Le Hunte Properties

Proposed ski lodge development – Lot 768 DP 1119757 Thredbo

Bushfire Assessment Report

23 May 2022

→ The Power of Commitment

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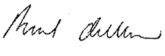
S3	0	P. de Mar	M. George		P. de Mar		23/5/22

Contents

1. Introduction

GHD has been engaged by Le Hunte Properties Pty Ltd (Le Hunte) to provide a bush fire assessment report, satisfying the requirements of Planning for Bushfire Protection 2019 (**PBP 2019**), to inform a Development Application under preparation for the development of a ski lodge (and associated in-house facilities/amenities for the convenience of lodge visitors) within the Thredbo Village Alpine Resort. The proposed ski lodge development is for development of Lot 768 DP 1119757 on Diggings Terrace, Thredbo, NSW. Noting the proposed development site lies within the designated boundaries of the Thredbo Alpine Resort, Chapter 4 'Kosciuszko National Park and Alpine Resorts ' in State Environmental Planning Policy (Precincts-Regional) 2021 the State Environmental Planning Policy (Kosciuszko National Park—Alpine Resorts) 2007 (SEPP) applies to the Site. As set out in the Development Application, "Tourist accommodation" is permitted with development consent within the Thredbo Alpine Resort zoning. The SEPP defines this use as:

(a) a building or buildings used for the accommodation of visitors, including apartments, serviced apartments and lodges that may have facilities for the convenience of those visitors, such as conference facilities, entertainment facilities, recreation facilities and restaurants, or

(b) staff accommodation, or

(c) a hotel.".

The entire Thredbo Alpine Village, including the development site, is on land mapped as being bushfire-prone.

1.1 Applicant and Property details

The applicant and property covered by this bush fire assessment report are:

Proponent:	Le Hunte Properties Pty Ltd
Sub-Lessee:	Le Hunte Properties Pty Ltd
Consent Authority:	NSW Department of Planning, Industry and Environment
Council:	Snowy Monaro Regional Council
Property:	Lot 768 DP 1119757
Address:	5 Diggings Terrace, Thredbo, NSW

1.2 Type of proposal

Proposed construction and use of a tourist accommodation development including the following:

- Vegetation removal;
- Construction of a new multi-storey building in the northern portion of the site comprising:
  - 16 accommodation units;
  - Visitor recreation and food and beverage facilities including a restaurant and bar;
  - Street level car parking and bicycle spaces; and
  - Staff room.
- Construction of 5 x 3-storey detached lodges in the southern portion of the site; and
- Associated drainage, services and landscape works.

Under the National Construction Code (NCC), the main building and connected lodge buildings are classifiable as Class 3 buildings. On account of the proposed development being classifiable as tourist accommodation, the development is classifiable as a Special Fire Protection Purpose (SFPP) development as defined by Section 100B of the *Rural Fires Act*, 1997 (RF Act), and thus the development is integrated development and will require the issue of a Bush Fire Safety Authority (BFSA) (incorporating General Terms of Approval) from the NSW Rural Fire Service under section 100B of the RF Act.

2. Location and Site plans

The proposed ski lodge development location is shown at Figure 1 (on Diggings Terrace, Thredbo depicted by the dashed yellow line). The location of the development is within Thredbo Alpine Resort adjacent to and opposite existing ski lodges on Diggings Terrace. Upper panel in Figure 1 shows site in relation to existing roads and cadastre, lower panel provides local development and vegetation cover context. Red colour wash in Figure 1 indicates bushfire prone land extent.

Figure 1 Location of development site Lot 768 DP 1119757 on Diggings Terrace on bushfire prone land

Source: NSW Government ePlanning Spatial Viewer bushfire prone land layer

2.1 Project description

Proposed construction and use of a tourist accommodation development including the following:

- Vegetation removal;
- Construction of a new multi-storey main building in the northern portion of the site comprising:
  - 16 accommodation units;
  - Visitor recreation and food and beverage facilities including a restaurant and bar;
  - Street level car parking and bicycle spaces; and
  - Staff room.
- Construction of 5 x 3-storey detached lodges in the southern portion of the site; and
- Associated drainage, services and landscape works.

A general site plan for the proposed development are shown in Figure 2, noting that more detailed site planning information is contained in the Development Application.

Figure 2 Site plan of the proposed development

2.2 PBP development type

The PBP 2019 development type is classified in Table 1, with rationale for classification explained in sections 2.2.1 to 2.2.3.

Table 1 PBP development type assessment

PBP Type	SFPP Type	Tourism Use classification
Special Fire Protection Purpose	Tourist Accommodation	Holiday Let

2.2.1 Special Fire Protection Purpose (SFPP)

The proposed ski lodge development, being a form of 'tourist accommodation' is classifiable as a SFPP as defined by Section 100B of the RF Act. SFPP developments are Integrated Development in accordance with Section 4.46 of the Environmental Planning and Assessment Act, 1979 which require the issue of General Terms of Approval in a BFSA from the NSW Rural Fire Service under section 100B of the RF Act.

In establishing bushfire protection objectives applicable for SFPP development, Section 6.3 of PBP 2019 articulates that:

> *Particular SFPP developments demonstrate different characteristics and may require different levels of protection. As such, tailored objectives are specified for these development types, though a BFSA is still required under RF Act s.100B*.

This recognizes that not all SFPP developments are the same – different SFPP development types have different characteristics – and thus application of a framework which tailors objectives to different types of SFPP is appropriate, as opposed to application of a one-size-fits-all approach. Section 100B (6) (d) of the RF Act specifically recognizes tourist accommodation as a particular type of SFPP. Section 6.6 of PBP 2019 identifies that alpine resort areas within the Kosciuszko National Park (including Thredbo) are predominantly used for short-term tourist accommodation and are considered to be SFPP development.

2.2.1.1 Holiday Let tourism use classification

Section 6.3.1 of PBP 2019 explicitly recognises that there are different types of 'tourist use' for tourism accommodation, and establishes the following specified classes of short-term tourist accommodation:

- Caravan Parks
- Camping
- Primitive camping
- Bed and breakfast and farmstay accommodation
- Holiday Lets
- Ecotourism

Under the 'Kosciuszko National Park and Alpine Resorts ' section in the State Environmental Planning Policy (Precincts-Regional) 2021 (**the SEPP**), "tourist accommodation" of the type proposed is permitted with development consent. The proposed development will provide short-term holiday accommodation for visitors to Thredbo and Kosciuszko National Park generally. Holiday Let class of tourism use is most applicable to the proposed development. Section 6.3.1 of PBP 2019 defines *Holiday Let* as:

> ***Holiday Lets*** *– Where a building is proposed to be used as a holiday let in an area with reticulated water, it does not back onto public reserves, and the setback and construction requirements of BAL-29 can be applied, they should be treated as a residential infill arrangement. Alternatively, a performance based solution will be required demonstrating adequate levels of bush fire safety before such a proposal can be supported by the NSW RFS.*

The *Holiday Let* definition in PBP 2019 refers to a *building* in terms of its scope of application. The definition does **not** limit the scope of the Holiday Let tourism use category to dwelling houses or residwntial dwellings. A range of building scales and characteristics can be contemplated, including buildings used for tourist accommodation such as ski lodges, dwelling houses or residential dwellings. In GHD's assessment, supported by planning law specialist advice obtained by Kosciuszko Thredbo Pty Ltd from Minter Ellison in 2020 (copy appended at Appendix 1) the proposed development falls within the scope of PBP 2019 *Holiday Let* tourism use category, subject to it satisfying the other criteria of *Holiday Let* definition.

In terms of the remaining criteria of PBP 2019 *Holiday Let* definition, GHD assesses that the proposed development can meet all of the specified criteria:

- Reticulated water – Lot 768 is serviced by reticulated water supply
- Does not back onto public reserves – Lot 768 is bounded on all sides by leasehold land, leased by Kosciuszko Thredbo Pty Ltd, with sub-leases in place on adjoining developed lots – thus Lot 768 does not back on to a public reserve;
- Setbacks and construction requirements of BAL-29 can be applied – appropriate setbacks (from vegetation in the form of asset protection zones (APZ)) can be applied fully within land leased by Kosciuszko Thredbo Pty Ltd.

Therefore, the proposed development meets the classification as a *Holiday Let* class of tourism use under PBP 2019. The *Holiday Let* definition specifies that buildings should be treated as a 'residential infill' arrangement. To be clear, this is not to say that a *Holiday Let* is residential infill (noting the proposed development is not residential infill, it is tourist accommodation) but rather that it should be treated as such, for the purpose of applying PBP 2019.

Accordingly, this Bushfire Assessment is applied on the basis that the proposed development is a tourist accommodation form of SFPP development, and specifically that it is a *Holiday Let* class of tourist accommodation.

In accordance with PBP's specific provisions applying for *Holiday Lets* the proposed development assessed with the relevant bushfire protection objectives, performance criteria and acceptable solution for residential infill development applied (as per Section 7 of PBP 2019).

2.3 Landscape context

The development site is located within the extensively developed Thredbo Village precinct (being one of very few remaining (if not the only) undeveloped lots along Diggings Terrace in the Thredbo Alpine Resort lease area within Kosciuszko National Park. Services such as sealed road access, electricity supply mains, reticulated water supply, and sewer mains are available to the site. Effectively, development of the site is consistent with general concepts of 'infill development' whereby the development is occurring on a vacant land parcel fronting a developed street with access to all services, and with existing ski lodges either side and directly opposite.

Thredbo Village is situated at the bottom of a steep-sided, narrow valley (Thredbo River valley). Most of Thredbo Village, including the entire development site, is situated just below 1,400 metres elevation, with landform to the north rising to over 2,000 metres on the Rams Head Range (and more than 2,200m at Mount Kosciuszko immediately further north), and to more than 1,800 metres to the south on Brindle Bull Hill and Mount Leo (above Thredbo to the south). Due to this sheltered topographic position, Thredbo Village benefits from the sheltering effects of the main range when adverse bushfire weather develops as a result of warm dry winds prevailing from the north-west or west. The highest part of the main range - from Mount Kosciuszko in the north, through Rams Head North, Rams Head to South Rams Head to the west – occupies the landscape above Thredbo village from the north through to the west-south-west. When adverse north to west winds blow during periods of elevated fire danger, winds in Thredbo Valley are typically half to one third the strength of winds up on the main range.

A key consequence of the sheltering from adverse fire winds, in combination with its elevation around 1,400 metres, is that Thredbo rarely ever experiences levels of Forest Fire Danger Index (FFDI) above FFDI 50. Historical analysis of Bureau of Meteorology weather data demonstrates that Thredbo Village

has only ever recorded FFDI 50 exceedance once in 52 years of data, reaching FFDI 51.1 on 21 January 2003. The only other recorded time FFDI in Thredbo Village exceeded FFDI 40 was on 7 January 2009. Even on 4 January 2020, the most severe FFDI day of the 2019/20 Black Summer fire season when fires including the Green Valley and Dunns Road fires were making major high intensity mid to late afternoon runs up the western fall of the Great Dividing Range and burning deep into Kosciuszko National Park, the 3PM FFDI in Thredbo Valley was only 26.1.

Thredbo Village has never been impacted by a major fire coming over the range into the valley (neither directly nor by spotting/ember attack). This is despite its remote location deep within Kosciuszko National Park, and severe drought-affected fire seasons and major fire conflagrations in alpine areas in 2003 and 2020. Fire did not make it over the range in 2020, and in 2003, fire was successfully contained away from the village with backburning by NSW National Parks and Wildlife Service (NPWS) west of the Funnel Web Ski Run and above the golf course, noting that both those features (maintained by Kosciuszko Thredbo Pty Ltd - KT) were successfully used as a containment lines. These KT-maintained features and other ski runs are maintained as APZs, and remain an ongoing component of KT's ongoing fire preparedness planning to protect the Thredbo Alpine Village and resort.

2.4 Site bushfire protection context

The proposed ski lodge development occurs within the broader context of being an integral part of the Thredbo Alpine Village and resort. Accordingly, it is relevant to consider bushfire protection measures applied at individual development site scale in conjunction with historically successful and effective bushfire protection measures applying to the whole of Thredbo Alpine Resort.

NPWS administers the lease area on behalf of the State Government (Department of Planning, Industry and Environment – DPIE). The head lease holder, KT, actively participates in whole-of-village bush protection planning with NPWS and NSW Rural Fire Service (RFS). Bushfire protection measures applied at whole-of-village scale, implemented by KT in consultation with NPWS and NSW RFS, contribute significantly to bushfire protection for individual sub-leases. These measures include:

- Planning and implementation of the Thredbo Bushfire Preparation Plan Map (produced by NSW RFS CSC South), assigning responsibility to KT for:
  - Implementation and maintenance of mapped APZ and Strategic Fire Advantage Zones within the lease area aimed at preventing or impeding bushfire fire spread toward and within the village. APZ's designated in the Thredbo Bushfire Preparation Plan Map include over-sized APZ areas (substantially larger than dimensions typically required for individual developments under PBP 2019) on the lower ski run areas, golf course, Village Ski Terminal and open space areas surrounding and within the village urban footprint;
  - Preparation and implementation of a Thredbo Emergency Management and Evacuation Plan applying to the Thredbo Resort;
  - Maintenance of the Thredbo Village Neighbourhood Safer Place (as depicted on the Thredbo Bushfire Preparation Plan Map) and associated APZ providing a last-resort shelter location for personnel not evacuated during bushfire evacuations.
- Preparation of the Thredbo Bushfire Evacuation Plan (in place since 2009 and last reviewed Nov 2020) endorsed by NPWS, which provides operational planning for the evacuation preparedness and management of Thredbo Resort in the event of escalating bushfire threats and triggers. These are applied to the whole Thredbo Resort, and were successfully implemented during the 2019/20 Black Summer bushfire threats to NSW Alpine Resorts.
- Full cooperation with, and provision of assistance to NPWS (lease administrator) during operational response actions they undertake to protect Thredbo Village against bushfire threats during bushfire incidents and emergencies. This is not limited to implementing evacuations but extends also to making such things as reticulated snow making outlets available to support fire containment operations.

These collective, whole-of-resort bushfire protection measures are important contextually to the application of individual sub-lease site level bushfire protection measures applied through the NSW planning and development control process. These cooperative ‘collective’ measures have been effective in preserving human life and averting any bushfire damage to lessee and sub-lessee property within Thredbo Village (despite extensive presence of building stock constructed prior to the introduction of bushfire planning and development controls) and despite major fire threats of bushfire coming over the main range and in to Thredbo Valley in Kosciuszko National Park in 2003.

3. Bushfire Assessment

A site bushfire assessment has been conducted and compiled in accordance with the site assessment methodology detailed in PBP 2019.

3.1 Vegetation and fuels

All vegetation formations for each aspect of the development within 140 metres of the development site have been assessed as per the vegetation formations of Keith (2004).

All vegetation within Lot 768 is assumed to be either cleared (for construction) or to be 'managed vegetation' forming part of any APZ applying to the development. Accordingly, vegetation assessment is 140 metres from Lot 768 boundaries (Figure 3).

Figure 3 Vegetation assessment area

Vegetation formation assessment results, for each aspect of the proposed development, are presented at Table 2 on the following page. GHD notes that in *PBP 2019*, for the purpose of determining Bushfire Attack Levels (BAL), sub-alpine woodlands are grouped under the 'Forest' vegetation formation.

Table 2 Vegetation assessment results

Direction	Dominant vegetation formation	Comments
North	Managed land	Extensively occupied by developed lots and village green
East	Managed land	Extensively occupied by developed lots fronting Diggings Terrace and Buckwong Place. Vegetation patch to the SE is included in assessment for South
South	Forest	Sub-alpine woodland vegetation south and north of the Alpine Way upslope from Lot 768. Cleared grassy slope area above Lot 768 is maintained by KT as an APZ in accordance with the Thredbo Bushfire Preparedness Plan Map.
West	Forest	Sub-alpine woodland vegetation south-west of Lot 768, with developed lots on Diggings Terrace adjoining to the west.

Figure 4 below depicts vegetation assessment mapping results.

Figure 4 Mapped results of vegetation formation assessment

Notes:
1. Managed Land Area 1 is occupied by Thredbo Village developed lots and APZ (maintained by KT), and Thredbo Golf Course
2. Managed Land Area 2 is an existing APZ per Thredbo Bushfire Preparation Map (RFS)
3. Managed Land Area 3 is the Alpine Way and cleared road verge
4. The proposal site will be cleared to make way for proposed ski lodge and APZ

3.2 Effective slope assessment

In accordance with the requirements of PBP 2019, effective slope (underneath bushfire-prone vegetation) was assessed for the site. Slope assessment results are presented below at Table 3.

Table 3 Effective slope assessment results

Direction	Effective slope	Comments
North	Not applicable	No bushfire-prone vegetation areas within 140m
East	Not applicable	No bushfire-prone vegetation areas within 140m
South Segments:		Slopes under bushfire-prone vegetation up to 140m from Lot 768 are approximately 20º. This is based on the distance between the 1400 and 1500 metre contours being approximately 290 metres.
South-east	Upslope (Transect 1)	Based on a rise of 25 metres over a 140 metre horizontal run transect to the SE, noting a partially cross slope (downslope) fire approach
South	Upslope (Transect 2)	Maximum slope directly up hill south of Lot 768
South-west	Upslope (Transect 3)	Based on a rise of 25 metres over a 140 metre horizontal run transect to the SW, noting a partially cross slope (downslope) fire approach
West	Upslope	Calculated as for fire approaching from the SW.

The worst-case slope for fire approach from a south-west through south-east direction is a 10.1º upslope. Fire spread rate and therefore intensity is approximately half the spread rate on level ground.

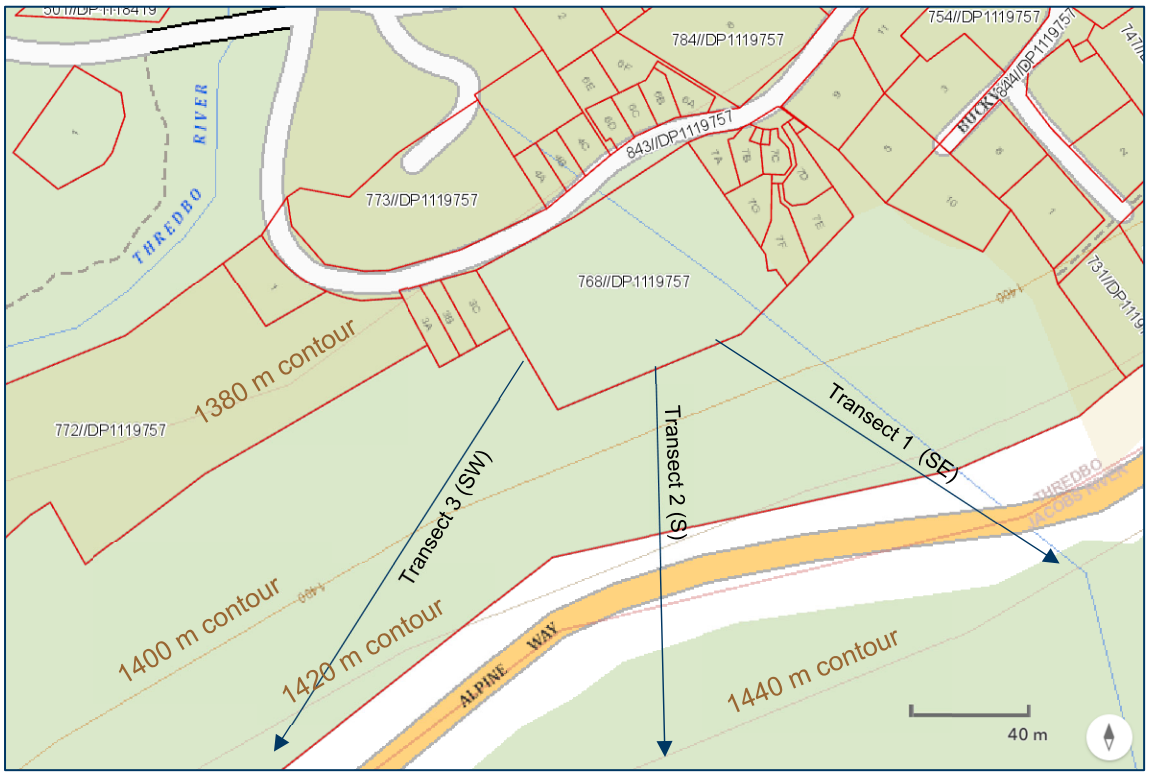


Figure 5 Effective slope assessment transects

3.3 Fire weather area determination

The FFDI input value for bushfire assessment is identified in classified in Table 5, with rationale for classification explained in section 3.3.1.

Table 4 Fire weather area assessment

Area	Assumed FFDI and PBP BAL determination Table	Comments
Alpine area	FFDI 50 PBP Table A1.12.7 FFDI 50 – Alpine areas	FFDI 50 applicable on the basis of Thredbo Village being a designated Alpine Area, and applicability of PBP 'residential infill' provisions to SFPP Holiday Let tourist accommodation

3.3.1 FFDI 50 selection rationale

For the purposes of PBP 2019, fire weather variable assumptions for BAL assessment use the Forest Fire Danger Index, as is also used under *Australian Standard AS 3959:2018 Construction of buildings in bushfire-prone areas (AS3959)*. Both AS3959 and PBP 2019 recognise 1 in 50 year fire weather scenarios as the basis for setting local or regional FFDI determination. In NSW, RFS has determined 1 in 50 year FFDI values on a Local Government Area basis. Thredbo falls within the Snowy Monaro Regional Council LGA, in which RFS assigns a regional FFDI of 80 for BAL determination purposes. GHD notes that landscapes across Snowy Monaro are highly variable, from cooler alpine elevations down to hotter lower elevations on the Southern Tablelands.

AS3959 attributes a FFDI of 50 to 'Alpine Resorts' in both NSW and VIC, which recognises the substantially lower FFDI's which prevail in alpine areas relative to lower elevation areas on surrounding tablelands and slopes. Consistent with AS 3959, PBP 2019 also explicitly recognises the appropriateness of FFDI 50 for alpine areas through its inclusion of Table A1.12.7 for determination of BAL for alpine areas using a FFDI value of 50. While Table A1.12.7 is not applicable for all categories of SFPP development, it is applicable for residential infill development, noting that PBP 2019 explicitly provides that a particular class of SFPP Tourist Accommodation development categorised as 'Holiday Let' should be treated as a residential infill arrangement'. Therefore, consistent with the rationale previously explained at section 2.2 of this bushfire assessment, the proposed development as classified as a *Holiday Let* class of *SFPP-tourist accommodation*, and thus bushfire assessment criteria and protection measures for residential infill are applicable.

GHD notes that the Strategic Bushfire Assessment for the Snowy Mountains Special Activation Precinct has recommended FFDI 50 should be applied to alpine resort areas for new development and assessment purposes. The recommendation was underpinned by a *Thredbo Fire Danger Index Analysis* paper commissioned by DPIE (Risk Frontiers, 2020), which analysed historical fire weather data for Thredbo finding that the 1:50 average recurrence interval (ARI) for maximum FFDI is 53. Pre-DA advice enquiries made to NSW RFS at the time of preparing this bushfire assessment, regarding the RFS position regarding the acceptance of FFDI 50 application in alpine resort areas were not met with a definitive answer, with advice that the matter remained under active consideration (RFS response to pre-DA information request).

GHD undertook review and analysis of Bureau of Meteorology historical weather data for Thredbo and Perisher resort areas. The maximum recorded FFDI at Thredbo Village (in 52 years of data) was 51.1 on 21 January 2003 (copy of study findings at Appendix 2).

3.4 Bushfire Attack Level determination

In accordance with Section 6.3.1 of PBP 2019 applying to Holiday Lets, BAL 29 requirements can be applied.

On the basis of the foregoing assessments of proposed development type, vegetation formation, effective slope and fire weather area, and assuming building construction to BAL 29, using PBP Table A1.12.7 Alpine Areas, the minimum acceptable solution for APZ width is determined at Table 5.

Table 5 BAL and minimum APZ determination

Development Type	Vegetation formation	Slope Class	FFDI	Max BAL	Min APZ
SFPP Tourist Accom Holiday Let	Forest (sub alpine woodland)	Upslope	50	BAL 29	15 metres

An extract from PBP Table A1.12.7 to show derivation of assessed minimum APZ width is depicted at Figure 3 below.

Table A1.12.7

Determination of BAL, FFDI 50 – alpine areas

KEITH VEGETATION FORMATION		BUSH FIRE ATTACK LEVEL (BAL)				
		BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5
		Distance (m) asset to predominant vegetation class				
	Rainforest	< 5	5 -< 7	7 -< 10	10 -< 15	15 -< 100
ALL UPSLOPE AND FLAT LAND	Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland	< 11	11 -< 15	15 -< 22	22 -< 30	30 -< 100
	Grassy and Semi-Arid Woodland (including Mallee)	< 6	6 -< 8	8 -< 12	12 -< 17	17 -< 100
	Forested Wetland (excluding Coastal Swamp Forest)	< 5	5 -< 6	6 -< 9	9 -< 13	13 -< 100
	Tall Heath	< 12	12 -< 16	16 -< 23	23 -< 32	32 -< 100
	Short Heath	< 7	7 -< 9	9 -< 14	14 -< 20	20 -< 100
	Arid-Shrublands (acacia and chenopod)	< 5	5 -< 6	6 -< 9	9 -< 14	14 -< 100
	Freshwater Wetlands	< 4	4 -< 5	5 -< 7	7 -< 11	11 -< 100
	Alpine Complex	< 4	4 -< 6	6 -< 8	8 -< 12	12 -< 100
	Grassland	< 6	6 -< 8	8 -< 11	11 -< 17	17 -< 50

Figure 6 Minimum APZ determination for Forest/Upslope/BAL29 in Alpine Areas (FFDI50)

4. Meeting the aims and objectives of PBP 2019

The aim of PBP 2019 is to provide for the protection of human life (including firefighters) and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.

PBP 2019 provides that the proposed development should be treated as a residential infill arrangement, being SFPP Tourist Accommodation for Holiday Let tourism use. Therefore, the development is to comply with the acceptable solutions and/or performance criteria for residential infill development, as per Tables 7.4a to 7.4d of PBP 2019.

Table 6 on the following page compiles the relevant PBP performance criteria and acceptable solutions for the development and identifies how the proposed development can comply with the requirements. For convenience, the key compliance requirements are summarized below:

Asset Protection Zones (APZ) ✓ **Acceptable Solutions proposed**

- Minimum 15m APZ provide all around the proposed buildings consistent with Table A1.12.7 requirements for achieving BAL 29 in FFDI 50 Alpine Area with upslope forest vegetation
- Slope under 15m wide APZ is approximately 16 degrees and to be managed in accordance with PBP Appendix 4
- APZ is on KT leasehold land and able to be managed in perpetuity

Construction standard ✓ **Acceptable Solutions proposed**

- A construction level of BAL-29 under AS 3959 or NASH and section 7.5 is to be applied (which is commensurate with the proposed APZ/setback from upslope forest)

Access/egress ✓ **Acceptable Solutions proposed**

- Existing access road (Diggings Terrace) is a sealed through road providing access for fire appliances (up to 23 tonnes) and egress for visitors, connecting via either Banjo Drive or Friday Drive to the Alpine Way (which is a through road between Jindabyne and Khancoban).

Appropriate access to water supply ✓ **Acceptable Solutions proposed**

- Lot 768 serviced by reticulated water supply with hydrants able to be provided in accordance with the relevant clauses of AS 2419.1:2005

Electricity Services ✓ **Acceptable Solutions proposed**

- Mains supply to the site is underground

Gas Services ✓ **Acceptable Solutions proposed**

- Bottled gas can be installed and maintained in accordance with AS/NZS 1596:2014 with metal piping used, shielded and more than 10m clear of vegetation hazard

Emergency Management ✓ **Acceptable Solutions proposed**

- KT has in place and maintains a Bushfire Emergency Management and Evacuation Plan for the Thredbo Alpine Resort which is executed as required in coordination with NPWS and NSW RFS
- A Bushfire Emergency Management and Evacuation Plan for the proposed development will be prepared, informed by and consistent with KT's Thredbo Alpine Village plan.

The aim of PBP 2019 can be met by achieving each of the performance criteria and acceptable solutions specified in Section 7 of PBP 2019 as detailed in Table 6.

Table 6 PBP compliance

Performance Criteria	Acceptable Solutions	Compliance notes
The intent may be achieved where:		
ASSET PROTECTION ZONES (APZ)		
APZs are provided commensurate with the construction of the building and a defendable space is provided	The building is provided with an APZ in accordance PBP requirements (at this site based on PBP BAL determination Table A1.12.7 for FFDI 50 Alpine Areas).	**Complies** Minimum 15 metre wide APZ to be provided all around the proposed development in accordance with Table A1.12.7 (FFDI 50 – Alpine Areas) in Appendix 1 of PBP.
APZs are managed and maintained to prevent the spread of fire to the building.	APZs is managed in accordance with the requirements of Appendix 4 of PBP	**Can comply** APZ to be managed in accordance with PBP
The APZ is managed in perpetuity APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	APZs are wholly within the leasehold area the APZ is located on lands with a slope less than 18 degrees.	**Can comply** APZs are wholly within KT's lease area The maximum land slope under the APZs is 16° to the south, with gentler slope in other directions

Performance Criteria	Acceptable Solutions	Compliance notes
The intent may be achieved where:		
Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation	Property access roads are two-wheel drive, all-weather roads.	**Complies** Diggings Terrace is a bitumen-sealed two-wheel drive all weather road providing access directly to the property frontage and adjacent vegetation. Firefighting access to adjacent vegetation is also available from Alpine Way.
Capacity of access roads is adequate for firefighting vehicles.	The capacity of road surfaces and any bridges/causeways is sufficient to carry fully loaded firefghting vehicles (up to 23 tonnes), bridges and causeways are to clearly indicate load rating	**Complies** No new roads are required – existing access road network for Thredbo Alpine Village provides for access by firefighting appliances
There is appropriate access to water supply	Hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005	**Complies** Lot 768 is serviced by reticulated water supply. Hydrants to be provided in accordance with the relevant clauses of AS 2419.1:2005
Firefighting vehicles can access the building and exit the property safely	At least one alternative property access road is provided for individual buildings or groups of buildings that are located more than 200 metres from a public through road.	**Not applicable** All proposed buildings are within 50 metres of the property access/street frontage

ACCESS

Performance Criteria	Acceptable Solutions	Compliance notes
The intent may be achieved where:		
WATER SUPPLIES		
An adequate water supply is provided for firefighting purposes	Reticulated water is to be provided to the development, where available.	**Complies** The proposed development is serviced by reticulated water supply.
Water supplies are located at regular intervals The water supply is accessible and reliable for firefighting operations	Fire hydrant spacing, design and sizing comply with the relevant clauses of Australian Standard AS2419.1:2005 Hydrants are not located within any road carriageway	**Can comply** Compliance with fire hydrant spacing, design and sizing with the relevant clauses of Australian Standard AS2419.1:2005 is proposed No hydrants are proposed within any road carriageways
Flows and pressure are appropriate	Hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005	**Can comply** The advice of a relevant authority or suitably qualified professional should be sought, for certification of hydrant design and installation in accordance with relevant legislation and Australian Standards
The integrity of the water supply is maintained	The above-ground water service pipes external to the building are metal, including and up to any taps	**Can comply** All above ground water service pipes to be metal
ELECTRICITY SERVICES		
Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings	Where practicable, electrical transmission lines are underground.	**Complies** Electrical mains supply to Lot 768 is underground.

Performance Criteria		Acceptable Solutions	Compliance notes
The intent may be achieved where:			
GAS SERVICES	Location or design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings	Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used; All fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side Connections to and from gas cylinders are metal; Polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not used; Above-ground gas service pipes external to the building are metal, including and up to any outlets	**Can comply** The advice of a suitably qualified professional should be sought, for certification of design and installation in accordance with relevant legislation, Australian Standards and PBP Table 7.4a – Gas Services
CONSTRUCTION STANDARDS	The proposed buildings can withstand bushfire attack in the form of embers, radiant heat and flame contact	BAL is determined in accordance with Table A1.12.7. Construction is provided in accordance with the NCC and as modified by section 7.5	**Can comply** BAL determined in accordance with Table A1.12.7. Construction to comply with BFSA General Conditions which specify NCC compliance
	Proposed fences and gates are designed to minimize the spread of bushfire	Fences and gates are constructed in accordance with section 7.6	**Not Applicable** No gates or fences proposed

Performance Criteria	Acceptable Solutions	Compliance notes
The intent may be achieved where:		
LANDSCAPING	Landscaping is designed and managed to minimize flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignition	Compliance with the NSW RFS Asset Protection Zone Standards A clear area of low-cut lawn or pavement is maintained adjacent to the building Trees are located so that branches do not overhang the roof, the tree canopy is not continuous and ay proposed windbreak is located on the elevation from which fires are likely to approach.	**Complies** All area within Lot 768 not occupied by buildings will form part of the APZ, complying with Appendix 4 of PBP Any retained trees not to overhang roof areas
EMERGENCY MANAGEMENT	A Bush Fire Emergency Management and Evacuation Plan is prepared	A Bush Fire Emergency Management and Evacuation Plan is prepared by the operator consistent with the RFS publication: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan, and the AS 3745:2010.	**Can comply** A Bushire Evacuation Plan for the whole of Thredbo Alpine Resort prepared by KT is in place. A Bush Fire Emergency Management and Evacuation Plan specific to the proposed development is to be prepared, informed by and consistent with the Thredbo Alpine Village Bushfire Evacuation Plan.

4.1 PBP Objectives specific to Alpine Resorts

Table 6 set out how the proposed development complies with relevant PBP objectives for SFPP Tourist Accommodation used for Holiday Let tourism use, noting these are to be treated as a residential infill arrangement.

Section 6.6 of PBP also details specific objectives for SFPP infill development in Alpine Areas. Table 7 below identifies how these objectives are met.

Table 7 PBP Section 6.6 specific objectives for Alpine Resorts

PBP Section 6.6 Objectives	Compliance
Provide an appropriate defendable space	**Can comply** - APZ to be provided in accordance with PBP Table A1.12.7 for Alpine Areas (as deemed appropriate by PBP for Holiday Let)
Provide a better bush fire protection outcome for existing structures (eg. via ember protection)	**Not applicable** - no existing structures
Ensure new building work complies with the construction standards set out in AS3959	**Complies** – BAL 29 compliance specified (as deemed appropriate by PBP for Holiday Let)
To ensure ongoing management and maintenance responsibilities are in place where APZs are proposed outside of the sub lease or leasehold area	**Not applicable** - APZ is fully within the sub lease and leasehold area
Proposed APZs outside of the sub lease or leasehold area are supported by a suitable legal mechanism to ensure APZs are managed under a binding legal agreement in perpetuity	**Not applicable** - APZ is fully within the sub lease and leasehold area
Written consent from the land managers is provided for all proposed works outside of the sub lease or leasehold area;	**Not applicable** - all proposed works are fully within the sub lease and leasehold area
Ensure building design and construction standards enhance the chances of occupant and building survival	**Complies** – BAL 29 compliance specified. Design provides for building evacuation on to Diggings Terrace away from the fire hazard, with BAL 10 achieved for the building exit point, and fully shielded from radiant heat by the main building
Provide safe emergency management procedures	**Can comply** - Thredbo Alpine Resort Bushfire Evacuation Plan already in place, and site-specific plan proposed to be prepared as condition of consent.

5. Conclusions

The requirements of, and the acceptable solutions identified in, PBP 2019 in relation to asset protection zones, public roads and accessibility, provision of services can be met in full for the proposed development, with requirements summarized in Table 8.

The aim of Planning for Bushfire Protection in respect of development on bushfire prone land is “to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to the development potential, site characteristics and protection of the environment”.

As documented in Section 4 of this bushfire assessment, the aims and objectives of PBP 2019 can be met for the proposed development.

5.1 Recommendations for compliance with Performance Criteria

The bushfire protection measures, and standard identified in this report are aligned to the acceptable solutions for each performance measure within Chapter 7 of PBP 2019, as are applicable for SFPP Tourist Accommodation Holiday Let developments which are treated as residential infill arrangements. These performance criteria are summarised in Table 8.

Table 8 Recommendations and summary of performance criteria – PBP 2019

Measures	Performance criteria
Asset Protection Zones (Per Appendix 1 PBP, 2019)	**Around full building footprint measured from external walls** – Minimum APZ width of 15 metres to be provided. – Full APZ to be managed to inner APZ specifications.
Construction requirements	Building work on bush fire prone land must comply with the requirements of the National Construction Code (NCC). Under the Deemed to Satisfy provisions of the NCC building work for the proposed development must comply with BAL-29 construction requirements in *AS3959:2018 Construction of buildings in bushfire-prone areas* (AS3959) or the National Association of Steel Framed Housing (2014) *Steel Framed Construction in Bush Fire Areas* (NASH Standard).
Access (per Appendix 3 PBP, 2019)	– Property access from Diggings Terrace is to comply with Appendix 3 of PBP
Services – water, electricity, and gas	**Water:** – Reticulated water is provided to the development. – Any additional fire hydrants to be installed as part of development works are to be constructed to ensure fire hydrant, spacing, design and sizing complies with the relevant clauses of Australian Standard AS 2419.1:2005; hydrants are not located within any road carriageway – Fire hydrant flows and pressures are to comply with the relevant clauses of AS 2419.1:2005. – All above-ground water service pipes are to be metal, including and up to any taps. **Electricity:** – Electrical services to all proposed buildings are underground

Measures	Performance criteria
	Gas: – Any reticulated or bottled gas is to be installed and maintained in accordance with AS/NZS 1596:2014 - The storage and handling of LP Gas, the requirements of relevant authorities, and metal piping is used – All fixed gas cylinders are to be kept clear of all flammable materials to a distance of 10 m and shielded on the hazard side – Connections to and from gas cylinders are to be metal – Polymer-sheathed flexible gas supply lines are not to be used – Above-ground gas service pipes are to be metal, including and up to any outlets
Emergency Management	Prior to occupation of the development a Bush Fire Emergency Management and Evacuation Plan must be prepared which includes planning for the early relocation of building occupants/visitors. The plan is to be consistent with: • The RFS document A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan; • Australian Standard AS 3745:2010 Planning for emergencies in facilities, and • The Thredbo Alpine Resort Bush Fire Evacuation Plan prepared by Thredbo Alpine Resort head lessee

6. References

Blackash Bushfire Consulting (2021) *Snowy Mountains Special Activation Precinct Bushfire Strategic Study* prepared for WSP. Submitted by WSP to the NSW Department of Planning, Industry and Environment.

Kosciuszko Thredbo Pty Ltd (2020 Edition) Thredbo Bushfire Evacuation Plan

New South Wales Rural Fire Service (2019). *Planning for Bushfire Protection – A guide for councils, planners, fire authorities and developers*. NSW Government.

New South Wales Rural Fire Service (2014). *Development Planning - A guide to developing a Bush Fire Emergency Management and Evacuation Plan*. NSW Government

New South Wales Rural Fire Service (2014). *Thredbo Bush Fire Preparation Map*. Map prepared by NSW RFS Customer Service Centre South. NSW Government

New South Wales ePlanning Spatial Viewer (2022). NSW Government.

SAI Global (2018) *Australian Standard AS 3959:2018 Construction of buildings in bushfire prone areas*

Appendix 1
Minter Ellison legal opinion letter

MinterEllison

18 June 2021

BY EMAIL

Jonathan McKenzie
General Manager: Property
Event Hospitality & Entertainment
478 George Street
SYDNEY NSW 2000

Dear Jonathan

**Proposed Ski-Lodge Development at Lot 768 in DP 1119757, Thredbo –
Advice re applicable development standards**

1. Introduction

1.1 We refer to your email of 17 May 2021, requesting advice in respect of a proposed ski-lodge development in Thredbo NSW (**Proposed Development**) to be carried out on Lot 768 in DP 1119757 at Diggings Terrace, Thredbo NSW (**Site**).

1.2 In particular, we have been asked to consider the following questions:

(a) The applicability of the Special Fire Protection Purpose (**SFPP**) - Tourism use classification - Holiday Let to the Proposed Development.

(b) Whether there is a reasonable legal basis to treat the Proposed Development as a "*residential infill development*" for the purpose of determining bushfire protection measures, specifically BAL rating and APZ requirements.

2. Summary

2.1 In response to your questions, we make the following conclusions in this advice:

(a) The Proposed Development is SFPP development.

(b) The proper legal basis is to treat the Proposed Development as "*residential infill development*" because:

(i) A "*Holiday Let*" under the *Planning for Bush Fire Protection* (NSW Rural Fire Service, 2019) (**PBFP**) is a species of SFPP development.

(ii) The Proposed Development is development for a "*Holiday Let*" under the PBFP.

(iii) Additionally, it is likely that the Proposed Development also falls within the definition of "*residential infill development*" as it is defined in the PBFP. However, this point is practically irrelevant because, given that the Proposed Development is "*Holiday Let*" development, it is required to be treated as if it were "*residential infill*".

3. Preliminary observations

3.1 The *State Environmental Planning Policy (Kosciuszko National Park—Alpine Resorts) 2007* (**SEPP**) applies to the Site. We understand that the Site is within Thredbo Alpine Resort shown

edged heavy black on the map marked "*State Environmental Planning Policy (Kosciuszko National Park—Alpine Resorts) 2007—Thredbo Alpine Resort*".

3.2 "*Tourist accommodation*" is permitted with development consent within the Thredbo Alpine Resort zoning. The SEPP defines this use as:

"*(a) a building or buildings used for the accommodation of visitors, including apartments, serviced apartments and lodges that may have facilities for the convenience of those visitors, such as conference facilities, entertainment facilities, recreation facilities and restaurants, or*

(b) staff accommodation, or

(c) a hotel."

3.3 Based on the information provided to us, the Proposed Development falls within the scope of this definition. Therefore, the Proposed Development will be permissible development under the SEPP.

3.4 We also note that the Site is classified as bushfire prone land under s 10.3 of the *Environmental Planning and Assessment Act 1979* (NSW) (**EPA Act**).

4. Applicability of SFPP Tourism Use classification

4.1 Section 4.14(1) of the EPA Act provides that development consent cannot be granted for development on bush fire prone land unless the consent authority:

(a) is satisfied that the development conforms to the requirements of the PBFP; or

(b) has been provided with a certificate confirming that the development conforms with such requirements, by a person recognised by the NSW RFS as a qualified consultant in bush fire risk assessment.

4.2 The two types of development to which the above do not apply are (per section 4.14(1)):

(a) subdivisions of land that could lawfully be used for residential or rural residential purposes; or

(b) development for a special fire protection purpose.

4.3 Section 4.14(2) of the EPA Act clarifies that "*special fire protection purpose*" has the meaning prescribed by the *Rural Fires Act 1997* (**RF Act**).

4.4 Relevantly, section 100B(6) of the RF Act defines development "*for a special fire protection purpose*" (**SFPP Development**) as development for (inter alia) the following purposes:

(a) a hotel, motel or other tourist accommodation; and

(b) any other purpose prescribed by the regulations.

4.5 The RF Act goes on to provide that a bushfire safety authority (**BFSA**) may be issued in respect of bushfire prone land to SFPP Development on the land, subject to various development standards and requirements (section 100B(1)-(2)).

4.6 Based on the information provided, it is our understanding that the Proposed Development will provide short-term tourist accommodation or holiday-let accommodation, with up to 108 bed capacity, an in-house lounge area, restaurant and bar.

4.7 Based on this description of the Proposed Development, in our view the Development would fall within "*hotel, motel or other tourist accommodation*", which is a type of SFPP Development outlined in section 100B(6) of the RF Act (above). While the terms "*hotel, motel or other tourist accommodation*" are not specifically defined in the RF Act, it is appropriate to interpret them having regard to their ordinary and plain meaning.

4.8 For this reason, the Proposed Development will require a BFSA in order to be carried out. While we note there are exceptions to this requirement (for example, as outlined in s 4.14(1A) of the

EPA Act), we have not considered these exceptions in further detail for the purposes of this advice.

4.9 The PBFP sets out various specific tourism uses under SFPP Development. The most relevant of these uses, based on the description of the Proposed Development provided in your briefing note, is "*Holiday Lets*", for which the PBFP notes:

"***Holiday Lets -*** *Where a building is proposed to be used as a holiday let in an area with reticulated water, it does not back onto public reserves, and the setback and construction requirements of BAL-29 can be applied, they should be treated as a residential infill arrangement. Alternatively, a performance based solution will be required demonstrating adequate levels of bush fire safety before such a proposal can be supported by the NSW RFS.*"

4.10 The term "*Holiday Lets*" is not defined in the PBFP. Therefore, a plain English meaning is appropriate.

4.11 The Macquarie Dictionary defines "*let*" relevantly as "*to grant the occupancy or use of (land, buildings, rooms, space, etc., or moveable property) for rent or hire.*" "*Holiday*" is defined as "*a period of cessation from work, or of recreation; a vacation*".

4.12 As the GHD report of 11 March 2021 notes, the Site is serviced by reticulated water. Moreover, it is our understanding (consistent with the GHD report) that the Site does not back on to any "*public reserve*" as the adjoining lands are leasehold/sub-leasehold lands. Finally, we understand that construction requirements of BAL 29 can be applied and appropriate setbacks can also be provided.

4.13 Therefore, based on the information provided to us, the Proposed Development will fall within the scope of "*Holiday Let*" under the PBFP.

5. Classification of Development as "*residential infill development*"

5.1 We have also been asked to consider:

"*Whether there is a reasonable legal basis to treat the development as a 'residential infill development'...*".

5.2 The PBFP describes residential infill development as "*development of land by the erection of, alteration or addition to, a dwelling which does not require the spatial extension of services including public roads, electricity, water or sewerage and is within an existing lot.*"

5.3 Based on this definition in the PBFP, there is a persuasive case that the Proposed Development falls within this definition. This definition of "*residential infill development*" is generally consistent with the use of the term "*infill development*" elsewhere. For example:

(a) The Greater Sydney Commission refers to ""*local infill development*" as "*medium density housing such as villas and townhouses within existing areas, that provide greater housing variety.*"

(b) The Institute for Public Policy & Economic Development defines "*infill development*" as "*the development of vacant or underutilized pieces of urban or suburban land into housing strategies.*"

(c) The NSW Heritage Office in its *Guidelines for Infill Development in the Historic Environment* notes that "*Infill buildings should aim to provide continuity in the built form rather than seeking to create an iconic or individualistic building.*"

5.4 Ultimately, the strength of an argument as to whether the Proposed Development falls within the definition of "*residential infill development*" under the PBFP is irrelevant. The reason for this is as follows.

5.5 First, as noted in paragraph [4.13], the Proposed Development can be characterised as "*Holiday Lets*", which itself is a sub-category of SFPP Development.

5.6 Secondly, the reference to "*Holiday Lets*" in the PBFP makes reference to residential infill, and specifies that a building that meets the following criteria may be treated as residential infill:

(a) it is located in an area with reticulated water;

(b) it does not back onto public reserves; and

(c) the setback and construction requirements of BAL-29 can be applied.

5.7 Thirdly, as noted above, it is our understanding that the Proposed Development on the Site can meet these criteria.

5.8 Therefore, provided that the Proposed Development will not require any spatial extension of services (such as public roads, electricity, water or sewerage), in that it can connect to and be fully serviced by existing utilities, then it would constitute residential infill development for the purposes of the PBFP.

Yours faithfully
MinterEllison

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Appendix 2

GHD Thredbo Fire Weather Study Report

11 May 2021

Mr D. Harper
Principal
Le Hunte Properties Pty Ltd

Analysis of Forest Fire Danger Index in Thredbo NSW

Dear David,

Thank you for your instructions to undertake an analysis of historical weather data (sourced from the Bureau of Meteorology) to assess historical levels of Fire Danger Index (FDI) occurrence at Thredbo, NSW. The analysis is intended for future use in support of a performance-based solution (for meeting the objectives of *Planning for Bushfire Protection 2019* – hereafter PBP) to be pursued for a proposed ski lodge development within Thredbo Village.

GHD notes that AS3959:2018 establishes jurisdictional and regional FDI values for alpine resort areas in NSW (and VIC) based on values provided by the Australian Fire and Emergency Service Authorities Council – AFAC, these being set at a FDI of 50. GHD further notes that for development other than *Special Fire Protection Purpose* (SFPP) development, PBP adopts FDI 50 for determination of Bushfire Attack Level and associated Asset Protections Zones in alpine areas for use in acceptable solutions (as evidenced by the inclusion of Table A1.12.7 *Determination of BAL – FFDI 50 - alpine areas* in PBP). In PBP, for SFPP, acceptable solutions for APZ minimum distances are for BAL ≤10 only (per Table A1.12.1 *Minimum distances for APZs – SFPP developments (≤10kW/m2, 1200K)*) which assumes FDI 100. However, for SFPP, Section 6.3 of PBP provides for tailored objectives for particular development types, with certain specific tourism types (including *Holiday Let* accommodation – per section 6.3.1) enabled to apply BAL-29 and specifically stating 'the setback and construction requirements of BAL-29 can be applied, they should be treated as a residential infill arrangement'. Accordingly, for such development Table A1.12.1 is not applicable or valid as it does not provide for BAL-29 and does not provide for FDI 50 solutions which are applicable for residential infill (and SFPP *Holiday Let* development eligible to be 'treated as residential infill'). Accordingly, as provided for by PBP, a performance-based solution can be proposed, noting that PBP contains Table A1.12.7 which caters specifically to determination of BAL in Alpine Areas, catering for BAL-29 using FDI 50.

GHD has been asked to validate if FDI 50 or a higher FDI is applicable at Thredbo. The attached summary report provides the findings of GHD's Alpine Resort Area Historical FDI Analysis.

Regards,

Paul de Mar

Technical Director, Bushfire Services

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NSW Alpine Resort Area Historical FDI Analysis

Purpose

GHD has been asked to analyse available historical weather data from the Bureau of Meteorology to determine maximum historical FDI occurrence at Thredbo, NSW.

Method

1. GHD obtained historical observed weather data sets from the Bureau of Meteorology. The following data sets were analysed:
    - Thredbo top station (BoM site 71032) DC02D daily observation summary data which provides daily observations data for daily rainfall (to 9AM) maximum and minimum temperature; with 9AM and 3PM observations (including wet and dry bulb temperatures, wind speed and direction) from 24 November 1966 to 23 April 2021 (19,875 observation time points in the data set)
    - Thredbo top station (BoM site 71032) HM01X data which provides all recorded observations data ranging from hourly to sub-30 minute observations from 27 April 1998 to 20 April 2021 (332,689 observation time points in the data set)
    - Thredbo Village station (Bom site 71041) DC02D daily observation summary data which provides daily observations data for daily rainfall (to 9AM) maximum and minimum temperature; with 9AM and 3PM observations (including wet and dry bulb temperatures, wind speed and direction) from 1 November 1969 to 23 April 2021 (18,802 observation time points in the data set)
    - Perisher Valley AWS (BoM site 71075) DC02D daily observation summary data which provides daily observations data for daily rainfall (to 9AM) maximum and minimum temperature; with 9AM and 3PM observations (including wet and dry bulb temperatures, wind speed and direction) from 25 May 2010 to 23 April 2021 (3,987 observation time points in the data set)
    - Perisher Valley AWS (BoM site 71075) HM01X data which provides all recorded observations data ranging from half hourly to sub-30 minute observations from 25 May 2010 to 20 April 2021 (196,106 observation time points in the data set)
    - Perisher Valley Ski Centre (BoM site 71072) DC02D data which provides daily observations data for daily rainfall (to 9AM) maximum and minimum temperature; with 9AM and 3PM observations (including wet and dry bulb temperatures, wind speed and direction) from 6 June 1976 to 20 July 2010 (12,463 observation time points in the data set)
    - Altogether there were 583,922 raw observation data lines analysed, noting that a proportion of these observations were missing key data required for FDI analysis.

2. GHD calculated the Forest Fire Danger Index for all observed data time points for which required FDI input data had been recorded. The FFDI formula used is

   FFDI = 2.0 exp (-0.450 + 0.987 ln (DF) – 0.0345 RH + 0.0338 T + 0.0234 U10)

   Where:

   DF is Drought Factor – GHD has used a DF value of 10 for JAN; FEB; & MAR; DF 8 for DEC and DF 6 for NOV, these being assumed to be maximum historical DF for these months in the NSW Alpine Resorts.

   RH is Relative Humidity taken directly from Bureau of Meteorology observations or calculated from wet and dry bulb temperatures where RH was not recorded (using the method of Lucas, 2010)

   T is Temperature (dry bulb) taken from Bureau of Meteorology observations, and

   U10 is wind speed (@ 10 metres in the open) taken from Bureau of Meteorology observations

3. Drought Factor, which is a required input value for FDI calculation, is not recorded in the historical BoM datasets. It is not possible to reconstruct from historical weather records because it incorporates the Keetch Byram Drought Index (KBDI) which is a cumulative index which requires a continuous unbroken daily record of rainfall and maximum temperature without data gaps, such gaps being a relatively common occurrence in the historical datasets used. It is not within the scope of this study to attempt to fill gaps in BoM rainfall and temperature data. Accordingly, using a daily evapotranspiration data value of 1 (determined using the method of Lucas (2010) identified to be relevant for all the Thredbo top station and village and Perisher Valley locations analysed – formula below)

$$ET_k = 10^{-3}\frac{(203.2 - KBDI_{i-1})(0.968\exp[0.0875T_{max}+1.5552] - 8.30)}{10.88\exp(-0.001736R_{ann}) + 1}$$

   Where:

   KBDI = Keetch Byram Drought Index

   T_{max} = maximum daily temperature

   R_{ann} = mean annual rainfall

   and using daily rainfall data from the lowest-on-record year for winter and spring rainfall (2006) for the alpine sites, and noting that historical KBDI data traces zero-out reliably each year in alpine areas and remain at their lowest ebb through August and September in alpine areas (noting also that natural snowfall is supplemented by artificial snow-making in the resort areas), maximum KBDI and Drought Factor were determined for November and December when fuels and soils undergo a drying trend after winter (DF 6 and 8 respectively) and the maximum value of 10 was applied for January to March. GHD notes that it would not be valid to apply max DF 10 to all months as this would not represent actual fuel availability conditions and would grossly inflate calculated FDI at times when DF is significantly less than DF 10. GHD further notes that using DF 6 for November and DF 8 for December is inherently conservative, and will still serve to over-state FDI relative to actual in a very high proportion of cases because actual DF will be lower than assumed. The period outside the NSW statutory bushfire danger period (April to September inclusive) is assumed to be a low fire threat period noting that there is no high risk fire history associated with this period in alpine areas.

Results

For each weather data set analysed calculated FDI data was sorted in order from highest to lowest FDI value.

FDI values with apparent anomalous input data were excised from the analysis.

For the highest resolution HM01X datasets which can have multiple records within a one hour period, a minimum one hour period was set for analysis – any FDI values occurring within a one hour period were averaged (noting single records are based on 10 minute wind speed only) – this degree (hourly) of smoothing is considered appropriate and practical in the context of the purpose of the analysis.

The following FDI results are reported:

Thredbo (top) long-term daily data 1966 - 2021 (daily FDI_{max} based on 3PM data)

Of the sites analysed Thredbo Top Station is the highest elevation site (1,957 metres). On average temperatures are approximately 5 degrees lower than in Thredbo Village (and relative humidity is higher) however wind speeds, particularly those coming across the range from the west, are substantially stronger – during elevated FDI events wind speeds at Thredbo Top station are commonly around twice the speed of those recorded in Thredbo Valley.

- The maximum calculated daily FDI value over the 55 year period is 51.6*
  - Occurred 20 JAN 1967 (3PM Temp © 18.2; RH (%) 20.4; Wind Speed (km/h) 64.8 (292.5); assumed DF 10 [*noting that 67.8mm rain fell in Jan 1967 and 240mm fell in Dec 1966 so the assumed DF10 is considered to be a gross over-assumption which would substantially inflate the FDI above the actual level]
- The only other daily FDI value over 50 is FDI 51.1**
  - Occurred 8 JAN 1969 (3PM Temp © 20.5; RH (%) 16.6; Wind Speed (km/h) 55.4 (337.5); assumed DF 10 [**noting that this DF would be a gross over-assumption as high rainfall was received over the last 3 months of 1968 – Oct (197.6mm); Nov (162.3mm); Dec (114mm)]
- 3PM FDI associated with severe events are:
  - 17/18 Jan 2003 (major fire run crossing the main range) 18 JAN 3PM FDI = 29
  - 30/31 Dec 2019 (major run of Black Summer fires including Dunns Road fire) 30 JAN 3PM FDI =26.6
  - 4Jan2020 (major run of Black Summer fires including Green Valley & Dunns Road fires) 4JAN 3PM FDI = 25.7
- **Analysis result: taking into account calculated FDIs based on known over-assumptions of DF, there are no actual exceedences of FDI 50 in the Thredbo (top station) long-term daily data 1966 - 2021**

Thredbo (top) half hourly HM01X data 1998 - 2021

- Three highest FDI records were excised on the basis of wind speed record anomalies:
  - 3NOV 2004 (two records 3 minutes apart) with wind speed of 248 and 239 km/h (Temp (C) -1.7; RH 99%)
  - 13 APR 1999 (one record) with wind speed 196.2 km/h (Temp (C) 8; RH 80%)
- The maximum calculated one-hour FDI value over the 24 year period is 53.3
  - Occurred between 11PM and midnight on 30DEC2019 (Temp (C) 20.5 – 20.9; RH (%) 13 – 15%; Wind Speed (km/h) 50 – 57.2 (270); assumed DF 10 - this was during one of the worst periods of the unprecedented 2019/20 'Black Summer' fire emergency season when the Dunns Road fire was making a ~90 km run on the

south-west slopes in the Snowy Valleys LGA and the fires on the NSW south coast made major high-consequence runs into Batemans Bay and Conjola.

- A single shortlived (10 minute) FDI peak of 62.9 was calculated on 24 DEC 2005
  - Occurred at 01:20AM (Temp (C) 20.5; RH (%) 23; Wind Speed (km/h) 113 (320); assumed DF 8 [noting that this DF would be a significant over-assumption as high rainfall was received throughout spring 2005 (Sep: 218 mm; Oct: 165.6mm; Nov: 87.8mm) – the actual FDI would be < 40
- Worst-case FDI's during significant emergency fire events are:
  - 17/18 Jan 2003 (major fire run crossing the main range) 17 Jan: $FDI_{max\ (1hr)}$ 23.1 (4-5PM); 18 JAN $FDI_{max\ (1hr)}$ = 29.9 (2:30-3:30PM)
  - 30/31 Dec 2019 (major run of Black Summer fires including Dunns Road fire): 30Dec: $FDI_{max\ (1hr)}$ 53.5 (11PM-midnight); 31Dec $FDI_{max\ (1hr)}$ = 45.9 (midnight – 1AM)
    - 4Jan2020 (major run of Black Summer fires including Green Valley & Dunns Road fires) 4JAN $FDI_{max\ (1hr)}$ = 26.7
- No other FDI>50 events were calculated noting that low DF (<5) in October and zero or near zero DF outside the bushfire danger period preclude high FDI which might otherwise be higher if DF10 were erroneously applied
- **Analysis result: the worst-case one-hour calculated FDI in the Thredbo (top station) long-term daily data 1966 – 2021 is 53.3 - there are no other actual exceedences of FDI 50 in the dataset**

Thredbo Village long-term daily data 1969 - 2021 (daily FDI_{max} based on 3PM data)

Thredbo Village is situated at 1,380 metres elevation, 577 metres lower than Thredbo top station. Although daytime temperatures are on average around 5 degrees warmer than the top station, wind speeds, particularly those coming across the range from the west, are substantially reduced relative to those at Thredbo top station. FDI is most sensitive to wind speed, so FDI during peak FDI events under prevailing westerly winds are lower down in Thredbo Valley than up on the main range.

- The maximum calculated 3PM FDI value over the 52 year period is 51.1 (the only occurrence of FDI>50)
  - Occurred on 21 JAN 2003 (Temp (C) 29; RH 18.8%; Wind Speed (km/h) 46.4 (310); assumed DF 10 - this was during the 2003 fire emergency when fires in NSW and VIC alpine area made periodic runs between 17 and 31JAN, during which time major firefighting campaign operations were undertaken in the Thredbo Valley and elsewhere in KNP.
- The only other calculated FDI > 40 was on 7 JAN 2009 (Temp (C) 28.2; RH 15.7%; Wind Speed (km/h) 37.1 (310); assumed DF 10
- Worst-case FDI's during significant historical fire events are:
  - 17/18 Jan 2003 (major fire run crossing the main range) 17 Jan: 3PM FDI 20.5; 18 JAN = 27.2
  - 30/31 Dec 2019 (major run of Black Summer fires including Dunns Road fire): 30Dec: 3PM FDI 30.1; 31Dec 3PM FDI = 10.6
  - 4Jan2020 (major run of Black Summer fires including Green Valley & Dunns Road fires) 4JAN 3PM FDI = 26.1
- **Analysis result: the worst-case calculated 3PM FDI in the Thredbo Valley long-term daily data 1969 – 2021 is 51.1 - there are no other actual exceedences of FDI 50 in the dataset**

Perisher Valley AWS HM01X data 2010 - 2021)

Perisher Valley is situated at 1,738 metres elevation. This is 358 metres higher than Thredbo Valley, but 219 metres lower than Thredbo top station. It is not as wind-exposed as Thredbo top station, but more wind exposed than Thredbo Valley.

- The maximum one-hour FDI value over the 12 year period is 28.8 (with an 10 minute peak maxFDI of 35.4)
  - Occurred between 4:30 – 5:30PM on 30DEC2019 (Temp 24.9 – 26; RH 15 – 18%; Wind Speed (km/h) 18.4 – 29.5 (270 - 290); assumed DF 10 - this was during one of the worst periods of the unprecedented 2019/20 'Black Summer' fire emergency season when the Dunns Road fire was making a ~90 km run on the south-west slopes in the Snowy Valleys LGA and the fires on the NSW south coast made major high-consequence runs into Batemans bay and Conjola.
- Worst-case FDI's during significant emergency fire events are:
  - 30/31 Dec 2019 (major run of Black Summer fires including Dunns Road fire): 30Dec: $FDI_{max\ (1hr)}$ 28.8 (4:30 – 5:30PM); 31Dec $FDI_{max\ (1hr)}$ = 24.2 (1AM -2AM)
  - 4Jan2020 (major run of Black Summer fires including Green Valley & Dunns Road fires) 4JAN $FDI_{max\ (1hr)}$ = 26.3 (12:30 – 1:30PM)
- No other FDI>50 events were calculated noting that low DF (<5) in October and zero or near zero DF outside the bushfire danger period preclude high FDI which might otherwise be higher if DF10 were erroneously applied.
- **Analysis result: the worst-case one-hour calculated FDI in the Perisher Valley AWS data 2010 – 2021 is 28.8 - there are no actual exceedences of FDI 50 in the dataset**

Perisher Valley Ski Centre data 1976 – 2010 (daily FDI_{max} based on 3PM data)

Perisher Valley is situated at 1,738 metres elevation. This is 358 metres higher than Thredbo Valley, but 219 metres lower than Thredbo top station. It is not as wind-exposed as Thredbo top station, but more wind exposed than Thredbo Valley.

- The maximum validated FDI value over the 34 year period is 27.4
  - Occurred on 8 JAN 1983 (Temp 21.2; RH 22.9%; Wind Speed (km/h) 37.1 (315); assumed DF 10 .
- The maximum raw calculated FDI value (uncorrected) over the 34 year period is 55.2 (but this warrants correcting down to 27.8 on account of low actual Drought Factor)
  - Occurred on 3 FEB 1987 (Temp 15.5; RH 9.4%; Wind Speed (km/h) 55.4 – (270); assumed DF 10 - this is assessed to be a substantial over-assumption of the actual DF, as very high rainfall occurred across the period Jul – Dec 1986 such that the DF would have been zero at the end of December 1986 (Jul (445mm); Aug (209 mm); Sep (158 mm); Oct (353 mm); Nov (96.4 mm); Dec (105.6 mm), then followed by a dry January 1987 .
- Worst-case FDI's during significant emergency fire events are:
  - 17/18 Jan 2003 (major fire run crossing the main range) 17 Jan: 3PM FDI 14.8; 18 JAN 3PM FDI – No input data (possibly unservicable due to fire)
- No other FDI>30 events were calculated noting that low DF (<5) in October and zero or near zero DF outside the bushfire danger period preclude high FDI which might otherwise be higher if DF10 were erroneously applied.

- **Analysis result: the worst-case calculated 3PM FDI in the Perisher Valley Ski Centre data 1976 – 2010 is 27.8 - there are no actual exceedences of FDI 50 in the dataset**

Conclusions

Based on all available Bureau of Meteorology weather data from 1966 to 2021 (56 years of data) for current and historical BoM weather stations in the Thredbo and Perisher Valley alpine area, the maximum one-hour FDI is 53.3. This FDI occurred at Thredbo Top Station on the top of the range, 219 metres higher than Perisher Valley, and 577 metres higher than Thredbo Village where alpine resort tourist accommodation is located.

The highest observed 3PM FDI value for Thredbo Village is 51.1 (noting that this is based on a 10 minute average wind speed only).

The maximum one-hour FDI value for Perisher Valley is 28.8, noting this is only 1.0 higher than the highest long-term historical 3PM value.

Accordingly, for both the Thredbo and Perisher alpine resorts the Regional **FDI 50** for NSW Alpine Resorts stated in Australian Standard AS3959:2018 appears to be sound on the basis of available meteorological evidence. On the basis of the available meteorological evidence, there is no credible basis for applying FDI 100 for bushfire attack level (BAL) assessment in NSW alpine resorts. Further assessment of Charlotte Pass and Selwyn resorts would be required to confirm applicability of FDI 50 for those resort areas.

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