5 areas and NSP locations in the township. However, as they are located generally on the western edge of the township, they could also be exposed to potentially extreme bushfire behavior. Any proposed development of these sites should be carefully considered and aim to have a minimum BAL-29 construction standard with maximum defensible space. A significant constraint for these sites, however, is that they would require vegetation removal on steep slopes. Due to the existing extent of modification of vegetation to the west and northwest of Site 8, this factor may be less of a constraint for this site.

Development of Site 4 would comprise infill development in a location within the township boundary and this site is, therefore, more suited than any other site to residential or other development. Development of this site would, however, require vegetation removal that may result in unacceptable biodiversity impacts.

Site 11 has reasonable access to the comparatively lesser risk BAL-12.5 area and NSP location in the south of the township. It has potential for BAL-29 development and due its proximity to the coast and the township is comparatively less exposed to hazardous vegetation.

Whilst BAL-12.5 may theoretically be achievable on some sites, it is considered that BAL-12.5 development is not appropriate on any site, due to the nature of the hazard exposure i.e. the potential for bushfire behavior and hence bushfire attack, above and beyond the presumptions underpinning the BMO/AS 3959 methodology. Additionally, many sites are exposed to modified vegetation which requires a minimum BAL-29 outcome.

Accordingly, it is considered that a minimum BAL-29 construction standard should apply for any future development on a site. However, this outcome would be contrary to that stipulated in the settlement planning strategies of Clause 13.02.

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