A decorative background element on the left side of the page, consisting of several concentric, irregular contour lines in a light grey color, resembling a topographic map. The lines are more densely packed in some areas and more spread out in others, creating a sense of depth and terrain.

Bushfire Protection Assessment  
Kamay Botany Bay National Park  
Stage 1 Masterplan – New Visitor Centre

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**National Parks and Wildlife Service**

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## DOCUMENT TRACKING

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## LIMITATIONS

The bushfire protection measures recommended in this report do not completely remove the risk to life and property, and they do not guarantee that a development will not be impacted by a bushfire event.

## ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from National Parks and Wildlife Service

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Template 2.8.1

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## Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BFMC	Bush Fire Management Committee
BFPL	Bush Fire Prone Land
BFRMP	Bush Fire Risk Management Plan
BPM	Bushfire Protection Measures
DSF	Dry Sclerophyll Forest
FDR	Fire Danger Rating
FFDI	Forest Fire Danger Index
GEV	Generalised Extreme Value
NPWS	National Parks and Wildlife Service
NSW	New South Wales
PBP	Planning for Bushfire Protection
RFS	Rural Fire Service

# 1 Introduction

This report documents a bushfire protection assessment for development contemplated by the Master Plan for Kamay Botany Bay National Park (Figure 1). Table 1 below outlines details of the site.

**Table 1: Subject site summary**

Street address or property name: Kamay Botany Bay National Park			
Suburb, town or locality	Kurnell	Postcode:	2231
Local Government Area:	Sutherland		
Zoning:	E1		
Type of development:	Master Plan – replacement visitor centre building and associated amenities buildings and other visitor infrastructure		

## 1.1 Description of proposal

The Kurnell Precinct of Kamay Botany Bay National Park is located on the southern headland of Botany Bay. Kamay Botany Bay National Park is listed on the New South Wales (NSW) State Heritage Register and the Kurnell Peninsula is registered on the National Heritage List. The Park's scenic values have been recognised by the National Trust in classifying it as a landscape conservation area. The Park is managed by the NSW National Parks and Wildlife Service (NPWS) and it is one of NSW's most popular national parks, receiving well over 800,000 visitors annually.

The Kurnell Precinct Master Plan (Figure 1) looks to deliver on the vision to make the Kurnell Precinct of Kamay Botany Bay National Park (herein referred to as the Study Area (Figure 3)) *'a place of significance to all Australians that contributes to their sense of identity as Australians.'* The Master Plan proposes construction of new visitor infrastructure and facilities in the Kurnell Precinct, to support an increase in visitor capacity, new community education and interpretation programs, and new ways to learn about and enjoy this historically important place. Notably, the Master Plan will increase recognition of Aboriginal significance and help to ensure that balanced storytelling includes both Indigenous and European history.

The Master Plan has been designed to improve visitor access and facilities, disabled access and to create a cohesive visitor experience at a highly desirable visitor destination and will be delivered in stages. Stage 1 of the updated Master Plan involves the upgrade of the most popular destination within the Kamay Botany Bay National Park and focusses on the construction of a new visitor centre, along with supporting infrastructure, upgrades to tracks and amenities, as illustrated in Figure 1. The only buildings proposed by the Master Plan are the new visitor centre and amenities buildings located in Commemoration Flat and adjoining the Cricket Pitch carpark. All other construction proposed relates to visitor management (e.g. tracks, signage, picnic facilities, car parking and other visitor related infrastructure). It is understood that no changes to Alpha House are proposed by the Master Plan.

The new visitor centre (Figure 1, Figure 2 and Figure 3) encompasses an exhibition area, café, education area, and NPWS local area office. The design of the building includes distinct pavilions beneath an open cola-style sheltering roof with a timbered hull. Walls will be of non-combustible masonry, cement sheet, steel sheeting and bushfire resistant timbers (Blackbutt or Spotted Gum). The visitor centre has a sheltered floor area of approximately 1500m<sup>2</sup>.

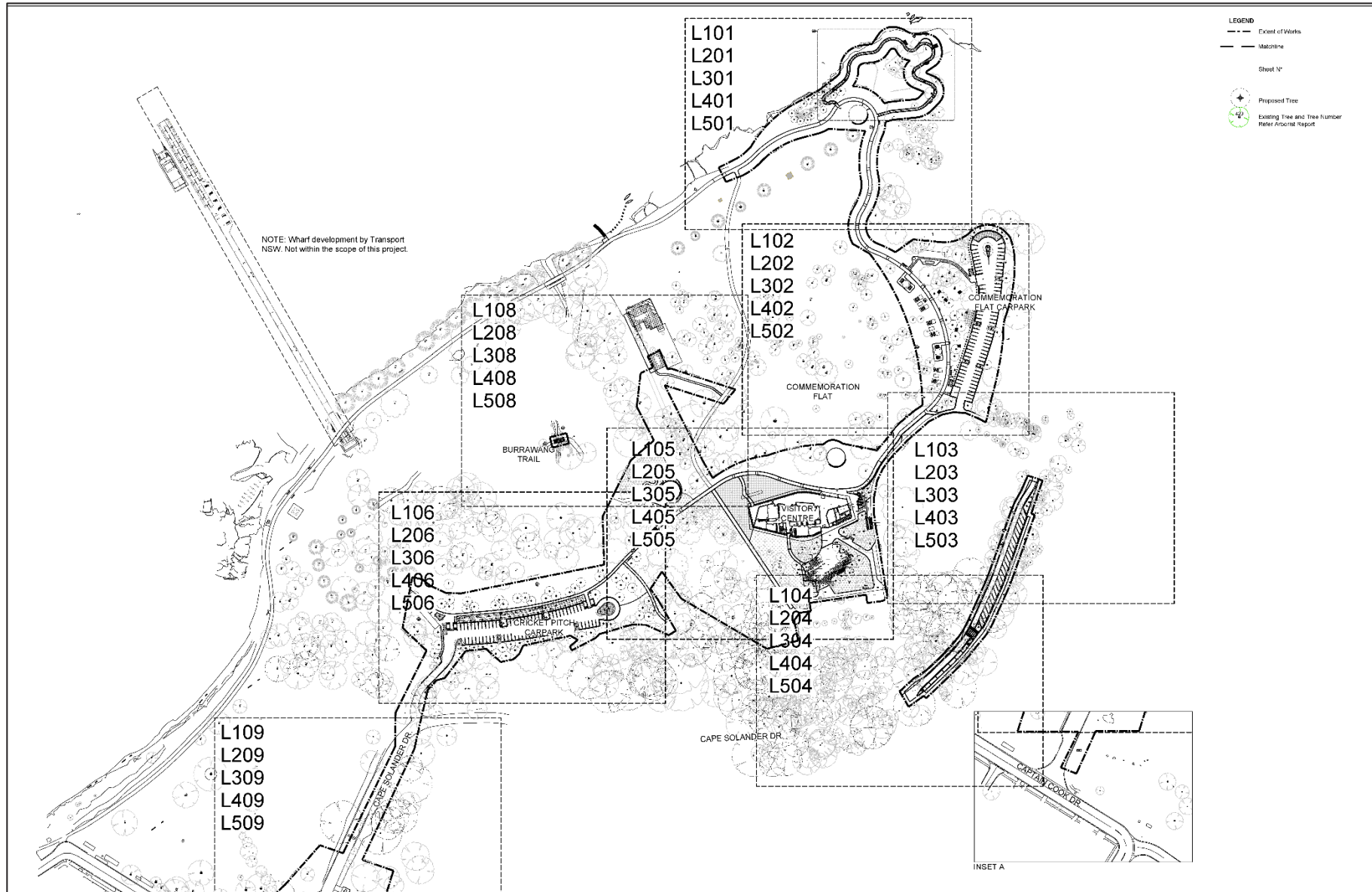


Figure 1: Kamay Master Plan Stage 1 (Taylor Cullity Lethlean 24/03/2023)

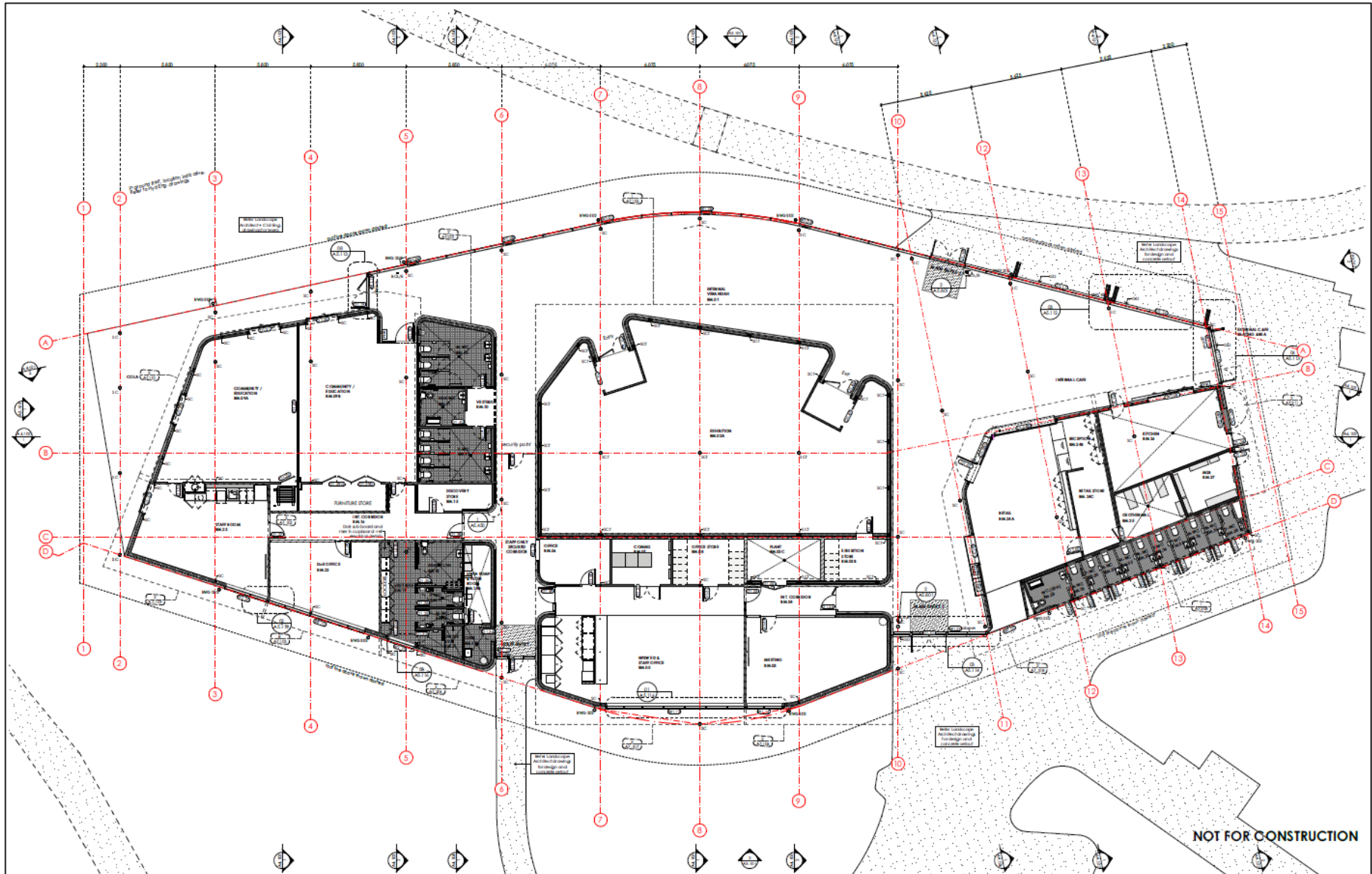


Figure 2: Visitor Centre Site Plan (Neeson Murcutt + Neille, 28/04/2023)



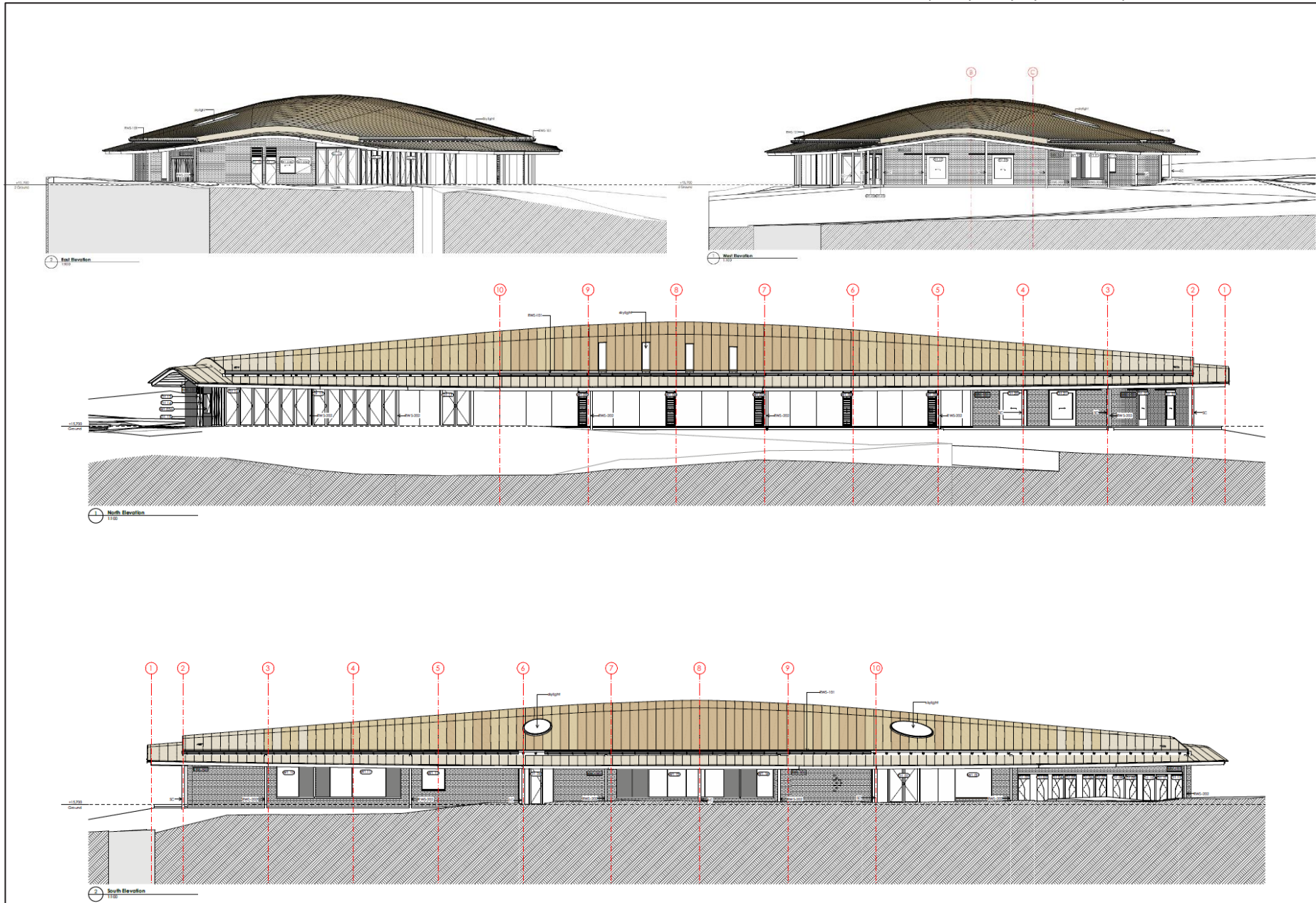


Figure 3: Visitor Centre Elevations (Neeson Murcutt + Neille, 6/04/2023)



Figure 4: Study Area for Bushfire Risk Assessment

## 1.2 Assessment Process

The redevelopment site includes land classified as bush fire prone on the Sutherland Shire Councils' bush fire prone land (BFPL) map. Therefore, bushfire protection of the proposed works should be considered.

As NPWS is the proponent, the works can be assessed as 'development permissible without consent' under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). There are no formal bushfire requirements triggered by Part 5 of the EP&A Act. However, the project approach is to investigate and assess the proposed development for fit-for-purpose bushfire protection measures in the context of the development intent, type and siting within a National Park.

The guideline '*Planning for Bush Fire Protection 2019*' (RFS 2019) and '*Planning for Bush Fire Protection Addendum November 2022*' (RFS 2022), herein collectively referred to as 'PBP' and Australian Standard (AS) 3959-2018 '*Construction of buildings in bushfire-prone areas*' (SA 2018) have been consulted as best practice guides, to inform fit-for-purpose bushfire protection solutions. PBP and AS-3959 focus on the Bushfire Attack Level (BAL) affecting buildings and by default their occupants, given the fire behaviour predicted. The BAL is determined largely by the hazard (vegetation and slope) found within 140 m of a building and the size of the Asset Protection Zone (APZ) separation distance of the building from unmanaged vegetation.

This Bushfire Protection Assessment identifies the bushfire hazard and risks associated with the construction and use of the infrastructure proposed under Stage 1 of the Master Plan. The assessment reviews the design against contemporary bushfire protection measures. The assessment included a review of background documentation and previous advice from 2019, site inspection, updated GIS analysis and desktop assessment.

## 1.3 Bushfire Hazard and Risk

Kamay Botany Bay National Park is classified as bush fire prone land and is located within a wider landscape of bush fire prone land. The bushfire hazard (i.e. the core bush fire prone land) is large and continuous enough to be at risk from larger sized bushfires. Bushfire hazard has been classified using the PBP methodology through assessment of vegetation and slope, illustrated in Figure 4.

The landscape bushfire risk has been assessed from the bushfire hazard, potential fire behaviour and bushfire history within an approximate 5 km radius of the Study Area. A range of maps are provided in Appendix B and support the bushfire risk assessment.

### 1.3.1 Vegetation

The vegetation within the Study Area is predominantly Forest and Short Heath. Smaller areas of Forested Wetlands, Rainforest and Wetlands occur within proximity to the redevelopment site with larger Saline Wetlands and Aquatic areas also present in the locality. The spatial extent and continuity of the vegetation has the potential to support higher intensity and difficult to control fires (Appendix B).

Vegetation has been classified into vegetation formations and Keith classes using PBP (RFS 2019) and Keith (2004). Table 2 shows the assessment of the vegetation in the Study Area.

**Table 2: Vegetation formations and Keith classes**

Vegetation formation	Keith Class
Forest (wet and dry sclerophyll)	Dry Sclerophyll Forest (DSF); North Coast Wet Sclerophyll Forests; Sydney Coastal DSF; Coastal Swamp Forest
Forested Wetland	Coastal Floodplain Wetlands;
Tall heath	Coastal Freshwater Lagoons (dry lagoon margins)
Short heath	Coastal Headland Heaths; Wallum Sand Heaths; Sydney Coastal heaths

### 1.3.2 Topography and Slope

The re-development site is located on slightly higher elevations to the surrounding Study Area to the south-west, although these areas to the west are largely urban areas, as shown in Appendix B. A ridgeline extends north south along the coast with the highest points south of the redevelopment site. Slopes within and adjoining the redevelopment site are relatively gentle with some steeper grades occurring over small areas.

### 1.3.3 Bushfire Weather

The area has a temperate climate with warmer summers and mild winters. Rainfall is more pronounced in summer while late winter and spring tends to be drier due to the influence of westerly winds. The Bush Fire Danger Period generally runs between October and March each year, with the most extreme fire weather occurs during late December or early January if summer rains do not occur (Sutherland Shire Bush Fire Management Committee, 2015).

If fires were to occur under a Fire Danger Rating (FDR) of Very High or above within the forested areas south of the re-development site, they have the potential to become uncontrollable within a short period of time. Days of Very High FDR or above occur on average about 10 days per year based on from the National Bushfire Weather Data set – Sydney Airport weather station (station number 066037) (Lucas 2010).

Data from the Sydney Airport weather station was analysed to determine the maximum 1 in 50-year FFDI, being the accepted recurrence period (i.e. time between events) currently used for bushfire related land use planning (RFS 2019). The dataset was analysed using accepted Generalised Extreme Value (GEV) analysis techniques (Douglas 2017, Douglas et al (2014; 2016)) to determine the 1 in 50-year recurrence FFDI under potential wind driven fire from the following directions:

- All directions;
- North to south-west (clockwise); and
- South-east to South-west (clockwise).

The data show that for the direction with the most extensive and continuous fuels (and highest potential fire attack pathway) from the south, the FFDI recurrence is 47, considerably lower than the maximum FFDI of 116 recorded from the west.

**Table 3: 1 in 50-year directional FFDI**

Weather Station	Max Recorded	All directions	N to SW	SE to SW
Sydney Airport	116	116	116	47

## 1.4 Potential Fire Behaviour

Bushfire intensity modelling has been used to review potential bushfire runs from various directions using fire intensity formulae of McArthur (for Forest) and Catchpole et al (for Heath). Two models were prepared using the GEV FFDI values for various wind directions as shown below:

- Bushfire attack from a westerly direction (north to south-west) at FFDI 116 (Figure 10, Appendix B); and
- Bushfire attack from a southerly direction (south-east to south-west) at FFDI 47 (Figure 11, Appendix B).

Figure 10 shows uncontrollable fire intensities are possible over most of the Study Area under westerly winds and an FFDI of 116. High bushfire intensities are predicted as possible in the vicinity of the re-development site. However, the model does not incorporate fire development as it models maximum intensity for each grid cell. Therefore, given the shorter fire runs to the west of the redevelopment site, lower intensities than those modelled, are more likely in these locations. Fuel management and strategically located ‘potential control lines’ can help lower this risk.

Figure 11 shows the potential head fire intensity associated with the longer fire runs toward the re-development site as it assumes southerly sector winds. When compared to Figure 10 it shows smaller areas of the highest intensities, due primarily to using FFDI 47 and different terrain influences given the direction of attack. It indicates that potentially uncontrollable fires can originate anywhere over many kilometres south of the re-development site.

Both Figure 10 and Figure 11 are predicting worst likely fire intensities. However, the probability of these occurring is not considered by the models and whilst weather conditions that could support uncontrollable fire intensities occur a number of days every year, the likelihood of a fire being ignited upwind of the re-development site under those weather conditions may be very infrequent. It likely over-estimates the intensity in some situations (e.g. from the west as outlined above) as it does not incorporate fire development and spread from the ignition point.

## 1.5 Bushfire History

Advice from NPWS (pers comm) is that the *main* sources of ignition in the Kamay Botany Bay National Park area are from human activity (deliberate or accidental). The fire history for the Study Area from 1978 – 2018 for unplanned fire (wildfire) from the NPWS fire history mapping data set is illustrated in Appendix B. A total of 129 fires have been recorded in the Kamay Botany Bay National Park over this period, with the largest being approximately 350 hectares in September 2017. A significant number of the unplanned fires (94 in total) have been of an area of less than 1 ha, potentially indicating that the response to fire ignitions has been effective. However, if this rate of fire ignition continues, it means that the potential for the ‘worst likely fire intensities’ (Figure 10 and Figure 11) may be realised.

## 1.6 Summary of Bushfire Risk Assessment

The landscape risk analysis indicates that the potential for uncontrollable bushfires exists every year. Although this potential exists, fire history shows the majority of unplanned fires are small in size and no fires with damage potential have impacted the redevelopment site over the past 40 years.

Notwithstanding the fire history, it is reasonably foreseeable that Bushfire Attack Levels (BAL) under elevated Fire Danger Rating days could impact the redevelopment site. Assessment of the BAL under AS 3959-2009 and PBP 2019 benchmarks are therefore appropriate.

The direction of fire attack on the re-development site is mitigated by urban development to the west and the ocean to the north and east. This potentially enables fire management strategies to target specific areas to strategically reduce the risk e.g. from fire runs from the south.

## 2 Bushfire Protection Measures

The proposed development of the visitor centre can be considered under Section 8.3.11 of PBP as a public assembly building. PBP s.8.3.11 specifies *'Buildings used for public assembly with a floor space area of greater than 500m<sup>2</sup> are required to consider bush fire. These developments will be treated technically as SFPP due to the evacuation challenges presented by large numbers of occupants'*.

The site is likely to be used by some visitors unfamiliar to the area, visitors of various mobility such as children and the elderly, and visitors from different cultural backgrounds. SFPP considers human vulnerability to bush fire attack through reduced capacity to evaluate risk and respond, lack of local knowledge, limited capacity to evacuate, vulnerability to stress and anxiety triggered by bushfire attack and significant communication barriers. This level of vulnerability requires SFPP development to meet a more stringent set of bushfire protection measures in comparison to residential development.

PBP specifies the aims and objectives for bushfire protection generally, which can be met by addressing the 'Performance Criteria' and 'Acceptable Solutions'. These are the standard requirements that apply to most development on bushfire prone land, such as that undertaken under Part 4 of the EP&A Act. 'Alternate solution' approaches can be taken to meet the Performance Criteria where acceptable solutions cannot be provided.

As the natural, cultural and visitor values of the Kamay Botany Bay National Park environs require minimum disturbance of vegetation, a 'fit for purpose' combination of Bushfire Protection Measures (BPMs) are required. The most important among these are appropriate building construction standard and a robust and reliable bushfire emergency response and evacuation plan. This report provides specific assessment on an alternate solution approach to managing the bushfire risk to the proposed development. Where the design achieves a lesser bushfire protection standard than that prescribed by PBP performance criteria, then NPWS is accepting a higher level of residual bushfire risk.

### 2.1 Asset Protection Zones (APZ)

PBP and bushfire attack modelling utilising Method 2 of AS 3959 (SA 2018), has been used to determine the width of APZs and Bushfire Attack Level (BAL) exposure for the proposed development, using the slope, vegetation, fuel and weather data identified in Table 4 and Appendix B. Appendix C contains the results of the modelling and Table 5 details the results of this assessment, which are shown in Figure 5 and Figure 6.

PBP specifies the acceptable solution APZ and BAL construction for SFPP developments, which is based on a 10kw/m<sup>2</sup> SFPP APZ setback and construction to BAL-12.5. As demonstrated in Figure 6, an APZ of this magnitude cannot be afforded to the proposed Visitor Centre building, without significant vegetation removal, which is not appropriate at this site due to the environmental constraints at the site. As such, an alternative solution approach is required, of construction to the BAL exposure and increased conservatism in evacuation management planning.

The amenities buildings are considered as non-habitable buildings and not suitable for refuge in a bushfire, thus they are not afforded an APZ or a particular construction standard. NPWS is accepting a higher level of risk that they could be damaged or destroyed without an APZ or construction standard.

**Table 4: Bushfire Hazard Assessment & Bushfire Attack Modelling Inputs**

Transect <sup>1</sup>	Slope	Mapped Vegetation	Keith Formation (Class)	Fuel (t/ha) (Surface/Overall) <sup>2</sup>	FFDI <sup>3</sup>	PBP Acceptable Solution SFPP APZ
1	Downslope >10 to 15 degrees	Plantation (native and/or exotic)	Forest	-	100	100m
2	Downslope >0 to 5 degrees	Plantation (native and/or exotic)	Forest	-	100	79 m
3	Upslope 2 degrees	Coastal Sandstone Foreshores Forest	Forest (Sydney Coastal Dry Sclerophyll Forest)	21.3/27.3	46	67 m
4	Upslope 3 degrees	Coastal Sand Swamp Mahogany Forest	Forest Wetland (Coast Swamp Forest)	22.6/34.1	57	67 m
5	Upslope 9 degrees	Coastal Sand Swamp Mahogany Forest to Coastal Sand Apple-Bloodwood Forest	Forest (Coastal Dune Dry Sclerophyll Forests)	20.5/31.1	57	67 m
6	Downslope 1 degree	Coastal Sand Swamp Mahogany Forest	Forest Wetland (Coast Swamp Forest)	22.6/34.1	63	79 m

<sup>1</sup>Detailed assessment undertaken for Transect 3-6 for use in bushfire attack modelling; <sup>2</sup>Detailed vegetation fuel loads (RFS 2019); <sup>3</sup> Assessed from bushfire weather analysis

**Table 5: PBP & Modelled BAL Setback Distances (m)**

Transect <sup>1</sup>	BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5	10 kW/m <sup>2</sup>
T1	< 36	36 - < 45	45 - < 60	60 - < 77	77 - < 100	100
T2	< 22	22 - < 29	29 - < 40	40 - < 54	54 - < 100	79
T3	< 8	8 - < 11	11 - < 17	17 - < 24	24 - < 100	40
T4	< 11	11 - < 14	14 - < 21	21 - < 29	29 - < 100	46
T5	< 7	7 - < 10	10 - < 15	15 - < 22	22 - < 100	36
T6	< 14	14 - < 18	18 - < 26	26 - < 36	36 - < 100	55

<sup>1</sup>BAL setbacks for Transect 1 and 2 are taken from PBP. Transects 3 – 6 were modelled using site specific inputs detailed in Appendix C.



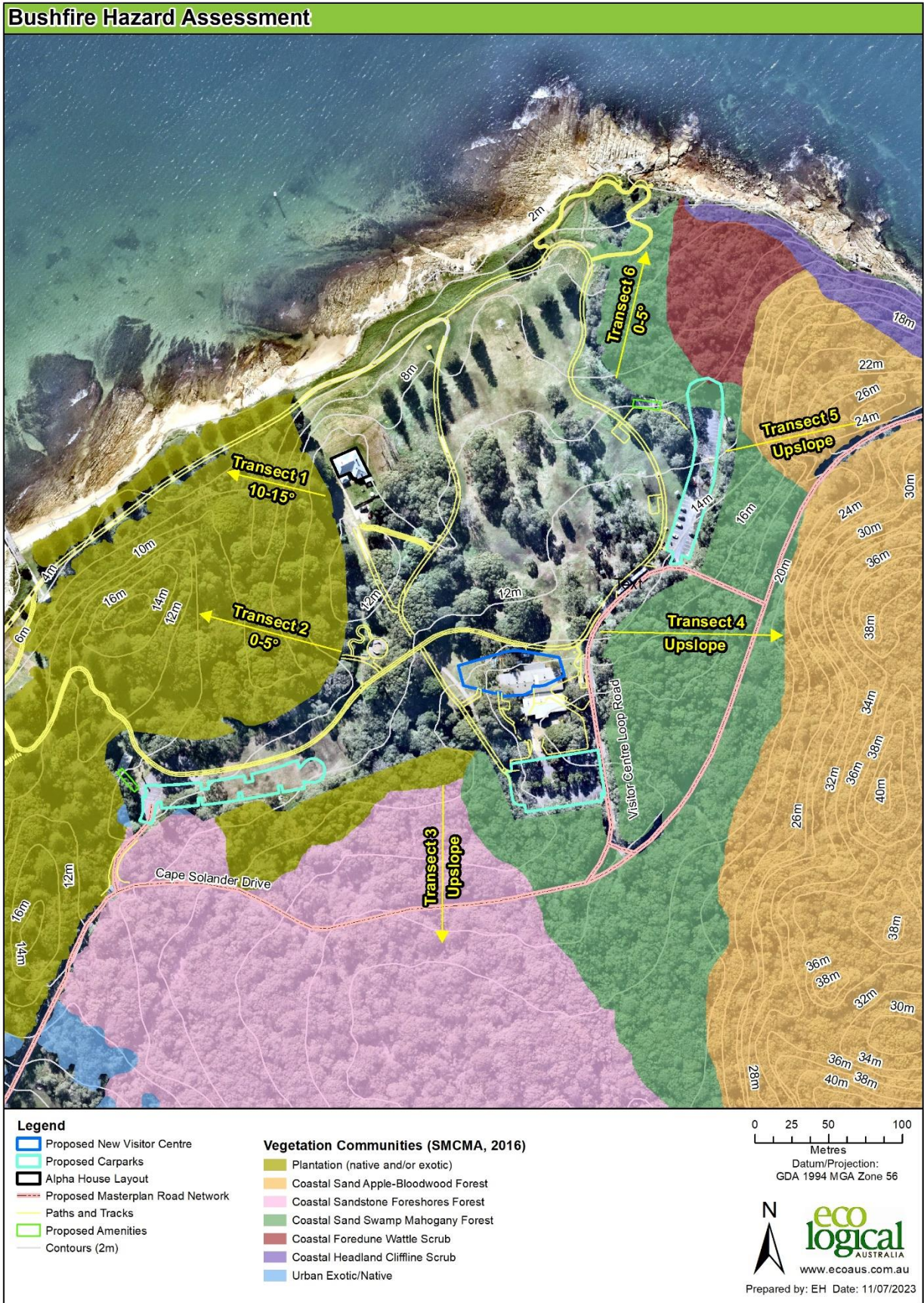


Figure 5: Bushfire Hazard Assessment

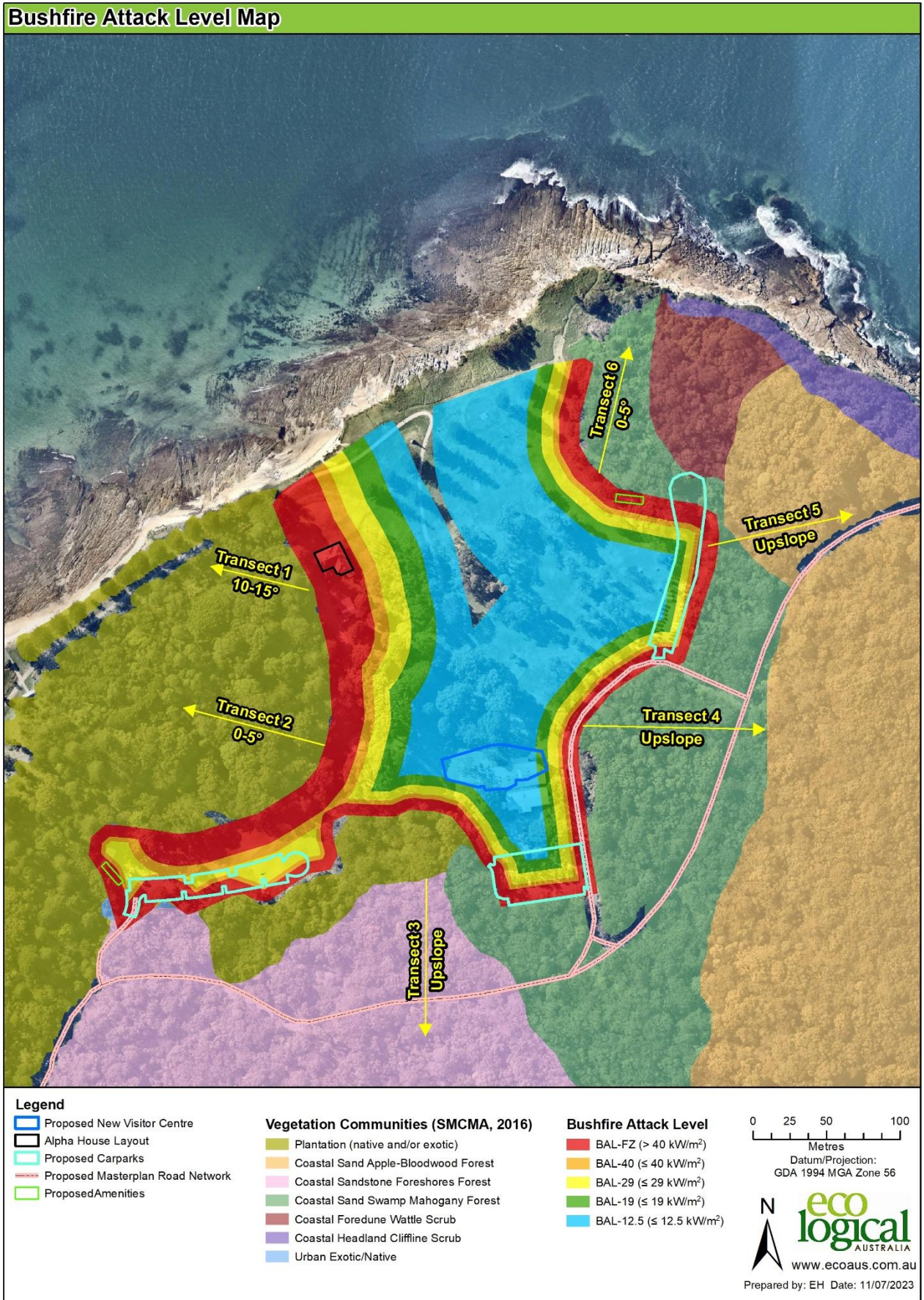


Figure 6. Bushfire Attack Level Assessment

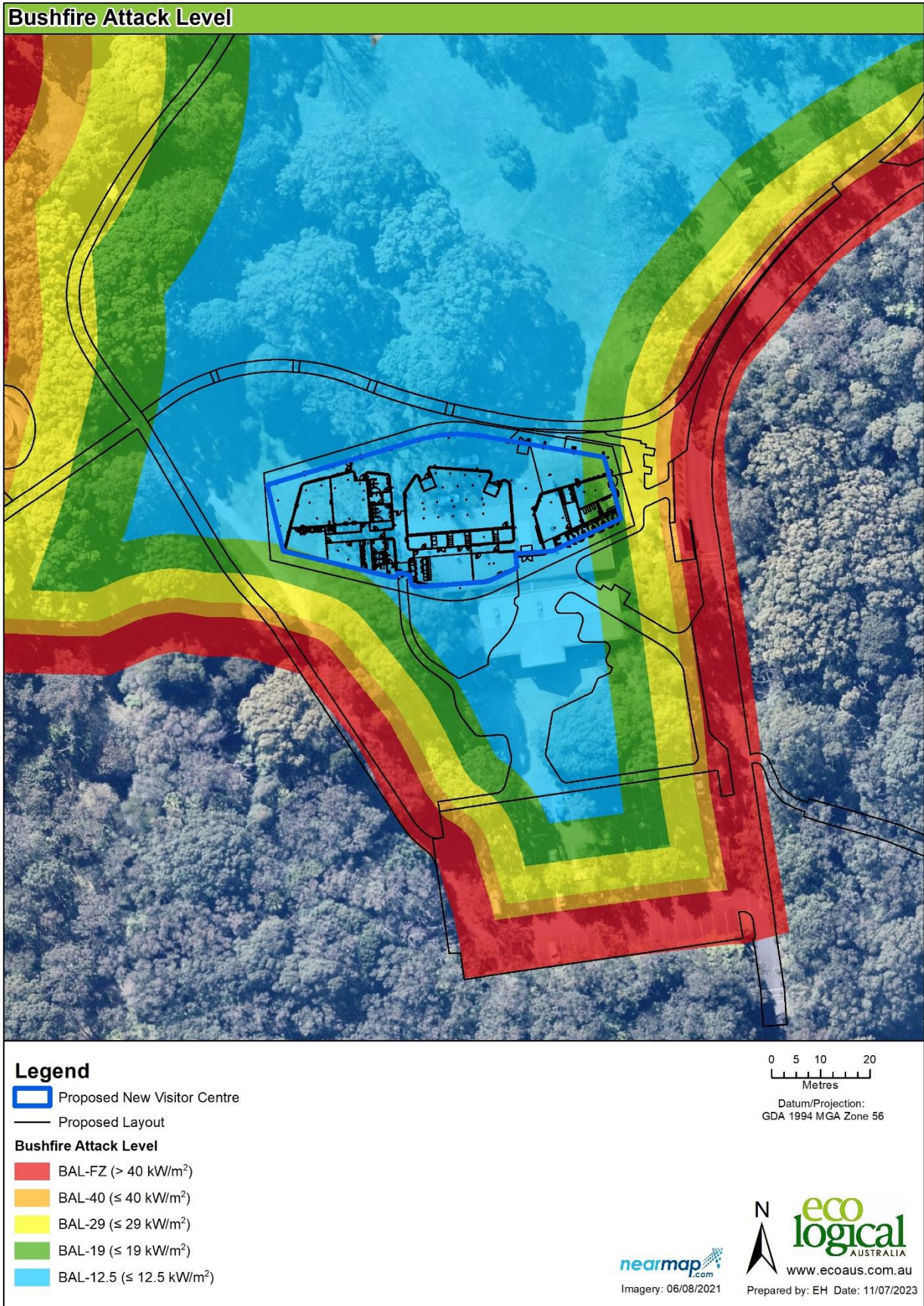


Figure 7. Detailed Visitor Centre Bushfire Attack Level Assessment

## 2.2 APZ Maintenance Plan

Given the site context in a national park, no additional APZs for the Master Plan development are proposed. Vegetation management of the APZs around the proposed Visitor Centre should continue, so that the hazard setback assessed in Section 2.1 is maintained.

It is important that landscaping does not reduce the available APZ from the current footprint and that current management and maintenance standards are maintained. Any landscaping within the subject land, particularly in proximity to any existing or proposed buildings, should achieve the specifications of an Inner Protection Area (IPA) as described by PBP and as outlined below:

### *Trees*

- 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 2 m above ground;
- canopies should be separated by 2 to 5 m; 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;
- 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*

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

## 2.3 Construction Standards

Construction standards are governed by the National Construction Code, which calls up AS 3959 for the construction of buildings in bushfire prone areas. The construction standard required is determined by the BAL of the building, which is based on the hazard exposure given the APZ setback (see Section 2.1). In addition to the construction requirements of AS 3959, PBP also prescribes a number of variations to the AS 3959 construction standard, in Section 7.5 of PBP.

The Visitor Centre is exposed mostly to BAL-12.5, apart from the eastern and southern elevations which are exposed to BAL-19. The visitors centre has been designed to BAL 19 (Neeson Murcutt Neille 2023).

## 2.4 Access

Public road access to the site is via Captain Cook Drive onto the single access (dead end) road Cape Solander Drive. A single access road of >200m does not comply with the Acceptable Solutions within PBP 2019 and therefore the proposal results in a higher residual risk than that sought under PBP.

As an alternative access road is not feasible and road upgrades of little benefit, a greater emphasis is required on managing the access risk through evacuation planning and management of staff and visitors in response to elevated bushfire weather and the occurrence of actual bushfire incidents. Control of access to the development site is however readily achieved by stopping access at the entrance of Cape Solander Drive.

Upgrades to the existing walking trails in the Stage 1 development for the proposed Foreshore Loop will include making it accessible for a Cat 1 light appliance fire vehicle. It is recommended that any trail upgrades should seek to meet the PBP access standards (Appendix D) to provide an alternate access/egress option to the development site. Further, the Foreshore Loop trail provides an alternative pedestrian connection to safer locations along the foreshore and within the village of Kurnell, should they be needed in a bushfire emergency.

Boat access will also be available to the site, with upgrades to the wharf for ferry access proposed as part of the redevelopment. A number of walking tracks and fire trails are also located across the National Park (see Appendix A – Emergency Management Plan), providing a number of alternative access points for access and egress of park users and responding emergency service vehicles. These tracks should continue to be maintained to NPWS standards.

## 2.5 Water Supply

The subject land is serviced by reticulated water and is capable of complying with PBP performance criteria as detailed within Section 6.8.3 of PBP and summarised in Table 7. A hydrant booster pump is proposed near the entrance gate. Power supply dependencies for this pump may warrant bushfire protection.

**Table 6: Performance criteria and acceptable solutions for water supply (RFS 2019)**

Performance Criteria	Acceptable Solutions
An adequate water supply for firefighting purposes is installed and maintained.	<ul style="list-style-type: none"> <li>reticulated water is to be provided to the development, where available, or</li> <li>a 10,000 litres minimum static water supply dedicated for firefighting purposes is provided for each occupied building where no reticulated water is available.</li> </ul>
water supplies are located at regular intervals	<ul style="list-style-type: none"> <li>fire hydrant spacing, design and sizing comply with the relevant clauses of Australian Standard AS2419.1:2005; and</li> </ul>
the water supply is accessible and reliable for firefighting operations	<ul style="list-style-type: none"> <li>hydrants are not located within any road carriageway; and</li> <li>reticulated water supply to SFPPs uses a ring main system for areas with perimeter roads; and</li> </ul>
flows and pressure are appropriate	<ul style="list-style-type: none"> <li>fire hydrant flows and pressures comply with the relevant clauses AS2419:2005, and</li> </ul>
the integrity of the water supply is maintained	<ul style="list-style-type: none"> <li>all above-ground water service pipes external to the building are metal, including and up to any taps.</li> </ul>

## 2.6 Electricity Services

The proposed development is capable of complying with the performance criteria for the supply of electricity services prescribed in Section 6.8.3 of PBP and documented in Table 7.

**Table 7: Performance criteria and acceptable solutions for the supply of electricity services (RFS 2019)**

Performance Criteria	Acceptable Solution
Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.	<ul style="list-style-type: none"> <li>• Where practicable, electrical transmission lines are underground;</li> <li>• Where overhead, electrical transmission lines are proposed as follows:</li> <li>• Lines are installed with short pole spacing (30 m), unless crossing gullies, gorges or riparian areas; and</li> <li>• No part of a tree is closer to a power line than the distance set out in ISSC3 <i>Guide for the Management of Vegetation in the Vicinity of Electricity Assets</i> (ISSC3 2016).</li> </ul>

## 2.7 Gas Services

The proposed development is capable of complying with the performance criteria for the supply of gas services (reticulated or bottle gas) prescribed in Section 6.8.3 of PBP and documented in Table 8.

**Table 8: Performance criteria and acceptable solutions for the supply of gas services (RFS 2019)**

Performance Criteria	Acceptable Solution
Location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	<ul style="list-style-type: none"> <li>• Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 – The Storage and handling of LP gas, the requirements of relevant authorities, and metal piping is used;</li> <li>• All fixed gas cylinders are kept clear of all flammable materials to a distance of 10 m and shielded on the hazard side;</li> <li>• Connections to and from gas cylinders are metal;</li> <li>• Polymer-sheathed flexible gas supply lines are not used; and</li> <li>• Above-ground gas service pipes are metal, including and up to any outlets.</li> </ul>

## 2.8 Emergency Management and Evacuation

SFPP developments must provide suitable emergency management plans addressing emergency evacuation arrangements for occupants. The PBP prescribed performance criteria and acceptable solutions for emergency management are covered in Table 9. Due to the nature of the proposed Visitor Centre and redevelopment within the National Park context, emphasis is placed on leaving early and non-operation during days of elevated fire danger, along with preparation of robust emergency management plans.

An existing Emergency Management Plan is in place for the Kamay Botany Bay National Park (see Appendix A). This plan should be updated to reflect the development as it proceeds.

Initial assessment of emergency evacuation has occurred and includes the following:

- An analysis of the most relevant bushfire attack scenarios (i.e. – fire from the south); and
- Identification of evacuation and refuge locations.

The existing identified assembly areas relevant to the proposed development are at Commemoration Flat and in the north-west corner of the site opposite Endeavour Café. The proposed Visitor Centre should be constructed to withstand bushfire attack (i.e. designed and built to its BAL exposure) however it will not provide appropriate capacity for use as a bushfire refuge building. As such, the primary strategy is evacuation offsite into the neighbouring urban areas, rather than remaining onsite.

The closest RFS identified Neighbourhood Safer Place in proximity to the site is located at Marton Park, Caption Cook Drive, Kurnell. This location is approximately 1.4 km from the proposed visitor centre (RFS 2019). However, the urban area along Prince Charles Parade is easily accessed from the park entrance or walking tracks and would also provide suitable evacuation locations from potential bushfire attack.

Management of a bushfire emergency with regard to coordination of evacuation or refuge, generally requires on-site staff, in order to be effective and safe. Thus, the minimum staffing level required for safe and effective emergency management should be explored.

Visitor information should be provided, including clear signage to evacuation areas, on-site emergency response information and emergency management arrangements.

**Table 9: Performance criteria and acceptable solutions for emergency management (RFS 2019)**

Performance Criteria	Acceptable Solutions
<ul style="list-style-type: none"> <li>A Bush Fire Emergency and Evacuation Management Plan is prepared</li> </ul>	<ul style="list-style-type: none"> <li>bush fire emergency management and evacuation plan is prepared consistent with the:                             <ul style="list-style-type: none"> <li>The NSW RFS document: A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan;</li> <li>NSW RFS Schools Program guide;</li> <li>Australian Standard AS 3745:2010 Planning for emergencies in facilities; and</li> <li>Australian Standard AS 4083:2010 Planning for emergencies – Health care facilities.</li> </ul> </li> <li>the bushfire emergency and evacuation management plan should include a mechanism for the early relocation of occupants.</li> </ul> <p>Note: A copy of the bush fire emergency management plan should be provided to the Local Emergency Management Committee for its information prior to occupation of the development.</p>
<ul style="list-style-type: none"> <li>Appropriate and adequate management arrangements are established for consultation and implementation of the bush fire emergency and evacuation management plan.</li> </ul>	<ul style="list-style-type: none"> <li>an Emergency Planning Committee is established to consult with residents (and their families in the case of aged care accommodation and schools) and staff in developing and implementing an Emergency Procedures Manual; and</li> <li>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 annual (as a minimum) trial emergency evacuation is conducted.</li> </ul>

### 3 Conclusion and Recommendations

This report presents an assessment of the updated Stage 1 Master Plan for Kamay National Park redevelopment. It identifies the proposed development as SFPP type development under PBP, given the increased vulnerability of the occupants. The industry standard bushfire protection requirements prescribed by PBP, that apply to any development of this type undertaken outside of Part 5 of the EP&A Act, are summarised in the report. The report identifies that there are constraints to the application of acceptable solution approaches for some bushfire protection measures. As such, a performance solution approach is required, especially construction to the BAL exposure, management of site vegetation / landscaping and conservatism in evacuation management planning.

Analysis of the hazard, bushfire history and potential fire behaviour at the site indicates there is potential for major fire attack, thus bushfire protection and emergency management are critical. There are a number of measures that can be taken to improve the bushfire protection of the proposed development. These have been identified in the report, and are summarised as follows:

- The Visitor Centre building is currently located in BAL-19;
- The AS 3959 construction standard has been applied to the Visitor Centre building to meet or exceed the buildings BAL exposure (BAL-19);
- Managed open spaces within the development site are to be maintained to Inner Protection Area standards as specified in Section 2.2;
- Any landscaping proposed in proximity to the Visitor Centre, should aim to achieve the specifications of an Inner Protection Area as specified in Section 2.2;
- Upgrades to Foreshore Loop access tracks should aim to provide for alternate access/egress for emergency services vehicles;
- The supply of water, electricity and gas supplies to the proposed buildings should meet the performance criteria outlined herein;
- Any building protection systems may have dependencies that warrant additional bushfire protection (e.g. protection of pumps, power supply and pipes for fire water supply); and
- The Emergency Management Plan should be updated to reflect new buildings and infrastructure proposed, and emergency management prescriptions of PBP and recommendations outlined in this report. Specifically, that procedures within the Plan prescribe leaving early and non-operation during days of elevated fire danger, along with preparation of robust evacuation plans, procedures and visitor information.

The report notes that a performance solution approach is needed for the proposed development and further that there are constraints to meeting the performance criteria of PBP given the National Park context and development intent. A 'fit-for-purpose' approach is thus required to afford the building and occupants protection from bushfire. The report notes that if the development design achieves a lesser bushfire protection standard than the performance criteria prescribed by PBP, then NPWS is accepting a higher level of residual bushfire risk.



## 4 References

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## Appendix A – Emergency Management Plan

## EMERGENCY MANAGEMENT PLAN: Visitor Use Areas – Kamay Botany Bay National Park - Kurnell

<p><b>Location details</b></p> <p><b>Facility type:</b></p> <ul style="list-style-type: none"> <li>Picnic Areas and Walking Tracks</li> </ul> <p><b>Location:</b></p> <ul style="list-style-type: none"> <li>Kurnell, Sutherland Shire.</li> </ul> <p><b>Infrastructure:</b></p> <p>Visitor Centre, toilet blocks, picnic tables, bbqs, monuments, ferry wharf/shelter, whale deck, lighthouse, walking tracks.</p> <p><b>Visitation:</b></p> <ul style="list-style-type: none"> <li>Number of day visitors (peak day 1600, average weekend 400).</li> </ul> <p><b>Access:</b></p> <ul style="list-style-type: none"> <li>2WD public road, no secondary alternatives.</li> </ul> <p><b>Communications</b></p> <p><b>Radio:</b></p> <ul style="list-style-type: none"> <li>NPWS VHF Ch 124 (ELAN).</li> <li>RFS - Fireground 19</li> </ul> <p><b>Mobile:</b></p> <ul style="list-style-type: none"> <li>Mobile reception is good at Commemoration Flat (northern section of park), patchy elsewhere.</li> </ul> <p><b>Other:</b></p> <ul style="list-style-type: none"> <li>Land line and fax facilities are available at Visitor Centre or RFS Kurnell Station.</li> </ul>	<p><b>Contacts</b></p> <table border="1"> <tr> <td>NPWS</td> <td>Branch Duty Officer</td> <td>8275 1754</td> <td></td> </tr> <tr> <td>NPWS</td> <td>Area Manager</td> <td>9337 7021</td> <td>0438 285 943</td> </tr> <tr> <td>NPWS</td> <td>Branch Director</td> <td>9472 8901</td> <td>0418 277 548</td> </tr> <tr> <td>NSW RFS</td> <td>Sutherland Fire Control</td> <td>000</td> <td>8508 4040</td> </tr> <tr> <td>NSW Police</td> <td>Sutherland LAC</td> <td>000</td> <td>9542 0899</td> </tr> <tr> <td>NSW Ambulance</td> <td>Emergencies</td> <td>000</td> <td>131 233</td> </tr> <tr> <td>NSW SES</td> <td>Sydney Southern Region</td> <td>13 25 00</td> <td>9766 9000</td> </tr> <tr> <td>Local Council</td> <td>Sutherland Shire Council</td> <td>9710 0333</td> <td></td> </tr> </table> <p><b>Responsibilities and procedures for specific emergencies</b></p> <p><b>For bushfire:</b></p> <ul style="list-style-type: none"> <li>Call 000. First response District Operations Plan protocols apply.</li> <li>Responsibility will shift to relevant agency as per Operations Plan.</li> </ul> <p><b>For medical emergency:</b></p> <ul style="list-style-type: none"> <li>Call 000. Apply first aid until ambulance arrives: DR5ABCD</li> <li>Helipad locations (see map).</li> </ul> <p><b>For oil or chemical spill:</b></p> <ul style="list-style-type: none"> <li>Call 000. Oil and chemical spills will be managed by FRNSW crews.</li> <li>Notify Environment Line 131 555.</li> </ul> <p><b>For sewerage spill:</b></p> <ul style="list-style-type: none"> <li>Notify Environment Line 131 555.</li> </ul>	NPWS	Branch Duty Officer	8275 1754		NPWS	Area Manager	9337 7021	0438 285 943	NPWS	Branch Director	9472 8901	0418 277 548	NSW RFS	Sutherland Fire Control	000	8508 4040	NSW Police	Sutherland LAC	000	9542 0899	NSW Ambulance	Emergencies	000	131 233	NSW SES	Sydney Southern Region	13 25 00	9766 9000	Local Council	Sutherland Shire Council	9710 0333		<p><b>Triggers – Evacuate or Stay</b></p> <p>Include very clear statements on triggers and instructions on actions:</p> <p><b>Preparedness Procedures (fire danger):</b></p> <ul style="list-style-type: none"> <li>During Severe+ Fire Danger / TOBANS – walking tracks, trails and visitor use areas may be closed.</li> <li>During Catastrophic Fire Danger – Park will be closed to visitors, contractors and non-fire trained staff.</li> <li>During large fire operations or fire threat to visitor areas, the park will be closed and evacuation or stay procedures implemented.</li> </ul> <p><b>Time to impact and associated actions (going fire):</b></p> <ul style="list-style-type: none"> <li>&lt; 2 hrs: implement evacuate or stay procedures</li> <li>&gt; 2 – 12 hrs: notify all visitors to prepare; assess number of visitors in park; close walking tracks and visitor areas</li> <li>&gt; 12 hrs: close park</li> </ul> <p><b>Preparedness Procedures (severe weather):</b></p> <ul style="list-style-type: none"> <li>Recommend visitors not commence bush walks before or during severe storm events.</li> </ul> <p><b>Park residents, lessees etc.:</b></p> <ul style="list-style-type: none"> <li>Tenants must, as a minimum, be fully informed of a catastrophic fire risk warning or other emergency, including Alpha House and Environmental Education Centre.</li> </ul> <p><b>If Evacuate:</b></p> <ul style="list-style-type: none"> <li>Refer to Evacuation Procedures below</li> </ul> <p><b>If Stay:</b></p> <ul style="list-style-type: none"> <li>Refer to Assembly Areas below.</li> </ul>
NPWS	Branch Duty Officer	8275 1754																																
NPWS	Area Manager	9337 7021	0438 285 943																															
NPWS	Branch Director	9472 8901	0418 277 548																															
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Local Council	Sutherland Shire Council	9710 0333																																
<p><b>Evacuation Procedures</b></p> <p><b>Initiation:</b></p> <ul style="list-style-type: none"> <li>By combat agency for specific incident or event via NPWS or Police.</li> <li>NB: consideration is to be given to safety of park visitors on roads during an evacuation.</li> </ul> <p><b>Notification:</b></p> <ul style="list-style-type: none"> <li>Visitors to the park will be notified directly by NPWS or combat agency with information related to specific emergency.</li> <li>Where direct access is not available NPWS website will be updated, contact OEH media, local radio (702AM), Visitor Centre, temporary signage may be placed at all Park entrances OR by relevant combat agency.</li> </ul> <p><b>Evacuation Locations / Reconnaissance:</b></p> <ul style="list-style-type: none"> <li>Primary tracks/trails and infrastructure that need to be searched for visitors have been identified on the map.</li> <li>Reconnaissance in the immediate vicinity of the emergency should be undertaken to inspect for visitors.</li> <li>Access via Captain Cook Drive and Cape Solander Drive or Sir Joseph Banks Drive and Potter Point Road. Alternative access is via boat in Botany Bay. See map.</li> </ul> <p><b>Coordination &amp; Control:</b></p> <ul style="list-style-type: none"> <li>Evacuation may be coordinated by NSW Police with support from NPWS if requested OR other combat agency.</li> <li>Incident management team location to be determined by lead agency on the day.</li> <li>Details of visitors evacuated may be recorded by NSW Police such as residents.</li> </ul>	<p><b>Assembly Areas</b></p> <p><b>Location: (refer to map)</b></p> <ul style="list-style-type: none"> <li>Main Flagstaff – Commemoration Flat</li> <li>Front grass – opposite Endeavour Café</li> <li>Cape Solander – cliff top at end of Cape Solander Dr</li> <li>Potter Point – cliff top area east of car park</li> </ul> <p><b>Access: (refer to map)</b></p> <ul style="list-style-type: none"> <li>Access via Cape Solander Dr.</li> </ul> <p><b>Capacity:</b></p> <ul style="list-style-type: none"> <li>Main Flagstaff – Commemoration Flat: 1600</li> <li>Front grass: 1000</li> <li>Cape Solander: 400</li> <li>Potter Point: 200</li> </ul> <p><b>Logistics</b></p> <p><b>Visitor welfare:</b></p> <ul style="list-style-type: none"> <li>Depending on the nature of the incident, arrangements may be made to provide welfare for visitors where they are required to stay on NP estate.</li> <li>A community relations officer may be appointed to coordinate welfare and the provision of information to visitors.</li> <li>Evacuation management requiring shelter and sustenance would be coordinated by welfare agency / functional area.</li> </ul> <p><b>Security requirements:</b></p> <ul style="list-style-type: none"> <li>Nil</li> </ul>	<p><b>Transport Procedures</b></p> <p><b>Method:</b></p> <ul style="list-style-type: none"> <li>Road - drive/escorts (RMS/Police/NPWS/RFS)</li> </ul> <p><b>Route: (refer to map)</b></p> <ul style="list-style-type: none"> <li>Visitors may be evacuated via Botany Bay foreshore by foot or Cape Solander Dr by vehicle, after safety has been assessed, appropriate signage will be erected at effected locations.</li> </ul> <p><b>Procedures for Road Closure:</b></p> <ul style="list-style-type: none"> <li>Coordination - NSW Police will coordinate closure of public roads within the park.</li> <li>Location - e.g. Road closure points to prevent access in to the park have been identified on the map. e.g. NSW Police or RMS Certified Traffic Controllers should staff each of these points.</li> </ul> <p><b>Post-emergency Procedures</b></p> <p><b>For re-opening reserve:</b></p> <ul style="list-style-type: none"> <li>After an emergency incident major access roads should remain closed until the area is deemed suitable for entry by members of the public.</li> <li>After a bushfire/storm event all picnic areas should remain closed until they have been assessed for the presence of hazardous trees or damaged infrastructure.</li> <li>Update NPWS website via ELEMENTS.</li> </ul>																																

This EMP should be read in conjunction with: Sutherland Local Emergency Management Plan, Metro South West Regional Incident Procedures, KBBNP NP FMS, Sutherland BFMC: Operations Plan and Risk Management Plan.



## Appendix B – Bushfire Risk Maps

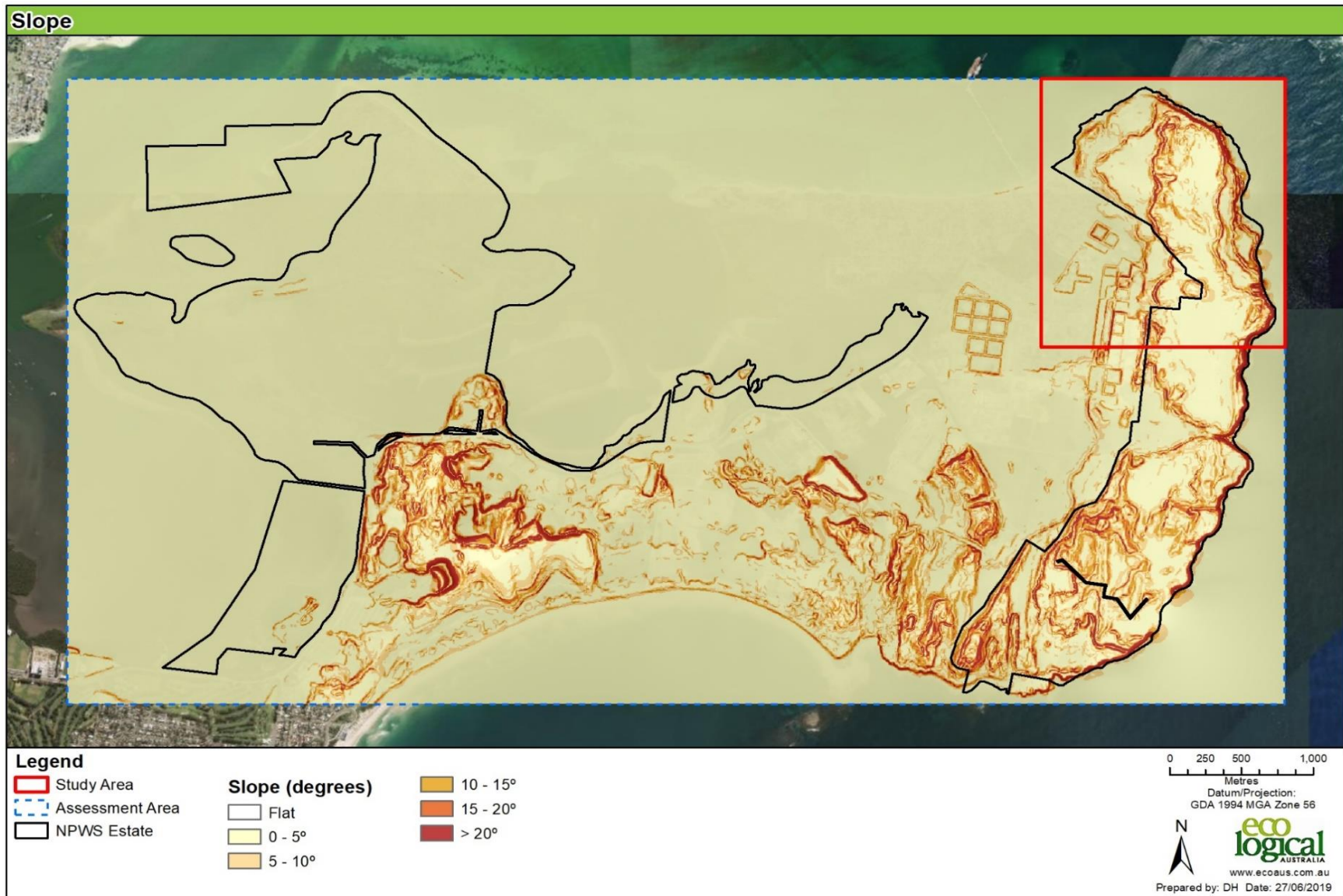


Figure 8: Slope across Kamay Botany Bay National Park and nearby areas



Figure 9. Vegetation formations and their maximum fuel loads within the Study Area

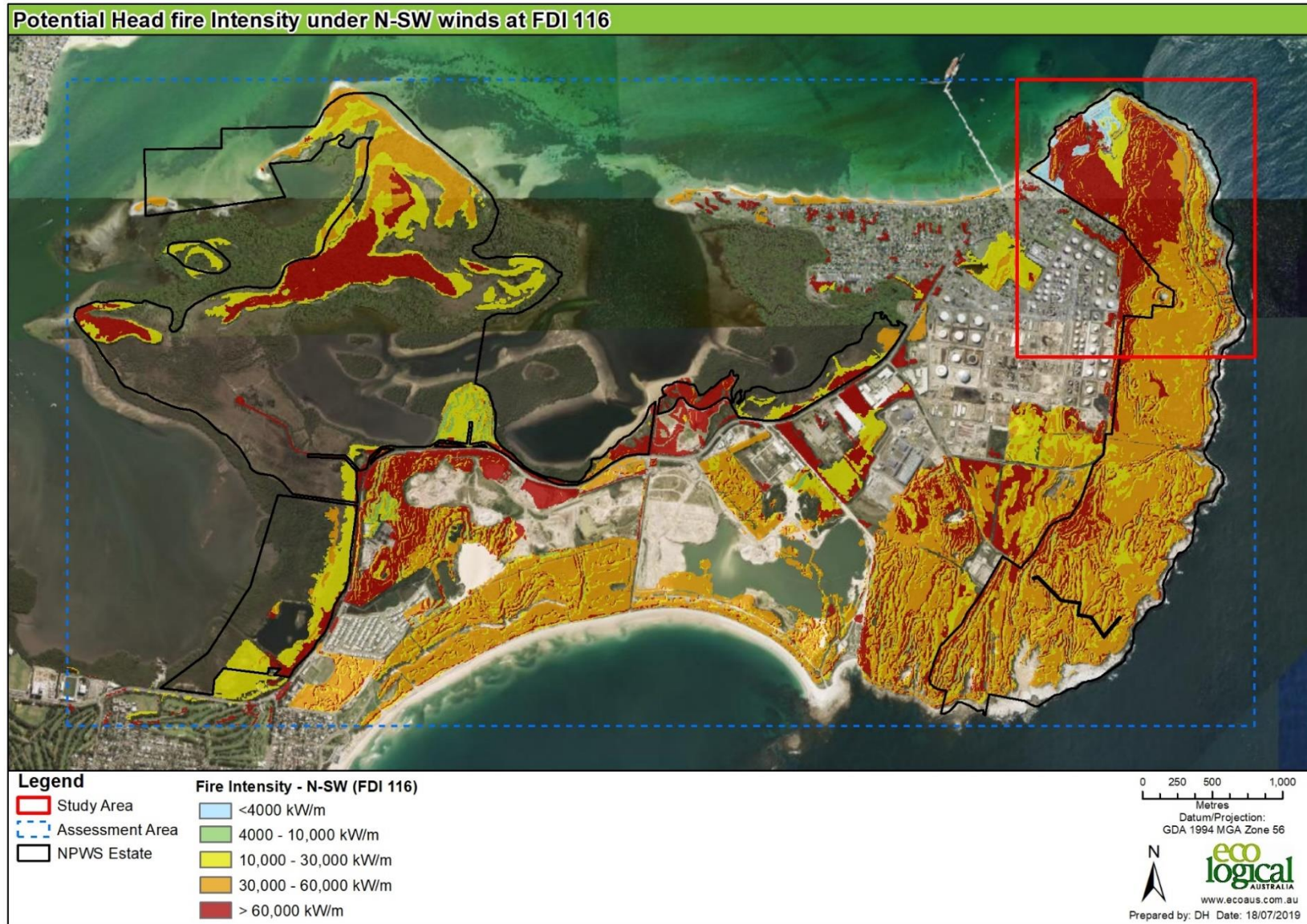


Figure 10: Potential Fire Intensity (westerly wind, FDI 116)



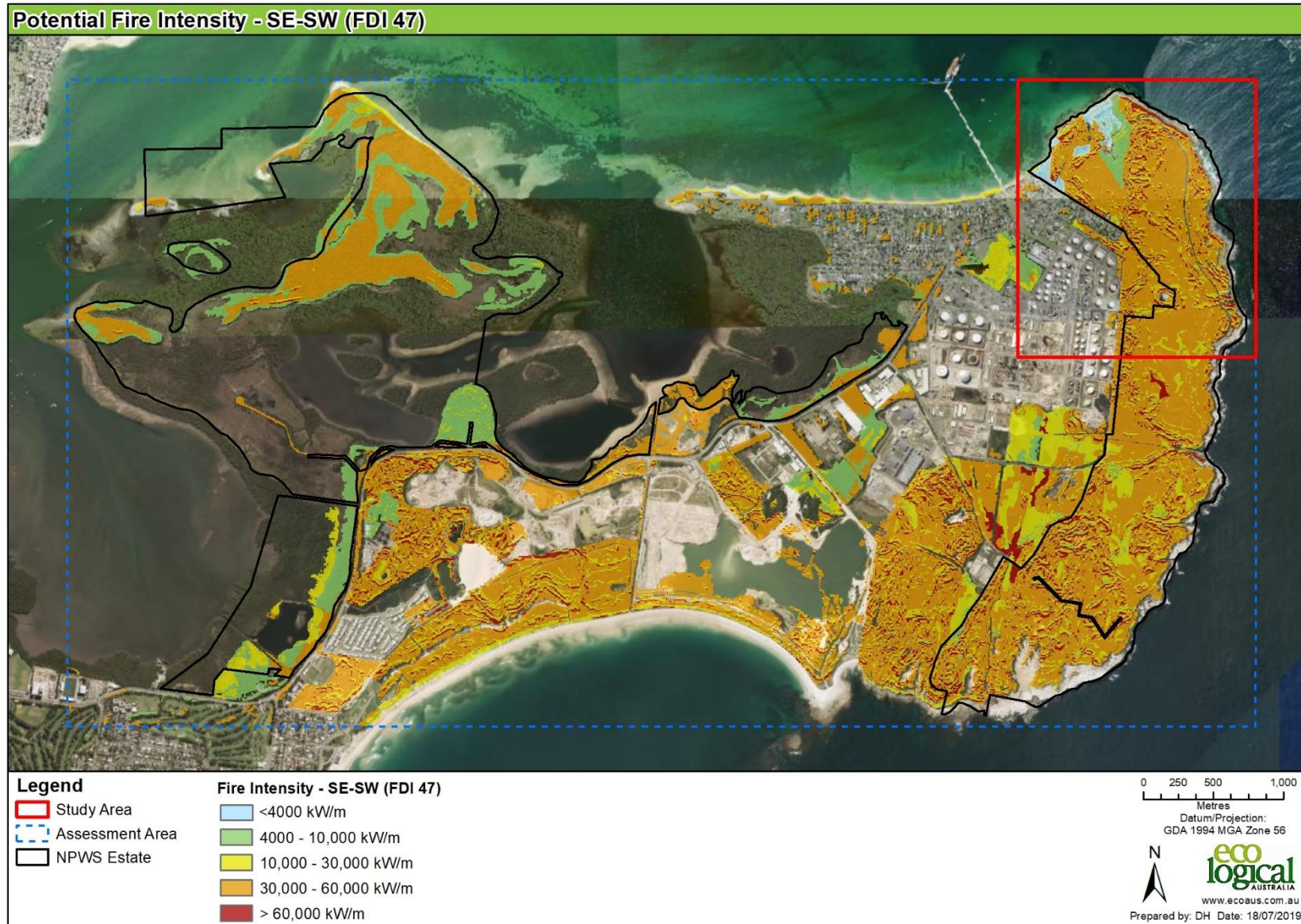


Figure 11. Potential Fire Intensity (southerly wind, FDI 47)

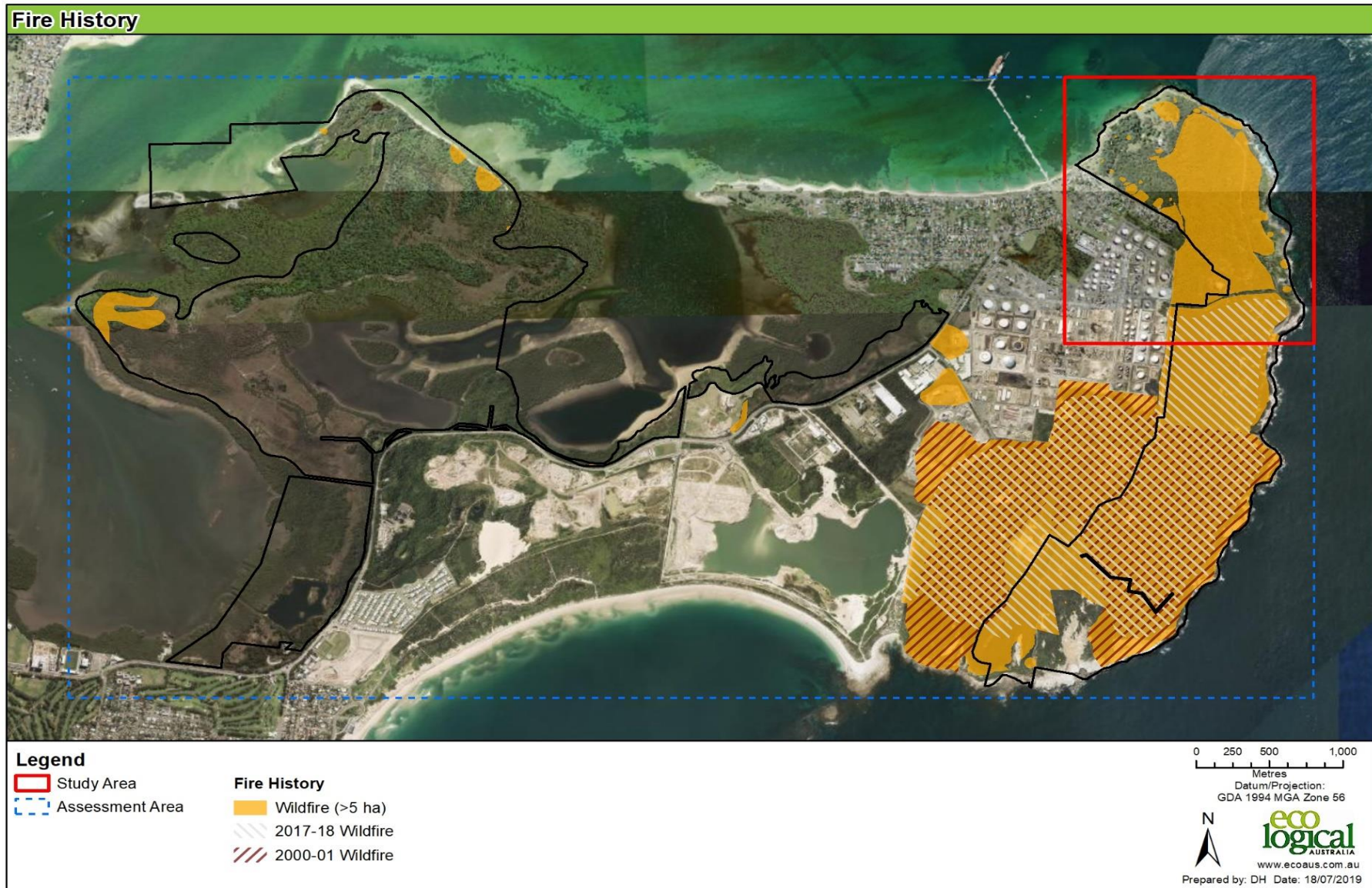



Figure 12. Fire history of study area 1978 – 2018 (prescribed burns and wildfire)

## Appendix C - BFAA Modelling

 <b>NBC Bushfire Attack Assessment Report V4.1</b> AS3959 (2018) Appendix B - Detailed Method 2 <b>Print Date:</b> 17-Jun-21 <b>Assessment Date:</b> 17-Jun-21					
<b>Site Street Address:</b>	Kamay National Park, Kurnell				
<b>Assessor:</b>	Nathan Kearnes; Eco Logical Australia				
<b>Local Government Area:</b>	Sutherland Shire				
<b>Alpine Area:</b>	No				
<b>Equations Used</b>					
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					
<b>Run Description:</b>	T3 - South				
<b>Vegetation Information</b>					
<b>Vegetation Type:</b>	Sydney Coastal DSF				
<b>Vegetation Group:</b>	Dry Sclerophyll Forests (Shrubby)				
<b>Vegetation Slope:</b>	2 Degrees				
<b>Vegetation Slope Type:</b>	Upslope				
<b>Surface Fuel Load(t/ha):</b>	21.3				
<b>Overall Fuel Load(t/ha):</b>	27.3				
<b>Vegetation Height(m):</b>	1.4				
	Only Applicable to Shrub/Scrub and Vesta				
<b>Site Information</b>					
<b>Site Slope:</b>	0 Degrees				
<b>Site Slope Type:</b>	Level				
<b>Elevation of Receiver(m)</b>	Default				
<b>APZ/Separation(m):</b>	24				
<b>Fire Inputs</b>					
<b>Veg./Flame Width(m):</b>	100				
<b>Flame Temp(K):</b>	1090				
<b>Calculation Parameters</b>					
<b>Flame Emissivity:</b>	95				
<b>Relative Humidity(%):</b>	25				
<b>Heat of Combustion(kJ/kg)</b>	18600				
<b>Ambient Temp(K):</b>	308				
<b>Moisture Factor:</b>	5				
<b>FDI:</b>	46				
<b>Program Outputs</b>					
<b>Level of Construction:</b>	BAL 19				
<b>Peak Elevation of Receiver(m):</b>	4.84				
<b>Radiant Heat(kW/m2):</b>	12.52				
<b>Flame Angle (degrees):</b>	77				
<b>Flame Length(m):</b>	9.93				
<b>Maximum View Factor:</b>	0.2				
<b>Rate Of Spread (km/h):</b>	1.02				
<b>Inner Protection Area(m):</b>	15				
<b>Transmissivity:</b>	0.823				
<b>Outer Protection Area(m):</b>	9				
<b>Fire Intensity(kW/m):</b>	14446				
<b>BAL Thresholds</b>					
<b>BAL-40:</b>	<b>BAL-29:</b>	<b>BAL-19:</b>	<b>BAL-12.5:</b>	<b>10 kw/m2:</b>	<b>Elevation of Receiver:</b>
Asset Protection Zone(m): 8	11	17	24	40	6

<b>Run Description:</b>	T4 - East					
<b>Vegetation Information</b>						
Vegetation Type:	Coastal Swamp Forests					
Vegetation Group:	Forested Wetlands					
Vegetation Slope:	3 Degrees	Vegetation Slope Type:	Upslope			
Surface Fuel Load(t/ha):	22.6	Overall Fuel Load(t/ha):	34.1			
Vegetation Height(m):	1.4	Only Applicable to Shrub/Scrub and Vesta				
<b>Site Information</b>						
Site Slope:	0 Degrees	Site Slope Type:	Level			
Elevation of Receiver(m)	Default	APZ/Separation(m):	24			
<b>Fire Inputs</b>						
Veg./Flame Width(m):	100	Flame Temp(K):	1090			
<b>Calculation Parameters</b>						
Flame Emissivity:	95	Relative Humidity(%):	25			
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308			
Moisture Factor:	5	FDI:	57			
<b>Program Outputs</b>						
Level of Construction:	BAL 19	Peak Elevation of Receiver(m):	5.89			
Radiant Heat(kW/m2):	15.51	Flame Angle (degrees):	74			
Flame Length(m):	12.26	Maximum View Factor:	0.247			
Rate Of Spread (km/h):	1.26	Inner Protection Area(m):	13			
Transmissivity:	0.824	Outer Protection Area(m):	11			
Fire Intensity(kW/m):	22143					
<b>BAL Thresholds</b>						
	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	11	14	21	29	46	6

<b>Run Description:</b>	T5 - East					
<b>Vegetation Information</b>						
Vegetation Type:	Coastal Dune DSF					
Vegetation Group:	Dry Sclerophyll Forests (Shrubby)					
Vegetation Slope:	9 Degrees	Vegetation Slope Type:	Upslope			
Surface Fuel Load(t/ha):	20.5	Overall Fuel Load(t/ha):	31.1			
Vegetation Height(m):	2	Only Applicable to Shrub/Scrub and Vesta				
<b>Site Information</b>						
Site Slope:	0 Degrees	Site Slope Type:	Level			
Elevation of Receiver(m)	Default	APZ/Separation(m):	24			
<b>Fire Inputs</b>						
Veg./Flame Width(m):	100	Flame Temp(K):	1090			
<b>Calculation Parameters</b>						
Flame Emissivity:	95	Relative Humidity(%):	25			
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308			
Moisture Factor:	5	FDI:	57			
<b>Program Outputs</b>						
Level of Construction:	BAL 12.5	Peak Elevation of Receiver(m):	4.24			
Radiant Heat(kW/m2):	10.86	Flame Angle (degrees):	79			
Flame Length(m):	8.63	Maximum View Factor:	0.174			
Rate Of Spread (km/h):	0.75	Inner Protection Area(m):	15			
Transmissivity:	0.822	Outer Protection Area(m):	9			
Fire Intensity(kW/m):	12108					
<b>BAL Thresholds</b>						
	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	7	10	15	22	36	6

<b>Run Description:</b>	T6 - Northeast					
<b><u>Vegetation Information</u></b>						
<b>Vegetation Type:</b>	Coastal Swamp Forests					
<b>Vegetation Group:</b>	Forested Wetlands					
<b>Vegetation Slope:</b>	1 Degrees	<b>Vegetation Slope Type:</b> Downslope				
<b>Surface Fuel Load(t/ha):</b>	22.6	<b>Overall Fuel Load(t/ha):</b> 34.1				
<b>Vegetation Height(m):</b>	1.4	Only Applicable to Shrub/Scrub and Vesta				
<b><u>Site Information</u></b>						
<b>Site Slope:</b>	0 Degrees	<b>Site Slope Type:</b>				Level
<b>Elevation of Receiver(m)</b>	Default	<b>APZ/Separation(m):</b>				24
<b><u>Fire Inputs</u></b>						
<b>Veg./Flame Width(m):</b>	100	<b>Flame Temp(K):</b>				1090
<b><u>Calculation Parameters</u></b>						
<b>Flame Emissivity:</b>	95	<b>Relative Humidity(%):</b>				25
<b>Heat of Combustion(kJ/kg)</b>	18600	<b>Ambient Temp(K):</b>				308
<b>Moisture Factor:</b>	5	<b>FDI:</b>				63
<b><u>Program Outputs</u></b>						
<b>Level of Construction:</b>	BAL 29	<b>Peak Elevation of Receiver(m):</b>				7.46
<b>Radiant Heat(kW/m2):</b>	20.38	<b>Flame Angle (degrees):</b>				69
<b>Flame Length(m):</b>	15.99	<b>Maximum View Factor:</b>				0.324
<b>Rate Of Spread (km/h):</b>	1.83	<b>Inner Protection Area(m):</b>				13
<b>Transmissivity:</b>	0.828	<b>Outer Protection Area(m):</b>				11
<b>Fire Intensity(kW/m):</b>	32252					
<b><u>BAL Thresholds</u></b>						
	<b>BAL-40:</b>	<b>BAL-29:</b>	<b>BAL-19:</b>	<b>BAL-12.5:</b>	<b>10 kw/m2:</b>	<b>Elevation of Receiver:</b>
<b>Asset Protection Zone(m):</b>	14	18	26	36	55	6

## Appendix D – Property Access Standards

**Table 10: Performance Criteria and Acceptable Solutions for Property Access (Table 5.3b of PBP, RFS 2019).**

Performance Criteria	Acceptable Solutions
<ul style="list-style-type: none"> <li>firefighting vehicles can access the dwelling and exit the property safely.</li> </ul>	<ul style="list-style-type: none"> <li>There are no specific access requirements in an urban area where an unobstructed path (no greater than 70m) is provided between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles.</li> </ul> <p>In circumstances where this cannot occur, the following requirements apply:</p> <ul style="list-style-type: none"> <li>minimum 4m carriageway width;</li> <li>in forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m at the passing bay;</li> <li>a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches;</li> <li>provide a suitable turning area in accordance with Appendix 3;</li> <li>curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress;</li> <li>the minimum distance between inner and outer curves is 6m;</li> <li>the crossfall is not more than 10 degrees;</li> <li>maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads; and</li> <li>a development comprising more than three dwellings has access by dedication of a road and not by right of way.</li> </ul> <p>Note: Some short constrictions in the access may be accepted where they are not less than 3.5m wide, extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. The gradients applicable to public roads also apply to community style development property access roads in addition to the above.</p>

