# Bushfire Assessment Report

## Proposed Thredbo Golf Course subdivision and re-design

Kosciuszko Thredbo Pty Ltd

14 July 2023

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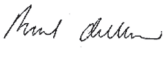
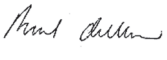
| S3 | 0 | P. de Mar | M. George | On file | P. de Mar |  | 4 July 2023 |
| S4 | 1 | P. de Mar | M. George | On file | P. de Mar |  | 14 July 2023 |
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# Contents

# 1. Introduction

Kosciuszko Thredbo Pty Ltd (**KT**) is seeking development consent for creation of a new 19 lot subdivision development within the existing Thredbo Golf Course. The development will also involve a re-design of the golf course to accommodate the proposed subdivision, and provision of an access road and services to all lots within the subdivision, and outdoor carparking spaces. The proposed development is located within Thredbo Alpine Resort (Thredbo), Kosciuszko National Park (KNP), New South Wales (NSW) 2625.

GHD has been engaged by KT to provide a bushfire assessment report, satisfying the requirements of Planning for Bushfire Protection 2019 (**PBP**), to inform KT's Development Application (DA) for the development and to document bushfire assessment of the development proposal against PBP requirements. The site is located at the Thredbo Golf Course, 2/4 Crackenback Drive, Thredbo, NSW, 2625, on land formally described as Lot 876/DP1243112. The site is on bushfire prone land (as is the entire Thredbo Village and ski-slopes lease area), and therefore bushfire risk management issues will necessarily be a constraint for development within the proposed development site.

Noting the proposed development site lies within the designated boundaries of the Thredbo Alpine Resort, development in NSW alpine resort areas is governed by the State Environmental Planning Policy (Precincts – Regional) 2021 (Precincts – Regional SEPP). The development proposal has been designed to achieve the relevant provisions of the *Precincts – Regional SEPP*, *Environmental Planning and Assessment Act 1979* (EP&A Act) and *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation). The Department of Planning and Environment (DPE) Minister for Planning is the consent authority for development in the alpine resort areas under Part 4 of the EP&A Act.

## 1.1 Applicant and Property details

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

| | |
|---|---|
| Proponent: | Kosciuszko Thredbo Pty Ltd (KT) (ABN 95 000 139 015). |
| Consent Authority: | NSW Department of Planning and Environment |
| Council: | Snowy Monaro Regional Council |
| Property: | Land formally described as Lot 876/DP1243112 |
| Address: | 2/4 Crackenback Drive, Thredbo, New South Wales 2625, |

## 1.2 Works to be undertaken

The DA is seeking development approval for the following works:

- Woody vegetation removal (with retention of significant vegetation wherever possible) in uncleared parts of proposed subdivision lots and for subdivision access road construction;
- Vegetation thinning (with retention of significant vegetation) for golf fairway widening and playing area improvement;
- Subdivision access road and adjacent parking area construction and connection to Crackenback Drive;
- Works to extend services (water, power, sewer) to the proposed subdivision;
- Landscaping and golf playing area modification works (shaping and turfing works to develop tees, greens, fairways and playing areas).

The development of individual lots will be subject to separate DAs in the future.

## 1.3 Development type for application of PBP

For application of PBP, categorisation of the proposed development is not straight-forward. PBP specifies different categories of development, and establishes performance criteria and acceptable solutions for each category, setting these out in PBP chapters addressing each. The four main development categories specified in PBP are:

- *Residential and rural residential subdivision* (PBP Chapter 5)
- *Special Fire Protection Purpose (SFPP) developments* (PBP Chapter 6)
- *Residential Infill developments* (PBP Chapter 7)
- *Other development* which includes a range of residential and non-residential development categories (PBP Chapter 8)

Both the *Residential Infill* and *Other Development* categories are not directly applicable for the proposed development.

Taking a strictly literal interpretation of PBP, the *Residential and rural residential subdivision* category is also not applicable because the proposed subdivision lots are not intended for residential or rural residential development. Residential development is not permissible in the Alpine Resorts. The intended future development of subdivided lots will be for tourist accommodation, which is permissible with consent. Under PBP, tourist accommodation is a form of SFPP development, however the DA for which this bushfire assessment has been prepared is for subdivision works, not for actual development of any tourist accommodation.

Again, taking a strictly literal interpretation of PBP, the SFPP category is also not applicable, because all SFPP tourist accommodation types are for buildings used for short-term accommodation, or for specific tourism uses (eg. caravan parks, camping and primitive camping) – there are no performance criteria or acceptable solutions for land subdivision within the SFPP development category.

Accordingly, it is unclear which suite of performance criteria and acceptable solutions in PBP apply to the proposed development (subdivision for future development as SFPP). This matter was raised with RFS during an on-site meeting seeking pre-DA advice. RFS advised that for some developments the bushfire assessment may need to address more than one section of PBP. In multi-category developments comprised of residential components in certain areas, SFPP in other areas, and potentially 'Other development in yet other areas, then compliance with the relevant criteria for each discrete development category and footprint can be set out in the one bushfire assessment. However, this development is different – the land area proposed to be subdivided occupies the same footprint as the area on which future SFPP developments are intended, but the subdivision provisions of PBP only apply for residential and rural residential subdivision. The works covered by the DA do not involve any construction of tourist accommodation and therefore no SFPP building construction or use works are proposed as part of the DA. The DA is for land subdivision only – subsequent DA's will need to be lodged for construction of SFPP tourist accommodation on each subdivision lot.

To address the development category issues outline above, in undertaking the bushfire assessment, GHD has sought to implement a reasonable and pragmatic approach which addresses performance criteria and acceptable solutions relevant for subdivision, but applies lot design/building footprint metrics which accommodate future SFPP developments (as opposed to residential developments) within each lot. Noting that the future SFPP developments pursued on each of the subdivided lots will necessarily be for short-term tourist accommodation and will be consistent with the *Holiday Let* category of tourism use as defined in PBP (i.e. does not back on to public reserves – all subdivision lots being contained fully within the KT lease area, connected to reticulated water, and located such that BAL 29 construction requirements can be applied), subdivision lots have been designed to

contain viable building envelopes which can meet a radiant heat threshold of 29 kW/m$^2$, as is an acceptable solution for SFPP Holiday Let category tourism development.

## 1.4 Basis for assuming future developments within the subdivision lots will be SFPP *Holiday Let* tourism use category

Firstly, under the *Precincts – Regional SEPP,* in Thredbo Alpine Resort residential development is prohibited. Tourist and visitor accommodation, staff accommodation and recreation facilities (outdoor) are among development activities which are permissible with consent. Section 100B (6) (d) of the *Rural Fires Act 1997* (RF Act) specifically recognizes tourist accommodation as a particular type of SFPP.

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 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.

### 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

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 residential dwellings. A range of building scales and characteristics can be contemplated, including buildings used for tourist accommodation such as ski lodges and visitor accommodation buildings. 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) tourist accommodation developments fall 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 – All lots will be serviced by reticulated water supply
- Does not back onto public reserves – All lots are bounded on all sides by leasehold land, leased by Kosciuszko Thredbo Pty Ltd, with the surrounding head lease land being the Thredbo Golf Course – none of the proposed lots 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, lots in the proposed subdivision would be capable of future development involving the construction of tourist accommodation meeting the classification of 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. This provides a maximum allowable BAL of BAL 29 for tourist accommodation buildings used for Holiday Let.

Accordingly, in this Bushfire Assessment, consideration of performance criteria for building footprint within subdivision lots is on the basis that future development within the lots will be of the tourist accommodation form of SFPP development, and specifically that it will be properly classifiable as a *Holiday Let* class of tourist accommodation.

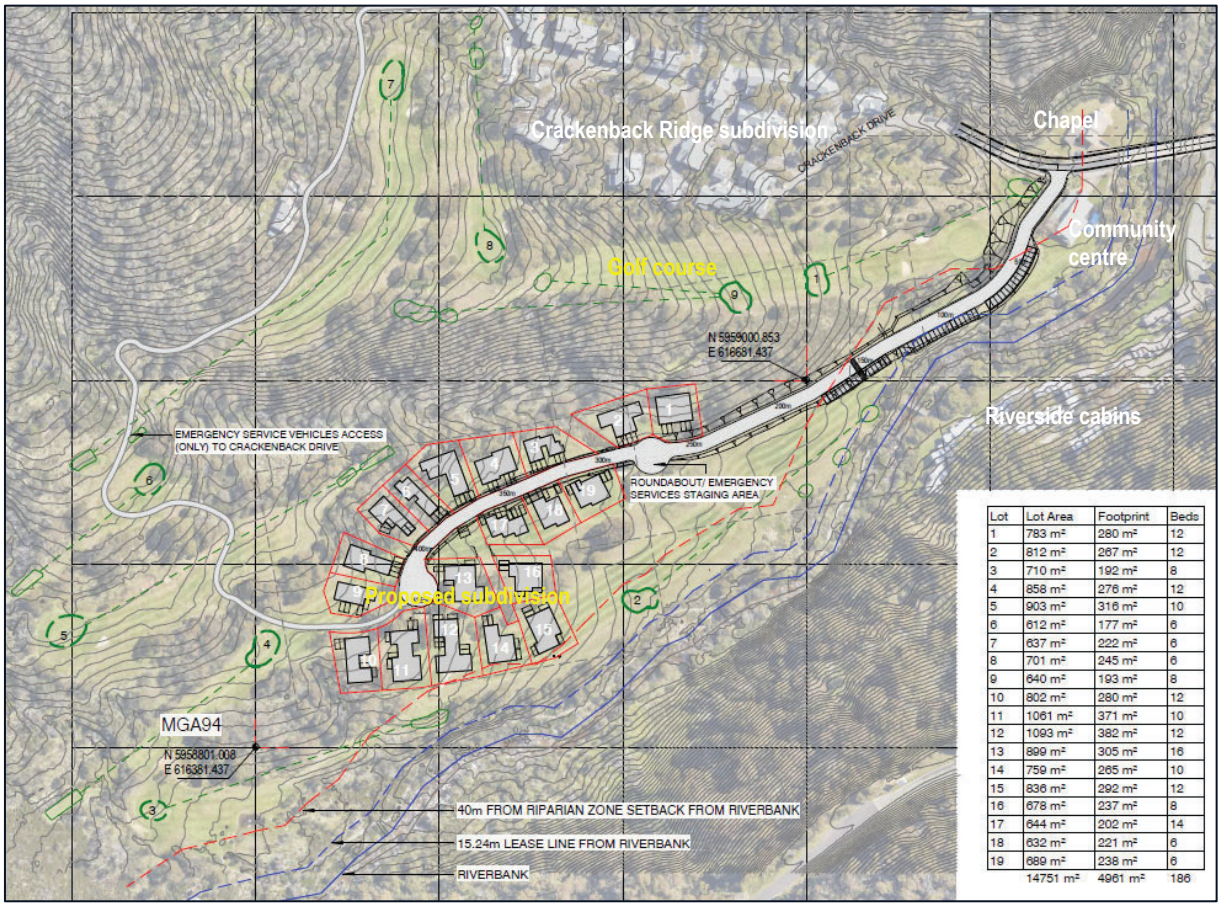
## 1.5 Integrated development

Being subdivision intended for future SFPP development, the development is classifiable as 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 location of the proposed development is the Thredbo golf course which is situated within Thredbo Alpine Resort (Figure 1). Whilst golf course modification works (including the relocation of 2 tees and 4 greens) associated with the golf course re-design are mostly constrained to existing golf playing areas, some fairway re-alignment works and vegetation thinning works in playing areas adjacent to fairways to improve playability is proposed in areas where vegetation thickening and encroachment has occurred over more than five decades. Detailed golf course re-design plans are submitted with the DA.

The subdivision location is confined to the southern-central part of the existing Thredbo golf course, largely on the existing 1st, 3rd and 4th fairways with some encroachment into patches of native vegetation adjacent to those cleared fairway areas. The subdivision access road (and parking spaces adjacent to it) extends from Crackenback Drive (opposite the Thredbo Chapel) along the northern edge of the existing 1st fairway into the proposed subdivision (Figure 1).




| Lot | Lot Area | Footprint | Beds |
|---|---|---|---|
| 1 | 783 m² | 280 m² | 12 |
| 2 | 812 m² | 267 m² | 12 |
| 3 | 710 m² | 192 m² | 8 |
| 4 | 858 m² | 276 m² | 12 |
| 5 | 903 m² | 316 m² | 10 |
| 6 | 612 m² | 177 m² | 6 |
| 7 | 637 m² | 222 m² | 6 |
| 8 | 701 m² | 245 m² | 6 |
| 9 | 640 m² | 193 m² | 8 |
| 10 | 802 m² | 280 m² | 12 |
| 11 | 1061 m² | 371 m² | 10 |
| 12 | 1093 m² | 382 m² | 12 |
| 13 | 899 m² | 305 m² | 16 |
| 14 | 759 m² | 265 m² | 10 |
| 15 | 836 m² | 292 m² | 12 |
| 16 | 678 m² | 237 m² | 8 |
| 17 | 644 m² | 202 m² | 14 |
| 18 | 632 m² | 221 m² | 6 |
| 19 | 689 m² | 238 m² | 6 |
| | 14751 m² | 4961 m² | 186 |

*Figure 1 Thredbo Golf Course and proposed subdivision location*

## 2.1 Project description

The Development proposes 19 lots located largely on the existing first, third and fourth fairways and adjacent playing area. Building envelopes catering for future tourist accommodation development of 19 separate free-standing buildings with a proposed bed count of approximately 186 beds are planned for. The combined footprint of the 19 subdivision lots is 14,751 $m^2$.

The development proposal incorporates the following key elements:

- Woody vegetation removal (with retention of significant vegetation wherever possible) in uncleared parts of proposed subdivision lots and for subdivision access road construction
- Vegetation thinning (with retention of significant vegetation) for golf fairway widening and playing area improvement and tee shot safety
- Subdivision access road and adjacent parking area construction and connection to Crackenback Drive;
- Works to extend services (water, power, sewer) to the proposed subdivision;
- Landscaping and golf playing area modification works (shaping and turfing works to develop tees, greens, fairways and playing areas)

Detailed site development plans for both the golf course re-development works and subdivision works are contained in KT's DA. Key features of the subdivision development and golf redevelopment are summarised at section 2.1.1 to 2.1.3.

### 2.1.1 Subdivision

The Development provides for 19 separate buildings lots (Table 1) and sits largely on the existing first, third and fourth fairways. The majority of lots have been orientated to maximise solar access. All lots are sufficiently sized to accommodate future tourist accommodation buildings, vehicle access and open space. Where possible, significant vegetation within lots has been retained. The majority of lots have frontage to the proposed new access road. KT will impose building set-backs of 6 metres from road frontage and 4 metres from all other Lot boundaries. To inform the impact assessment of the proposal, conceptual building envelopes and footprints have been provided in Table 1 and depicted on the Site Plans. Final built form after sub-division, sale and sub-lease will not likely match the conceptualised plan.

***Table 1: Proposed Lots***

| Lot | Lot Area ($m^2$) | Building Footprint ($m^2$) | Beds (nominal) |
|---|---|---|---|
| **1** | 783 | 280 | 12 |
| **2** | 812 | 267 | 12 |
| **3** | 710 | 192 | 8 |
| **4** | 858 | 276 | 12 |
| **5** | 903 | 316 | 10 |
| **6** | 612 | 17 | 6 |
| **7** | 637 | 222 | 6 |
| **8** | 701 | 245 | 6 |
| **9** | 640 | 193 | 8 |
| **10** | 802 | 280 | 12 |
| **11** | 1061 | 371 | 10 |

| Lot | Lot Area ($m^2$) | Building Footprint ($m^2$) | Beds (nominal) |
|---|---|---|---|
| **12** | 1093 | 382 | 12 |
| **13** | 899 | 305 | 16 |
| **14** | 759 | 265 | 10 |
| **15** | 836 | 292 | 12 |
| **16** | 678 | 237 | 8 |
| **17** | 644 | 202 | 14 |
| **18** | 632 | 221 | 6 |
| **19** | 689 | 238 | 6 |
| **Total:** | **14,751** | **4,961** | **186** |

## 2.1.2 Golf Course Re-design

The Development necessitates a re-design of the golf course. The proposed re-design retains a nine-hole course, albeit shortened in distance with all bar one hole being par three holes. A summary of the re-design is provided in Table 2 . Detailed golf course plans (prepared by DAWSON DESIGN golf + resorts Pty Ltd), are provided in the DA.

***Table 2: Golf Course Re-design***

| Existing | | | Proposed | | | | |
|---|---|---|---|---|---|---|---|
| **Hole** | **Metres (m)** | **Par** | **Hole** | **Metres (m)** | **Elevation tee to green (m)** | **Par** | **Existing hole used** |
| **1** | 432 | 5 | **1** | 125 | +9 | Short 3 | Most 9th |
| **2** | 167 | 3 | **2** | 162 | +6 | Medium 3 | 1st |
| **3** | 348 | 4 (5) | **3** | 167 | - | Long 3 | 2nd |
| **4** | 132 | 3 | **4** | 160 | +2 | Long 3 | 3rd & new tee |
| **5** | 199 | 3 | **5** | 200 | +6 | Long 3 | 5th |
| **6** | 90 | 3 | **6** | 96 | +3 | Short 3 | 6th |
| **7** | 294 | 4 | **7** | 294 | +4 | Short 4 | 7th |
| **8** | 124 | 3 | **8** | 124 | -6 | Medium 3 | 8th |
| **9** | 322 | 4 | **9** | 181 | -23 | Long 3 | Most 9th |
| **Total** | **Mens 2,180** | **32** | | **Total** | **Mens 1,509** | **28** | **9 holes used** |
| | **(Womens) 1,947** | **(33)** | | **Change** | **-599** | **-4** | |

## 2.1.3 Provision of services to the subdivision

The Development will include provision of municipal infrastructure, including new road access and car parking, water, electricity, sewer, communications, stormwater drainage and gas infrastructure. All services will be underground and where possible located within a single trench. Connections to the existing village services will be made on the northern side of Crackenback Drive. Services plans are provided in the DA for further details. Design features of services of relevance for bushfire protection are summarized below.

#### 2.1.3.1 Subdivision access road and turnaround provision

A new subdivision access road has been designed with consideration of the following:

- The road carriageway will be 6.1 metres wide which satisfies the requirements for emergency vehicle access and can accommodate two-way traffic.
- The access road alignment follows natural contours to reduce stormwater velocities, and minimise changes to the existing drainage network.
- Clearances for snow clearing machinery.

Detailed design will be provided at the Construction Certificate stage.

#### 2.1.3.2 Car Parking

An additional 48 public carparks will be provided along the sides of the subdivision access road. Provision of these parking spaces (which are additional to future parking space provision for each of the subdivision lots when developed) will ensure that emergency vehicle access and visitor vehicle egress along the subdivision access road is not partially blocked or compromised by caps parking within the road area.

Detailed design of the proposed car parking will be provided at the Construction Certificate stage.

#### 2.1.3.3 Water Supply

The Development will provide water supply infrastructure and tap into the existing Crackenback water supply network (refer to the DA for more detail). The Development will include the provision of a new water storage tank adjacent to the existing Crackenback Water Storage tank.

#### 2.1.3.4 Electricity and Gas

The Development will include electricity and gas infrastructure to service the lots. Undergrounded services will connect into the existing network on the northern side of Crackenback Drive (refer to DA for alignment details). The lots will be connected to electricity and gas services in accordance with the relevant requirements of the supply/service provider.

#### 2.1.3.5 Telecommunications

The Development will provide telecommunications services (undergrounded) to service the lots. The services will connect into the existing network on the northern side of Crackenback Drive.

#### 2.1.3.6 Additional services

- street lighting to ensure the safety of pedestrians, cyclists and vehicles (mix of solar and LED);
- signage and wayfinding; and
- dual head fire hydrants in accordance with Australian Standard (AS 2419.1:2021).

## 2.2 Landscape context

The development site is located within the Thredbo Golf Course 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 Crackenback Drive which runs adjacent to eastern edge the golf course.

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 at around 1,400 metres elevation, with landform to the north and north west rising to over 2,000 metres on the Rams Head Range (and more than 2,200m at Mount Kosciuszko immediately further to the north-west), 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.

## 2.3 Site bushfire protection context

The proposed golf course subdivision 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 and Environment – DPE). 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 Alpine 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 Alpine 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. Site Assessment

A site bushfire assessment (including APZ and BAL determination) has been conducted and compiled in accordance with the site assessment methodology detailed in Appendix 1 of 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).

The DA involves works which will clear or modify vegetation in parts of the golf course. Accordingly, in considering BAL assessment for subdivision lots it is necessary and appropriate to assess vegetation on the basis of the vegetation cover and characteristics that will exist (assuming that Development consent is granted) noting that some vegetated areas will be cleared or modified under the DA. Vegetation clearing and modification works to be undertaken as part of the development include:

- Clearing of woody vegetation within subdivision lots (with retention of significant vegetation outside building footprints wherever possible)
- Clearing of vegetation within the access road and carpark area footpints to make way for the road and carparking spaces;
- Selected tree removal along in specified fairway edge areas on the golf course in accordance with the golf course re-design
- Selected woody vegetation thinning (with retention of significant vegetation wherever possible) in golf playing areas in accordance with the golf course re-design.

**Vegetation condition and management assumptions:**

- All vegetation within each proposed subdivision lot is assumed to be either cleared (for construction) or to be ‘managed vegetation’ (managed consistent with *low threat vegetation – exclusion* criteria per Section A1.10 of PBP) forming part of any APZ which will apply to future development of each lot.
- All vegetation within areas of the golf course designated as ‘playing area’ is assumed to be ‘managed vegetation’ (managed consistent with *low threat vegetation – exclusion* criteria per Section A1.10 of PBP) being areas where understorey vegetation will be limited to managed grass cover under retained mature trees, maintained in such condition by ongoing golf course maintenance/greenkeeping works to maintain such areas in a playable condition. This assumption was confirmed during site inspection on 17 February 2023.

Accordingly, the proposed golf course design plan has been used as a basis for vegetation assessment (Figure 3).

In Figure 3 , the subdivision area (red dashed polygons) and golf course playing areas (light blue dashed lines indicate the edge of playing areas) are classifiable as ‘managed land. Patches of retained sub-alpine woodland vegetation larger than 0.25 hectares are classified as ‘Forest’. Small internal patches of sub-alpine woodland smaller than 0.25 hectares and narrow tree strips less than 20 metres wide are incorporated into the managed land area as they are low threat vegetation – exclusion areas.

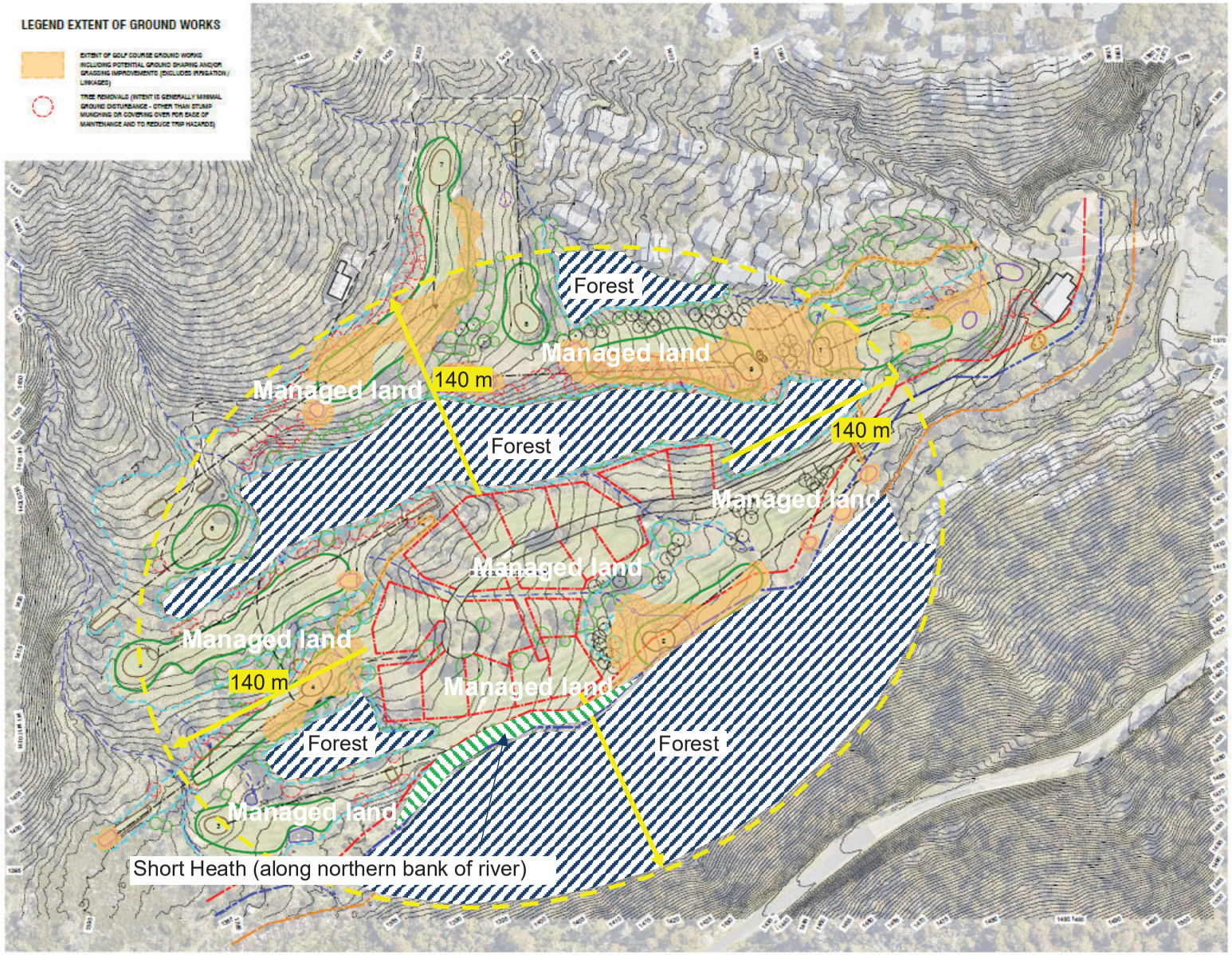



*Figure 2 Vegetation classification within 140 metres of subdivision*

Areas indicated in Figure 2 as ‘managed land’ are Low Threat Vegetation – Exclusion areas for the purpose of PBP application. Managed land areas have been assessed as low threat vegetation in accordance with PBP Section A1.10 on the basis that they are occupied by golf course playing areas or by the proposed subdivision lots which subject to approval will be managed as an APZ as a condition of consent.

Vegetation formation assessment results, for each aspect of the proposed development, are presented at Table 3. 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 3 Vegetation assessment results***

| Direction | Dominant vegetation formation | Comments |
|---|---|---|
| **North** | Forest (adjacent) and managed land (further out) | Long narrow patch of forest less than 50 metres wide on a steep slope above the subdivision area between the creekline at the northern edge of the subdivision and cleared managed land (low threat vegetation) in the northern part of golf course. |
| **East** | Managed land (adjacent) and Forest (further out) | Managed land (golf course playing areas - low threat vegetation) occupy land adjacent to subdivision to the east, then a large patch of forest lies beyond the golf course on the southern-eastern side of Thredbo River |
| **South** | Managed land (adjacent); Short Heath along river bank; and Forest (south of river) | Managed land (golf course playing areas - low threat vegetation) occupy land adjacent to subdivision to the south, then short (alpine) heath occupies the riparian zone between the river and the golf course) and then forest lies beyond the riparian zone on the southern side of Thredbo River |
| **West** | Principally managed land with a small patch of forest | Managed land (golf course playing areas - low threat vegetation) occupy land adjacent to subdivision to the west with a small patch (< 1ha) of forest situated adjacent to the south-west corner of the subdivision |

## 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 4.

Thredbo golf course's location next to the Thredbo river at the bottom of a deep, steep sided valley places it in a favourable location from a fire approach perspective with downhill or cross-slope approach from every direction.

Fire approach direction with contour mapping is depicted below at Figure 3.

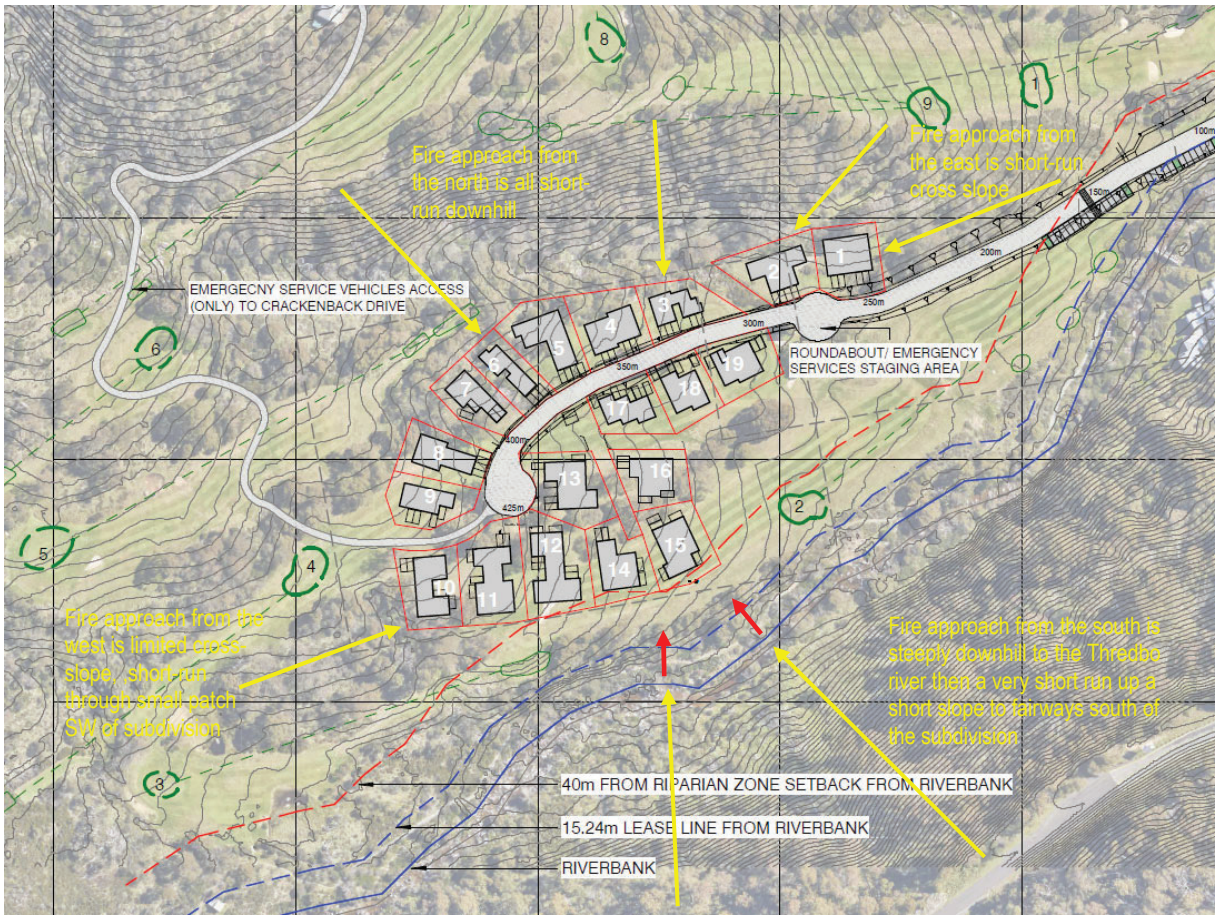



*Figure 3 Fire approach transects overlaid on contours*

*Table 4 Effective slope assessment results*

| Direction | Effective slope | Comments |
|---|---|---|
| **North** | Upslope | Land under the narrow forest patch north of the subdivision is on a steep short upslope (fire must approach downhill)<br><br>Fire approaching the subdivision from the north would be descending the long steep slope from the top of the range down to the golf course (with multiple cleared ski runs impeding fire spread from the north), would then need to spot across the northern part of the golf course into the narrow retained vegetation patch, and then descend through the steep narrow forest patch, across the creek to the subdivision. |

| Direction | Effective slope | Comments |
|---|---|---|
| | | In Thredbo's recorded history, no fire has ever come down toward the golf course – the only recorded fire in this area was uphill fire spread from defensive backburns lit above the golf course for village protection during the severe 2003 fires. |
| **East** | [Only applicable to Lot 1]<br>Downslope 0 – 5 degrees<br>(managed land lies east of all other lots) | Fire approach from the east would principally be cross-slope<br>Fire approach from the east limited to a very small patch of sub-alpine woodland east of Lot 1. |
| **South** | Downslope 0 – 5 degrees (very short run ~25 m in Short Heath between the river and golf fairway) | Forest above the riparian zone on the southern side of Thredbo River is on a steep upslope (fire must come steeply downhill from the south).<br>Fire crossing Thredbo river from the south has a short run of around 25 metres through short heath up a 0-5 degree slope before encountering short mown grass fairways on holes 2 and 3 south of the subdivision |
| **West** | Upslope 0 – 5 degrees | The area west of the subdivision is dominated by managed land (golf course playing area and very small fragmented remnant snow gum patches – Low Threat Vegetation exclusions)<br>Fire approach from the west would principally be from an upslope position with some cross slope areas from the south-west. |

## 3.3 Fire weather area determination

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

*Table 5 Fire weather area assessment*

| Area | Assumed FFDI and PBP BAL determination Table | Comments |
|---|---|---|
| Alpine area | FFDI 50<br>PBP Table A1.12.7 FFDI 50 – Alpine areas | FFDI 50 applicable on the basis of Thredbo Village being a designated Alpine Area, further supported by meteorological studies undertaken for KT, and for the Snowy Special Activation Precinct Bushfire Strategic Study |

### 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 1.4 of this bushfire assessment, the proposed subdivision development being for subsequent development as a *Holiday Let* class of *SFPP-tourist accommodation*, FFDI 50 is proposed for application of PBP to the development.

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 DPE (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 Remnant bushland and narrow vegetation corridor consideration

PBP explicitly recognises that small or narrow parcels of vegetation parcels have less opportunity to support fully developed bushfires due to their limited size, and makes provision at Section A1.11.1 for APZ reduction due to the lower hazard level associated with small scale remnant vegetation parcels. Under PBP's 'Simplified approach' for dealing with remnant vegetation parcels and narrow vegetation corridors, those less than 1 hectare or not exceeding 50 metres width may have APZ width determined as if they were 'rainforest' vegetation, regardless of what their actual vegetation type is.

The Thredbo golf course is effectively 12.5 hectares of 'managed land' which under PBP is considered 'low threat vegetation – exclusion' for the purpose of APZ and BAL determination, containing some remnant vegetation patches and narrow vegetation corridors within the golf course area. Retained tree canopy cover evident in aerial imagery of the golf course is not representative of the full extent of managed land because golf playing areas with mown grass and slashed grass ('short rough') extend under small clusters/patches of trees and into the edges of larger retained patches. This was viewed and confirmed with RFS during the pre-DA advice site inspection.

Figure 2 shows the golf course area, with light blue dashed lines depicting the edge of the playing areas proposed for the re-designed golf course. There is only one remnant patch of vegetation within the golf course area which exceeds 1 hectare. All other patches are fragmented, and less than 0.25

hectares, and most of the fragmented patches have mown grass underneath. The largest remnant patch in the central area of the golf course is approximately 1.7 hectares, is separated from larger expanses of native vegetation above the golf course by short mown tees, fairways and greens on the 6th, 7th and 8th golf holes. This central remnant patch takes the form of a vegetation corridor and when the re-designed golf course and subdivision are in place will not exceed 50 metres wide across the potential fire approach direction toward the subdivision from the north. This central vegetation corridor has the added bushfire protection advantage that it sits on a steep narrow upslope, above the proposed subdivision, with maintained tees, greens and fairways separating the corridor from native vegetation to the north of the golf course. On this basis, as provided for in PBP, the central vegetation corridor within the golf course and the smaller sub-hectare patches within the golf course have had the PBP 'simplified approach' (as per PBP section A1.11.1) applied for APZ determination.

## 3.5 APZ determination

**Acceptable Solution applied**

APZ determination as proposed in this bushfire assessment has been undertaken through application of PBP's 'acceptable solution' methodology for determining BALs and APZ's, as set out in PBP (2019) Appendix 1.

APZ determination method summary:

- Vegetation - a worst-case vegetation classification of 'Forest' has been applied to sub-alpine woodland vegetation influencing the site. Where small remnant patches (<1 ha) and narrow vegetation corridors (<50 wide) are present within the Golf Course, the PBP 'simplified approach' (PBP acceptable methodology) as per PBP section A1.11.1 has been applied which provides that such patches are considered as for rainforests for APZ determination.
- Effective Slope – the PBP slope category system has been used which assumes worst-case slope for each category (performance-based approach using actual slope to replace worst-case slope has not been used)
- FFDI – An FFDI of 50 has been assumed for APZ determination as is provided for in Table A1.12.7 which is specifically applicable for Alpine Resorts.
- Acceptable solution BAL for APZ determination for land subdivision is maximum BAL 29. BAL 29 is also the maximum allowable BAL for SFPP Tourist Accommodation – Holiday Let tourism use. Accordingly, BAL 29 has been used as the maximum acceptable BAL for APZ width determination.

Noting that the DA to which this bushfire assessment applies is for land subdivision, and that future development of each lot will be for developments classifiable as SFPP tourist accommodation of a Holiday Let classification under PBP, proposed lots and building envelopes have been assessed for their capacity to establish and maintain an APZ able to achieve a building envelope BAL not exceeding BAL 29.

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 6.

A plan view of APZ application to the proposed Thredbo Golf Course subdivision is depicted at Figure 4.

*Table 6 APZ determination for SFPP Tourist Accommodation – Holiday Let tourism use category*

| Development Type / Lots | Vegetation formation | Slope Class | FFDI | Max BAL | Min APZ | Comments regarding Lot ability to house a viable building envelope and APZ |
|---|---|---|---|---|---|---|
| SFPP Tourist Accommodation – Holiday Let tourism use category with PBP A1.11.1 "simplified approach' provisions applied for narrow vegetation corridors and remnant vegetation patches <1ha | | | | | | |
| Lots 1 to 9 | Narrow corridor of sub-alpine woodland to the north (deemed as rainforest for APZ calculation) | Upslope | 50 | BAL 29 | 7 metres to north | Based on proposed building footprints for each Lot, the APZ has potential to extend over northern boundary of Lots 1 to 7 by up to 3 metres. It is proposed that a 3 metre wide, natural surface cleared break is maintained along the northern perimeter of the subdivision, within the head-lease area, to be maintained by KT. Formal written agreement of KT has been obtained – alternative is to adjust subdivision boundary or move building envelopes south by around 3 metres). Lots 8 and 9 have golf course playing area (behind 4th green) up to the lot boundary which can/will be maintained as APZ. |
| Lot 1 | Section of narrow corridor of sub-alpine woodland to the east (deemed as rainforest for APZ calculation) | Downslope | 50 | BAL 29 | 8 metres to east | Based on proposed building footprint for Lot 1, the APZ extending east of Lot 1 has potential to extend over eastern boundary of Lot 1 by up to 3 metres. It is proposed that a 3 metre wide, natural surface cleared break is maintained |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | along the eastern perimeter of Lot 1, within the head-lease area, to be maintained by KT. Formal written agreement of KT has been obtained |
| Lot 10 | Small (<1ha) patch of sub-alpine woodland to the west (deemed as rainforest for APZ calculation) | Downslope 0-5 degrees | 50 | BAL 29 | 8 metres to west | Based on proposed building footprint for Lot 10, the APZ extending west of Lot 10 has potential to extend over western boundary of Lot 10 by up to 3 metres. It is proposed that a 3 metre wide, natural surface cleared break is maintained along the western perimeter of Lot 10, within the head-lease area, to be maintained by KT. Formal written agreement of KT has been obtained |
| Lots 10 to 19 | Maintained golf course playing area immediately south of lots Extending for more than 10 m from lot boundaries, flanked by riparian zone occupied by narrow 25 metre wide strip of short alpine heath along Thredbo river to the south | Downslope[1] 0-5 degrees | 50 | BAL 29 | 10 metres to south | Based on proposed building footprints for each Lot, the APZ extending south of Lots 10 to 15 and Lots 18 and 19 will extend over the southern boundary of the subdivision into already cleared golf playing area which will be playing area on the 2nd and 3rd golf holes and transit area in between. The APZ extension into the golf course playing area is within the head-lease area, to be maintained by KT. Formal written agreement of KT has been obtained |

[1] In practice a bushfire approaching from the south would need to descend down the long steep southern side of Thredbo Valley, and would only encounter a downslope below the development for around 25 metres along the northern bank of the Thredbo River

*Figure 4 APZ plan view for Thredbo Golf Course subdivision*

## 3.5.1 Calculation of APZ using Acceptable Solutions

An extract from PBP Table A1.12.7 to show derivation of assessed minimum APZ width for the Lots along the northern edge of the subdivision is depicted at Figure 5 below. The 8 metre APZ width along the western side of the subdivision adopts the same methodology but the downslope 0-5 degrees table is used. The 10 metre APZ width along the southern side of the subdivision adopts the same methodology but the Short Heath vegetation category is used (on the basis of the vegetation type I the Thredbo River riparian zone and that vegetation to the south is not a small remnant patch or narrow corridor) and the downslope 0-5 degrees table is used.

**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 | | | | |
| ALL UPSLOPE AND FLAT LAND | Rainforest | < 5 | 5 -< 7 | 7 -< 10 | 10 -< 15 | 15 -< 100 |
| | 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 5 Minimum APZ determination for Forest/Upslope/BAL29 in Alpine Areas (FFDI 50)*

| | 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 | | | | |
| > 0 > 5 DEGREES – DOWNSLOPE | Rainforest | < 6 | 6 -< 8 | 8 -< 12 | 12 -< 18 | 18 -< 100 |
| | Forest (wet and dry sclerophyll) including Coastal Swamp Forest, Pine Plantations and Sub-Alpine Woodland | < 14 | 14 -< 18 | 18 -< 26 | 26 -< 36 | 36 -< 100 |
| | Grassy and Semi-Arid Woodland (including Mallee) | < 7 | 7 -< 10 | 10 -< 14 | 14 -< 21 | 21 -< 100 |
| | Forested Wetland (excluding Coastal Swamp Forest) | < 6 | 6 -< 8 | 8 -< 11 | 11 -< 16 | 16 -< 100 |
| | Tall Heath | < 13 | 13 -< 18 | 18 -< 26 | 26 -< 36 | 36 -< 100 |
| | Short Heath | < 8 | 8 -< 10 | 10 -< 15 | 15 -< 22 | 22 -< 100 |
| | Arid-Shrublands (acacia and chenopod) | < 5 | 5 -< 7 | 7 -< 11 | 11 -< 16 | 16 -< 100 |
| | Freshwater Wetlands | < 4 | 4 -< 6 | 6 -< 8 | 8 -< 12 | 12 -< 100 |
| | Alpine Complex | <5 | 5 -< 6 | 6 -< 10 | 10 -< 14 | 14 -< 100 |
| | Grassland | < 7 | 7 -< 9 | 9 -< 13 | 13 -< 19 | 19 -< 50 |

*Figure 6 Minimum APZ determination for Short Heath/Downslope 0-5 degrees / BAL 29 in Alpine Areas (FFDI 50)*

# 3.6 Determination of Construction standard

Noting that the DA for which this bushfire assessment report has been prepared covers land subdivision (no construction of buildings within subdivision lots is proposed in the DA), no construction standards apply to the DA. However, noting that the subdivision is for the intended purpose of future development of SFPP Tourist Accommodation for Holiday Let tourism use, in assessing the potential for each proposed lot to accommodate a viable building envelope and APZ, a maximum BAL 29 has been assumed for assessment.

# 4. Bushfire Protection Measures to meet the aims and objectives of PBP 2019

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

As explained in detail at section 1.3 of this bushfire assessment report, the proposed development is unusual in that it seeks to undertake land sub-division, not for residential or rural residential use, but for SFPP use in an alpine resort area for the future creation of new tourist accommodation categorizable under PBP as *Holiday Let* tourism use. In undertaking the bushfire assessment, GHD has sought to implement a reasonable and pragmatic approach which addresses performance criteria and acceptable solutions relevant for land subdivision, but applies lot design/building footprint metrics which accommodate future SFPP developments (as opposed to residential developments) within each lot. Noting that the future SFPP developments pursued on each of the subdivided lots will necessarily be for short-term tourist accommodation and will be consistent with the *Holiday Let* category of tourism use as defined in PBP (i.e. does not back on to public reserves – all subdivision lots being contained fully within the KT lease area, connected to reticulated water, and located such that BAL 29 construction requirements can be applied), subdivision lots have been designed to contain viable building envelopes which can meet a radiant heat threshold of 29 kW/m$^2$, as is an acceptable solution for SFPP Holiday Let category tourism development.

Table 7 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**

- For all subdivision lots, a viable building envelope and APZ achieving a maximum BAL 29 is able to be achieved, with minor APZ extension over sub-lease lot boundaries into head lease land within the golf course for which KT has provided written agreement to maintain any portion of the APZ extending into the head leas area. Acceptable solution APZ dimensions have been determined using Table A1.12.7 requirements for achieving BAL 29 in FFDI 50 Alpine Area, where appropriate applying PBPs 'simplified approach' for remnant vegetation patches < 1ha and narrow vegetation corridors up to 50 wide.
- Slope within all APZ areas is substantially less than 18 degrees and able to be managed in accordance with PBP Appendix 4
- APZ potions within sub-lease lots and on KT leasehold land are able to be managed in perpetuity

**Construction standard** ✓ **Acceptable Solutions can be applied**

- A construction level of BAL-29 under AS 3959 or relevant requirements of the NASH Standard, and section 7.5 of PBP, can be applied for future development of the proposed subdivision lots.

**Access/egress** ✓ **Performance-based Solution proposed**

- All elements of site access provision can satisfy minimum requirements for an 'Acceptable Solution' pathway except that a two-way dead-end road with two turnaround areas is proposed in lieu of a through road. The proposed access road will traverse clear open golf course areas with unimpeded visibility to and within the subdivision, and is set back at least 25

metres from the narrow remnant vegetation corridor north of the subdivision, and all performance criteria for non-perimeter access roads can be met or exceeded.

- Details of the performance-based solution for subdivision access are documented at Section 4.1

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

- All lots will have access to reticulated water supply with hydrants able to be provided in accordance with the relevant clauses of AS 2419.1:2021

**Electricity Services** ✓ **Acceptable Solutions proposed**

- Mains supply to the subdivision lots is underground

**Gas Services** ✓ **Acceptable Solutions proposed**

- Gas supply infrastructure to subdivision lots proposed

**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

The aim of PBP 2019 can be met by achieving each of the performance criteria and acceptable solutions specified in Section 5 of PBP 2019 as detailed in Table 7.

*Table 7 PBP compliance*

| | Performance Criteria | Acceptable Solutions | Compliance notes |
|---|---|---|---|
| | **The intent may be achieved where:** | | Noting that maximum BAL (29) for SFPP Tourist Accommodation - Holiday Let tourism use is the same as for land subdivision: |
| **ASSET PROTECTION ZONES (APZ)** | Potential building footprints must not be exposed to radiant heat levels exceeding 29 kW/$m^2$ on each proposed lot | APZs are provided in accordance with Tables A1.12.2 and A1.12.3 based on the FFDI [noting that the appropriate Table for FFDI 50 (Alpine Resorts) is Table A1.12.7] | **Complies with all Acceptable Solutions specification**<br>APZs for each of the 19 proposed subdivision lots (based on application of Table A1.12.7 (FFDI 50 – Alpine Areas) in Appendix 1 of PBP) are viable. The following APZ's can achieve APZ compliance for the planned building footprints:<br>• Entire lot area for each lot to be maintained as APZ IPA<br>• 7 metres from northern or north-western edges of building footprints in Lots 1 to 9<br>• 8 metres from western edge of building footprint in Lot 10<br>• 10 metres from southern edge of building footprints in Lots 10, 11, 12, 14, 15, 18 & 19<br>• 8 metres from the eastern edge of building footprint in Lot 1<br>To the extent that any of the above APZs extend across sublease lot boundaries into the head lease area within the golf course, KT agrees to maintain any portion of the APZ within the head lease area. |
| | 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 with Acceptable Solution**<br>APZ to be managed in accordance with PBP |
| | The APZ is managed in perpetuity<br>APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised. | APZs are wholly within the leasehold area<br>the APZ is located on lands with a slope less than 18 degrees. | **Can comply with Acceptable Solution**<br>APZs are wholly within sublease lots and KT's head lease area<br>The maximum land slope under the APZs does not exceed 10° |

| Performance Criteria | | Acceptable Solutions | Compliance notes |
|---|---|---|---|
| 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<br>A clear area of low-cut lawn or pavement is maintained adjacent to the building<br>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. | **Can comply with Acceptable Solution**<br>All area within each of the 19 sub-lease lots not occupied by buildings will form part of the APZ, complying with Appendix 4 of PBP<br><br>Any retained trees not to overhang roof areas |

| Performance Criteria | | Acceptable Solutions | Compliance notes |
|---|---|---|---|
| **The intent may be achieved where:** | | | |
| ACCESS | Firefighting vehicles are provided with safe, all-weather access to structures | | **Cannot comply with Acceptable Solutions for through road provision and perimeter road provision for three or more allotments – Performance based solution proposed which complies with performance criteria** |
| | | Property access roads are two-wheel drive, all-weather roads. | Complies with Acceptable Solution |
| | | Perimeter roads are provided for residential subdivisions of three or more allotments | Performance-based solution proposed – subdivision location not suitable for perimeter road provision – full access functionality for firefighting around the subdivision is available via wide golf course fairways, and an additional access track around the northern perimeter of the golf course connecting the subdivision to the golf course maintenance shed and through to the end of Crackenback Drive is also provided |
| | | Subdivisions of three or more allotments have more than one access in and out of the development | |
| | | Traffic management devices are constructed to not prohibit access by emergency services vehicles | NA – no traffic management devices |
| | | Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by | Complies |

| Performance Criteria | Acceptable Solutions | Compliance notes |
|---|---|---|
| | road design standards, whichever is the lesser gradient | |
| | All roads are through roads | Cannot provide through road for Acceptable Solution, however the proposed performance solution satisfies access performance criteria (see section 4.1) |
| | Dead end roads are not recommended, but if unavoidable are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly signposted as a dead end | Cannot keep dead end road to less than 200m to comply with Acceptable Solution however the proposed performance solution satisfies access performance criteria (see section 4.1) |
| | Where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road | NA – no perimeter road incorporated |
| | Where access/egress can only be achieved through forest, woodland and heath vegetation, secondary access shall be provided to an alternate point on the existing public road system | NA – access/egress is not through forest, woodland or shrubland – access is via managed land (golf course) |
| | One way only public access roads are no less than 3.5 m wide and have designated parking bays with hydrants located outside these areas to ensure accessibility to reticulated water for fire suppression | NA – No one way public roads proposed |
| 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 with Acceptable Solution** |
| There is appropriate access to water supply | Hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005 | **Complies with Acceptable Solution**<br>All proposed lots will be serviced by reticulated water supply. Hydrants to be provided in accordance with the relevant clauses of AS 2419.1:2021 |

| Performance Criteria | Acceptable Solutions | Compliance notes |
|---|---|---|
| Access roads [non-perimeter] are designed to allow safe access and egress for firefighting vehicles while residents are evacuating | Minimum 5.5m carriageway width kerb to kerb | **Complies – 6.1 metre carriageway proposed** |
| | Parking is provided outside carriageway width | Complies |
| | Hydrants are located clear of parking areas | Complies |
| | Roads are through roads and these are linked to the internal road system at an interval of no greater than 500m | Cannot comply with through road specification of Acceptable Solution – Performance-based solution complies with performance criteria (see section 4.1) |
| | Curves of roads have a minimum inner radius of 6 metres | Complies |
| | The road crossfall does not exceed 3 degrees | Complies |
| | A minimum vertical clearance of 4m to any overhanging obstructions including tree branches is provided. | Complies |

| 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**<br>The proposed development will be serviced by reticulated water supply. |
| | Water supplies are located at regular intervals | Fire hydrant spacing, design and sizing comply with the relevant clauses of Australian Standard AS2419.1:2021 | **Can comply**<br>Compliance with fire hydrant spacing, design and sizing with the relevant clauses of Australian Standard AS2419.1:2021 is proposed<br>No hydrants are proposed within any road carriageways |

| Performance Criteria | | Acceptable Solutions | Compliance notes |
|---|---|---|---|
| | The water supply is accessible and reliable for firefighting operations | Hydrants are not located within any road carriageway | |
| | Flows and pressure are appropriate | Hydrants are provided in accordance with the relevant clauses of AS 2419.1:2021 | **Can comply**<br>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**<br>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**<br>Electrical mains connection to lots will be 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;<br>Above-ground gas service pipes external to the building are metal, including and up to any outlets | **Can comply**<br>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 |

| | Performance Criteria | Acceptable Solutions | Compliance notes |
|---|---|---|---|
| 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.<br>Construction is provided in accordance with the NCC and as modified by section 7.5 | **Can comply**<br>BAL determined in accordance with Table A1.12.7.<br><br>Future development and construction within subdivision lots 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**<br>No gates or fences proposed |

| | Performance Criteria | Acceptable Solutions | Compliance notes |
|---|---|---|---|
| | **The intent may be achieved where:** | | |
| 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**<br>A Bushire Evacuation Plan for the whole of Thredbo Alpine Resort prepared by KT is in place.<br><br>As resulting lots/subleases are developed in the future (subject to DA consent) a Bush Fire Emergency Management and Evacuation Plan specific to the proposed development can be prepared, informed by and consistent with the Thredbo Alpine Village Bushfire Evacuation Plan. |

# 4.1 Subdivision Access – Performance based solution

**Performance Based Solution proposed**

All acceptable solutions can be provided for all subdivision access Acceptable Solution requirements except Acceptable Solutions requiring that the subdivision access road be a 'through road' and that subdivisions of more than 3 lots be provided with a perimeter road. Noting the National Park setting and objectives to minimize subdivision road impacts in sensitive alpine environment and riparian zone along the Thredbo River, such solutions are not practicable at the site. Accordingly, a performance-based solution for subdivision access is proposed.

The PBP performance criteria for providing subdivision access (general requirements) are:

- *Firefighting vehicles are provided with safe, all-weather access to structures*
- *The capacity of access roads is adequate for firefighting vehicles*
- *There is appropriate access to water supply*
- *Access roads (non-perimeter) are designed to provide safe access and egress fire firefighting vehicles while residents are evacuating*

## 4.1.1 Bushfire design brief development

The development of a performance based solution requires the development of an appropriate bushfire design brief to enable and support analysis and evaluation of any proposed performance-based solution.

KT convened an on-site pre-DA advice meeting with RFS (M. Webster), attended also by GHD (Paul de Mar), on 17 February 2023. The on-site meeting included a walk-through viewing of the of the proposed subdivision site and golf course playing areas, discussion regarding vegetation types and fuels, golf course management and condition, and fire weather extremes, FFDI and fire behaviour (experienced and potential) for the Thredbo village locality. This bushfire design brief has been developed based on consultative discussion undertaken during the site visit.

**Bushfire design brief**

| | |
|---|---|
| Location | Thredbo Golf Course |
| Landscape position | In the bottom of a deep, steep sided valley within the Thredbo Village Alpine Resort |
| Elevation | Subdivision area of the golf course is at approximately 1,400m elevation.<br>Terrain in the worst-case fire approach direction to the north west rises steeply to more than 2,000m along Ramshead range then rises further to Australia's highest peak (Mt Kosciuszko – 2,228 metres) which lies approximately 6.6 km north-west of Thredbo village.<br>The southern side of the valley also rises steeply to more than 1,800m |
| Most probable fire approach direction in adverse fire weather | Historically from the north west - fire approaching across the range must descend from the top of the main range down the steep south-east facing slopes between Ramshead Range and Thredbo Golf Course. |

| | |
|---|---|
| Assumed FFDI for BAL modelling | Assumed Forest Fire Danger Index (FFDI): FFDI 50 – consistent with PBP Alpine Areas BAL determination Table (A1.12.7) and the Strategic Bushfire Assessment undertaken for the Snowy Mountains SAP, and also with GHD analysis of all historical Bureau of Meteorology data for both Thredbo Village and Thredbo Top Station |
| Vegetation type and fuel input values for RHF modelling | Sub-alpine woodland vegetation above Thredbo Golf Course (to the north-west) and within remnant vegetation patches within the golf course. Assumed fuel values for sub-alpine woodland for fire behaviour modelling (from RFS Comprehensive Vegetation Fuel Loads publication – RFS, 2019)<br>o Surface and elevated fuels: 18 t/ha (for fire spread modelling)<br>o Overall fuel load (including bark and canopy) 27.3 t/ha |
| Slope assumptions | • Above Thredbo Golf Course: Typically steep slopes around 15 degrees and steeper (upslope).<br>• Slope within narrow vegetation corridor within Thredbo Golf Course: Approximately 12 degrees (upslope)<br>• Slope within riparian vegetation (short heath) on north bank of Thredbo River (variable with very short run from river to golf course ~25 metres): Downslope 5 degrees |
| Flame Temperature | 1200 K (as for SFPP) |

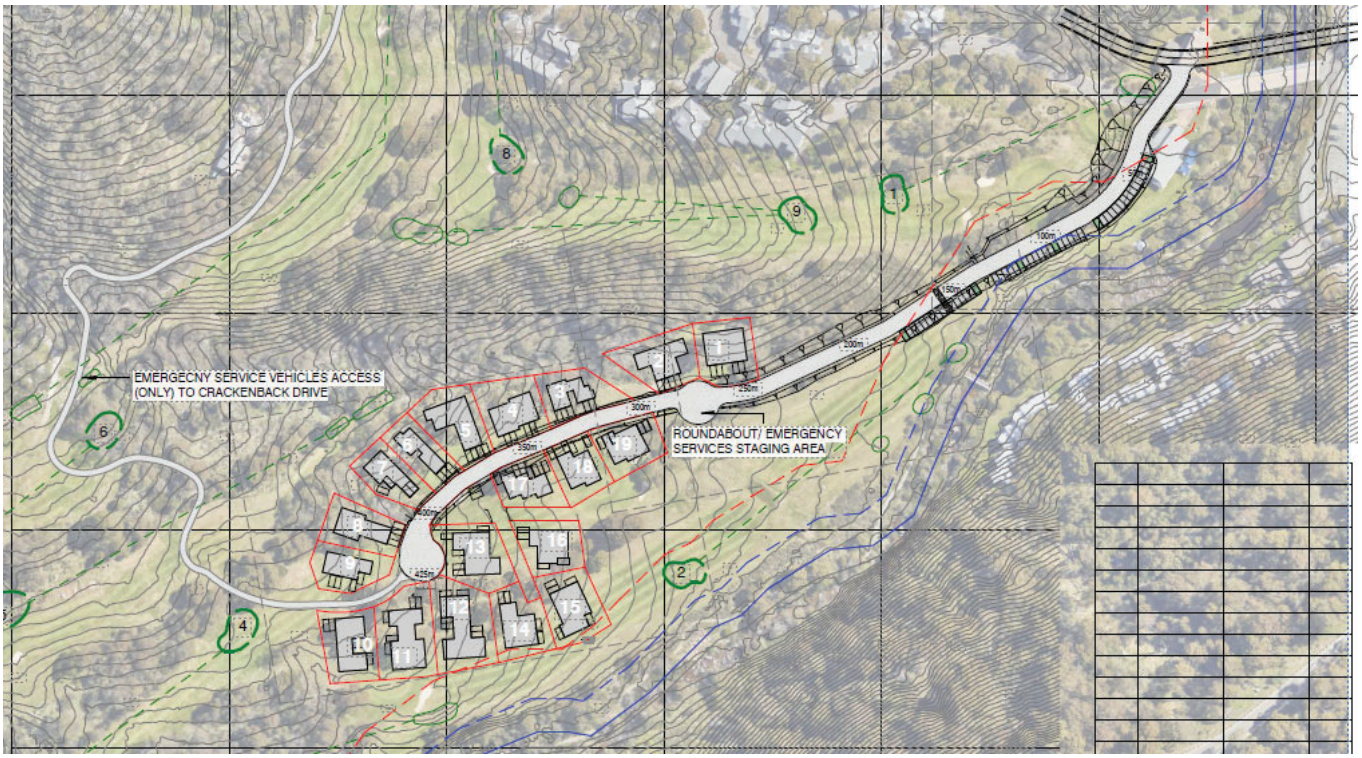
The above input values from the design fire brief have been used in analysis and evaluation of safe access for firefighters to all subdivision lots.

### 4.1.2 Proposed access road design

The key features of the proposed subdivision access road are summarised below:

- Location: Within existing Thredbo Golf Course
- Connection to existing public road system: Junction on Crackenback Drive opposite Thredbo Village Chapel (Figure 1)
- Access Road Sections (two):
  - Section 1 from Junction with Crackenback Drive to subdivision entry turnaround point and staging area (~270 metres)
  - Section 2 from subdivision entry turnaround to access road endpoint turnaround (~155 metres)
- Road carriageway width: 6.1 metres (noting section 1 design provides designated off-road car parking spaces (perpendicular to road direction) with parking bays approximately 4.5 metres deep.
- Road surface standard: All weather 2WD (bitumen sealed)
- Road alignment and oncoming traffic visibility: Straight-line visibility along Section 1 to subdivision entry turnaround area from at least 200 metres. Road alignment within subdivision (Section 2) – shallow arc formation facilitating unimpeded visibility more than 100 metres ahead from all road points within the subdivision.

- Radiant heat flux exposure along the access road: The subdivision access road has minimal direct exposure to bushfire prone vegetation and has substantial separation from remnant vegetation along a high proportion of its length. More than 80% of the access road length (from entry junction to end turnaround is flanked by either maintained irrigated golf fairway/playing areas or by the subdivision lots. As subdivision lots are developed, the presence of ski lodge buildings within the subdivision will provide substantial radiant heat shielding from any fire sources potentially burning in isolated remnant vegetation patches north and west of the subdivision, and to the south from riparian vegetation along the Thredbo River. The only part of the entry road directly flanked by retained native vegetation is a 100 metre segment of Section 1 – this patch of vegetation will be less than 40 metres wide and is on an upslope above the road. Fire spread into the patch and toward the access road would either be by spotting (noting the patch is immediately adjacent to the irrigated 1st and 9th greens) or cross-slope flanking within the narrow vegetation corridor. Spot fire ignition or flanking fire in the patch can be expected to burn at an intensity well below the potential fireline intensity for sub-alpine woodland vegetation, noting also a downhill spread direction toward the road. Immediately opposite the vegetation remnant is an open grass fairway area on the 2nd golf hole. In summary, more than 80% of the subdivision access road will be set back from the closest remnant vegetation patch (to the NW) by between 25 to 30 metres and the only direct exposure to remnant vegetation along the entrance road is a 100m road section where the vegetation patch is 40m wide and on an upslope above the road. These subdivision access road features provide safe all weather access by firefighting vehicles to all structures.
- It should be borne in mind that in accordance with the Thredbo Resort Bushfire Evacuation Plan prepared by KT Chief Fire Warden in consultation with NSW RFS, NSW Fire & Rescue (Thredbo) and NPWS, all resort visitors, residents and non-essential staff are evacuated from within KNP when a fire Incident Management Team assesses a fire is potentially within 12 to 48 hours of potential impact on Thredbo Village. Due to Thredbo Alpine Village's location in a deep steep sided valley in the lee of the highest part of the main range, historically, potential fire threats to Thredbo Village have always provided ample advanced warning timeframe for planned and precautionary village evacuation. In practice, as has occurred in 2003 and 2020, all tourist accommodation is evacuated well prior to a fire threat and thus emergency services have clear access along resort roads, noting it can be expected this will also be the case in the proposed subdivision.



### 4.1.3 Subdivision access road performance based solution evaluation

GHD concludes that the analyses presented in section 4.1.2 above, and the evaluation below, demonstrates that the proposed subdivision access road satisfies the appropriate access road performance criteria.

***Performance Criterion 1:*** *Firefighting vehicles are provided with safe, all-weather access to structures.*

- While the subdivision access road is not a through road (as required for 'acceptable solution' pathway), it makes provision for firefighting appliance turnaround at two separate locations – the first turnaround is within the golf course area at the entrance to the subdivision and the second is at the access road termination within the subdivision – this provides two locations for safe turnaround of firefighting vehicles, approximately 150 metres apart;
- The subdivision access road will not be through forest, woodland or heath – it will be through a golf course (managed land – low threat vegetation) and when developed, the access road will be an internal non-perimeter road within a 19 lot subdivision. No segment of the access road will be 'through' forest, woodland or heath on both sides of the road, thus acceptable solutions requiring a secondary access to an alternate point on the existing public road system are not required.
- The design of the access road with long near-straight sections through the golf course toward the subdivision and a gentle arc alignment within the subdivision will provide a high degree of oncoming traffic visibility and safety;
- Bitumen sealing of the full length of the subdivision access road and turnaround points will provide for all weather access, including for 2WD firefighting vehicles;
- Golf course subdivision design will provide lots on both sides of the access road such that the road is set back from the nearest remnant native vegetation corridor by at least 25 metres. This road set back from remnant vegetation, in combination with the presence in the future of BAL 29 rated built structures as lots are developed will provide safe set back and shielding opportunities for firefighting vehicles from any radiant heat sources in the narrow vegetation corridor north of the subdivision. At road frontage location in front of all subdivision lots, BAL will be less than BAL 10 along the road frontage. Within the subdivision, the set back distance between the road and riparian vegetation along the Thredbo River is 60 metres at the end turnaround and exceeds 60m along the rest of the road within the subdivision. This will provide firefighting vehicles with safe access to structures (for structure defence when these are developed).

***Performance Criterion 2****: The capacity of access roads is adequate for firefighting vehicles*

- The bitumen-sealed access road capacity will be able to carry fully loaded firefighting vehicles up to 23 tonnes and there are no bridges or causeways along the access road.

***Performance Criterion 3:*** *There is appropriate access to water supply*

- Hydrants will be located outside of road carriageways and parking reserves;
- Hydrant design will comply with the relevant clauses of AS 2419.1:2021

***Performance Criterion 4:*** *Access roads (non-perimeter) are designed to provide safe access and egress fire firefighting vehicles while residents are evacuating*

- The 6.1 metre width of the access road exceeds minimum width requirements for non-perimeter roads and will provide safe two-way access for firefighting vehicles and visitor/resident evacuation;
- Parking is provided outside of the carriageway width;
- The subdivision access road will comply with all PBP requirements for maximum and average grade, maximum crossfall, minimum inner radius for curves, firefighting vehicle load carrying capacity, minimum width and vertical clearance.

On the above basis, the performance criteria for the subdivision access road can be met without the need to provide through access (through sensitive riparian vegetation along the Thredbo River) or an alternative access.

## 4.2 PBP Objectives specific to Alpine Resorts

Table 7 set out how the proposed development complies with relevant PBP objectives for SFPP Tourist Accommodation used for Holiday Let tourism use.

Section 6.6 of PBP also details specific objectives for SFPP infill development in Alpine Areas. Table 8 below identifies how these objectives are met.

*Table 8 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 head lease area |
| Proposed APZs outside of the sub lease or head lease 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 head lease 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 head lease area |
| Ensure building design and construction standards enhance the chances of occupant and building survival | **Complies** – BAL 29 compliance specified. Design provides for future building evacuation on to the subdivision access road away from the fire hazard, with BAL 10 achieved for the building exit point, and fully shielded from radiant heat by each 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 5 of PBP 2019, as are applicable for subdivision for SFPP Tourist Accommodation Holiday Let developments. These performance criteria are summarised in Table 8.

*Table 9 Recommendations and summary of performance criteria – PBP 2019*

| Measures | Recommended Bushfire Protection Measures |
|---|---|
| **Asset Protection Zones**<br>(Per Appendix 4 PBP, 2019) | **Minimum APZ specifications for the proposed Thredbo Golf Course subdivision:**<br>– The full extent of unbuilt area within each subdivision lot to be established and maintained as an APZ – Inner Protection Area.<br>– Noting that the DA is for land subdivision and does not entail building construction within lots, building envelopes indicated in the DA for each lot will result in APZ’s extending beyond sub-lease lot boundaries such that when development of lots occurs, APZ’s will extend into the head lease area within the golf course. Accordingly, KT will need to provide written acknowledgement that any portion of an APZ extending beyond sublease boundaries will be the responsibility of KT to establish and maintain. Noting that actual APZ dimension will be determined as part of the DA process for future development of each individual lot within the proposed subdivision, indicatively, the following minimum APZ widths have been assessed:<br>– Extending from the northern or north-western elevations of building footprints in Lots 1 to 9: Minimum APZ = 7 metres<br>– Extending from the western elevation of the building footprint in Lot 10: Minimum APZ = 8 metres<br>– Extending from the eastern elevation of the building footprint in Lot 1: Minimum APZ = 8 metres<br>– Extending from the southern elevation of of building footprints in Lots 10, 11, 12, 14, 15, 18 & 19: Minimum APZ = 10 metres |

| Measures | Recommended Bushfire Protection Measures |
|---|---|
| **Construction requirements** | Noting that the DA which is the subject of this bushfire assessment is for land subdivision (and not for building construction within individual subdivision lots) future building construction within building envelopes identifies in the DA will need to 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**<br>(per Appendix 3 PBP, 2019) | GHD recommends the subdivision access road plan incorporated in the DA be accepted as a conforming performance based solution.<br>It is further recommended the planned subdivision access road comply with the following PBP requirements:<br>– A minimum carriageway width of 5.5 m (kerb to kerb) consistent with PBP requirements for non-perimeter access roads<br>– Turning head dimension compliance with Appendix 3 of PBP<br>– Other minimum functional specifications as for "non-perimeter roads" in Table 5.3b of PBP. |
| **Services – water, electricity, and gas** | **Water:**<br>– Reticulated water to be provided to the development.<br>– Fire hydrants 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 2419.1:2021; hydrants are not located within any road carriageway<br>– Fire hydrant flows and pressures are to comply with the relevant clauses of AS 2419.1:2021.<br>– All above-ground water service pipes are to be metal, including and up to any taps.<br>**Electricity:**<br>– Electrical services to all proposed lots are underground<br>**Gas:**<br>– Gas services infrastructure to lots to be underground |

# 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

# GHD Thredbo Fire Weather Study Report

# 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 have 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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