BLACKASH
BUSHFIRE CONSULTING

Bushfire Hazard Assessment

New Primary school at Gregory Hills

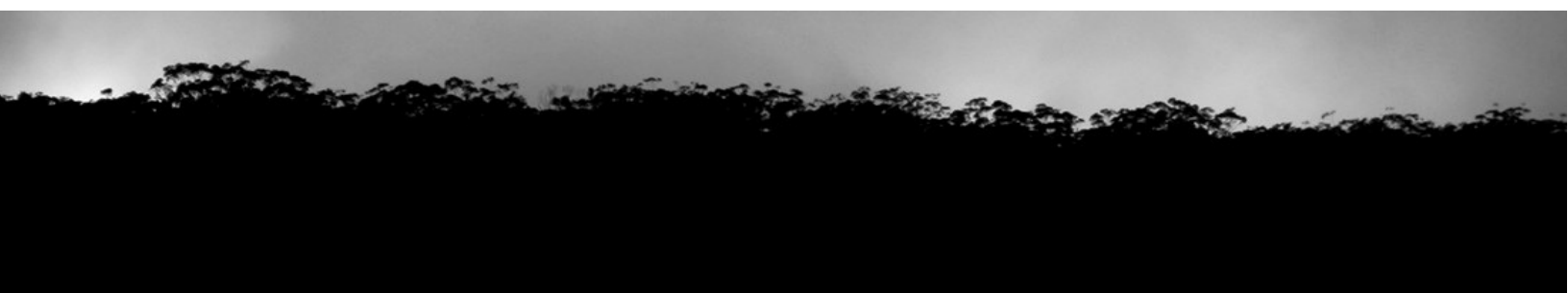
Special Fire Protection Purpose Development
State Significant Development (SSD-41306367)

Prepared for

School Infrastructure NSW

28 October 2022 | Version 1.7

BPAD Bushfire Planning & Design Accredited Practitioner Level 3



Document Tracking:

Project Name:	Bushfire Hazard Assessment Gregory Hills Primary School
Prepared by	Scott Palin & Lew Short
Client Details:	School Infrastructure NSW C/O Marisa Sidoti | Project Manager - Design | Jacobs
Project Number:	J2809
BlackAsh Contact Details	
Lew Short	Director
M: 0419 203 853	E: lew.short@blackash.com.au

Document Control:

Version	Primary Author(s)	Description	Date Completed
1.7	Scott Palin & Lew Short	Updated with DPE's Comments	28 October 2022

Lew Short | Director
BlackAsh Bush fire Consulting
B.A., Grad. Dip. (Design for Bush fires), Grad. Cert. of Management (Macq), Grad. Cert. (Applied Management)
Fire Protection Association of Australia BPAD Level 3 BPD-PA 16373

Contents

PO BOX 715 WAHROONGA NSW 2076 AUSTRALIA
M 0419 203 853 | E lew.short@blackash.com.au
W blackash.com.au

1. Abbreviations

APZ	Asset protection zone
AS2419	*Australian Standard – Fire hydrant installations*
AS3745	*Australian Standard – Planning for emergencies in facilities*
AS3959	*Australian Standard – Construction of buildings in bushfire-prone areas 2018*
BAL	Bushfire Attack Level
NCC	*National Construction Code*
BFSA	Bush Fire safety authority
EP&A Act	*Environmental Planning & Assessment Act 1979*
EPA Reg	*Environmental Planning and Assessment Regulation 2000*
GTA	General terms of approval
PBP	*Planning for Bush Fire Protection 2019*
RF Act	*Rural Fires Act 1997*
RFS	NSW Rural Fire Service
RFR	*Rural Fires Regulation* 2013
SFPP	Special fire protection purpose

2. Glossary

AS3959	Australian Standard AS 3959 Construction of buildings in bushfire-prone areas, Standards Australia, 2018, that outlines construction standards applicable to residential developments in bush fire prone areas
Bushfire Prone Area	An area of land that can support a bush fire or is likely to be subject to bush fire attack.
Bush fire safety authority	An approval of the Commissioner of the RFS required for a subdivision for residential or rural residential purpose or for a special fire protection purpose listed under section 100B of the RF Act.
Special Fire Protection Purpose	Refers to the development of land for which the end user/s are people who are considered to be at-risk members of the community, and thus more susceptible to the impacts of bushfire. These include schools, hospitals, nursing homes and tourist accommodation.

3. 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	Special Fire Protection Purpose Development
NCC Classification	5, 6, 7b, 9b (as per BCA Assessment Report, MBC Group, dated 02 June 2022)
Location	28 Wallarah Circuit Gregory Hills 2557 Lot 3257 DP 1243285
Local Government Area	Camden Council
Can this proposal comply with AS3959:2018	Yes, Buildings numbered 3 and 4 (Figure 17) can comply with the construction requirements of BAL-12.5
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 the proposal for a State Significant Development (SSD)	Yes
Is referral to the NSW RFS required?	No
Is a Bush Fire Safety Authority (BFSA) required?	No

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

4. Introduction

School Infrastructure NSW (SINSW) have commissioned Blackash Bushfire Consulting (Blackash) to prepare a Bushfire Hazard Assessment in support of a proposed new primary school at 28 Wallarah Circuit, Gregory Hills NSW 2557 (refer Figure 1). The legal description of the site is Lot 3257 DP 1243285. The site is located within the Camden Local Government Area and is within the Turner Road Precinct of the South-West Growth Centre. The site has an area of approximately 2.9ha and falls from the south-east corner (RL116.5) to the north-west corner (RL113). The site and its surrounds are highly disturbed from previous developments, with the current site being cleared land. This bushfire hazard report aims to consider and manage the risk associated with the classified Forested Wetland vegetation to the western aspect of the site. Gregory Hills is a suburb nominated as a high growth urban area, with a current population of approximately 12,000.

This Bushfire Hazard Assessment accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act), in support of a State Significant Development Application (SSDA) for the construction and operation of a new primary school at Gregory Hills (SSD-41306367).

This report addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

SEARs Requirement	Response
Item 22: **Bush Fire Risk** If the development is on bush fire prone land, provide a bush fire assessment that details proposed bush fire protection measures and demonstrates compliance with Planning for Bush Fire Protection.	Preparation of this Bushfire Hazard Assessment Report.

The State Design Review Panel (23/3/22) and Draft Concept Design (23/3/2022) documentation has been provided to Blackash for the basis of this assessment.

This bushfire hazard assessment details the proposed bush fire protection measures and demonstrates compliance with *Planning for Bush Fire Protection 2019 (PBP)*. This assessment has been prepared by Scott Palin, Bushfire Specialist and Lew Short, 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 has been accredited by the Fire Protection Association of Australia as a suitably qualified consultant to undertake alternative solution proposals.

A site inspection was performed on the 29th of March 2022 as part of the assessment process.

Figure 1: Site Location

5. The Proposal

The project comprises the construction of a new primary school at Gregory Hills (the proposal). The proposal is located at 28 Wallarah Circuit Gregory Hills (the site).

The proposal is for a new primary school at Gregory Hills that generally comprises the following:

- 44 General Learning Spaces.
- 4 Support Learning Spaces.
- Administration, staff hub, amenity and building service areas.
- Library, communal hall and canteen.
- Outside School Hours Care (OSHC) services.
- Sport courts, outdoor play space, a Covered Outdoor Learning Area (COLA) and site landscaping.
- Dedicated bicycle and scooter parking.
- Three (3) kiss and drop spaces for Supported Learning Students (SLS) located on Wallarah Circuit.
- On-site car parking.
- Signage.
- Footpath widening on Wallarah Circuit.

The school's proposed design has the building structures sited along the southern and eastern boundaries. A new vehicle access and separate pedestrian access is proposed off Wallarah Circuit, along with an additional access point located along Long Reef Circuit for waste management. A number of options were considered by SINSW, with the final option reflecting the best use of the site and reflecting bushfire requirements within PBP.

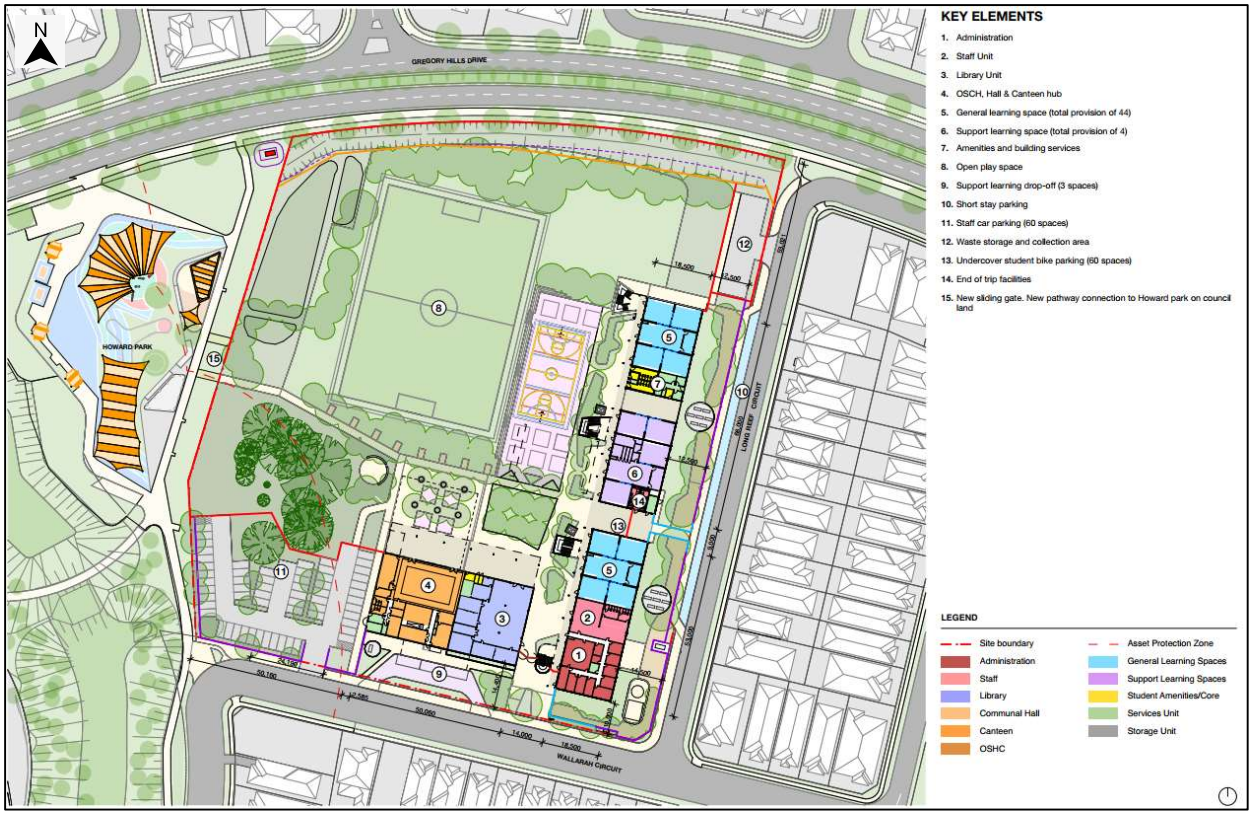


Figure 2: Proposed Site Plan


Figure 3: Design Concept

6. Site Description and Location

The site is located in Dharawal Country at 28 Wallarah Circuit, Gregory Hills NSW 2557, and is legally described as Lot 3257 DP1243285.

The site is located within the Camden Local Government Area and is within the Turner Road Precinct of the South-West Growth Centre.

The site has an area of approximately 2.926ha (by Deposited Plan). This will be reduced to 2.907ha under approved DA2022/742/1 once Long Reef Circuit has been widened.

Topography is minimal with a fall from the south-east corner (RL116.5) to the north- west corner (RL113).

The site has three (3) street frontages:

- Wallarah Circuit (southern boundary)
- Gregory Hills Drive (northern boundary)
- Long Reef Circuit (eastern Boundary)

The site is primarily vacant land, with the exception of an existing group of trees in the southwest corner of the site that pre-date the subdivision and development of the precinct. There is also an existing electrical substation located on the south-eastern boundary.

There are easements of varying widths located to the northern boundary identified for drainage.

A temporary school will be located on the north/north-western section of the site (temporary school does not form part of the works proposed under this SSDA). It is anticipated that the temporary school will be removed during construction/on completion of the permanent school.

A narrow and low bushfire risk section of approximately 1.4 hectares of Category 2 Vegetation to the west and south-western aspects of the site, within a vegetated swale that was constructed as part of the previous development works (refer Figure 7). The vegetated swale has been designed as a natural Riparian Corridor with the vegetation communities planted as per Figure 4.

Table 3: Planting areas and densities per zone

Zone	Description	Vegetation Community	Revegetation Area (m^2)	Site Prep	Planting densities				Total
					Tree	Shrub	Herbs / Scramblers	Sedge / Grass	
Zone 1	Bio-retention basins	FW	1,400	Jute Mat	-	-	-	6/m^2	*8,400*
Zone 2	Detention basins	FW / AW	5,500	Jute Mat	*1/100m^2	*1/50 m^2	1/m^2	3/m^2	*22,165*
Zone 3	Riparian areas / batters	AW / CPW	7,500	Mulch	1/100m^2	1/50m^2	1/m^2	3/m^2	*30,225*
Zone 4	Pathway edges	AW / CPW	500	Mulch	-		1/m^2	5/m^2	*3,000*
Total			**14,900**		***130***	***260***	***13,500***	***49,900***	**63,790**

** No trees or shrubs to be installed in low flow channel, culverts or rock rip rap*

Figure 4: Planting areas and densities (Gregory Hills – Town Centre Precinct, Vegetation Management Plan p. 16, Ecological Australia November 2017).

* Note: FW – Freshwater Wetland | AW – Alluvial Woodland | CPW – Cumberland Plain Woodland.

7. Site Surrounding Development

To the north, east and south of the site is emerging and recently completed residential development.

To the east of the residential area fronting Long Reef Circuit are high voltage power lines within an easement which include pedestrian paths and cycleways.

To the west of the site, beyond Sykes Creek and Howard Park, is the Gregory Hills town centre. A pedestrian bridge links Wallarah Circuit with the town centre across Sykes Creek.

These areas are all developed and do not represent a bushfire risk (refer Figure 1).

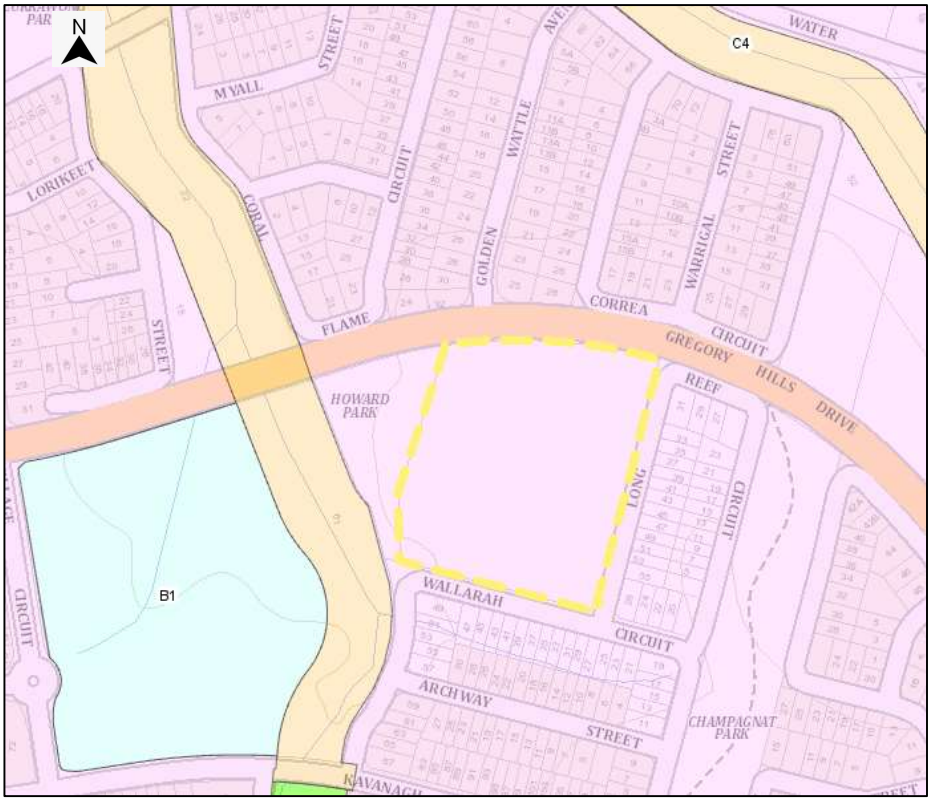


Figure 5: Zoning map (planningportal.nsw.gov.au)

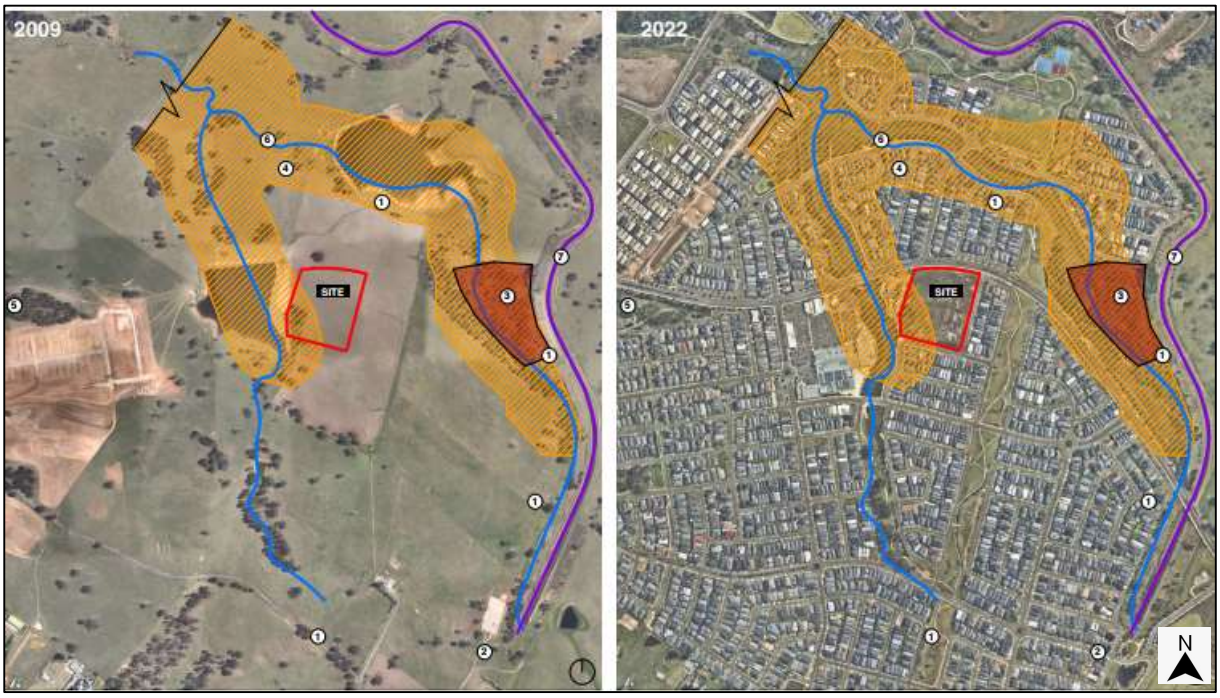


Figure 6: Land Modification Maps

Figure 7: Previous Development Works (maps.six.nsw.gov.au)

8. Legislative Framework

The site is located on designated Bushfire Prone Land (BFPL). BFPL is designated in accordance with s.10.3 of the EP&A Act. BFPL is land which can support a bushfire or is subject to bushfire attack, that has been identified and mapped by the local council and certified by the Commissioner of the NSW RFS. The BFPL provide a trigger for formal assessment of new development and compliance with PBP.

Under the *Rural Fires Act 1997* (RF Act), a school is identified as being a Special Fire Protection Purpose Development (SFPP). Section 4.46 of the EP&A Act requires a Bush Fire Safety Authority (BFSA) from the NSW RFS under Section 100B of the RF Act for a SFPP development on BFPL. A BFSA authorises development to the extent that it complies with standards regarding setbacks, provision of water supply and other matters considered by the RFS Commissioner to be necessary to protect persons, property or the environment from danger that may arise from a bushfire.

Section 2.4.2 of PBP 2019 acknowledges State Significant Development and infrastructure following the EP&A Act pt. 3A being repealed in 2011, leading to the creation of two new major project development categories: state significant infrastructure (SSI) and state significant development (SSD). Due to their size, complexity, importance and/or potential impact, the Department of Planning and Environment (DPE) is predominantly responsible for assessing these Development Applications. The Minister for Planning is the consent authority for SSI and SSD applications. *Applications under the now-repealed Part 3A of the EP&A Act and state significant projects are exempt from requiring a BFSA and are not required to be assessed under EP&A Act s4.14* (PBP p. 20).

All new development on Bush Fire Prone Land (BFPL) must comply with PBP regardless of SSI and SSD EP&A Act exemptions. As a new SFPP development, the application needs to be able to justify that the proposal can achieve a worst-case bushfire radiant heat level exposure to buildings of a maximum 10kW/m^2.

PBP (p. 50) outlines considerations for vulnerable communities including schools:

> *The nature of SFPP developments means that occupants may be more vulnerable to bush fire attack for one or more of the following reasons:*
>
> - *They may be less aware in relation to bush fire impacts;*
> - *They may have reduced capacity to evaluate risk and respond adequately to the bush fire threat;*
> - *They may present operational difficulties for evacuation and or management;*
> - *They may be more vulnerable to stress and anxiety arising from bush fire threat and smoke;*

- *There may be significant communication barriers; supervision during a bush fire may be difficult; and*
- *They may be unfamiliar with the area.*

The NSW Government has introduced a new education-based State Environmental Planning Policy. The State Environmental Planning Policy (SEPP) Transport and Infrastructure 2021 (the SEPP) has provisions that will make it easier for child-care providers, schools, TAFEs and Universities to build new facilities and improve existing ones by streamlining approval processes to save time and money and deliver greater consistency across NSW. The SEPP balances the need to deliver additional educational infrastructure with a focus on good design. The SEPP provides for the legislative planning framework for NSW.

This bushfire assessment has been completed as a deemed to satisfy assessment. Performance calculations have been completed and provided in Section 11.7 of this report, to further satisfy the risk based approach to bushfire attack. The school buildings (Figure 2) can be located in accordance with PBP 2019 and can be constructed to comply with the *Australian Standard for Construction of Buildings in Bushfire Prone Areas* (AS3959).

Blackash (Lew Short) being a Level 3 Certified Practitioner can confirm whether the proposed development conforms to the relevant specifications and requirements of *Planning for Bush Fire Protection 2019* in compliance with s4.14 (1)(b) of the *Environmental Planning and Assessment Act 1979*. As such, no formal referral under the EP&A Act is required to the NSW RFS for the development proposal.

9. Planning for Bushfire Protection 2019

The PBP 2019 guidelines are performance-based, seeking to achieve a safe outcome based on innovation and the specific circumstances of the individual site and development proposal. PBP provides a planning framework for developments in rural and urban areas close to land, which is likely to be affected by bushfire.

PBP 2019 (p. 49) identifies the vulnerable nature of occupants of SFPP developments:

> *"An SFPP development is one which is occupied by people who are identified as at-risk members of the community. In a bush fire event, these occupants may be more susceptible to the impacts of radiant heat and other bush fire effects. Evacuating at-risk members of the community is more challenging because they may be physically or psychologically less able to relocate themselves or are unfamiliar with their surroundings. Examples of SFPP developments are schools, hospitals, nursing homes and tourist accommodation."*

PBP sets out an overall framework consisting of an aim and objectives, specific objectives for defined development types, types of bushfire protection measures (**BPMs**), which may be employed in a development, and performance criteria for each BPM. In this regard, the structure of PBP 2019 is similar to the structure of the National Construction Code (NCC) and provides considerable flexibility for outcomes. However, the aim of PBP in terms of ensuring appropriate consideration of risk and protection is paramount.

The intent (aim) of PBP is:

> *to protect people and property from the impact of bushfires. It also helps ensure that the firefighters who come to their aid in an emergency are not placed in greater danger because of unsuitable or unsafe developments.*

The objectives are to:

i. *Afford buildings and their occupants protection from exposure to a bush fire*
ii. *Provide for a defendable space to be located around buildings*
iii. *Provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition*
iv. *Ensure that appropriate operational access and egress for emergency service personnel and residents is available*
v. *Provide for ongoing management and maintenance of BPMs*
vi. *Ensure that utility services are adequate to meet the needs of firefighters.*

Due to the vulnerable nature of the occupants of SFPP developments, there is more reliance on the provision of an APZ and emergency management. For SFPP development, PBP 2019 provides a range of specific objectives (PBP p. 50):

- *minimise levels of radiant heat, localised smoke and ember attack through increased APZ, building design and siting;*
- *provide an appropriate operational environment for emergency service personnel during firefighting and emergency management;*
- *ensure the capacity of existing infrastructure (such as roads and utilities) can accommodate the increase in demand during emergencies as a result of the development; and*
- *ensure emergency evacuation procedures and management which provides for the special characteristics and needs of occupants.*

PBP requires that a planning and development proposal satisfy:

- The broad aim and objectives of PBP 2019;
- The planning principles;
- Specific objectives for the development type under consideration;
- The intent of measures for the various (BPM's);
- The performance criteria for the various proposed BPMs, which can be achieved by providing either the "acceptable solutions" specified in PBP 2019 or alternative solutions, which fulfill the intent of the relevant performance criterion.
- Infill provisions for SFPP development.

This report aims to demonstrate that these requirements have been met for the proposed development.

10. Building Code of Australia

The Building Code of Australia (BCA) Performance Requirement GP5.1(NSW) relates to the protection of buildings on bushfire-prone land (applicable to Class 9 buildings that is a special fire protection purpose):

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

a) Potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and
b) Intensity of the bushfire attack on the building.

The proposed development can comply to the relevant specifications and requirements of *Planning for Bush Fire Protection 2019.*

10.1. Deemed-to-Satisfy Requirement

Deemed-to-Satisfy Clause G5.2 (NSW) States:

> In a designated bushfire prone area, a Class 2 building, a Class 3 building, a Class 4 part of a building or a Class 9 building that is a special fire protection purpose or a Class 10a building or deck associated with such a building or part, must comply with the following—
>
> (a) AS 3959 except for Section 9 Construction for Bushfire Attack Level FZ (BAL-FZ). Buildings subject to BAL-FZ must comply with specific conditions of development consent for construction at this level; or
> (b) the requirements of (a) above as modified by the development consent following consultation with the NSW Rural Fire Service under section 79BA of the Environmental Planning and Assessment Act 1979; or
> (c) the requirements of (a) above as modified by development consent with a bushfire safety authority issued under section 100B of the Rural Fires Act 1997 for the purposes of integrated development.

The proposed buildings numbered 3 and 4, as identified in Figure 17, can be constructed to comply with the *Australian Standard for Construction of Buildings in Bushfire Prone Areas* (AS3959).

10.2. Bushfire Protection Measures

PBP 2019 identifies that the Bushfire Protection Measures (BPMs) are general measures which are required to improve life safety, property protection and community resilience to bushfire attack. PBP promotes detailed site analysis and the application of a combination of BPMs to achieve an acceptable outcome. The BPMs work in combination to provide a suite of measures that meet the Aim and Objectives, and Chapter 6 (SFPP) of PBP. Appropriate combinations depend upon the type of development, and the specific geographic location and site circumstances.

The types of protection measures include APZs, access, landscaping, water supply, building design and construction and emergency management arrangements as shown in Figure 8. These measures assist building and occupant survival during a bushfire. They also contribute to the safety of firefighters and members of the community occupying buildings during the passage of a bushfire front.

Each of the BPMs have been reviewed and applied separately based upon the development type and the assessed level of bushfire risk. Specific strategies have been put in place for each of the BPMs that meet or exceed the requirements of PBP 2019. These will be discussed throughout the report.

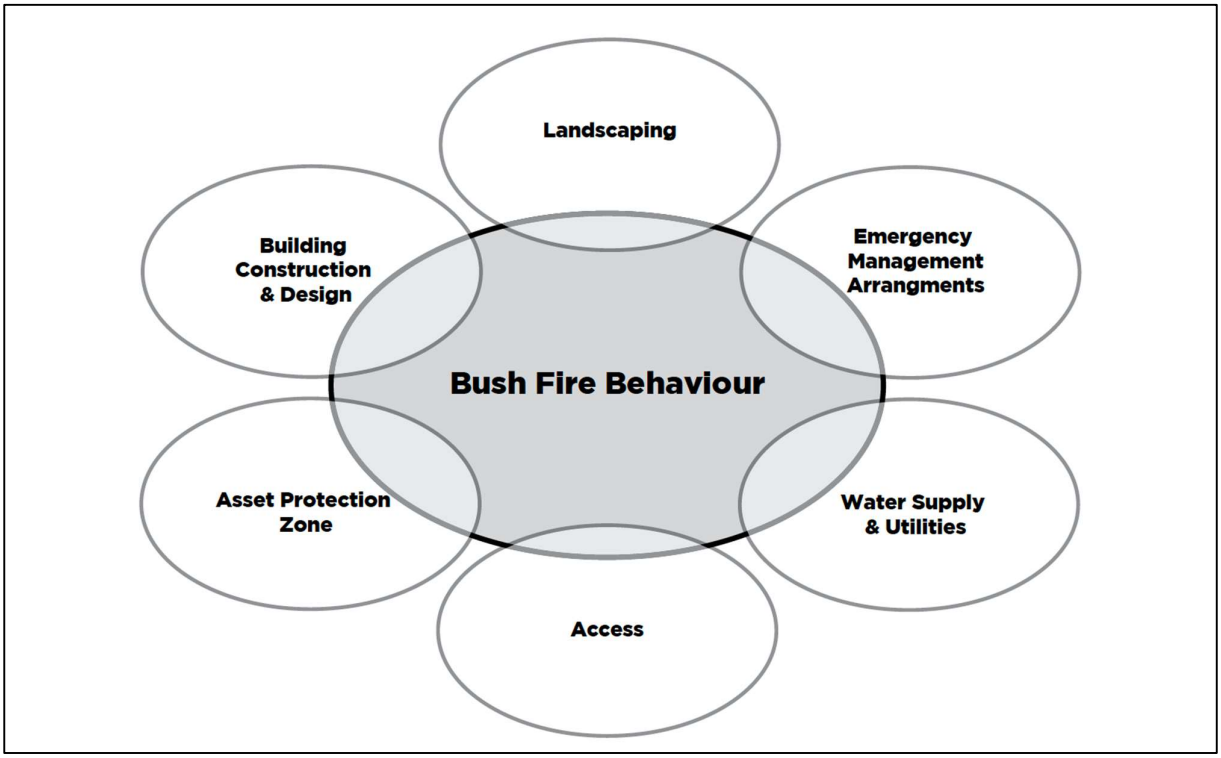


Figure 8: Bushfire Protection Measures in combination (PBP p.26)

11. Bushfire Hazard Assessment

11.1. Bushfire Prone Land

The site is identified as 'bushfire prone land' (Figure 9) for the purposes of Section 10.3 of the EPA Act and the legislative requirements for building on bushfire prone lands are applicable.

Bush fire prone land maps provide a trigger for the development assessment provisions and consideration of sites that are bushfire prone. Bush fire 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 the local council and certified by the Commissioner of the RFS.

The BFPL Map shows the site as affected by the vegetation buffer zone that surrounds the Category 2 vegetation related to the Forested Wetland to the western aspect of the site.

11.2. Category 2 Vegetation

The site is impacted to the west by Bushfire Prone Land associated with the Category 2 Vegetation of the adjacent constructed Riparian Corridor. The RFS *Bushfire Prone Land Mapping Guidelines* (p. 11) define Category 2 land as:

> *Vegetation Category 2 is considered to be a lower bush fire risk than Category 1 and Category 3 but higher than the excluded areas. It is represented as light orange on a bush fire prone land map and will be given a 30 metre buffer. This vegetation category has lower combustibility and/or limited potential fire size due to the vegetation area shape and size, land geography and management practices. Vegetation Category 2 consists of:*
>
> - *Rainforests.*
> - *Lower risk vegetation parcels. These vegetation parcels represent a lower bush fire risk to surrounding development and consist of:*
>   - *Remnant vegetation;*
>   - *Land with ongoing land management practices that actively reduces bush fire risk. These areas must be subject to a plan of management or similar that demonstrates that the risk of bush fire is offset by strategies that reduce bush fire risk; AND include:*

- *Discrete urban reserve/s;*
- *Parcels that are isolated from larger uninterrupted tracts of vegetation and known fire paths;*
- *Shapes and topographies which do not permit significant upslope fire runs towards development;*
- *Suitable access and adequate infrastructure to support suppression by firefighters;*

- *Vegetation that represents a lower likelihood of ignitions because the vegetation is surrounded by development in such a way that an ignition in any part of the vegetation has a higher likelihood of detection.*

The Camden Council and RFS determination of the remnant vegetation as Category 2 is supported and reflects the low bushfire risk affecting the site.

The land within the site that is impacted on by the Category 2 Vegetation buffer zone will be managed as an asset Protection Zone. This will modify the hazard to managed land as defined within PBP (p. 112):

> *Managed land is land that has vegetation removed or maintained to limit the spread and impact of bush fire. It may include existing developed land (i.e. residential, commercial or industrial), roads, golf course fairways, playgrounds or sports fields, vineyards, orchards, cultivated ornamental gardens and commercial nurseries. Most common will be gardens and lawns within curtilage of buildings. These areas will be managed to meet the requirements of an Asset Protection Zone.*

The school has been designed to provide the necessary setbacks from the area of Category 2 Vegetation to meet the acceptable solutions within PBP and more specifically limit the radiant heat level exposure to the sited buildings to a maximum 10kW/m^2.

Figure 9: BFPL Map

12. Bushfire Threat Assessment

12.1. Bushfire Hazard

An assessment of the Bushfire prone land is necessary to determine the application of bushfire protection measures such as APZ locations, risk and Bushfire Attack Levels (BAL).

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 the bushfire planning framework and PBP 2019.

The bushfire hazard affecting the investigation area was assessed during site inspections and using recent aerial photographs for at least a distance of 140m from the perimeters of the investigation area (in line with PBP 2019).

This assessment identifies the potential bushfire threat from outside of the site. The method used for this assessment is outlined in PBP 2019 and relies on consideration of vegetation and slope and is outlined below along with results.

12.2. Methodology

PBP provides a methodology to determine the bushfire threat and commensurate size of any asset protection zone (APZ) that may be required to offset possible bushfire attack. These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation. For new schools, APZ requirements are based on keeping radiant heat levels at new buildings below 10kW/m^2.

The following assessment is prepared in accordance with Section 100B of the RF Act, Clause 44 of the RF Reg and PBP. This assessment is based on the following resources:

- Planning for Bush Fire Protection (NSW RFS, 2019)
- Camden Council Bushfire Prone Land Map
- Aerial mapping
- Detailed GIS analysis
- Site inspection

The methodology used in this assessment is in accordance with PBP Appendix 1 Site Assessment Methodology and is outlined in the following sections.

- Step 1: Determine vegetation formation in all directions around the building to a distance of 140 metres;

- Step 2: Determine the effective slope of the land from the building for a distance of 100 metres;
- Step 3: Determine the relevant FFDI for the council area in which the development is to be undertaken; and
- Step 4: Match the relevant FFDI, vegetation formation and effective slope to determine the APZ required from the appropriate table of PBP.

12.3. Fire Danger

For SFPP development, PBP has designated the appropriate fire areas and corresponding Forest Fire Danger Rating (**FDI**). The FDI within PBP 2019 is based on a historical fire weather assessment which assumes a credible worst-case scenario and an absence of any other mitigating factors relating to aspect or prevailing winds.

The 1:50 year fire weather scenario for most of the State was determined as FDI 80. However, a number of areas including the Greater Sydney, Greater Hunter, Illawarra, Far South Coast and Southern Ranges Fire Areas have higher FDIs which are set at 100 and does not take into account climate change.

The site has a Fire Danger Index (FDI) of 100 as the Camden LGA is within the Greater Sydney Region Fire Weather District per PBP.

12.4. Vegetation Analysis

PBP requires a classification of the vegetation on and surrounding the site out to a distance of 140 metres from the boundaries of the property in accordance with the system for classification of vegetation contained in PBP 2019.

The predominant vegetation is classified by structure or formation using the system adopted by *Ocean Shores to Desert Dunes* (Keith, 2004) and by the general description using PBP 2019. There are 7 vegetation formations (with sub-formations) identified in PBP. 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. Where a mix of vegetation types exist, the type providing the greater hazard is said to predominate.

The classified vegetation is shown in Figure 10 as Forested Wetland, which has been used in the assessment as the basis to determine APZ and radiant heat loads within the site. As stated in the historical Vegetation Management Plan and provided in Figure 4 of this report, the known vegetation communities within the vegetated swale / riparian corridor are Freshwater Wetland, Alluvial Woodland

and Cumberland Plain Woodland. Following the site inspection performed on the 29th of March 2022, Blackash have reviewed the vegetation in its present formation and provide the following observations:

- Freshwater Wetlands as a vegetation community dominates the base of the vegetative swale through Sedges and Grass flora species (refer photos 1, 2 and 3);
- Alluvial Woodland and Cumberland Plain Woodland flora species represent a mixed vegetation community that dominate the batters of the vegetative swale, with the identification of the tree and shrub flora species being predominately eucalypts, tea-trees and Casuarinas (refer photos 3, 4 and 5).

As the classified vegetation demonstrates a mixture of vegetation communities, the greater hazard of Forested Wetland has been applied. Figure 10 demonstrates that the classified vegetation within the constructed vegetated swale / riparian corridor to the west, is the only vegetation impacting on the site.

Due to the surrounding commercial and residential development, the classified vegetation to the west is narrow and only has a limited fire run potential. The adjoining managed residential properties and road corridors restrict the ability for any major fire run. Blackash have taken an additional conservative approach to the classified vegetation and performed radiant heat modelling using Forest type vegetation as the input for the calculated Short Fire Runs (see section 11.7).

Photo 1: Base of vegetative swale, looking north from Kavavagh Street.

Photo 2: Base of vegetative swale, looking north from the elevated walkway.

Photo 3: Looking south towards Kavavagh Street at the base of the vegetated swale (adjacent the elevated walkway).

Photo 4: Looking west towards the commercial properties, from the elevated walkway.

Photo 5: Looking northeast towards Howard Park Street from the base of the vegetated swale.

Photo 6: Looking east towards the residential properties, from the batter of the vegetative swale.

PO BOX 715 WAHROONGA NSW 2076 AUSTRALIA
M 0419 203 853 | E lew.short@blackash.com.au
W blackash.com.au

TINTAGEL INVESTMENTS PTY LTD T/A BLACKASH BUSHFIRE CONSULTING ABN 99 000 704 861

12.5. Slopes Influencing Bushfire Behavior

The RF Reg requires an assessment of the slope of the land on and surrounding the property out to a distance of 100 metres from the boundaries of the property or from the proposed development footprint.

The 'effective slope' influencing fire behaviour approaching the sites has been assessed in accordance with the methodology specified within PBP and is shown in Figure 10. This is conducted by measuring the worst-case scenario slope where the vegetation occurs over a 100 meter transect measured outwards from the development boundary or the existing/ proposed buildings.

- Effective Slopes to the west – Downslope 5 – 10 degree range;
- Effective Slopes to the east – no vegetation;
- Effective Slopes to the south – no vegetation; and
- Effective Slopes to the north – no vegetation.

The effective slopes for the site are shown in Figure 10 and range between 3.5 - 7.9 degrees downslope. The effective slope falls within the PBP range of >5 - 10 degrees downslope.

Figure 10: Slope and Vegetation map

12.6. Asset Protection Zones

An APZ is a fuel-reduced area surrounding a built asset or structure which provides a buffer zone between a bushfire hazard and an asset. The APZ includes a defendable space within which firefighting operations can be carried out.

An APZ is land that has vegetation removed or maintained to a level that limits the spread and impact of bushfire. This may include:

- developed land (residential, commercial, or industrial),
- permanent roads, bike paths, parking areas,
- golf course fairways, playgrounds, sports fields,
- vineyards, orchards, cultivated ornamental gardens and commercial nurseries,
- most common will be gardens and lawns within curtilage of buildings.

As per Figure12, the proposed school carpark location would be suitable within the APZ.

For SFPP developments, the APZ requirements must result in radiant heat levels at new buildings being below 10kW/m^2.

The APZ is required to be managed in compliance with the APZ standards set out in NSW RFS document *Standards for Asset Protection Zones (refer Appendix 3)*. As the APZ provides a fuel-reduced, physical separation between buildings and bush fire hazards, it is a key element in the suite of bush fire measures and dictates the type of construction necessary to mitigate bushfire attack. In practical terms, the setback of each building will form part of the APZ and will need to be conditioned to be maintained to the standard of an Inner Protection Area as detailed in PBP Appendix 4 (p. 107).

Table 2 provides a summary of the APZs for the proposed development.

Table 2: APZ Assessment

Direction	Slope	Vegetation	APZ Required (metres)	APZ Proposed (metres)
North	NA	No hazard	Nil	NA
East	NA	No hazard	Nil	NA
South	NA	No hazard	Nil	NA
West	5-10° Downslope	Forested Wetland	51	57.9

As demonstrated in Table 2 and Figure 11 below, the site can accommodate the required 51-meter SFPP development APZ to achieve the maximum radiant heat level of 10kW/m^2 at the proposed new sited buildings.

As part of the development, the State Design Review Panel (SDRP) have set a target to provide 40% tree canopy cover within the site. This fundamentally clashes with the RFS requirement for APZs of 15% for an Inner Protection Area (IPA) and 30% for an Outer Protection Area (OPA). Usually, the RFS will seek to optimize the provision of APZs to an entire site. However, due to the tension between canopy creation and retention and management of bushfire risk, Blackash have provided specific recommendations that provide the canopy retention and compliance with PBP within the APZ, while the remainder of the site can provide a higher canopy cover.

Figure 11 shows the APZ analysis for the Forested Wetland that is provided for the development, that demonstrates the 10kW/m² Radiant Heat Exposure.

In accordance with Table A1.12.4 of PBP, the APZ (refer Figure 12) that is required to be applied to the building structures has been broken up as follows:

- Total APZ distance 51m
- Inner Protection Area distance – 26m
- Outer Protection Area distance - 25m

The area outside the site is buffered by the applied APZ, which will not provide for the transfer of fire into the site. The remainder of the site (outside the APZ) can be revegetated to provide a canopy cover up to 40%. Note, Blackash confirm that the required Asset Protection Zone as demonstrated in Figure 12, will not require the removal of the stand of existing trees located in the south western portion of the site.

The requirements for vegetation within the APZ are:

IPA Requirements (PBP p. 107)

Trees

- *tree canopy cover should be less than 15% at maturity;*
- *trees at maturity should not touch or overhang the building;*
- *lower limbs should be removed up to a height of 2m above the ground;*
- *tree canopies should be separated by 2 to 5m; and*
- *preference should be given to smooth barked and evergreen trees.*

Shrubs

- *create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided;*
- *shrubs should not be located under trees;*

- *shrubs should not form more than 10% ground cover; and*
- *clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.*

Grass

- *grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and*
- *leaves and vegetation debris should be removed.*

OPA Requirements (PBP p. 107)

Trees

- *tree canopy cover should be less than 30%; and canopies should be separated by 2 to 5m.*

Shrubs

- *shrubs should not form a continuous canopy; and shrubs should form no more than 20% of ground cover.*

Grass

- *grass should be kept mown to a height of less than 100mm; and*
- *leaf and other debris should be removed.*

Figure 11: Asset Protection Zone Analysis – 10kW/m² Radiant Heat Exposure (SFPP)

PO BOX 715 WAHROONGA NSW 2076 AUSTRALIA
M 0419 203 853 | E lew.short@blackash.com.au
W blackash.com.au

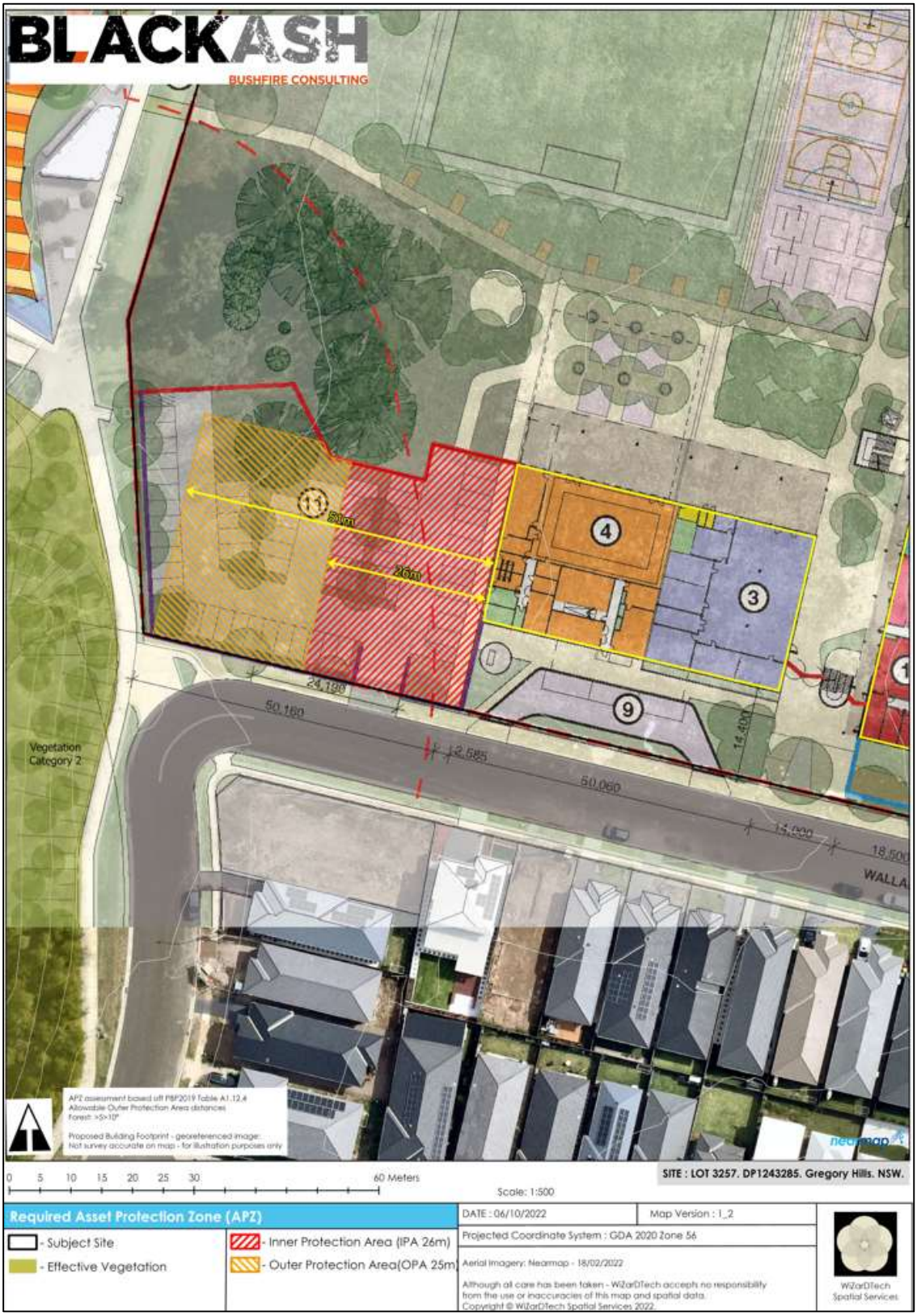


Figure 12: Required Asset Protection Zone - IPA and OPA

12.7. Radiant Heat Modelling

As a redundancy, detailed radiant heat modelling has been performed for the classified vegetation to the west, due to a current Vegetation Management Plan being unavailable at the time of this assessment. Blackash have provided an additional layer of risk assessment and considered a worst-case scenario that the vegetation associated with the riparian corridor is left unmanaged, resulting in Forest type vegetation fuel loads in the classified vegetation to the west. Three short fire run (SFR) calculations were performed with the results of each SFR transect provided in Table 3 below. The detailed inputs and outputs from the SFR calculations are provided in Figures 14, 15 and 16. The key inputs used in the SFR calculations can be found on the map as provided in Figure 13.

The riparian corridor at its widest perpendicular transect is 61.1 metres and contains a variety of revegetation, pathways and detention basins. For the purposes of the SFR modelling, a redundancy is provided in that the area is completely revegetated as Forest to create an additional level of conservatism in the design.

Short Fire Run

Due to the surrounding commercial and residential development, the bushland to the west is narrow and only has a limited fire run potential (see Figure 13). The adjoining managed residential properties and road corridors restrict the ability for any major fire run.

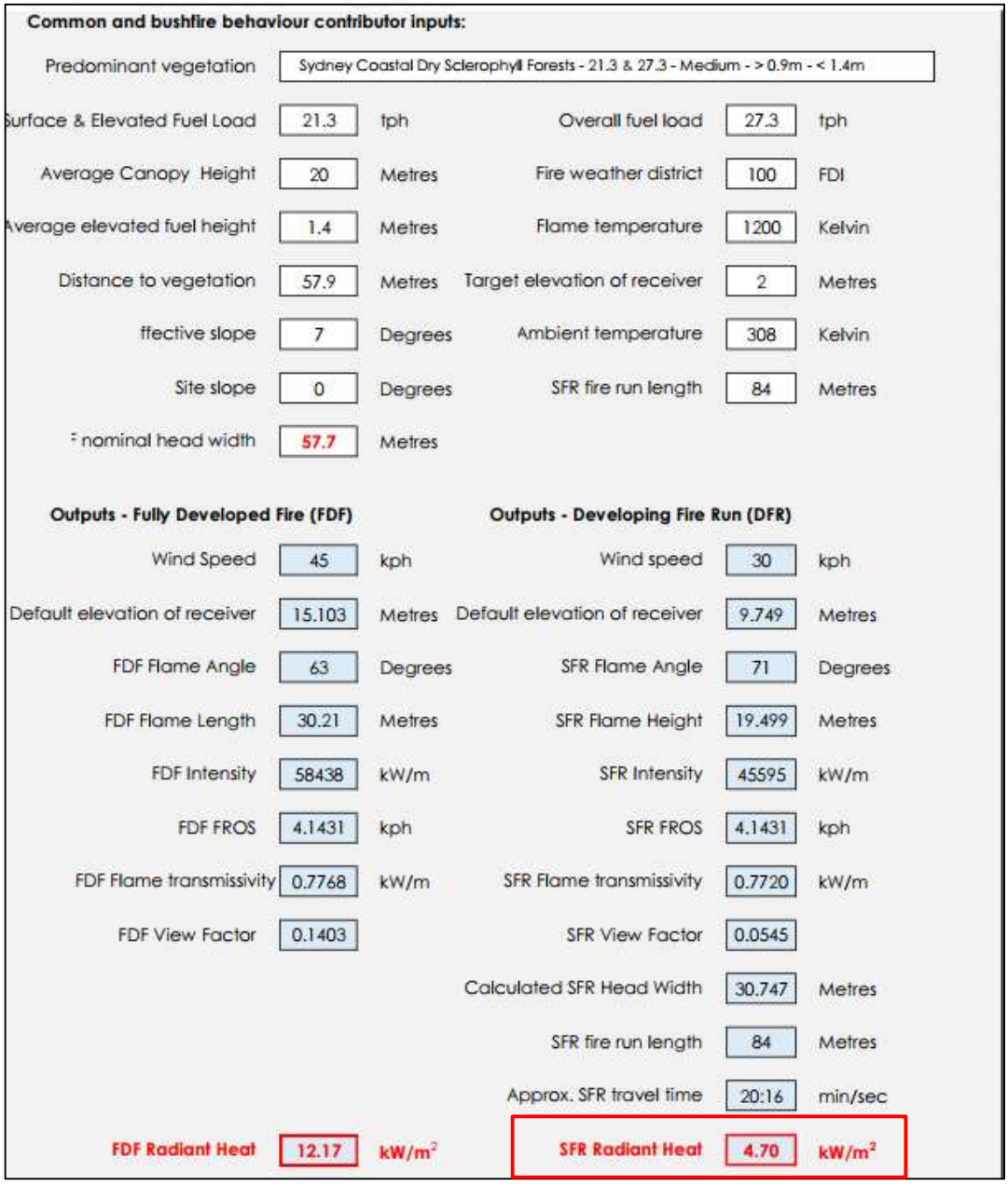
Figure 13 shows the 3 transects along the riparian corridor to the west. These transects have been used to inform the modelling using the radiant heat calculator and the outputs shown below.

Table 3: Radiant heat modelling summary

Transect	Slope	Vegetation	Short Fire Run	APZ provided	Radiant Heat
01	7° Downslope	Forest	84 metres	57.9 metres	4.70kW/m^2
02	8° Downslope	Forest	62 metres	57.9 metres	3.73kW/m^2
03	4° Downslope	Forest	84 metres	57.9 metres	4.04kW/m^2

The SFR transects, based on the "worst-case" Forest vegetation type, are all well below the 10kW/m^2 radiant heat exposure limits at the nearest sited building.

Figure 13: SRF Modelling Map

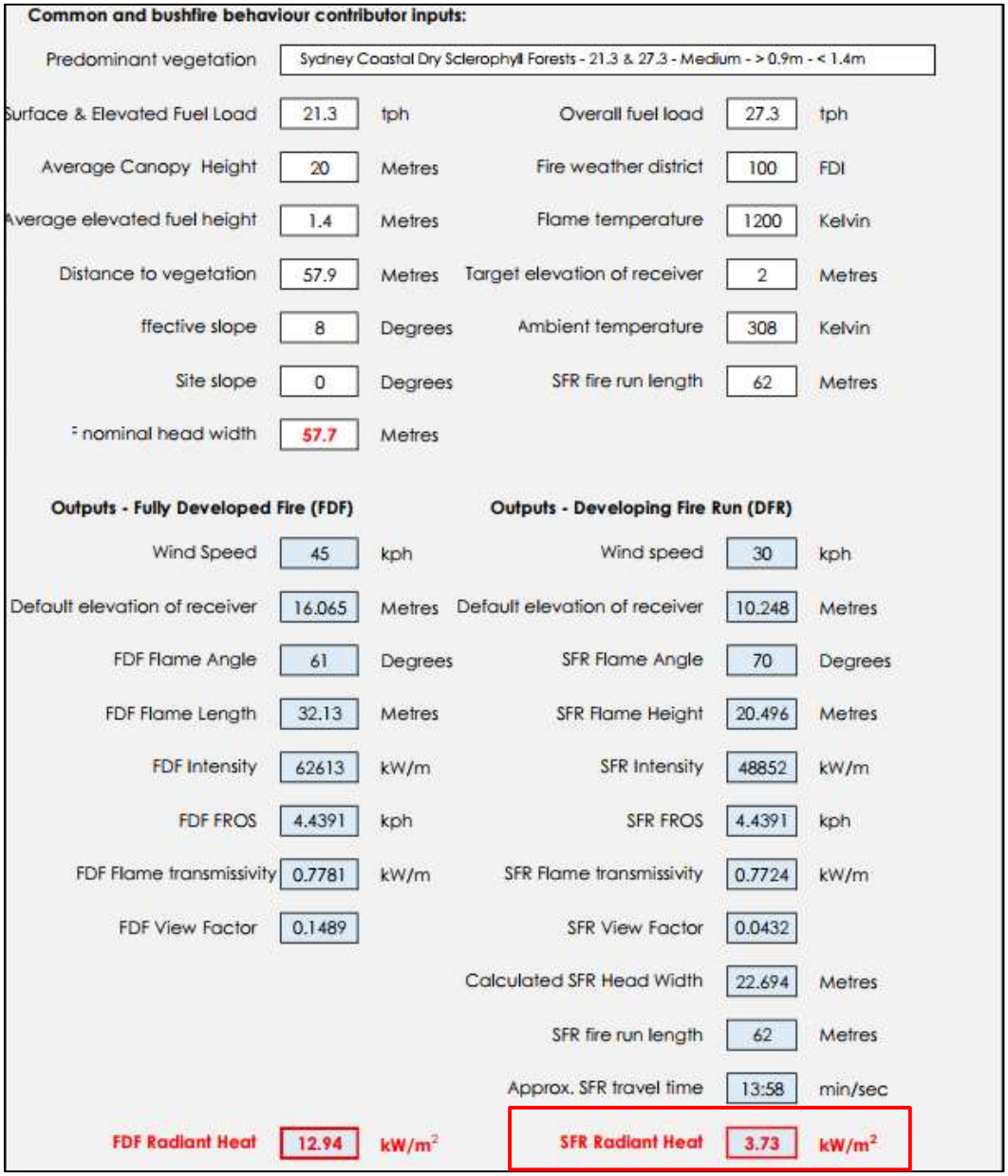


Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
urface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire weather district	100	FDI
verage elevated fuel height	1.4	Metres	Flame temperature	1200	Kelvin
Distance to vegetation	57.9	Metres	Target elevation of receiver	2	Metres
ffective slope	7	Degrees	Ambient temperature	308	Kelvin
Site slope	0	Degrees	SFR fire run length	84	Metres
nominal head width	57.7	Metres			

Outputs - Fully Developed Fire (FDF)			Outputs - Developing Fire Run (DFR)		
Wind Speed	45	kph	Wind speed	30	kph
Default elevation of receiver	15.103	Metres	Default elevation of receiver	9.749	Metres
FDF Flame Angle	63	Degrees	SFR Flame Angle	71	Degrees
FDF Flame Length	30.21	Metres	SFR Flame Height	19.499	Metres
FDF Intensity	58438	kW/m	SFR Intensity	45595	kW/m
FDF FROS	4.1431	kph	SFR FROS	4.1431	kph
FDF Flame transmissivity	0.7768	kW/m	SFR Flame transmissivity	0.7720	kW/m
FDF View Factor	0.1403		SFR View Factor	0.0545	
			Calculated SFR Head Width	30.747	Metres
			SFR fire run length	84	Metres
			Approx. SFR travel time	20:16	min/sec
FDF Radiant Heat	12.17	kW/m^2	**SFR Radiant Heat**	4.70	kW/m^2

Figure 14: SRF Modelling – 01



Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
Surface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire weather district	100	FDI
Average elevated fuel height	1.4	Metres	Flame temperature	1200	Kelvin
Distance to vegetation	57.9	Metres	Target elevation of receiver	2	Metres
ffective slope	8	Degrees	Ambient temperature	308	Kelvin
Site slope	0	Degrees	SFR fire run length	62	Metres
nominal head width	57.7	Metres			

Outputs - Fully Developed Fire (FDF)			Outputs - Developing Fire Run (DFR)		
Wind Speed	45	kph	Wind speed	30	kph
Default elevation of receiver	16.065	Metres	Default elevation of receiver	10.248	Metres
FDF Flame Angle	61	Degrees	SFR Flame Angle	70	Degrees
FDF Flame Length	32.13	Metres	SFR Flame Height	20.496	Metres
FDF Intensity	62613	kW/m	SFR Intensity	48852	kW/m
FDF FROS	4.4391	kph	SFR FROS	4.4391	kph
FDF Flame transmissivity	0.7781	kW/m	SFR Flame transmissivity	0.7724	kW/m
FDF View Factor	0.1489		SFR View Factor	0.0432	
			Calculated SFR Head Width	22.694	Metres
			SFR fire run length	62	Metres
			Approx. SFR travel time	13:58	min/sec
FDF Radiant Heat	12.94	kW/m^2	**SFR Radiant Heat**	3.73	kW/m^2

Figure 15: SRF Modelling - 02

Common and bushfire behaviour contributor inputs:

Predominant vegetation	Sydney Coastal Dry Sclerophyll Forests - 21.3 & 27.3 - Medium - > 0.9m - < 1.4m				
urface & Elevated Fuel Load	21.3	tph	Overall fuel load	27.3	tph
Average Canopy Height	20	Metres	Fire weather district	100	FDI
verage elevated fuel height	1.4	Metres	Flame temperature	1200	Kelvin
Distance to vegetation	57.9	Metres	Target elevation of receiver	2	Metres
ffective slope	4	Degrees	Ambient temperature	308	Kelvin
Site slope	0	Degrees	SFR fire run length	84	Metres
nominal head width	57.7	Metres			

Outputs - Fully Developed Fire (FDF)			Outputs - Developing Fire Run (DFR)		
Wind Speed	45	kph	Wind speed	30	kph
Default elevation of receiver	12.585	Metres	Default elevation of receiver	8.394	Metres
FDF Flame Angle	67	Degrees	SFR Flame Angle	74	Degrees
FDF Flame Length	25.17	Metres	SFR Flame Height	16.789	Metres
FDF Intensity	47512	kW/m	SFR Intensity	37069	kW/m
FDF FROS	3.3684	kph	SFR FROS	3.3684	kph
FDF Flame transmissivity	0.7742	kW/m	SFR Flame transmissivity	0.7709	kW/m
FDF View Factor	0.1177		SFR View Factor	0.0470	
			Calculated SFR Head Width	30.747	Metres
			SFR fire run length	84	Metres
			Approx. SFR travel time	0:56	min/sec
FDF Radiant Heat	10.18	kW/m^2	**SFR Radiant Heat**	4.04	kW/m^2

Figure 16: SRF Modelling - 03

12.8. Application of AS3959 (2018)

The application 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 has been applied to the two buildings (numbered 3 and 4) that are within 100 metres of the bushfire hazard, refer Figure 17. Consistent with AS3959, construction requirements for the buildings that are greater than 100 metres from the bushfire hazard are classified as BAL-Low. AS3959 describes BAL-Low as "*There is insufficient risk to warrant specific construction requirements*".

Figure 17: 100 meter transect from the bushfire hazard

12.9. Construction Requirements

The proposed new buildings numbered 3 and 4, as identified in Figure 17, are to be constructed to comply with the **BAL-12.5** applicable sections of the Australian Standard AS3959-2018 *Construction of buildings in bush fire-prone areas,* or NASH Standard *National Standard Steel Framed Construction in Bushfire Areas* – 2014 and Sections 7.5 & 7.6 of *Planning for Bush Fire Protection 2019*.

The remainder of the proposed buildings are considered BAL-Low and as such *there are no specific construction requirements*.

The construction of the buildings in this manner complies with *Planning for Bush Fire Protection 2019* and the National Construction Code (NCC).

12.10. Access

PBP Section 3.4 Access arrangements prescribes the following requirement when designing access roads for a development:

> *Design of access roads shall enable safe access and egress for residents attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations.*

Multiple access points from the overall site and in different directions, can assist in maintaining access / egress in case one route is blocked due to fires or related incidents (e.g. tree fall, car accident). Importantly there is also the ability to evacuate the site from fires approaching from different directions.

The site has sufficient opportunities to meet the specified access requirement. The main access point is a dual access driveway provided via Wallarah Circuit (South) into the staff carpark, with a secondary pedestrian access point and pathway connection into Howard Park (East). The two access points provide adequate opportunity for vehicles and persons attempting to enter and exit the site simultaneously, especially in an emergency situation.

The design of public access roads and property access (within a site) should enable safe access, egress and defendable space for fire fighters and emergency services.

Given the nature of the existing public road network and the proposed design of the defendable space within the staff carpark, the proposal complies with the requirements of PBP 2019.

12.11. Water Supply & 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.

Reticulated water supply will be available to the proposed site, from a reliable source (Sydney Water Asset).

Electricity supplies will be provided through a new substation, which will supply electricity via inground submains.

Reticulated gas supply will not be provided to the site, and any bottled gas supply will be managed accordingly.

It is considered the provision of adequate water services and the location of electricity and gas supplies can be planned and managed to comply with PBP.

13. Evacuation and Emergency Management

Schools are particularly prone to traffic-generated congestion on roads at start and finish times. This is heightened when parents believe that their children are likely to be exposed to bushfire and in seeking to reach the school, cause road congestion and hamper the firefighting effort. A detailed *Bushfire Evacuation Plan* consistent with NSW RFS publication: A Guide to *Developing a Bush Fire Emergency Management and Evacuation Plan* will be completed prior to occupation.

14. Significant Environmental Features

Separate assessment to be completed by suitably qualified consultant.

15. Threatened Species

Separate assessment to be completed by suitably qualified consultant.

16. Aboriginal Objects or Places of Significance

Separate assessment to be completed by suitably qualified consultant.

17. Compliance Summary Tables

17.1. Aim and Objectives

The RF Reg requires an assessment of the extent to which the proposed development conforms with or deviates from the standards, aim and objectives and performance criteria set out in Chapter 6 of PBP. All development in Bushfire Prone Areas needs to comply with the aim and objectives of PBP. Table 4, 5 and 6 is an assurance approach using expert judgement.

Table 4: Aim and Objectives of PBP (Section 1.1)

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	Areas around the school will meet APZ requirements.
Objectives	**Meets Criteria**	**Comment**
Afford occupants of any building adequate protection from exposure to a bushfire.	Yes	Buildings 3 and 4 are designed and built in accordance with Section 5 (BAL-12.5) of AS3959.
Provide for defendable space to be located around buildings.	Yes	Defendable space is provided for on all sides of the proposed development.
Provide appropriate separation between a hazard and buildings, which, in combination with other measures, prevent direct flame contact and material ignition.	Yes	An asset protection zone is provided within the site.
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. A detailed evacuation plan will be completed prior to occupation.
Provide for ongoing management and maintenance of bushfire protection measures, including fuel loads, in the asset protection zone.	Yes	A bushfire management plan will be provided prior to completion of the building. A management plan is to be prepared that describes the maintenance measures required to maintain the APZ
Ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bushfire fighting).	Yes	Utility services are to comply with PBP.

17.2. PBP Chapter 6: Specific Objectives

Table 5: Compliance summary against specific objectives of Chapter 6:

Objectives	Meets Criteria	Comment
Minimise levels of radiant heat, localised smoke and ember attack through increased APZ, building design and siting.	Yes	A compliant asset protection zone is provided within the site. Buildings 3 and 4 are designed and built in accordance with Section 5 (BAL-12.5) of AS3959.
Provide an appropriate operational environment for emergency service personnel during firefighting and emergency management.	Yes	Defendable space is provided for on all sides of the proposed development.
Ensure the capacity of existing infrastructure (such as roads and utilities) can accommodate the increase in demand during emergencies as a result of the development.	Yes	The site has direct access to public roads, and access and egress for emergency vehicles and evacuation is adequate. A detailed evacuation plan will be completed prior to occupation.
Ensure emergency evacuation procedures and management which provides for the special characteristics and needs of occupants.	Yes	A detailed evacuation plan will be completed prior to occupation.

17.3. PBP Chapter 6: Performance Criteria

Table 6: Compliance summary against performance criteria Tables 6.8a, 6.8b, 6.8c and 6.8d:

Performance Criteria		Comment	Complies
Asset Protection Zones	Radiant heat levels of greater than 10kW/ m² (calculated at 1200K) will not be experienced on any part of the building.	The required APZs as specified in Table A1.12.1 of PBP are provided.	YES
	APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	APZs are located on lands with a slope less than 18 degrees.	YES
	APZs are managed and maintained to prevent the spread of fire to the building.	APZs are to be managed in accordance with the requirements of Appendix 4 of PBP.	YES
	The APZ is provided in perpetuity.	APZs are to be provided in perpetuity.	YES
Landscaping	Landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions.	Landscaping is to comply with Appendix 4 of PBP. Fencing is to be constructed in accordance with section 7.6 of PBP. Consideration required during design phase of the development - can be achieved.	YES
Construction Standards	The proposed building can withstand bush fire attack in the form of wind, embers, radiant heat and flame contact.	A construction level of BAL-12.5 under AS 3959 or NASH Standard and section 7.5 of PBP is to be applied to buildings 3 and 4. Consideration required during design phase of the development - can be achieved.	YES
Access	Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation.	Access through existing public road system. Access roads are two-wheel drive, all-weather roads.	YES
	The capacity of access roads is adequate for firefighting vehicles.	The capacity of road surfaces and any bridges / causeways are to be sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes). Consideration required during design phase of the development - can be achieved.	YES

	There is appropriate access to water supply.	Reticulated water supply.	YES
	Perimeter roads - access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface.	Perimeter roads are provided by the existing public road network around the site.	YES
	Non-perimeter roads - access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	No internal access roads are provided for in the current design.	NA
Water supplies	An adequate water supply for firefighting purposes is installed and maintained.	Reticulated water supply.	YES
	Water supplies are located at regular intervals.	Reticulated water supply.	YES
	The water supply is accessible and reliable for firefighting operations.	Reticulated water supply.	YES
	Flows and pressure are appropriate.	Reticulated water supply.	YES
	The integrity of the water supply is maintained.	Reticulated water supply.	YES
	Water supplies are adequate in areas where reticulated water is not available.	Reticulated water supply.	YES
Electricity Services	Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.	Consideration required during design phase of the development - can be achieved.	YES
Gas services	Location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	Any new gas services are to be installed and maintained in accordance with AS/NZS 1596:2008. Consideration required during design phase of the development - can be achieved.	YES

Emergency Management	A Bush Fire Emergency Management and Evacuation Plan is prepared.	A Bush Fire Emergency Management and Evacuation Plan is to be prepared consistent with the: • The NSW RFS document: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan; • NSW RFS Schools Program Guide; and • Australian Standard AS 3745:2010 Planning for emergencies in facilities.	**Yes**
	Appropriate and adequate management arrangements are established for consultation and implementation of the Bush Fire Emergency Management and Evacuation Plan.	• An Emergency Planning Committee is to be established to consult with residents (and their families) and staff in developing and implementing an Emergency Procedures Manual; and • Detailed plans of all emergency assembly areas including on site and off-site arrangements as stated in AS 3745:2010 are clearly displayed, and an annually emergency evacuation is conducted.	**Yes**

18. Recommendations

The following recommendations are provided:

Recommendation 1: The proposed new buildings numbered 3 and 4, as identified in Figure 17, are to be designed and constructed to comply with BAL-12.5 of AS3959 2018 Construction of buildings in bushfire-prone areas and Sections 7.5 & 7.6 of *Planning for Bush Fire Protection 2019*.

Recommendation 2: Water, electricity and gas supplies through the proposed development must comply with section 6.8.3 of PBP (pages 59-60) and included in Appendix 4 of this report.

Recommendation 3: APZs are provided in accordance with Figure 12 within this report.
The APZ is made up of the following:

- Total APZ distance 51m
- Inner Protection Area distance – 26m
- Outer Protection Area distance - 25m

The area outside the site is buffered by the APZ, which will not provide for the transfer of fire into the site. The remainder of the site (outside the APZ) can be revegetated to provide a canopy cover up to 40%.
All Asset Protection Zones and landscaping within the proposed APZ site are to be maintained in accordance with Appendix 4 of PBP 2019 and the NSW RFS "Asset protection zone standards".

Recommendation 4: A Bushfire Management Plan is to be produced as part of the development to ensure the suite of bushfire measures are managed on an ongoing basis. This shall include at a minimum the APZ maintenance, landscape maintenance, pre-incident planning and Hazard Reduction burn planning.

Recommendation 5: A Bushfire Emergency Management and Evacuation Plan is to be produced as part of the development to ensure suitable emergency and evacuation arrangements for occupants of the proposed site.

19. Conclusion

This Bushfire Hazard Assessment is in response to the Planning Secretary's Environmental Assessment Requirements (SEAR) Section 4.12(8) of the Environmental Planning and Assessment Act 1979 (EPA Act) and Division 5 of the Environmental Planning and Assessment Regulation 2021 (SSD-41306367). Applications under the now-repealed Part 3A of the EP&A Act and state significant projects are exempt from requiring a BFSA and are not required to be assessed under EP&A Act s4.14. This report has addressed the Secretary's Environmental Assessment Requirements (SEARs), Condition 22 of the SEAR requires that the Department of Education and demonstrated that the new school is able to comply with PBP 2019.

The five recommendations have been provided to ensure compliance with Planning for PBP 2019. This assessment has demonstrated that the proposed SFPP development can comply with *PBP 2019*. The required APZs are achieved, which renders the site able to meet the minimum performance-based requirement of 10kW/m^2 radiant heat at the sited buildings.

Scott Palin | Bushfire Specialist
Blackash Bushfire Consulting
B.EnvScMan | Grad. Cert. in Bushfire Protection (UWS)

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Lew Short | Principal
BlackAsh Bushfire Consulting
B.A., Grad. Dip. (Design for Bushfires), Grad. Cert. of Management (Macq), Grad. Cert. (Applied Management)
Fire Protection Association of Australia BPAD Level 3 BPD-PA 16373

Appendix 1 References

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

Standards Australia. 2005. *Fire hydrant installations - System design, installation and commissioning*, AS 2419.1, Fourth edition 2005, SAI Global, Sydney

Standards Australia. 2008. The storage and handling of LP Gas, AS/NZS 1596:2008, Fourth edition 2005, SAI Global, Sydney.

Standards Australia. 2009. Construction of buildings in bushfire-prone areas, AS 3959-2018. SAI Global, Sydney.

Australian Building Codes Board Building Code of Australia Volumes 1&2

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 Government (1979) Environmental Planning and Assessment Act 1979.

D Brennan, L Brown, 2017. Gregory Hills – Town Centre Precinct, Vegetation Management Plan. *Ecological Australia.*

Appendix 2 Overview of bushfire attack mechanisms

Bushfires have long remained a fundamental characteristic of the Australian bush landscape, and likewise Australians have long retained a strong affinity with bush environments. There remain a number of common factors which are associated with bushfire hazard and events and these include the incidence of fire weather, availability of fuel along with its type, structure and continuity or fragmentation, and the context of development at the bushland interface.

Bushfire attack refers to the various methods in which bushfire may impact upon life and property and principally encompass:

- Direct flame contact
- Ember attack
- Radiant heat flux
- Fire-driven wind
- Smoke

In the progression of a bushfire event, these methods interact either exclusively or in concert and are explained in the following section.

Direct flame contact

Direct flame attack refers to flame contact from the main fire front, where the flame which engulfs burning vegetation is one and the same as that which assumes contact with the building. It is the highest level of bushfire attack because of direct flame contact from the fire front in addition to heat flux and ember attack.

Ember attack

The convective forces of bushfire raise burning embers into the atmosphere on prevailing winds and deposit them to the ground ahead of the fire front. Typically, ember attack occurs approximately 30 minutes prior to the arrival of the fire front and continues during the impact of the fire front and for several hours afterwards, thus it is the longest lasting impact of bushfire attack.

Ember attack is attack by smoldering or flaming windborne debris that is capable of entering or accumulating around a building, and that may ignite the building or other combustible materials and debris.

In essence, building loss via ember attack relates largely to the vulnerabilities and peculiarities of each

PO BOX 715 WAHROONGA NSW 2076 AUSTRALIA
M 0419 203 853 | E lew.short@blackash.com.au
W blackash.com.au

building, its distance from hazardous vegetation and whether an occupant (or the like) is present to actively defend it. It is estimated by the CSIRO that approximately 80 to 90 per cent of buildings lost by bushfire are lost as a result of ember attack either in isolation or in combination with radiant heat impact.

Radiant heat flux

Exposure to radiant heat remains one of the leading causes of fatalities associated with bushfire events. Measured in kilowatts per square metre (kWm^2), radiant heat is the heat energy released from the fire front which radiates to the surrounding environment, deteriorating rapidly over distance.

In terms of impact on buildings, radiant heat can pre-heat materials making them more susceptible to ignition or can cause non-piloted ignition of certain materials if the energy transmitted reaches a threshold level. Radiant heat can also damage building materials such as window glazing, allowing openings into a building through which embers may enter. Radiant heat impact is an especially important factor in building-to-building ignition.

In terms of radiant heat exposure for humans, it can cause pain to unprotected skin in milder situations or life threatening and fatal injury in higher exposure thresholds. The effects of radiant heat are shown in Table 3.

Table 2 The effects of radiant heat (NSWRFS 2006; Drysdale, 1999; CFA, 2012)

Radiant heat flux kW/m^2	Observed effect
1	Maximum for indefinite skin exposure
3	Hazardous conditions, firefighters expected to operate for a short period (10 minutes)
4.7	Extreme conditions, firefighters in protective clothing will feel pain after 60 seconds of exposure
6.4	Pain after 8 seconds of skin exposure
7	Likely to be fatal to unprotected person after exposure for several minutes
10	Critical conditions, firefighters not expected to operate in these conditions although they may be encountered. Considered to be life threatening in less than 60 seconds in protective equipment. Fabrics inside a building could ignite spontaneously with long exposure.
12.5 (BAL-12.5)	Volatiles from wood may be ignited by pilot after prolonged exposure. Standard float glass could fail during the passage of a bushfire.
16	Blistering of skin after 5 seconds
19 (BAL-19)	Screened float glass could fail during the passage of a bushfire.
29 (BAL-29)	Ignition of most timbers without piloted ignition (3 minutes of exposure) during the passage of a bushfire. Toughened glass could fail.
40+	Flame zone – exposure to direct flame contact from fire front

Fire driven wind

The convective forces of bushfire typically result in strong to gale force fire-driven winds which in itself, can lead to building damage. The typical effects of fire driven wind include the conveyance of embers, damage from branches and debris hitting the building, as well as direct damage to vulnerable building components such as lifting roofs or roof materials and the damage / breakage of windows.

Smoke

Smoke emission remains a secondary effect of bushfire and is one which is typically not addressed by bushfire assessments. Irrespective, it is important to note the potentially severe impact of smoke emission on the human respiratory system. It can lead to difficulties in breathing, severe coughing, blurred or otherwise compromised vision, and can prove fatal. It is also important to note that toxic smoke can occur during bushfire, particularly where buildings or materials are ignited. With regard to evacuation, it can reduce visibility and create difficulties for particularly vulnerable persons.

Appendix 3 Asset Protection Zone Requirements

Source PBP 2019. P. 107

A4.1.1 Inner Protection Areas (IPAs)

The IPA is the area closest to the building and creates a fuel-managed area which can minimise the impact of direct flame contact and radiant heat on the development and act as a defendable space. Vegetation within the IPA should be kept to a minimum level. Litter fuels within the IPA should be kept below 1cm in height and be discontinuous.

In practical terms the IPA is typically the curtilage around the building, consisting of a mown lawn and well maintained gardens.

When establishing and maintaining an IPA the following requirements apply:

Trees

- tree canopy cover should be less than 15% at maturity;
- trees at maturity should not touch or overhang the building;
- lower limbs should be removed up to a height of 2m above the ground;
- tree canopies should be separated by 2 to 5m; and
- preference should be given to smooth barked and evergreen trees.

Shrubs

- create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided;
- shrubs should not be located under trees;
- shrubs should not form more than 10% ground cover; and
- clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.

Grass

- grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and
- leaves and vegetation debris should be removed.

A4.1.2 Outer Protection Areas (OPAs)

An OPA is located between the IPA and the unmanaged vegetation. It is an area where there is maintenance of the understorey and some separation in the canopy. The reduction of fuel in this area aims to decrease the intensity of an approaching fire and restricts the potential for fire spread from crowns; reducing the level of direct flame, radiant heat and ember attack on the IPA.

Because of the nature of an OPA, they are only applicable in forest vegetation.

When establishing and maintaining an OPA the following requirements apply:

Trees

- tree canopy cover should be less than 30%; and
- canopies should be separated by 2 to 5m.

Shrubs

- shrubs should not form a continuous canopy; and
- shrubs should form no more than 20% of ground cover.

Grass

- grass should be kept mown to a height of less than 100mm; and
- leaf and other debris should be removed.

An APZ should be maintained in perpetuity to ensure ongoing protection from the impact of bush fires. Maintenance of the IPA and OPA as described above should be undertaken regularly, particularly in advance of the bush fire season.

PO BOX 715 WAHROONGA NSW 2076 AUSTRALIA
M 0419 203 853 | E lew.short@blackash.com.au
W blackash.com.au

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

TINTAGEL INVESTMENTS PTY LTD T/A BLACKASH BUSHFIRE CONSULTING ABN 99 000 704 861

Appendix 4 Section 6.8.3 of PBP

6.8.3 Services – Water, gas and electricity

Intent of measures: to provide 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.

Table 6.8c

Performance criteria and acceptable solutions for water, electricity and gas services for SFPP development.

	PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS
	The intent may be achieved where:	
WATER SUPPLY	› an adequate water supply for firefighting purposes is installed and maintained.	› reticulated water is to be provided to the development, where available; or › a 10,000 litres minimum static water supply for firefighting purposes is provided for each occupied building where no reticulated water is available.
	VARIATIONS	
	Caravan and camping grounds: an adequate water supply for firefighting purposes is installed and maintained. **Primitive camping**: an adequate water supply for firefighting purposes is installed and maintained.	› either a reticulated water supply is provided or a 10,000 litres minimum water supply on site.
	› water supplies are located at regular intervals. › the water supply is accessible and reliable for firefighting operations.	› fire hydrant spacing, design and sizing comply with the relevant clauses of AS 2419.1:2005; › hydrants are not located within any road carriageway; and › reticulated water supply to SFPPs uses a ring main system for areas with perimeter roads.
	› flows and pressure are appropriate.	› fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005.
	› the integrity of the water supply is maintained.	› all above-ground water service pipes external to the building are metal, including and up to any taps.
	› water supplies are adequate in areas where reticulated water is not available.	› a connection for firefighting purposes is located within the IPA or non hazard side and away from the structure; a 65mm Storz outlet with a ball valve is fitted to the outlet; › ball valve and pipes are adequate for water flow and are metal; › supply pipes from tank to ball valve have the same bore size to ensure flow volume; › underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank; › a hardened ground surface for truck access is supplied within 4m of the access hole; › above-ground tanks are manufactured from concrete or metal; › raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959); › unobstructed access is provided at all times; › tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters; and › underground tanks are clearly marked.

Table 6.8c *Continued*

	PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS
	The intent may be achieved where:	
WATER SUPPLIES	*(continued from previous page)* › water supplies are adequate in areas where reticulated water is not available.	› all exposed water pipes external to the building are metal, including any fittings; › where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; Any hose and reel for firefighting connected to the pump shall be 19mm internal diameter; and › fire hose reels are constructed in accordance with AS/NZS 1221:1997 *Fire hose reels*, and installed in accordance with the relevant clauses of AS 2441:2005 *Installation of fire hose reels*.
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; › where overhead, electrical transmission lines are proposed as follow: › lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; and › no part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 *Guideline for Managing Vegetation Near Power Lines*.
GAS SERVICES	› location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	› reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used; › all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side; › connections to and from gas cylinders are metal; › if gas cylinders need to be kept close to the building, safety valves are directed away from the building and at least 2m away from any combustible material, so they do not act as a catalyst to combustion; › polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used; and › above-ground gas service pipes external to the building are metal, including and up to any outlets.