BLACKASH
BUSHFIRE CONSULTING

Bushfire Hazard Assessment

Westlink Industrial (Stage 2)

SSD-46983729

1030 – 1050 Mamre Road, Kemps Creek

Prepared for

ESR Australia

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Version 3.0

20 September 2023

Project Name:	Westlink Industrial (Stage 2) - SSD-46983729
Site Details	Westlink Industrial Estate
Client Details:	Grace Macdonald Senior Planner ESR Australia Level 29, 20 Bond Street, SYDNEY, NSW 2000 By email: Grace.Macdonald@esr.com
BlackAsh Contact Details	
Corey Shackleton	Principal – Bushfire & Resilience
0418 412 118	corey.shackleton@blackash.com.au

Version	Primary Author(s)	Description	Date Completed
0.1	Corey Shackleton	Draft	30 September 2022
1.0	Corey Shackleton	Final	27 October 2022
2.0	Corey Shackleton	Updated plans	8 August 2023
3.0	Corey Shackleton	Updated plans	20 September 2023

Corey Shackleton / Principal Bushfire & Resilience
Blackash Bushfire Consulting
B.Sc., Grad. Dip. (Design for Bushfire Prone Areas)
Fire Protection Association of Australia BPAD Level 3 – 34603

Disclaimer

Blackash Bushfire Pty Ltd has prepared this document in good faith based on the information provided to it, and has endeavored to ensure that the information in this document is correct. However, many factors outside the current knowledge or control of Blackash affect the recipient's needs and project plans. Blackash does not warrant or represent that the document is free from error or omissions and does not accept liability for any errors or omissions. The scope of services was defined in consultation with the client by time and budgetary constraints imposed by the client and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an on-going basis and readers should obtain up-to-date information. To the fullest extent possible Blackash expressly excludes any express or implied warranty as to condition, fitness, merchantability or suitability of this document and limits its liability for direct or consequential loss at the option of Blackash to re-supply the document or the cost of correcting the document. In no event shall responses to questions or any other information in this document be deemed to be incorporated into any legally binding agreement without the express written consent of an officer of Blackash. The information in this document is proprietary, confidential and an unpublished work and is provided upon the recipient's promise to keep such information confidential and for the sole purpose of the recipient evaluating products / services provided by Blackash. In no event may this information be supplied to third parties without written consent from Blackash.

Contents

1. Summary

Table 1 is a summary of compliance with relevant documents and approaches to limit bushfire attack and meet the requirements of the NSW planning framework for new development in Bushfire Prone Areas.

Table 1: Summary

Planning for Bushfire Protection 2019 Classification	"Other" commercial/ industrial
Location	Lot 3 & 4 DP 250002 Lot 11, 12 & 13 DP 253503
Local Government Area	Penrith
Can this proposal comply with AS3959, 2018	AS3959, 2018 does not apply as a DTS Provision
Does this development comply with the requirements of *Planning for Bushfire Protection 2019?*	YES
Does this development comply with the Aims and objectives of *Planning for Bushfire Protection 2019*?	YES
Is referral to the NSW RFS required?	NO

Assessment Framework	☒ *Planning for Bushfire Protection 2019*
	☒ Meets the deemed to satisfy provisions
	☐ Alternate solution/ performance-based assessment

2. Introduction

Blackash Bushfire Consulting has been engaged by ESR Australia to provide a Bushfire Hazard Assessment report to support an application for the State Significant Development Approval for the proposed warehouse buildings, forming Stage 2 of the Westlink Industrial Estate. The proposed development is classified as 'State Significant Development' (SSD) pursuant to Schedule 1 of *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

Industrial development such as the proposed warehouse is designated as "other" development in PBP 2019. As "other" development, the proposed development has considerable flexibility and the nature of the development often results in the structures providing a higher degree of bushfire resistance that required by the NSW Rural Fire Service (NSW RFS). As "other" development, a key issue for the proposal will be meeting the aim and objectives of *Planning for Bushfire Protection* and the performance requirements for industrial development.

This report has been completed having regard to Secretary for Planning and Environment's (the Secretary) Environmental Assessment Requirements (SEARs) issued for the proposal on 10 August 2022. The SEARs contain a requirement that "*If the development is on bush fire prone land, or a bush fire threat is identified on or adjoining the site, provide a bush fire assessment that details proposed bush fire protection measures and demonstrates compliance with Planning for Bush Fire Protection*".

This bushfire assessment details the proposed bush fire protection measures and demonstrates compliance with Planning for Bush Fire Protection. This assessment has been prepared by Corey Shackleton, Principal Bushfire & Resilience (FPAA BPAD Level 3 Certified Practitioner No. BPD-L3-34603) who is recognised by the NSW RFS as qualified in bushfire risk assessment and have been accredited by the Fire Protection Association of Australia as a suitably qualified consultant to undertake alternative solution proposals.

3. Site Context

The estate masterplan is shown in Figure 1 and is legally described as Lots 3 and 4 DP 250002 and Lots 11, 12 & 13 DP 253503. The site is located within the rapidly expanding Kemps Creek area.

The Westlink Industrial Estate is in the Penrith Local Government Area (LGA).

The estate is generally surrounded by existing farming land, with Mamre Road forming the western boundary. The Stage 2 site is bound to the north and east by other future stages of the Westlink Industrial Estate, west by Mamre Road and south by Faming land/grassland.

4. The Proposal

The proposal is for a warehouse and distribution centre with ancillary office space with a total gross floor area (GFA) of approximately 38,500m2. Specifically, the proposal seeks approval for:

- Site preparation works, including demolition, clearing of all vegetation, bulk earthworks and retaining walls, construction of new internal roads and stormwater and drainage works.
- Subdivision of the site;
- Construction of an industrial warehouse buildings with ancillary office space comprising a total GFA of approximately 38,500m2, including:
- Loading docks and hardstand area, on-lot car parking and internal accessways;
- Associated landscaping and signage; and
- Hours of operation of 24 hours, 7 days a week.

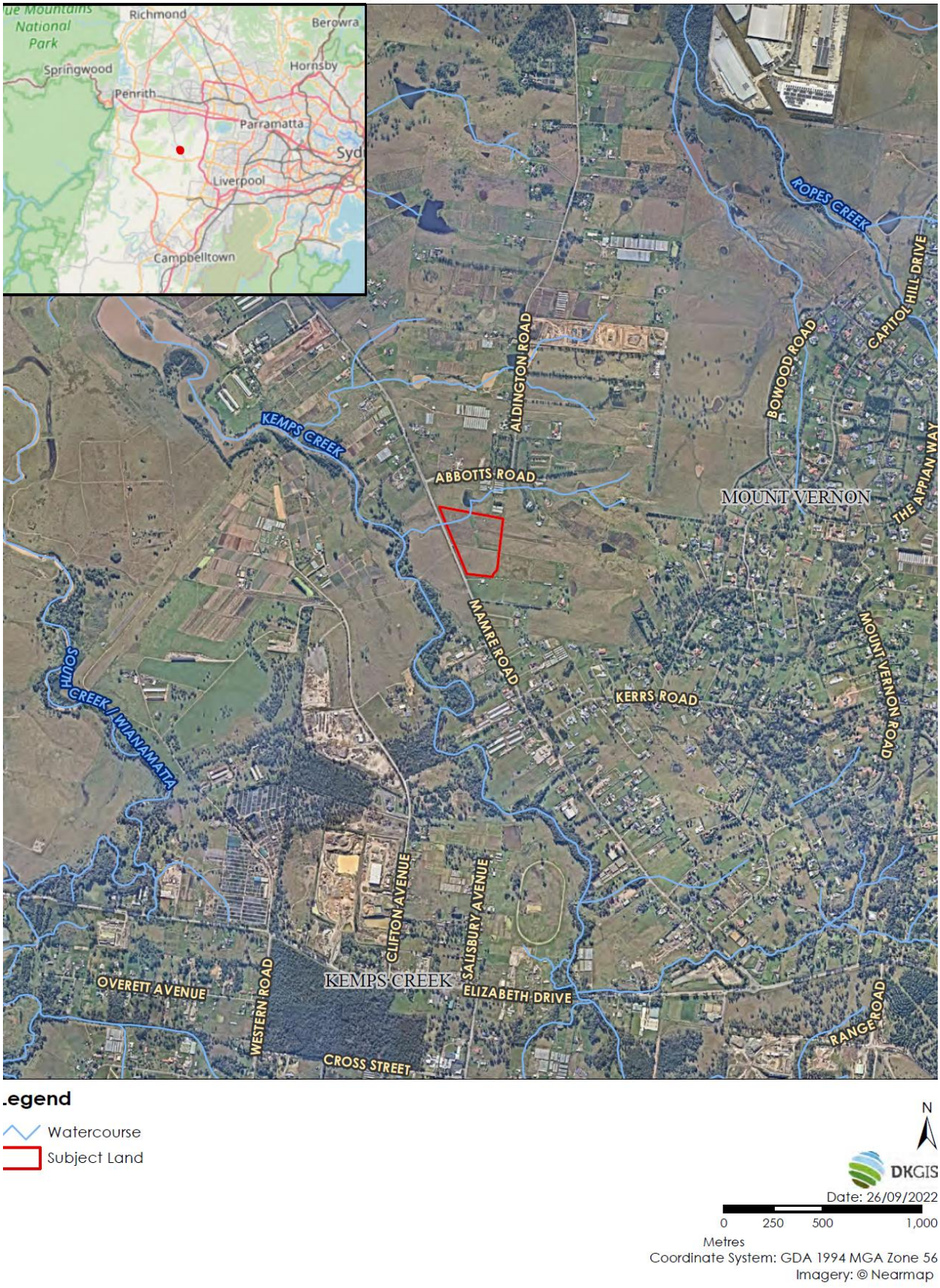


Figure 1: Site Location

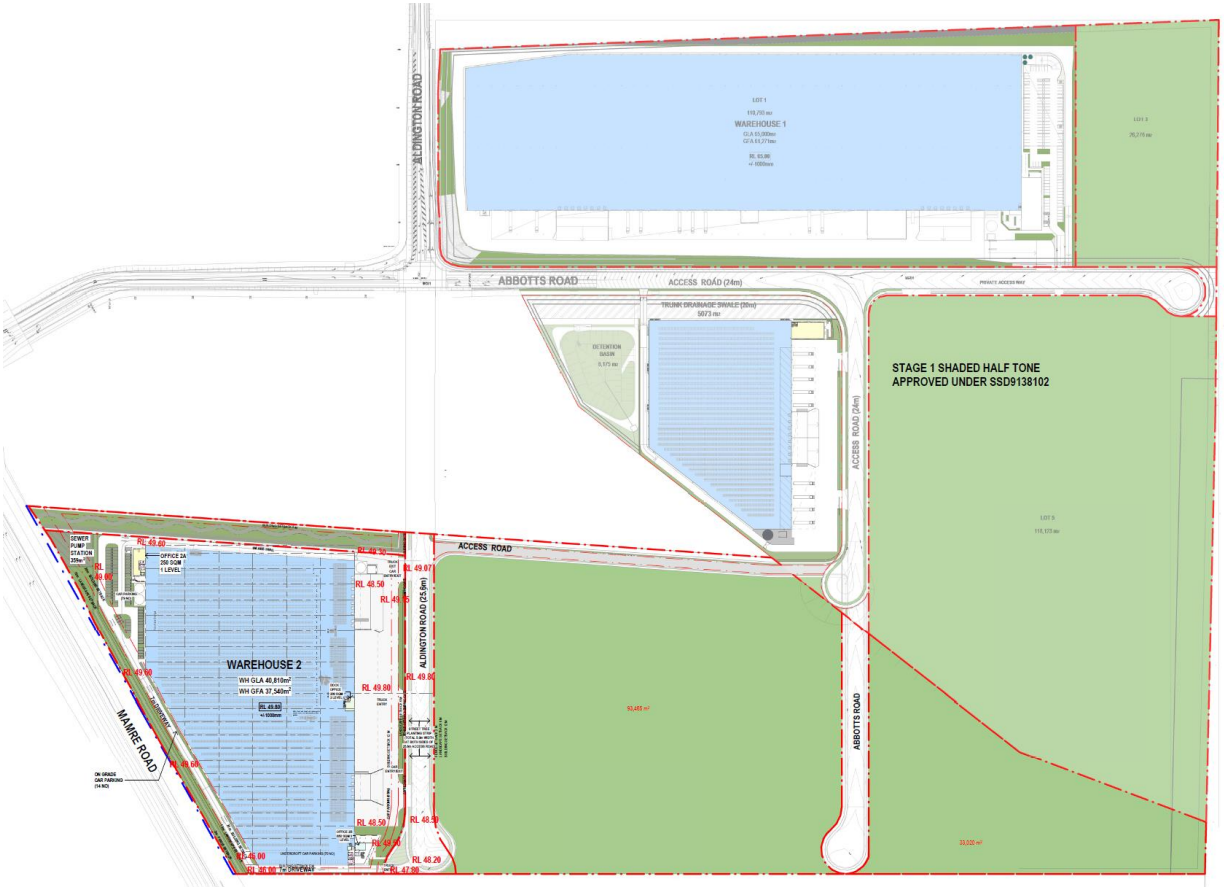


Figure 2: Westlink Industrial Masterplan.

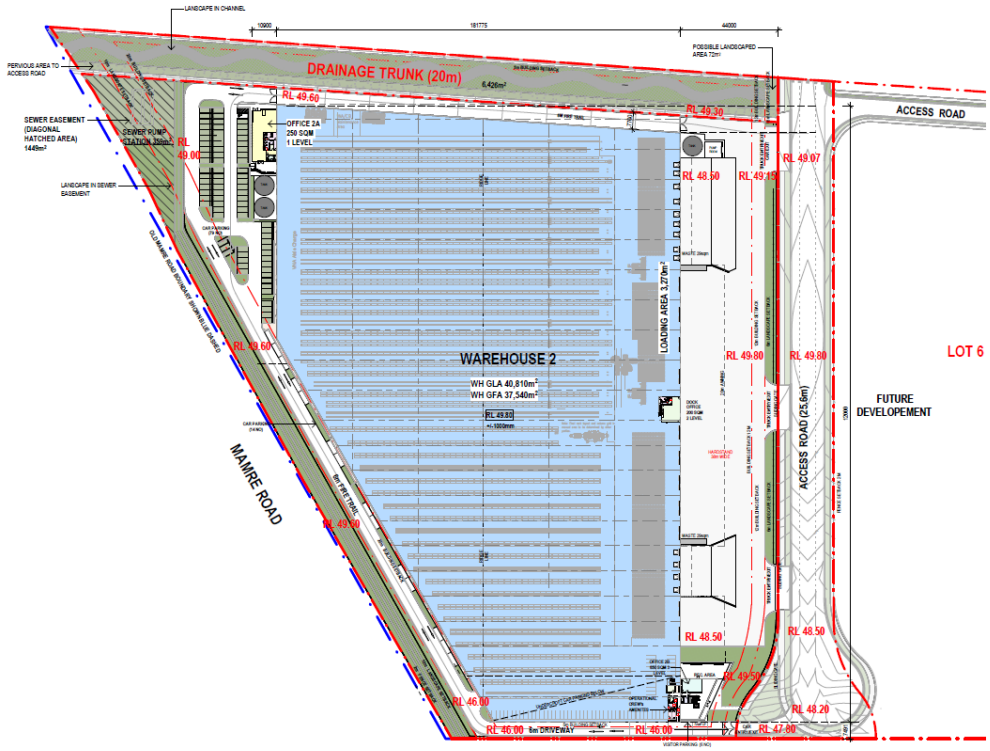


Figure 3: Proposed Stage 2 layout.

5. Legislative Framework

The proposed industrial development is designated as "other" development by the PBP 2006 and PBP 2019. The NSW RFS has reviewed PBP 2006 and now released a new document known as *Planning for Bushfire Protection 2019* (PBP 2019) and the NSW RFS has requested that all new proposals are assessed against PBP 2019.

The site is identified as 'bushfire prone land' (see Figure 4) for the purposes of Section 10.3 of the *Environmental Planning and Assessment Act, 1979* (EPA Act) and the legislative requirements for development on bushfire prone lands are applicable. All development on bushfire prone land must consider and comply with PBP 2019. However, industrial development has considerable flexibility and the nature of the development often results in the structures providing a higher degree of bushfire resistance than required by the NSW RFS.

As "other" development, the proposed industrial development and future development is addressed through demonstrating compliance with the aim and objectives of PBP.

Under the building classification system within the *National Construction Code* (NCC), Class 5 to 8 buildings include offices, shops, factories, warehouses, public car parks and other commercial and industrial facilities. The NCC does not provide for any bushfire specific performance requirements for these particular classes of building. As such the *Australian Standard for Construction of Buildings in Bushfire Prone Areas* (AS 3959) and the NASH Standard are not considered as a set of 'deemed to satisfy' provisions. However, compliance with AS 3959 and NASH should be considered when meeting the aims and objectives of PBP.

Whilst bushfire is not captured in the NCC for Class 5-8 buildings or storage of the pallets, PBP 2019 articulates the following objectives which will be applied in relation to access, water and services, and emergency and evacuation planning:

1. *to provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation;*
2. *to provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development;*
3. *to provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building; and*
4. *provide for the storage of hazardous materials away from the hazard wherever possible.*

The general fire safety construction provisions (of the NCC) are taken as acceptable solutions, however construction requirements for bush fire protection will need to be considered on a case-by-case basis.

Because of their size, complexity, importance and/or potential impact, the Department of Planning and Environment (DPE) is predominantly responsible for assessing development applications relating to State Significant Development. The Minister for Planning is the consent authority for SSD applications.

Applications designated as state significant projects are exempt from requiring a bushfire safety authority (BFSA). Given their scale however, the requirements of PBP should still be applied, and consultation with the NSW RFS has already occurred as part of the original SSD approval process.

Even where comments are sought at the strategic planning stage, further development applications may need to be referred to the NSW RFS.

6. Bushfire Prone Land

Bushfire prone land maps provide a trigger for the development assessment provisions and consideration of sites that are bushfire prone.

Bushfire prone land (BFPL) is land that has been identified by council, which can support a bushfire or is subject to bushfire attack. Bushfire prone land maps are prepared by local council and certified by the Commissioner of the NSW RFS.

Figure 4 shows the Bushfire Prone Land Map for the site. The extract from the Penrith Bushfire Prone Map shows that the site and surrounding areas contains Category 2 Bushfire Prone Vegetation (grassland) with an area of Category 1 vegetation occupying the creekline further to the west of the site.

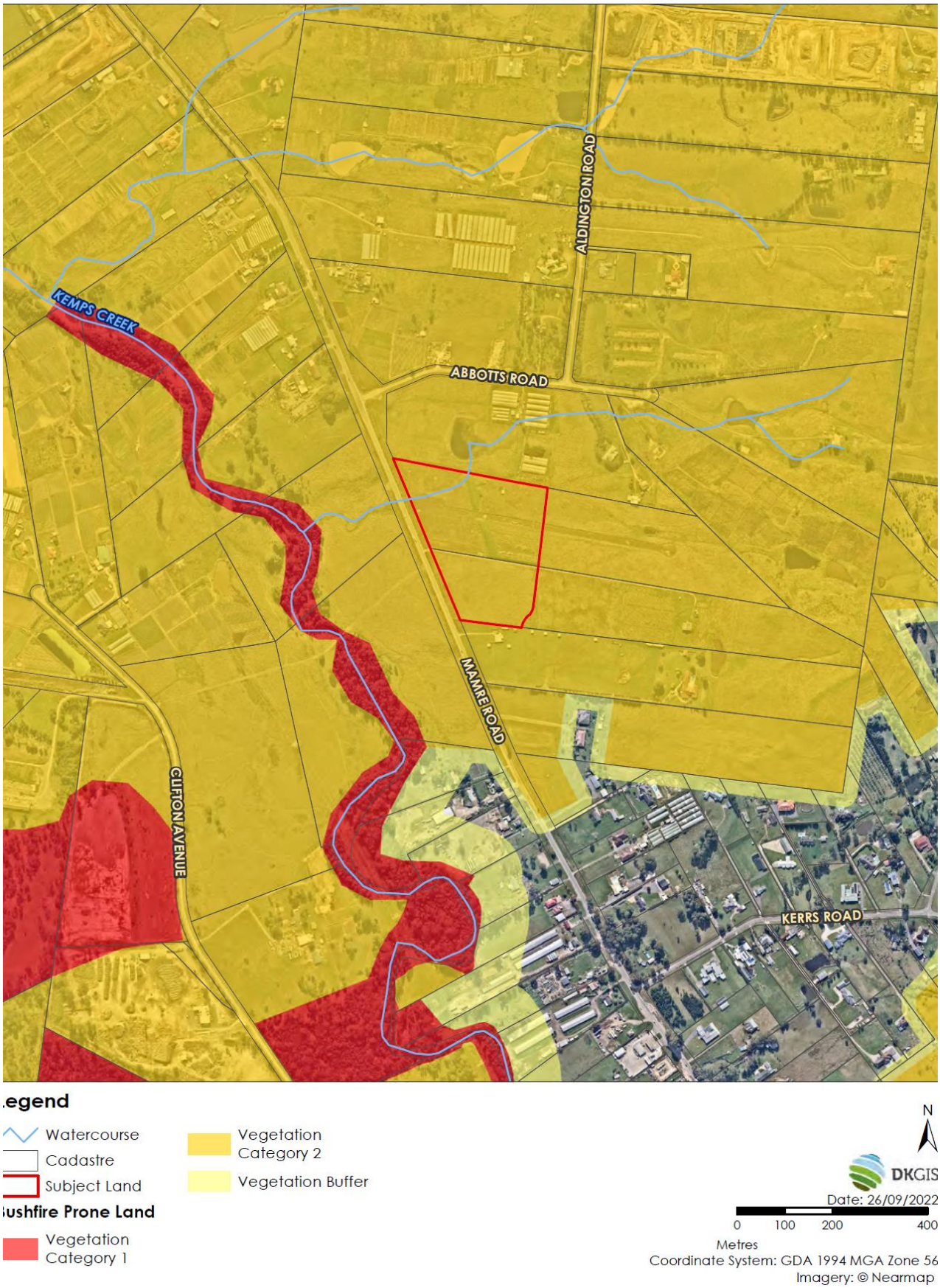


Figure 4: Bushfire Prone Land

7. Site Assessment Methodology

The Bushfire Assessment Report is based on a desktop assessment of the site utilising the following resources:

1. *Planning for Bushfire Protection* (NSW RFS, 2019);
2. Aerial mapping; and
3. Detailed GIS analysis.

The methodology used in this assessment is in accordance with PBP and is outlined in the following sections.

7.1. Bushfire Hazard

An assessment of the bushfire hazard is necessary to determine the application of bushfire protection measures such as Asset Protection Zone (APZ) locations and dimensions and future building levels.

The vegetation formations (bushfire fuels) and the topography (effective slope) combine to create the bushfire threat that may affect bushfire behaviour at the site and which determine the planning and building response of PBP 2019.

7.2. Vegetation

Predominant Vegetation is classified by structure or formation using the system adopted by Keith (2004) and by the general description using PBP 2019. Vegetation types give rise to radiant heat and fire behaviour characteristics.

The predominant vegetation is determined over a distance of at least 140 metres in all directions from the proposed site boundary or building footprint on the development site. Where a mix of vegetation types exist, the type providing the greater hazard is said to predominate.

The land around the site is identified as bushfire prone land (see Figure 4), with the majority of the area made up of farming land, however worst-case grassland (see Figure 5).

Figure 5: Vegetation and Slope

7.3. Slopes Influencing Bushfire Behavior

The 'effective slope' influencing fire behaviour approaching the sites has been assessed in accordance with the methodology specified within PBP 2019. This is conducted by measuring the worst-case scenario slope where the vegetation occurs over a 100 m transect measured outwards from the development boundary or the existing/ proposed buildings.

The slopes within and adjoining the site are mild and are generally level or slightly sloping (Figure 5).

7.4. Fire Weather

The fire weather is dictated by PBP and assumes a credible worst-case scenario and an absence of any other mitigating factors relating to aspect or prevailing winds. The sites have a Fire Danger Index (FDI) of 100 as per PBP 2019.

7.5. Asset Protection Zones

An Asset Protection Zone (APZ) is a buffer zone between a bushfire hazard and buildings. The APZ is managed progressively to minimise fuel loads and reduce potential radiant heat levels, flame, smoke and ember attack. The appropriate APZ is based on vegetation type, slope and the type of development.

The APZ can include roads or properties managed to be consistent with APZ standards set out in NSW RFS document *Standards for Asset Protection Zones*. The APZ provides a fuel-reduced, physical separation between buildings and bush fire hazards is a key element in the suite of bush fire measures and dictates the type of construction necessary to mitigate bushfire attack.

PBP 2019 requires APZs for commercial and industrial development to provide a defendable space and minimises material ignition. Table 2 (below) provides a summary of the APZ for the proposed development. Figure 6 depicts the minimum APZ required across the site.

Table 2: APZ Assessment.

Direction	Slope	Vegetation	Flame Zone Width	APZ Proposed
North	1.14° Upslope	Grassland	7 metres	27 metres
East	NA	No hazard	Nil	>23 metres
South	Level	Grassland	7 metres	8 metres
West	Level	Grassland	7 metres	>20 metres

Figure 6: Asset Protection Zones

7.6. Bushfire Attack Levels

The Bushfire Attack Level (BAL) is a means of measuring the severity of a buildings or sites potential exposure to ember attack, radiant heat and direct flame contact. In the Building Code of Australia, the BAL is used as the basis for establishing the requirements for residential construction to improve protection of building elements.

The Bushfire Attack Levels to the site has been completed using the distances from the PBP 2019 Table A1.12.5 (Table 3). The BAL for the site is shown in Figure 7.

As "Other" development, the development must comply with objective 3 of PBP 2019 which requires that the development:

3. *Provide appropriate separation between a hazard and buildings, which, in combination with other measures, prevent the likely fire spread to buildings.*

Asset Protection Zones (see section 7.5) will be provided around the development that will include perimeter roads and hardstand areas. The buildings will be constructed to meet the relevant requirements of AS3959-2018 as identified in PBP 2019 and through the radiant heat modelling consistent with the methodology in PBP 2019.

Table 3 provides a summary of the BALs and Figure 7 depicts the BAL requirements across the site.

Table 3: Bushfire Attack Levels

Direction	Slope	Vegetation	APZ Proposed	Bushfire Attack Level
North	1.14º Upslope	Grassland	27 metres	See Figure 7*
East	NA	No hazard	23 metres	See Figure 7*
South	Level	Grassland	8 metres	See Figure 7*
West	Level	Grassland	>20 metres	See Figure 7*

**Note: The extent of the BAL for the building is depicted in detail in Figure 7.*

7.6.1. Application of AS3959 (2018)

Construction must comply with the corresponding Bushfire Attack Level (BAL) as shown in Figure 7.

The application of each BAL is as defined on Figure 7 and not broadly applied across the entire elevation/building. The construction must comply with corresponding sections of the Australian Standard AS3959-2018 *Construction of buildings in bush fire-prone areas* or NASH Standard (1.7.14 updated) *National Standard Steel Framed Construction in Bushfire Areas* – 2014 as appropriate, and Section 7.5 of *Planning for Bush Fire Protection 2019*.

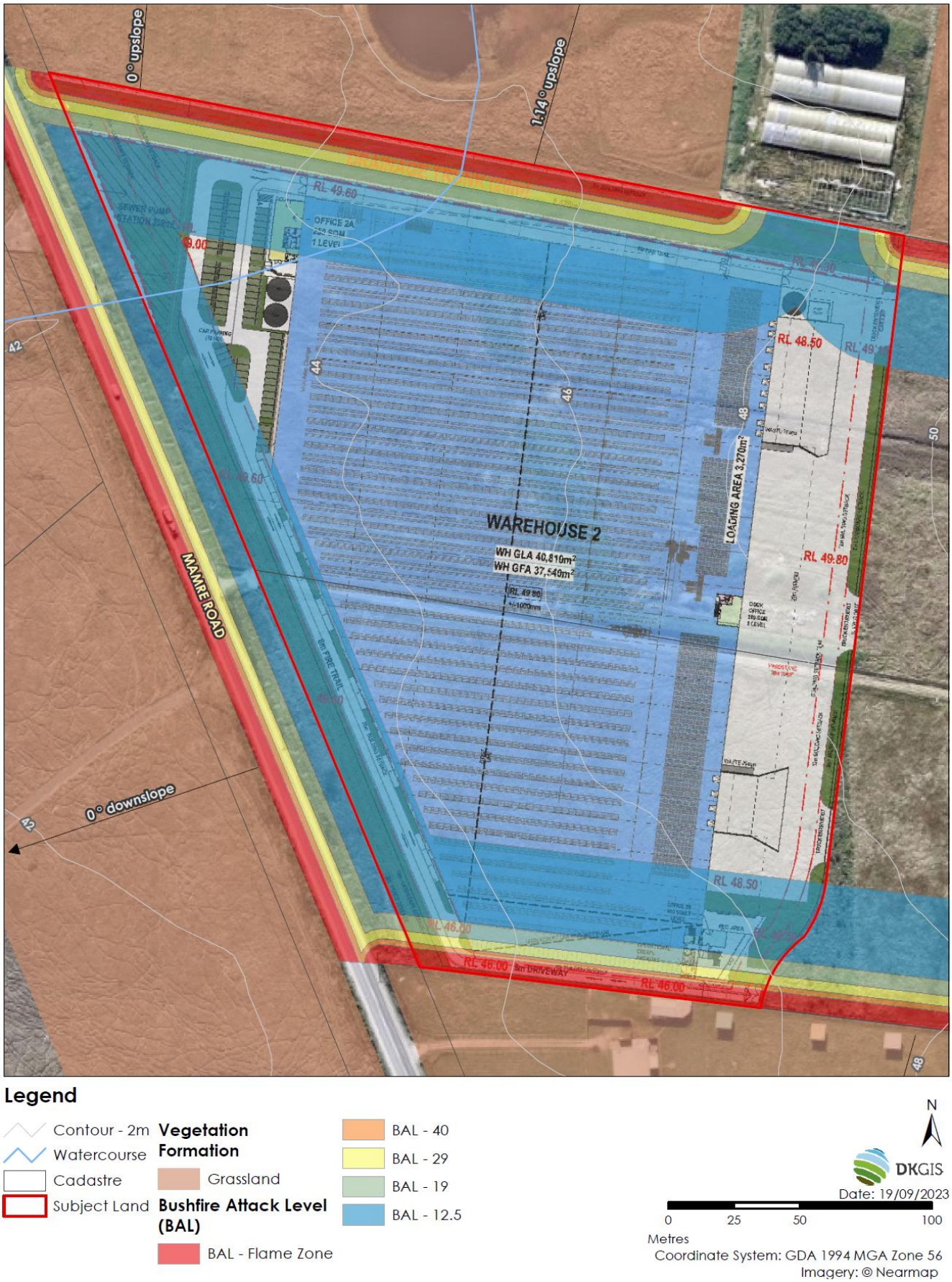
The construction for the remainder of the proposed buildings not denoted with a BAL in Figure 7 is greater than 100 metres from any bushfire hazard. Consistent with AS3959, construction greater than 100 metres from a bushfire hazard is classified as BAL-Low. AS3959 describes BAL-Low as "*There is insufficient risk to warrant specific construction requirements*". Therefore, the construction for the remainder of the proposed building not denoted with a BAL in Figure 8, is appropriately BAL-Low.

The construction of the buildings in this manner complies with *Planning for Bush Fire Protection 2019* and the National Construction Code (NCC). This policy position has been previously agree by the NSW RFS on multiple occasions.

7.7. Water Supply and Utilities

PBP 2019 (p. 47) requires that adequate services of water for the protection of buildings during and after the passage of a bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.

Suitable water supply arrangements will be provided for firefighting that meet the NSW RFS requirements. A reticulated water supply for potable water supply and fire hydrants will be provided to the site. The fire-fighting water supply to the new buildings shall comply with the Building Code of Australia [BCA] and A.S. 2419.1 – 2005.



Legend

- Contour - 2m
- Watercourse
- Cadastre
- Subject Land

Vegetation Formation

- Grassland

Bushfire Attack Level (BAL)

- BAL - Flame Zone
- BAL - 40
- BAL - 29
- BAL - 19
- BAL - 12.5

N

DKGIS

Date: 19/09/2023

0 25 50 100

Metres

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

Figure 7: Bushfire Attack Levels

7.8. Access

PBP 2019 requires that the design of access roads enables safe access and egress for people attempting to leave the area while emergency service personnel are arriving to undertake firefighting operations.

Figure 2 shows the approved layout of the Westlink Industrial Estate including the proposed access to the site from Abbotts Road.

Vehicular access to the proposed development is provided through the proposed internal road network (off Mamre Road and Abbotts Road).

The proposed internal access road will be constructed to provide heavy rigid and articulated vehicle access to the proposed buildings. This internal road network provides suitable access for fire-fighting appliances like NSW RFS Category 1 Tankers and Fire & Rescue NSW Composite and Aerial Appliances.

Given the nature of the existing public road network and the proposed design of the internal access, the proposal complies with the requirements of PBP 2019.

8. Assessment Against the Aim and Objective of PBP

All development in Bushfire Prone Areas needs to comply with the aim and objectives of PBP. Table 4 shows the compliance with PBP.

Table 4: Compliance with Aim & Objectives of PBP.

Aim	Meets Criteria	Comment
The aim of PBP is to use the NSW development assessment system to provide for the protection of human life (including fire fighters) and to minimise impacts on property from the threat of bushfire, while having due regard to development potential, onsite amenity and the protection of the environment.	Yes	Landscaping, defendable space, access and egress, emergency risk management and construction standards are in accordance with the requirements of PBP and the aims of PBP have been achieved.
Objectives	**Meets Criteria**	**Comment**
Afford occupants of any building adequate protection from exposure to a bushfire.	Yes	The development provides opportunity for all occupants to be shielded from any external bushfire. Construction material will comply with the relevant AS3959 requirements.
Provide for a defendable space to be located around buildings.	Yes	Defendable space is provided on all sides of the proposed building.
Provide appropriate separation between a hazard and buildings, which, in combination with other measures, prevent the likely fire spread to buildings.	Yes	The structures are separated from the grassland vegetation areas and provide APZs and commensurate construction in accordance with AS3959.
Ensure that safe operational access and egress for emergency service personnel and occupants is available.	Yes	The site has direct access to public roads, and access and egress for emergency vehicles and evacuation is adequate. The development provides for the movement of heavy articulated trucks about the site.
Provide for ongoing management and maintenance of bushfire protection measures.	Yes	The site will be managed as an APZ and landscaping in accordance with PBP.
Ensure that utility services are adequate to meet the needs of firefighters.	Yes	Utility services are adequate to meet the needs of firefighters (and others assisting in bushfire fighting).

9. Recommendations

The following recommendations are made to ensure the proposed building is provided with adequate bushfire protection in accordance with PBP:

Recommendation 1: The construction shall comply with the National Construction Code (2019), Australian Standard AS 3959:2018, *Construction of buildings in bush fire-prone areas* and/or NASH Standard (1.7.14 updated), *National Standard Steel Framed Construction in Bushfire Areas – 2014*, and Section 7.5 of *Planning for Bush Fire Protection 2019* on a prescriptive (deemed to satisfy and/or acceptable solution) basis and/or performance basis.

Recommendation 2: Fire hydrants are provided in accordance with Building Code of Australia E1.3, AS2419.1:2005, including the ring main requirements for large, isolated buildings and those identified in Section 7.7.

Recommendation 3: The entire site is to be maintained as an Inner Protection Area (IPA) in accordance with Appendix 4 of PBP 2019 and the NSW RFS "Asset protection zone standards".

10. Conclusion

Blackash Bushfire Consulting have completed a Bushfire Hazard Assessment Report for the proposed Stage 2 industrial development within the Westlink Industrial Estate. The application is for the subdivision and construction of two industrial warehouses and associated infrastructure.

The Department of Planning and Environment Secretary's Environmental Assessment Requirements require a bush fire assessment that details proposed bush fire protection measures and demonstrates compliance with Planning for Bush Fire Protection.

The proposed development is industrial development and considered as "other" development in *Planning for Bushfire Protection 2019* and complies with the aim and objectives of that document. This report demonstrates that the proposed development satisfies the requirements of *Planning for Bush Fire Protection 2019*, in particular the provision of asset protection zones, access and water supply for firefighting purposes.

The Building Code of Australia does not provide for any bushfire specific performance requirements for the proposed development and as such AS3959, 20018 does not apply as a deemed to satisfy provision.

This Bush Fire Hazard Assessment has detailed the proposed bush fire protection measures and demonstrates compliance with *Planning for Bush Fire Protection 2019* as required by the SEARs.

Corey Shackleton | Principal Bushfire & Resilience
Blackash Bushfire Consulting
B.Sc., Grad. Dip. (Design for Bushfire Prone Areas)
Fire Protection Association of Australia BPAD Level 3 - 34603

Appendix 1: References

Australian Building Codes Board Building Code of Australia Volumes 1&2
Councils of Standards Australia AS3959 (2018) – Australian Standard Construction of buildings in bushfire-prone areas

Keith, David (2004) – Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT. The Department of Environment and Climate Change

NSW Rural Fire Service (2015) Guide for Bushfire Prone Land Mapping

NSW Rural Fire Service (NSW RFS). 2006. Planning for Bushfire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners. Australian Government Publishing Service, Canberra

NSW Rural Fire Service (NSW RFS). 2019. Planning for Bushfire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners.

NSW Government (1979) Environmental Planning and Assessment Act 1979. NSW Government Printer.

Appendix 2: Radiant Heat Modelling

NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 28/09/2022 **Assessment Date:** 28/09/2022

Site Street Address: 1030 – 1050 Mamre Road, Kemps Creek

Assessor: Please Enter Your Name; Please Enter Company Name

Local Government Area: Penrith **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001/Vesta/Catchpole
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: North

Vegetation Information

Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	1 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	4.5	**Overall Fuel Load(t/ha):**	4.5
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	

Site Information

Site Slope:	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m):	Default	**APZ/Separation(m):**	7

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K):**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg)	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130

Program Outputs

		Peak Elevation of Receiver(m):	3.09
Radiant Heat(kW/m2):	34.59	**Flame Angle (degrees):**	59
Flame Length(m):	7.22	**Maximum View Factor:**	0.515
Rate Of Spread (km/h):	15.77	**Inner Protection Area(m):**	7
Transmissivity:	0.883	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	36673		

NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 28/09/2022 **Assessment Date:** 28/09/2022

Site Street Address: 1030 – 1050 Mamre Road, Kemps Creek

Assessor: Please Enter Your Name; Please Enter Company Name

Local Government Area: Penrith **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001/Vesta/Catchpole
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: North

Vegetation Information

Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Level
Surface Fuel Load(t/ha):	4.5	**Overall Fuel Load(t/ha):**	4.5
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	

Site Information

Site Slope:	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m):	Default	**APZ/Separation(m):**	7

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K):**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg)	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130

Program Outputs

		Peak Elevation of Receiver(m):	3.17
Radiant Heat(kW/m2):	35.83	**Flame Angle (degrees):**	58
Flame Length(m):	7.47	**Maximum View Factor:**	0.533
Rate Of Spread (km/h):	16.9	**Inner Protection Area(m):**	7
Transmissivity:	0.883	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	39293		