



Strategic Bushfire Study

Planning Proposal - 251, 260R, 278, and 280-282
Captain Cook Drive, Kurnell

Prepared for: Besmaw Pty Ltd

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Template 2.8.1

Executive Summary

This Strategic Bushfire Study has been prepared by Eco Logical Australia (ELA) to accompany a proponent-initiated Planning Proposal, which is understood to propose amendment to the *State Environmental Planning Policy (Precincts—Central River City) 2021* (SEPP Precincts) and the *Sutherland Shire Local Environmental Plan 2015* (SSLEP 2015). The Planning Proposal aims to translate and amend current land use zones under the applicable controls to be consistent with the standard instrument local environmental plan zones and has developed a Masterplan to guide the provision of a diverse range of land uses at the site.

The Planning Proposal will establish a new mixed-use community encompassing residential, employment, tourism, education, cultural facilities, ecological regenerative zones and public open space areas. The Planning Proposal and Masterplan outcome aligns with the strategic objective to deliver housing supply, while demonstrating compliance with Ministerial Direction 4.3 and the requirements of Planning for Bushfire Protection (PBP) (RFS, 2019 & 2022) whilst also balancing other requirements such as amenity, ecology, cultural heritage and the like.

Development planning for the site has been ongoing for some time and an early Masterplan was reviewed by RFS, and the commentary provided considered in the design of the current Masterplan proposal. The current Masterplan specifically responds to previous agency feedback by including considerable measures for onsite resilience and key measures to facilitate early offsite evacuation. This results in a proposal that can achieve a very high level of resilience and a residual risk that is well mitigated and far lower than the policy setting adopted by PBP.

The Masterplan proposed demonstrates alignment with the aim of PBP *‘to provide for the protection of human life and minimise impacts on property from the threat of bushfire, while having due regard to development potential, site characteristics and protection of the environment’*. This includes demonstration of low-risk development through an emphasis on risk based implementation of bushfire protection measures, including measures beyond the minimum required by PBP.

This report has been prepared to comply with the requirements set out in Chapter 4 (*Strategic Planning*) of PBP. The Study examined whether the Masterplan contemplated for the site is appropriate given its bushfire risk exposure context or whether it represents *‘inappropriate development’* as described by PBP.

The technical assessment compiled for this study considered the broader bushfire landscape and risk profile for the area, along with the feasibility for the provision of bushfire protection measures within the site and development layout. In consideration of the proposal with regard to the strategic planning principles of PBP, the landscape risk assessment included an assessment of the broader bushfire landscape, bushfire weather and potential fire behaviour, while the land use evaluation considered the appropriateness of future land uses and the ability for future development to comply with requirements set out in PBP.

Required minimum residential and SFPP asset protection zones, along with proposed additional asset protection zones are feasible on site, resulting in low-risk development outcomes for the proposed development. As evidence of this, for the primary bushfire attack direction from the east, the additional APZ along the eastern boundary results in a reduction of RHF of 91% for residential and 62% for SFPP development, compared to the RHF exposure achieved by PBP minimum APZs.

Furthermore, given the hazard context and setbacks proposed, most of the development will be outside of the area where bushfire protection measures are prescribed by PBP (i.e. greater than 100 m from hazard and no longer formally considered bushfire prone). This highlights the lower risk development outcomes possible within the site.

From an emergency management perspective, and whilst the site is considered very unlikely to require complete evacuation, Captain Cook Drive is proposed to be upgraded to four lanes, resulting in increased capacity for evacuation without compromising the capacity for existing Kurnell residents to evacuate simultaneously. Preliminary traffic modelling indicates there are multiple access points from the development onto Captain Cook Drive, providing for early offsite evacuation and that the duplication of Captain Cook Drive will provide increased network capacity and redundancy beyond that required for the development and existing community. In addition, the Masterplan provides for a minimum of six potential onsite refuge building locations spread throughout, which whilst they may be considered places of last resort, will provide options to support community resilience during scenarios where offsite evacuation may not be able to be undertaken or is unsafe.

A key finding of this study is that the site is not exposed to a level of bushfire risk that cannot be mitigated through the implementation of contemporary bushfire protection measures, along with the application of additional mechanisms resulting in a low residual risk that is not deemed inappropriate. This finding has been determined based on the risk profile of the site, being subject to just one extended external fire pathway, for which additional and very conservative onsite mitigation has been proposed.

The findings of this study in relation to the strategic planning principles of PBP indicate that the Planning Proposal, subject to the recommendations of this study:

- Does not trigger the “inappropriate development” exclusion requirements of PBP;
- That the Acceptable Solution bushfire protection measures within PBP can be met by the future development contemplated and that there is opportunity for protection measures beyond the minimum compliance under PBP;
- Compliance with PBP is not reliant on the intervention/response by emergency services or hazard management on adjoining land;
- The proposal will not adversely impact the bushfire safety of occupants of nearby existing development with provision in place to ensure the capacity of the road network is suitable

Given the above, the Planning Proposal is considered compliant with the strategic bushfire planning requirements of Chapter 4 of PBP, subject to the recommendations made herein being resolved/integrated as planning progresses. Specific recommendations include:

- Ensuring that the suite of bushfire protection measures outlined within this study, including the additional proposed measures, are incorporated in detailed designs as planning progresses, and implemented for all stages of activation;
- Adopting planning mechanisms to enforce maintenance of bushfire protection measures in perpetuity.

Contents

| | |
|---|------------|
| Executive Summary | iii |
| 1. Introduction..... | 1 |
| 1.1 Study Area | 1 |
| 1.2 Site Context..... | 1 |
| 1.2.1 Planning context..... | 1 |
| 1.3 Bushfire Prone Land Status..... | 2 |
| 1.4 Other Hazards | 2 |
| 1.5 Legislative Framework | 3 |
| 1.5.1 NSW Environmental Planning and Assessment Act (1979) | 3 |
| 1.5.2 Rural Fires Act 1997 (RF Act) | 3 |
| 1.6 Assessment Approach | 4 |
| 1.6.1 Assessment Framework | 5 |
| 2. Bushfire Landscape Risk Assessment..... | 8 |
| 2.1 Bushfire Hazard..... | 8 |
| 2.1.1 Vegetation | 8 |
| 2.1.2 Future Hazard | 10 |
| 2.1.3 Slope..... | 15 |
| 2.2 Bushfire Risk Considerations | 17 |
| 2.2.1 Bushfire Weather | 17 |
| 2.2.2 Potential Bushfire Behaviour and Potential Fire Pathways..... | 21 |
| 2.2.3 Fire History | 21 |
| 2.3 Existing Risk Mitigation | 22 |
| 2.4 Summary of landscape bushfire risk assessment..... | 22 |
| 3. Land Use Assessment..... | 29 |
| 3.1 Risk Profile..... | 29 |
| 3.2 Feasibility of Asset Protection Zones..... | 29 |
| 3.2.1 Improved Risk Mitigation Outcomes..... | 30 |
| 3.3 Land Use Evaluation..... | 34 |
| 3.3.1 Residential Subdivision..... | 34 |
| 3.3.2 SFPP Development | 34 |
| 3.3.3 Multi-storey Residential Development | 34 |
| 3.3.4 Commercial and Industrial Development..... | 35 |
| 3.3.5 Section 8.3.11 – Public Assembly Buildings..... | 35 |
| 3.3.6 Section 6.3.1 – Specific Tourism Uses | 35 |
| 3.4 Summary of Land Use Evaluation | 36 |
| 3.4.1 Staging..... | 36 |

| | |
|---|-----------|
| 4. Access, Egress and Evacuation | 37 |
| 4.1 Access..... | 37 |
| 4.1.1 Perimeter Access..... | 38 |
| 4.1.2 Staging of Road Infrastructure | 38 |
| 4.2 Evacuation..... | 39 |
| 4.2.1 Early Offsite Evacuation | 40 |
| 4.2.2 Capacity for Safe Onsite Refuge | 43 |
| 4.2.3 Low Risk Development Outcomes..... | 43 |
| 4.3 Emergency Services | 44 |
| 4.4 Evaluation of Access, Egress and Evacuation | 44 |
| 5. Infrastructure and Adjoining Land..... | 49 |
| 5.1 Water Supply | 49 |
| 5.2 Electricity and Gas | 49 |
| 5.3 Adjoining Land | 50 |
| 6. Evaluation..... | 51 |
| 7. Conclusion..... | 54 |
| References | 55 |
| Appendix A - Access Specifications..... | 57 |
| Appendix B - NSP Criteria..... | 59 |
| Appendix C - Services Specifications..... | 60 |

List of Figures

| | |
|--|----|
| Figure 1: Study Area..... | 3 |
| Figure 2: Masterplan (Source: Urbis 15/11/2023)..... | 0 |
| Figure 3: Staging Plan (Source: GroupGSA 2023) | 1 |
| Figure 4: Bushfire Prone Land..... | 0 |
| Figure 5: Activity Hazard Risk..... | 1 |
| Figure 6: Kurnell Peninsula Land Use Safety Study Risk Screening Results | 2 |
| Figure 7: Mapped Vegetation Communities as per the Native Vegetation of the Sydney Metropolitan Area mapping (Source: OEH, 2016) | 9 |
| Figure 8: Future Landscape and Open Space (GroupGSA, 27/11/2023). | 11 |
| Figure 9: Indicative land management scenario accommodating additional recommended asset protection zone | 12 |
| Figure 10: Landscape Regeneration Strategy (Source GroupGSA, 2023). | 13 |
| Figure 11: Vegetation Hazard compiled for the site..... | 14 |
| Figure 12: Slope within the study area | 16 |
| Figure 13: Mean annual rainfall and mean maximum temperature, 1991-2020, Sydney Airport AMO (BOM, 2023)..... | 19 |
| Figure 14: Highest temperature and lowest rainfall, 1991-2020, Sydney Airport AMO (BOM, 2023) | 19 |
| Figure 15: Mean 9am and 3pm wind speed, 1991-2020, Sydney Airport AMO..... | 20 |
| Figure 16: 3pm Wind Rose, Spring (left) Summer (right), 1991 – 2020 Sydney Airport AMO | 20 |
| Figure 17: FFDI Sectors within 5km buffer of the Site | 24 |
| Figure 18: Fire Catchments | 25 |
| Figure 19: Wildfire history in the study area since 1965 (NPWS, 2023)..... | 26 |
| Figure 20: Wildfire frequency in the study area since 1965..... | 27 |
| Figure 21: Extract from the Sutherland Shire BFRMP 2015 – 2020 (SSBFRMC, 2016) | 28 |
| Figure 22: Extract from Kamay NP Fire Management Strategy (NPWS, 2009) | 28 |
| Figure 23: Indicative Asset Protection Zones | 33 |
| Figure 24: Proposed Road Infrastructure Network (Source: SCT, 2023) | 37 |
| Figure 25: Network capacity following duplication (Source: SCT, 2023)..... | 39 |
| Figure 26: Potential Evacuation Routes..... | 42 |
| Figure 27: Potential Locations for Onsite Refuge Buildings | 46 |
| Figure 28: Low Risk Development Outcomes | 47 |
| Figure 29: Fire stations and existing NSPs | 48 |

List of Tables

| | |
|---|----|
| Table 1: Site Description | 1 |
| Table 2: Summary of PBP assessment considerations for a Strategic Bushfire Study (RFS 2019) | 5 |
| Table 3: PBP Considerations for future land uses | 5 |
| Table 4: Vegetation formation and class and fuel allocation for the study area | 8 |
| Table 5: Indicative APZs Applicable to the Proposed Development | 30 |
| Table 6: Future land use evaluation | 36 |

Table 7: High Level Evacuation Time Estimates of traffic movement along Captain Cook Drive (Source: SCT, 2023) 41

Table 8: Potential locations for offsite evacuation..... 43

Table 9: Evaluation of proposal against strategic requirements of PBP..... 51

Table 10: Considerations and Recommendations for Future Planning Phases 52

Table 11: Performance criteria for access for residential and rural residential subdivisions 57

Table 12: Assessment Criteria for a Neighbourhood Safer Place (RFS 2017) 59

Table 13: Principles for Site Identification (RFS 2017)..... 59

Table 14: Performance criteria for services provision for residential and rural residential subdivisions 60

Table 15: Water supply requirements for non-reticulated developments or where reticulated water supply cannot be guaranteed (Table 5.3d of PBP) 61

1. Introduction

1.1 Study Area

The land to which the planning proposal relates is 251, 260R, 278 and 280-282 Captain Cook Drive, Kurnell and is located within the Sutherland Shire Local Government Area (LGA). The key features of the site are summarised in Table 1. The subject site (Figure 1) is approximately 18 km south of the Sydney CBD. Kurnell is situated at the eastern most extent of Sutherland Shire, forming part of Botany Bay's South Coast.

The north and south of the site are bound by Quibray Bay and Bate Bay, respectively. The site is within close proximity to reserves and national parks such as Towra Point Nature Reserve to the north, Cronulla State Park (Wanda Reserve) to the southwest and Kamay Botany Bay National Park to the east. There is existing development adjoining and nearby the site to the north and northeast. An additional area, the Marang Parklands to the west of the subject site, has been finalised under a Voluntary Planning Agreement between the Minister for Planning and Public Spaces, Sutherland Shire Council and Breen Resources Pty Ltd, which was finalised and approved by Sutherland Shire Council on 17 February 2023. The VPA will come into effect when SSD-10412 is approved.

Table 1: Site Description

| Feature | Lot 2 North | Lot 2 South | Lot 8 | Lot 9 |
|------------------------------------|--|-------------------------------------|---------------------------------|----------------------------------|
| Street Address | 251 Captain Cook Drive, Kurnell | 280-282 Captain Cook Drive, Kurnell | 278 Captain Cook Drive, Kurnell | 260R Captain Cook Drive, Kurnell |
| Legal Description | Lot 2 in DP1030269 | Lot 2 in DP559922 | Lot 8 in DP586986 | Lot 9 in DP 586986 |
| Site Area | 16 hectares | 160 hectares | 34.5 hectares | 82m ² |
| | Total area: Approximately 210.5 hectares | | | |
| Local Government Area (LGA) | Sutherland Shire | | | |

1.2 Site Context

Historically, the Kurnell Peninsula has supported various industrial uses, including a sand quarry, waste management operations, along with the operational facilities for the Ampol Fuel Terminal and desalination plant. The southern precinct of the Subject Land has historically operated as a sand quarry.

1.2.1 Planning context

The site has a complex planning history, governed by the provisions of Chapter 5 Kurnell Peninsula of SEPP (Precincts – Central River City) 2021. This chapter of the SEPP was adopted in 1989 and does not reflect current planning practices. Therefore, the Planning Proposal seeks to zone the site in accordance with the current Sutherland LEP and standard instrument land use zones.

It is understood that the Department of Planning and Environment (DPE) is seeking to dissolve Chapter 5 of the Precincts SEPP and the Planning Proposal is required to translate the site's current zoning into Council's LEP for alignment with the current planning framework.

The strategic merit of the site for long-term housing supply has also been identified by DPE and therefore the Planning Proposal is supported by a Masterplan which includes a range of land uses with provision to establish a new mixed-use community encompassing residential, employment, tourism, education, cultural facilities, ecological regenerative zones and public open space areas. The Masterplan shown in Figure 2 outlines the proposed land uses and site layout, and the indicative staging plan for activation is shown in Figure 3.

The land uses proposed are largely consistent with those which are presently permissible on the site under the SEPP including:

- Hotel,
- Residential,
- Retail centre and commercial
- Playing fields.
- Roads and infrastructure

The land uses proposed are also consistent with past approvals granted for the site, and while not constructed, remain permissible under the current SEPP, including:

- Golf Course, Golf Clubhouse, 31 Hotel Rooms, 122 Condominiums and roadwork;
- Two Hotels (1969 rooms);
- 1278 condominiums;
- Private hospital;
- Research centre;
- Retail Centre, ancillary offices, a theatre;
- Equestrian centre, a tennis complex, swimming facilities, a sports ground, a network of pathways for walking, jogging, bike riding and horse riding; and
- Associated roads and infrastructure

1.3 Bushfire Prone Land Status

The Subject Land is currently partially mapped as bushfire prone land (Figure 4) as per the Sutherland Shire Council Bush Fire Prone Land (BFPL) map as published by the Department of Planning and Environment (DPE) on the NSW planning portal (DPE, 2023).

In regard to bushfire, consultation with relevant agencies including the NSW Rural Fire Service has been undertaken in 2022, and feedback provided considered in the revised masterplan that is presented in this study.

1.4 Other Hazards

The site is situated outside of the mapped Refinery Risk Area, as per the Activity Hazard Risk Map (Figure 5). Additionally, as per the Kurnell Peninsula Land Use Safety Study (DoP, 2007), any potential significant impacts resulting from adverse events occurring at the fuel terminal, can largely be contained with the refinery boundary (Figure 6).



Figure 1: Study Area



Figure 2: Masterplan (Source: Urbis 15/11/2023)

5.8 STAGING

- Stage 1A**
Quilbray Bay Ecological Corridor and Local Pocket Park
- Stage 1B**
Town Centre Ecological Corridor and Local Parks
- Stage 2**
Town Centre District Park, Local Parks and Arrival Precinct
- Stage 3**
Boat Harbour Cultural Walk
- Stage 4**
Town Centre North Local Park
- Stage 5**
Bate Bay District Park and Local Park

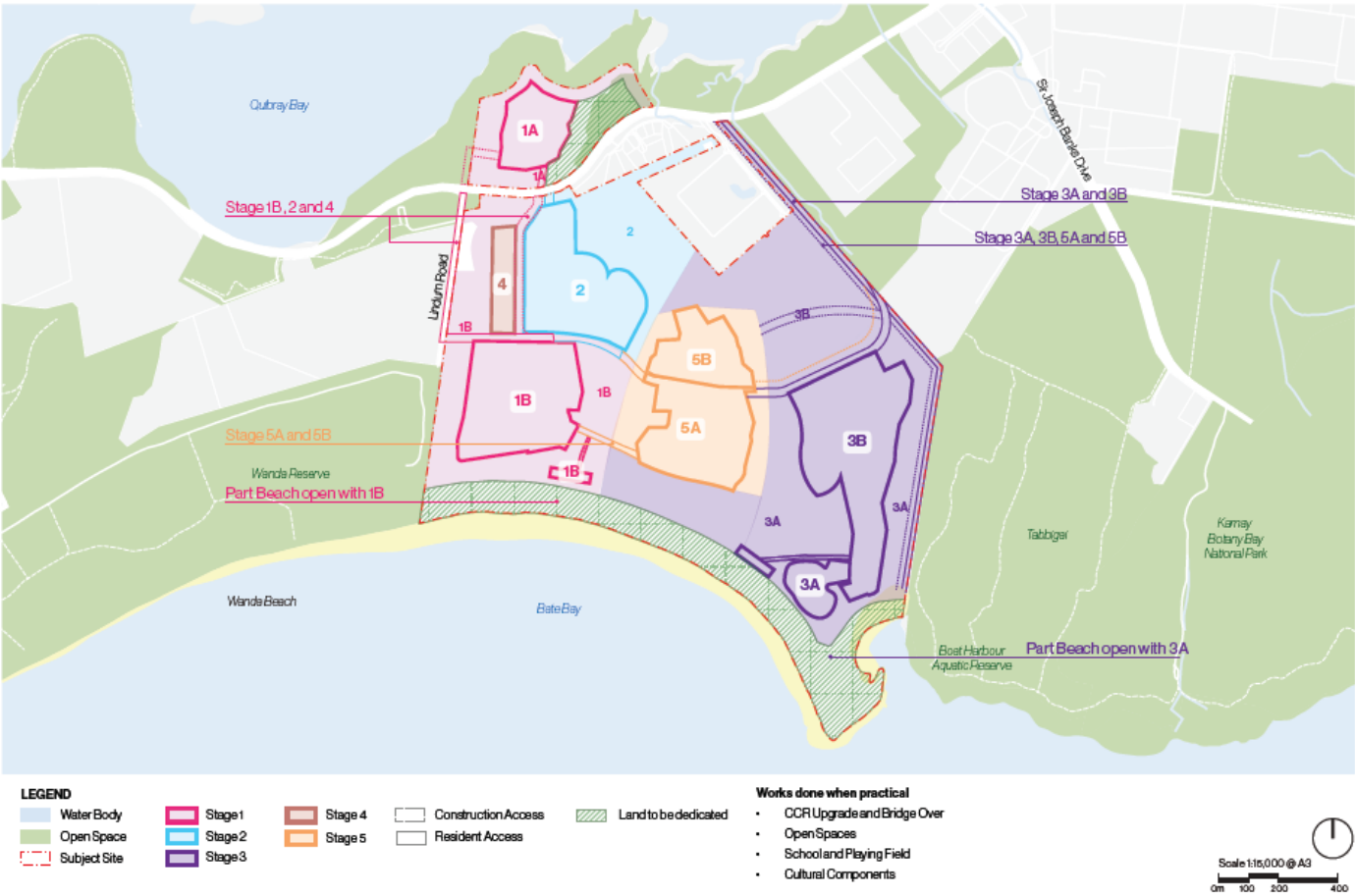


Figure 3: Staging Plan (Source: GroupGSA 2023)

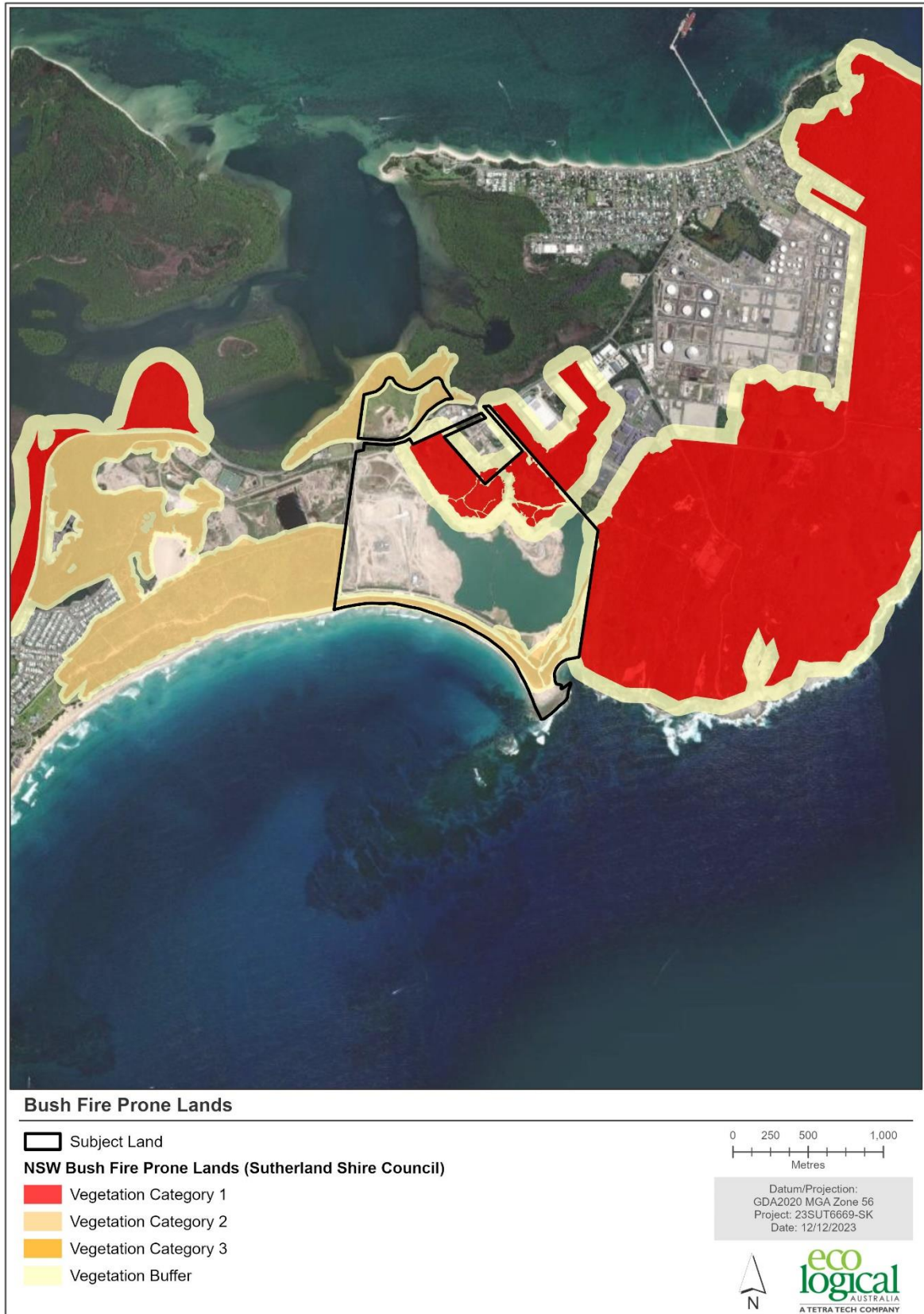


Figure 4: Bushfire Prone Land



Figure 5: Activity Hazard Risk (Source: Sutherland LEP, 20

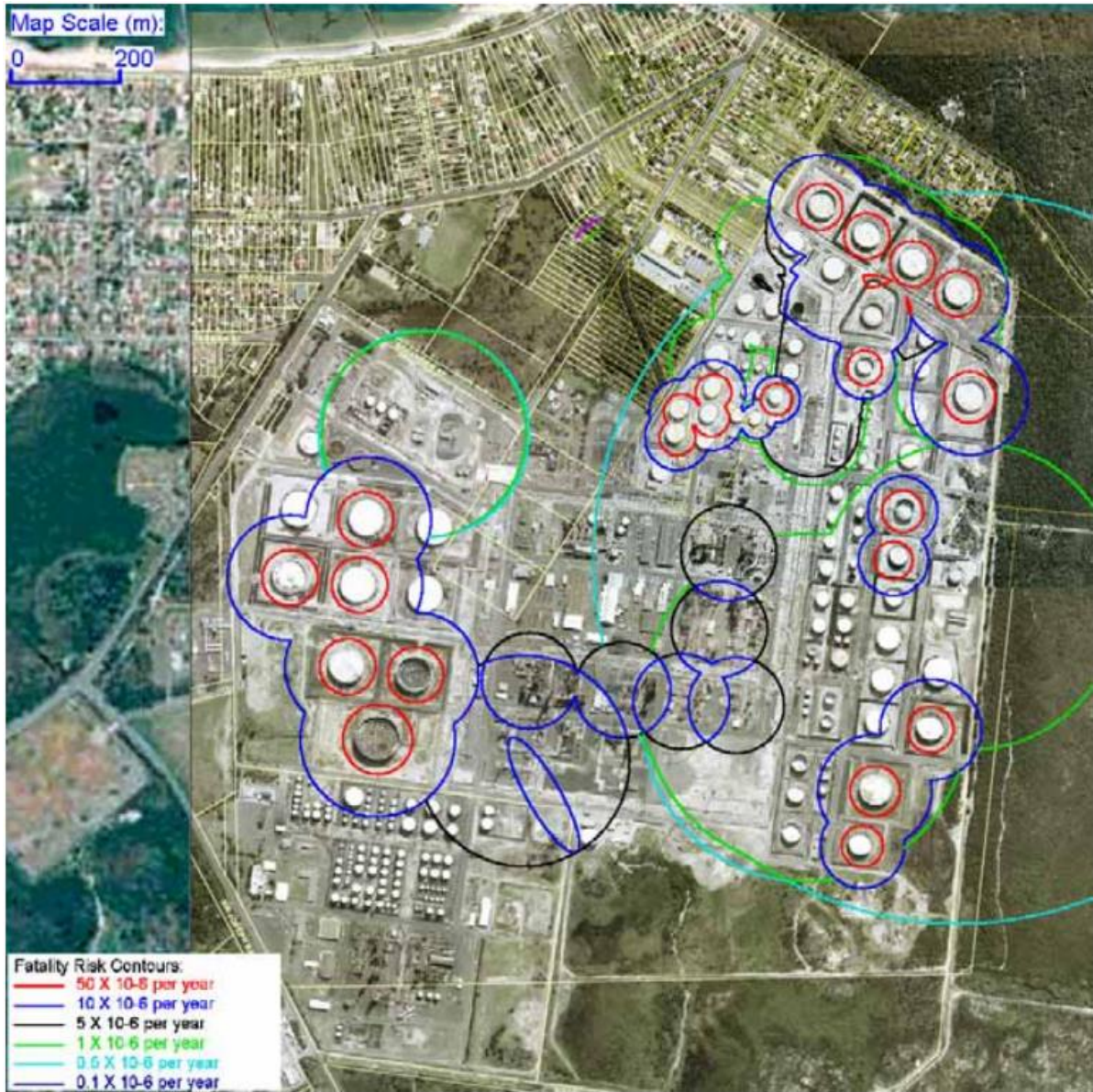


Figure 6: Kurnell Peninsula Land Use Safety Study Risk Screening Results (DoP, 2007).

1.5 Legislative Framework

Under the Ministerial Direction 4.3 (Planning for Bushfire Protection) issued under Section 9.1 (2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), where a proposal includes or is in close proximity to BFPL, the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service (RFS). Therefore, the assessment detailed in this study seeks to outline how the proposal can adhere to the requirements of PBP. The legislative framework guiding the assessment of bushfire risk and the application of bushfire protection measures at the strategic level, includes the NSW *EP&A Act* and the *Rural Fires Act 1997* (RF Act). Key aspects of these instruments are outlined below.

1.5.1 NSW Environmental Planning and Assessment Act (1979)

The NSW *EP&A Act* is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments are integrated with the *EP&A Act*, including the *RF Act*. Section 10.3 of the *EP&A Act* requires the identification of BFPL and development of BFPL maps, which act as a trigger for bushfire assessment provisions for strategic planning and development. When investigating the capability of BFPL in relation to Kurnell, consent authorities must have regard to 9.1 (2) Direction 4.3 – ‘Planning for Bushfire Protection’ of the *EP&A Act*. The objectives of Direction 4.3 are:

- *To protect life, property and the environment from bushfire hazards, by discouraging the establishment of incompatible land uses in bushfire prone areas; and*
- *To encourage sound management of bushfire prone areas.*

Direction 4.3 instructs the consent authority on the bushfire matters which need to be addressed with respect to masterplanning. This includes:

- Consultation with the Commissioner of the NSW RFS and consideration to any comments made;
- Regard to requirements of PBP; and
- Compliance with numerous bushfire protection provisions where development is proposed.

1.5.2 Rural Fires Act 1997 (RF Act)

The *RF Act* is integrated into the *EP&A Act* and triggered by Section 4.46 as outlined above. The key objectives of the RF Act are to provide for the:

- *Prevention, mitigation and suppression of bush and other fires;*
- *Co-ordination of bushfire fighting and bushfire prevention;*
- *Protection of persons from injury or death, and property from damage, arising from fires;*
- *Protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires; and*
- *Protection of the environment by requiring certain activities to be carried out having regard to the principles of ecologically sustainable development.*

1.6 Assessment Approach

Section 9.1 (2) of the *EP&A Act* triggers consideration of PBP for strategic planning. Chapter 4 of PBP contains strategic planning principles, ‘inappropriate development’ exclusions and assessment considerations required for strategic bushfire planning. Chapter 4 of PBP prescribes the completion of a Strategic Bushfire Study, which provides the opportunity to assess whether proposed land uses associated with masterplanning are appropriate in the bushfire risk context. It also provides the ability to assess the strategic implications of future development for bushfire risk management.

The strategic planning principles of PBP are:

- *Ensuring land is suitable for development in the context of bushfire risk;*
- *Ensuring new development on BFPL will comply with PBP;*
- *Minimising reliance on performance-based solutions;*
- *Providing adequate infrastructure associated with emergency evacuation and firefighting operations; and*
- *Facilitating appropriate ongoing land management practices.*

These principles trigger the consideration of bushfire protection measures at the strategic planning stage, to provide an opportunity to consider the suitability of future land uses within the broader bushfire risk setting and that future land uses can meet the aim and objectives of PBP outlined below:

The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bushfire, while having due regard to development potential, site characteristics and protection of the environment.

The objectives are to:

- i afford buildings and their occupants protection from exposure to a bushfire;*
- 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 bushfire protection measures; and*
- vi ensure that utility services are adequate to meet the needs of firefighters.*

In addition, Chapter 4 of PBP prescribes that strategic planning should exclude ‘inappropriate development’ in bushfire prone areas, where:

- *the development area is exposed to a high bushfire risk and should be avoided;*
- *the development is likely to be difficult to evacuate during a bushfire due to its siting in the landscape, access limitations, fire history and/or size and scale;*
- *the development will adversely affect other bushfire protection strategies or place existing development at increased risk;*
- *the development is within an area of high bushfire risk where density of existing development may cause evacuation issues for both existing and new occupants; and*
- *the development has environmental constraints to the area which cannot be overcome.*

This study therefore assesses the masterplan in the context of the PBP strategic planning principles, ‘inappropriate development’ exclusions as well as the assessment considerations identified in Table 4.2.1 of PBP, summarised in Table 2 below.

Table 2: Summary of PBP assessment considerations for a Strategic Bushfire Study (RFS 2019)

| Issue | Summary of Assessment Considerations |
|-------------------------------|---|
| Bushfire landscape assessment | A bushfire landscape assessment considers the likelihood of a bushfire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape. |
| Land use assessment | The land use assessment will identify the most appropriate locations within the Masterplan area or site layout for the proposed uses. |
| Access and egress | A study of the existing and proposed road networks both within and external to the Masterplan area and site layout. |
| Emergency services | An assessment of the future impact of the new development on emergency services provision. |
| Infrastructure | An assessment of the issues associated with infrastructure provision. |
| Adjoining land | The impact of new development on adjoining landowners and their ability to undertake bushfire management. |

1.6.1 Assessment Framework

Masterplanning is a step in the planning process to facilitate differing land use activities and future development across the site. It presents a plan that enables a variety of topologies facilitating a mixture of residential uses, commercial and enterprise development, infrastructure, open space, public recreation, and conservation.

Future land uses considered within the site would be subject to various aspects of PBP, when occurring on BFPL. Table 3 below outlines key PBP considerations for a variety of land uses and associated facilities that future development may be subject to.

Table 3: PBP Considerations for future land uses

| Future Land Use | Associated Facilities and/or Activities | Key PBP Considerations for future development |
|--|---|---|
| Residential | Townhouses and multi-storey residential development | Chapter 5 of PBP outlines the bushfire protection requirements for residential subdivision, including performance criteria identified for APZs, access and infrastructure. For multistorey development specific requirements are section 8.2.2 of PBP, including the requirement for an APZ which meets a threshold of 29kW/m ² . |
| Special Fire Protection Purpose | Independent Living and Aged Care, Childcare facilities, Education facilities, and Tourism (see below) | Chapter 6 of PBP outlines the bushfire protection requirements for this type of development, including performance criteria identified for APZs, access, infrastructure and emergency management. |
| Commercial/Neighbourhood Centre /Mixed use development | Retail and specialised retail /services including food services | Section 8.3.10 of PBP (Commercial and Industrial Development) applies to this type of development. Relevant bushfire protection measures are to meet the aim and objectives of PBP. |

| Future Land Use | Associated Facilities and/or Activities | Key PBP Considerations for future development |
|---------------------------|--|--|
| Public Assembly Buildings | Buildings used for public assembly with a floor space area of greater than 500m ² | Section 8.3.11 (Public Assembly Buildings) applies to this type of development. Relevant developments will be treated as SFPP |
| Tourism | Hotels and Camping | Consideration to Section 6.3 (Objectives for specific uses) and Table 6.8 (Performance criteria and acceptable solutions for SFPP development) of PBP which prescribes specific performance criteria |

Investigation of the suitability for development within an area of interest, involves a complex and large array of bushfire-related issues and concepts. Prioritisation of first principle bushfire risk considerations is critical. Therefore, the following bushfire assessment framework will guide this study.

1.6.1.1 Residual risk

All BFPL poses a bushfire risk. Complete removal of bushfire risk is not appropriate or possible in many instances, nor is it a policy setting under PBP. Determining whether the level of residual risk (i.e., the level of risk after application of bushfire protection measures) is a key factor in the strategic assessment of whether a development proposal is appropriate.

Provided the risk exposure is appropriately reduced, development can occur with an appropriate level of safety on BFPL. PBP outlines the measures to achieve bushfire risk reduction generally and establishes the NSW policy setting for appropriate bushfire protection. Experience and research have successfully demonstrated appropriate bushfire protection is feasible within a very wide range of bushfire risk situations. Nevertheless, development on BFPL always has a residual bushfire risk e.g. from burning debris or for offsite evacuation, regardless of the initial risk level and risk treatments. This Strategic Bushfire Study acknowledges that the outcome of any potential development on BFPL resulting from the Masterplan includes a level of residual risk and explores the acceptability of that risk.

1.6.1.2 Risk to life versus risk to property

A lower residual risk is required for the protection of life than that required for the protection of built assets, due to the vulnerability of people exposed to bushfire attack and the pre-eminent value assigned to human life. Assessment of the residual risk has therefore considered life and property risks separately, in the first instance.

1.6.1.3 Life protection and evacuation

An appropriately low residual risk to human life is fundamentally important in bushfire protection. Whilst offsite evacuation potentially offers a safer destination, the risks associated with undertaking offsite evacuation (e.g. travel during an emergency) can pose additional risks. Also, the logistical challenges of offsite evacuation can be high and should not become an unacceptable burden on emergency services, and in a strategic planning context, should not adversely impact the demands of the existing emergency service evacuation management.

Early offsite evacuation is the nationally accepted safest means for protection of life and for offsite evacuation to be effective, it should not require the assistance of emergency services. Notwithstanding that early unassisted offsite evacuation is key, experience and research has

demonstrated that it is not fail-safe or always feasible. Research and post incident inquiries have also found that providing evacuees options (along with warnings and information) is important to their survival (Blanchi et al. 2015, Whittaker 2019).

Alternative options such as onsite refuge and 'shelter-in-place' are also not fail-safe, but design solutions exist in many situations to lower the residual risk to an appropriate level for both onsite and offsite options. A well-designed combination of the two may achieve the lowest residual risk, even if the onsite options are considered a 'redundancy' in terms of bushfire risk planning.

1.6.1.4 Emergency service response

The acceptability of a proposed development should not be reliant on emergency service response / intervention. However, an emergency service response is a legitimate risk lowering consideration, that can be viewed as a bushfire protection 'redundancy' in a strategic planning context.

1.6.1.5 Adjoining lands

Whilst fuel management (e.g., hazard reduction burning) lowers bushfire risk under most circumstances, during extreme bushfire attack and with increasing time after a burn, the life and property protection benefit is likely to be minimal. As fuel management programs achieving a satisfactory level of risk reduction cannot be guaranteed, they cannot be relied upon for life and property protection design in a strategic planning context.

2. Bushfire Landscape Risk Assessment

The landscape bushfire risk includes assessment of bushfire hazard, potential fire behaviour and bushfire history within a 5 km radius of the subject site, herein called the ‘study area’.

2.1 Bushfire Hazard

The site is located within a broader area where bush fire prone vegetation (BFPV) is mapped, primarily to the east, southwest and northeast. Assessment of the bushfire hazard is considered below, including details of the hazard assessment classified using the PBP methodology, through assessment of vegetation, slope and bushfire weather.

2.1.1 Vegetation

The broader study area generally presents within a landscape containing consolidated vegetation hazards, with no areas of significantly large and contiguous vegetation. The vegetation to the east within Kamay National Park is the largest patch contiguous with the subject land. There is also BFPV to the south and southwest along the Bate Bay dune frontage, and to the north primarily presenting as fragmented remnant forested wetlands. Whilst there is extensive vegetation north of Captain Cook Drive, it is extensively saline wetlands, which are considered a low threat exclusion as per A1.10 of PBP (RFS, 2019).

Vegetation has been classified into Keith Formations and Keith Class (Keith 2004) and assigned a potential total fuel load (tonnes/hectare) using Table A1.12.8 from PBP (Figure 7) and Table 4 show the vegetation formations as mapped in the Native Vegetation of the Sydney Metropolitan Area mapping (OEH 2016).

Site inspections were conducted in 2020 and again in 2022 along with detailed desktop assessment to confirm mapping of both vegetation structure and management, to assist the establishment of a bushfire vegetation hazard dataset for this report, as detailed in Section 2.1.2 below.

Table 4: Vegetation formation and class and fuel allocation for the study area

| Form | Class | PBP Assignment | Overall Fuel Load (T/ha) |
|---|----------------------------|--------------------|--------------------------|
| Dry Sclerophyll Forests (Shrubby sub-formation) | Coastal Dune DSF | Forest | 36.1 |
| Forested Wetland | Coastal Swamp Forest | Forest | 36.1 |
| Forested Wetland | Coastal Floodplain Wetland | Forested Wetland | 15.1 |
| Freshwater Wetlands | Coastal Freshwater Lagoons | Freshwater Wetland | 4.4 |
| Freshwater Wetlands | Coastal Heath Swamps | Tall Heath | 36.9 |
| Heathlands | Wallum Sands Heath | Tall Heath | 36.9 |
| Heathlands | Coastal Headland Heaths | Tall heath | 36.9 |
| Heathlands | Sydney Coastal Heaths | Tall heath | 36.9 |
| Saline wetlands | Mangrove | Excluded | n/a |
| Saline wetlands | Saltmarshes | Excluded | n/a |

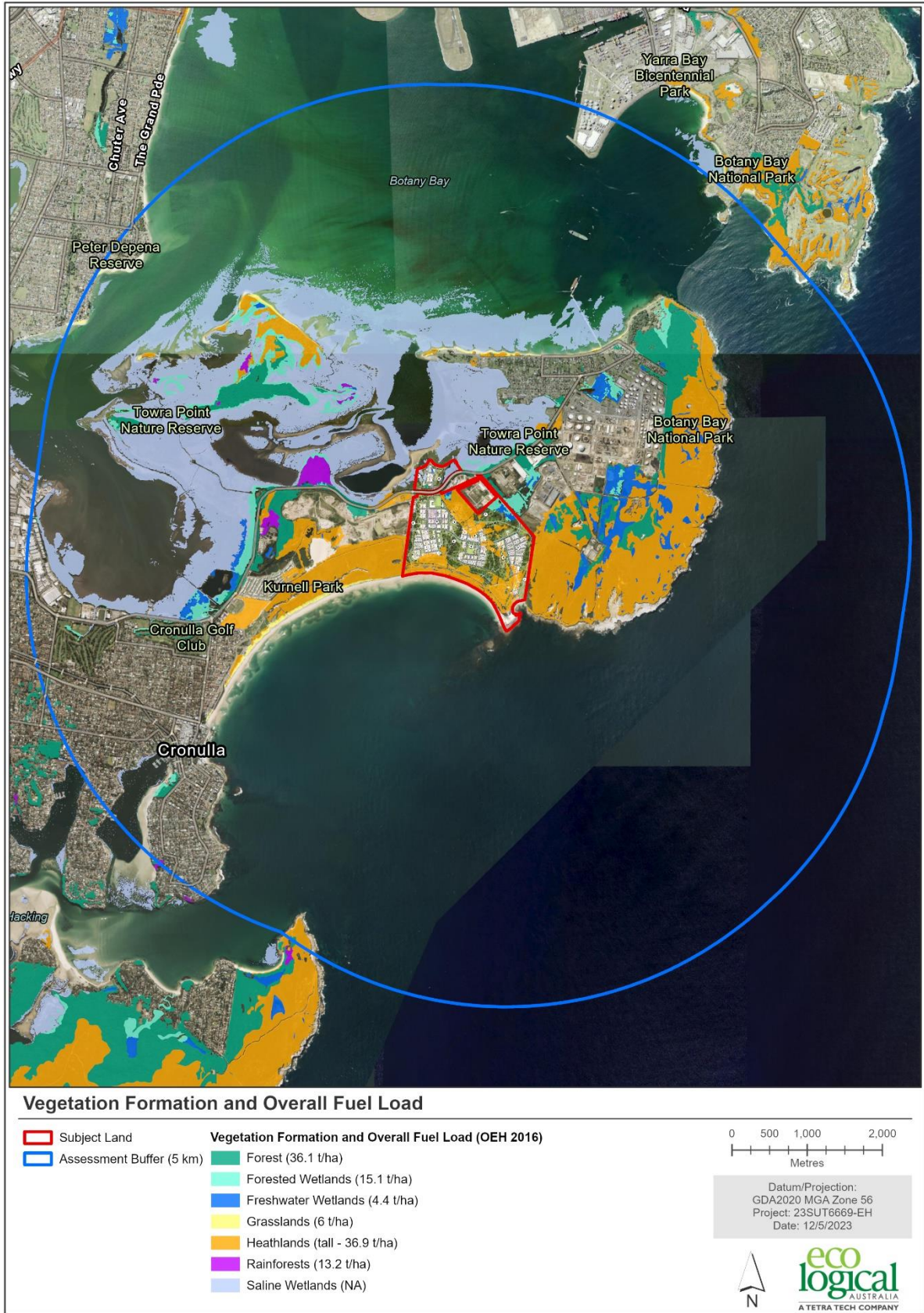


Figure 7: Mapped Vegetation Communities (Source: OEH, 2016)

2.1.2 Future Hazard

Based on the vegetation regeneration objectives of some of the land proposed for open space, and as per the Open Space Strategy (GroupGSA, 2023) (Figure 8), it is expected that outside of the required and recommended Asset Protection Zones, restoration of forest, forested wetland and tall heath communities would occur onsite, with the landscape strategy allowing for additional managed land as show in Figure 9 below.

Combining the outcomes of the site inspection, with the landscape regeneration strategy (Figure 10), along with desktop refinement of mapping based on the Native Vegetation of the Sydney Metropolitan Area mapping (OEH, 2016), Figure 11 below depicts the effective hazard influential to the site. These areas are representative of the indicative future hazard extent and indicative vegetation forms, which have also been considered in the land use feasibility assessment in Section 3 of this report.



Figure 8: Future Landscape and Open Space (GroupGSA, 27/11/2023)

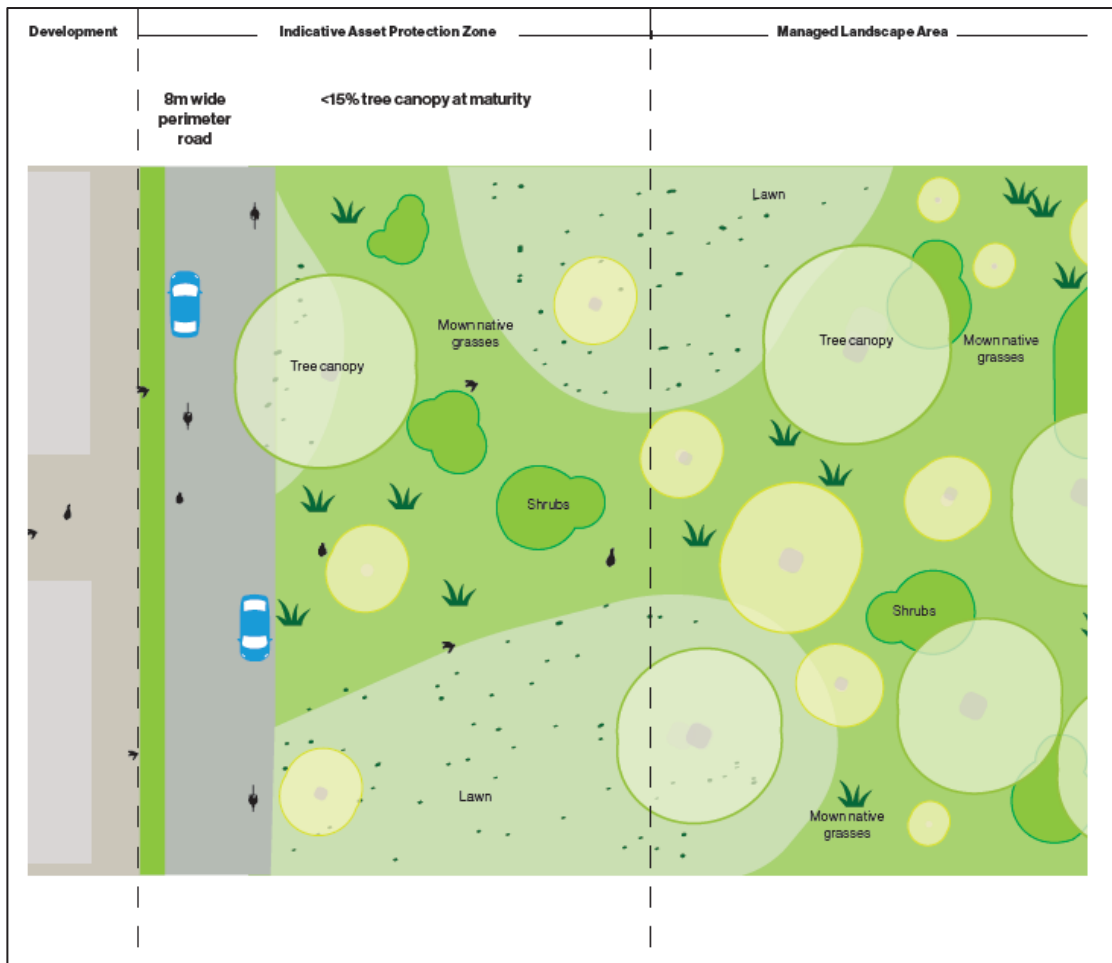


Figure 9: Indicative land management scenario accommodating additional recommended asset protection zone (GroupGSA, 2023).

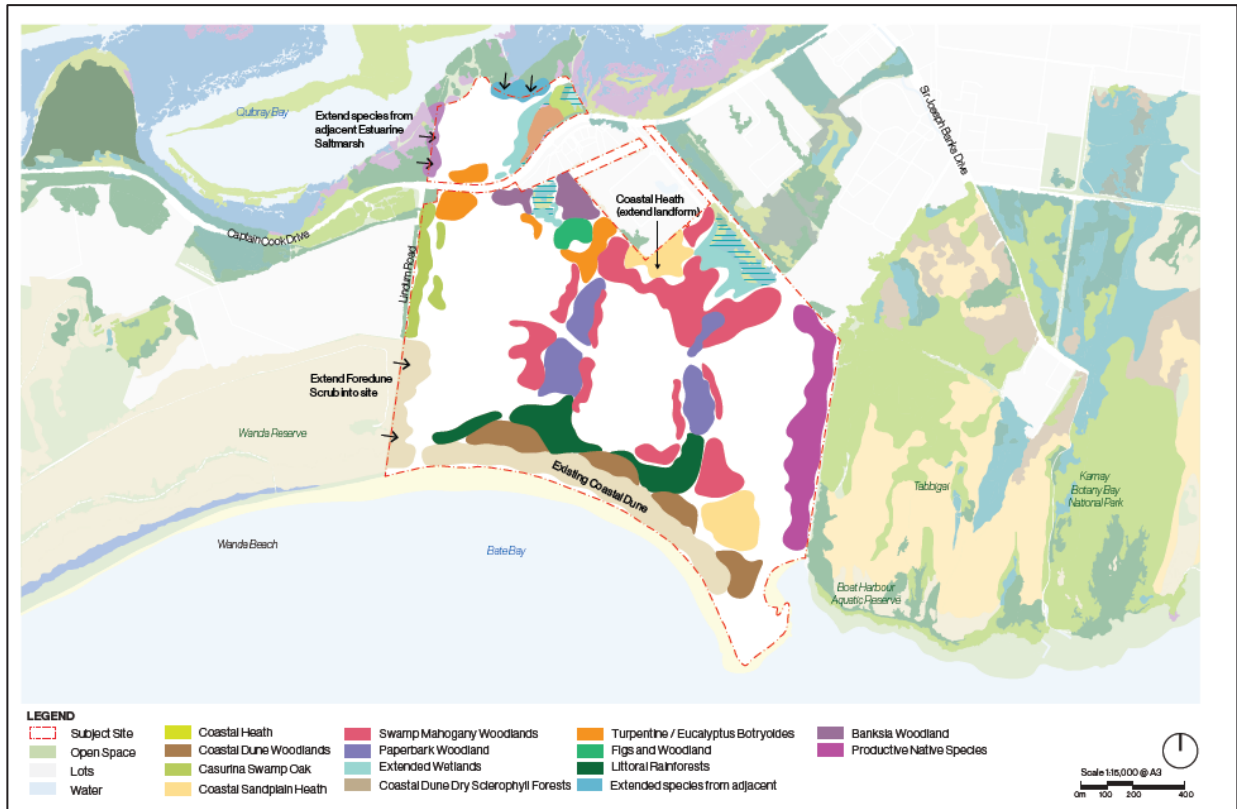


Figure 10: Landscape Regeneration Strategy (Source GroupGSA, 2023)



Figure 11: Vegetation Hazard Assessment

2.1.3 Slope

Slope has been identified from a Digital Elevation Model (DEM) generated from 2 m contours and classified into slope classes (see Figure 12).

The site has historically been subject to modification from sand quarry practices and is proposed for reshaping, however it is anticipated that the site will remain generally flat with minimal undulation. Existing on the site, the vegetated dune hazard is generally situated downslope of the proposed developable area, while sloped topography is present in the northeast corner of the southern precinct.

External and to the east of the southern precinct, land on which tall heath is present exhibits varied topography, meaning there is a greater risk of fire transfer from this direction particularly where the hazard lies on steeper land, downslope to the site. Other adjoining lands are more generally more gently sloped, with the northern precinct surround by land which is primarily flat.

The assessment of the effective slope is discussed further in Section 3.3.

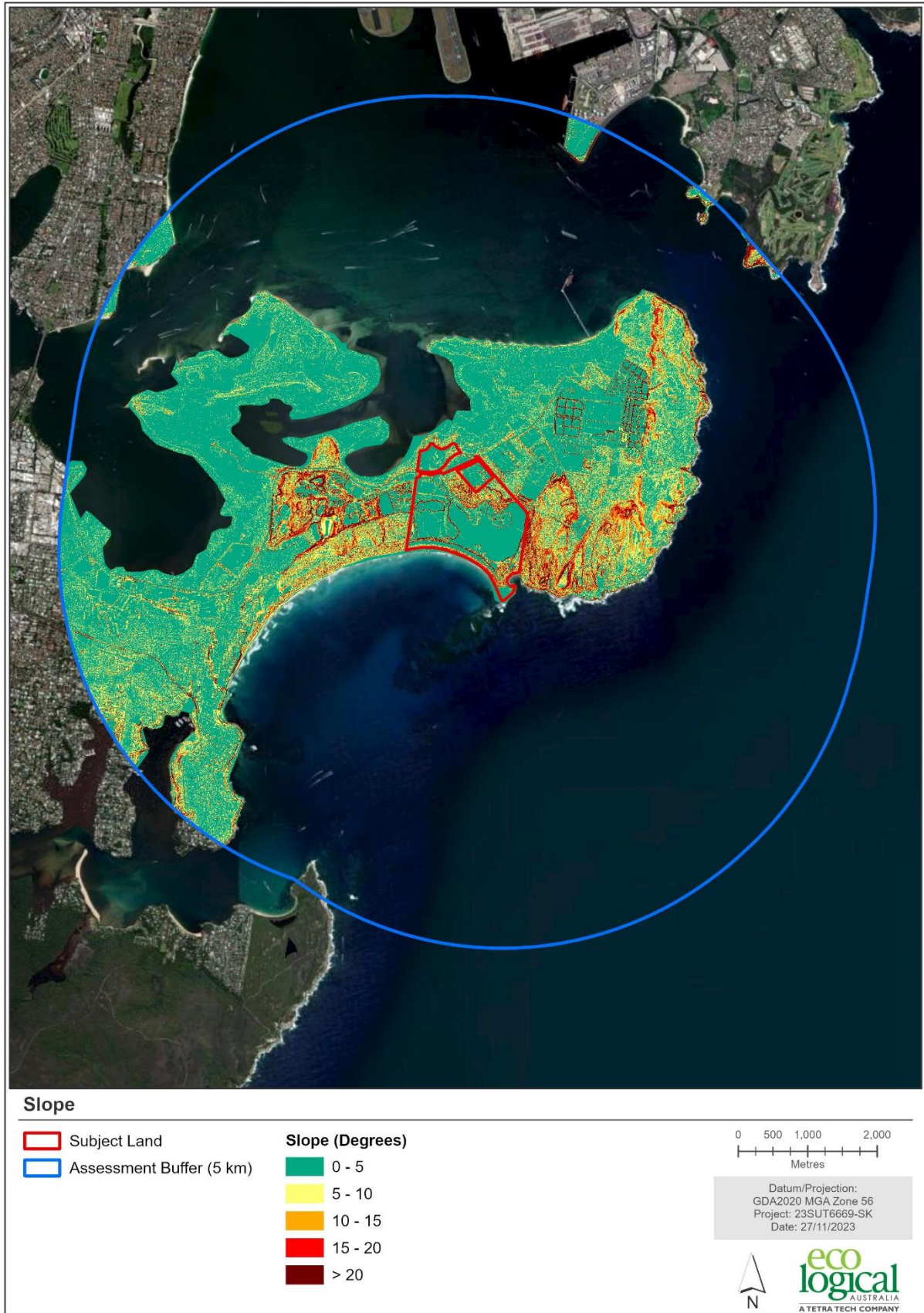


Figure 12: Slope within the study area

2.2 Bushfire Risk Considerations

The following sections outline key considerations informing the bushfire risk exposure of the site. This includes analysis of bushfire weather and potential fire behaviour, consideration of bushfire catchments and potential fire pathways, and bushfire history. Also included in the risk assessment is consideration of the existing and proposed Sutherland Bushfire Risk Management Plan (BFRMP) as developed by the Sutherland Shire Bush Fire Management Committee (SSBFMC).

2.2.1 Bushfire Weather

The SSBFMC area experiences a warm temperate climate with higher rainfall experienced in late summer and into autumn (Figure 13). While the gazetted bushfire season generally runs from October to March, according to the BFRMP (SSBFMC, 2016), bushfire weather can occur earlier when westerly winds occur in late winter resulting in drier conditions. Historic weather data (1991-2020) for Sydney Airport AMO (066037) (BOM 2023) indicates the driest part of the year on average is August to October (Figure 13) however very dry periods have also been experienced in April and May (Figure 14). When dry periods are coupled with higher temperature it can promote the earlier onset or extension of the bushfire season.

Also evident from the historic weather record is the tendency for increased afternoon winds, with an increasing trend from Spring months into Summer (Figure 15). Further examination of afternoon winds shows the direction of these winds is primarily from the north-east, and to a lesser extent east through to south during Spring and Summer (Figure 16). This highlights the potential for fire starts in Kamay National Park to have potential to spread towards the site under these conditions. Conversely, there is very little frequency of winds from the west in spring and summer, but when present they are generally stronger. Winds from this direction in spring and summer are often hot and dry and therefore generally associated with elevated bushfire weather. However, they don't occur often and there is a lack of BFPV west of the subject site and no significant potential fire runs (Section 2.2.2) indicating that this is not a direction of attack of elevated concern.

Until recently and for an extended historical period, bushfire weather was often described in terms of the Forest Fire Danger Index (FFDI). This metric has a correlation with the intensity of bushfire behaviour, with a higher FFDI corresponding to weather conditions with potential for higher intensity fires. For the purposes of PBP, the FFDI required to be used for development assessment for the site is 100, as identified for the Greater Sydney Region and Sutherland Shire LGA. The FFDI used by PBP influences certain bushfire protection measures including Asset Protection Zones (APZ) and construction standards via the assessment of the Bushfire Attack Level (BAL).

Weather data analysed by Lucas (2010) under the National Historical Fire Weather Dataset (1972-2020) incorporates the daily FFDI, where suitable inputs are available, from over 70 weather stations across Australia. Utilising historical data from the Sydney Airport weather station from the National Historical Fire Weather Dataset and applying the maximum FFDI for a 1 in 50-year event (being the accepted recurrence period for land use planning) provides a more refined understanding of the specific bushfire weather relevant to the Study Area.

To analyse the FFDI for a 1 in 50-year event from the Sydney Airport weather station data, a Generalised Extreme Value (GEV) analysis was undertaken using the process documented by Douglas (2017) and

Douglas et al (2014; 2016). The dataset was split into subsets based on identified directions of potential bushfire attack relevant to the site, being North to south-east (clockwise); South-east to South-west (clockwise); South-west to North (clockwise). The following directional FFDIs were identified through the GEV analysis of the historic weather records (1972 to 2020) for Sydney Airport:

- Maximum FFDI for wind directions from the north to south-east was 63;
- Maximum FFDI for wind directions from the south-east to south-west was 46; and
- Maximum FFDI for wind directions from the south-west to north was 114.

This analysis indicates that there is variation in the potential likelihood and consequence of bushfire attack from different directions, toward the proposed development area, as shown in Figure 17.

Based on the analysis, higher FFDI and potential for higher intensity fires could be expected from the southwest to northern sector. However there is limited BFPV in this direction, therefore mitigating potential fire attack on the site and infrastructure. Fire from the west to north is unlikely given the presence of saline vegetation in this direction. Fire from the west and southwest would be mitigated by the provision of onsite bushfire protection measures and it is also noteworthy that a significant landscape fire from this direction is not possible given the limited BFPV and reduced fire pathways.

Conversely, analysis of historic weather data indicated lower FFDI from the southeast to southwest and north to southeast sectors. Of these sectors, the north to southeast contains the larger and more likely fire pathways and has had a historical record of fire occurrence especially in Kamay National Park (Section 2.2.3). Despite this exposure, the GEV FFDI analysis indicates a maximum FFDI from this direction of 63, a difference of 45% from the FFDI 100 adopted by PBP. The implication of this reduced FFDI from this direction is that the PBP minimum APZs will result in radiant heat mitigation greater than the policy setting adopted by PBP.

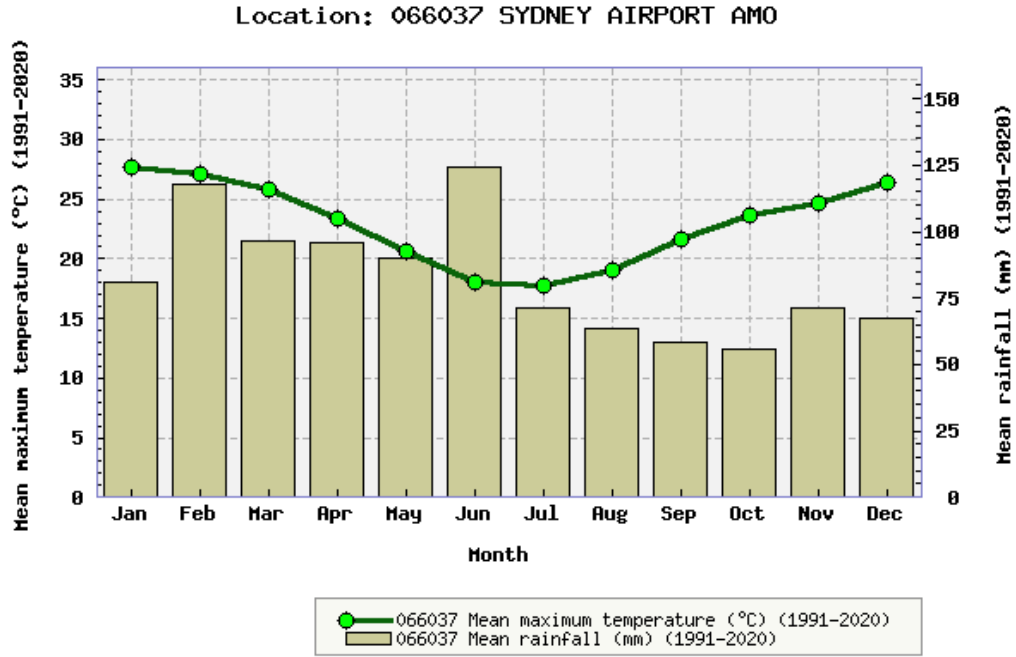


Figure 13: Mean annual rainfall and mean maximum temperature, 1991-2020, Sydney Airport AMO (BOM, 2023)

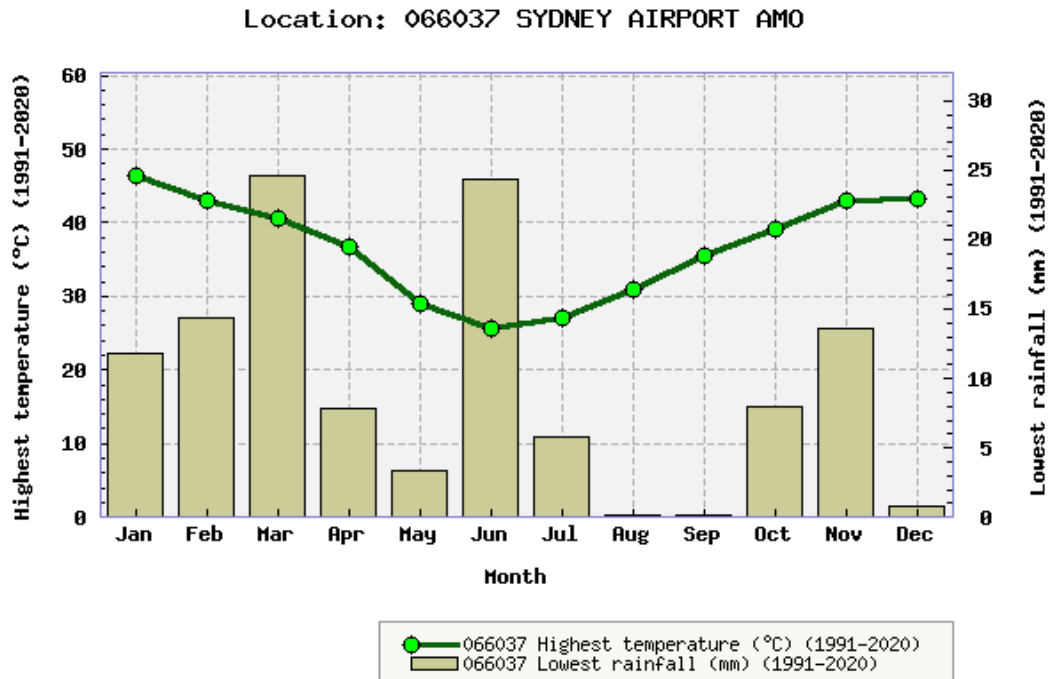


Figure 14: Highest temperature and lowest rainfall, 1991-2020, Sydney Airport AMO (BOM, 2023)

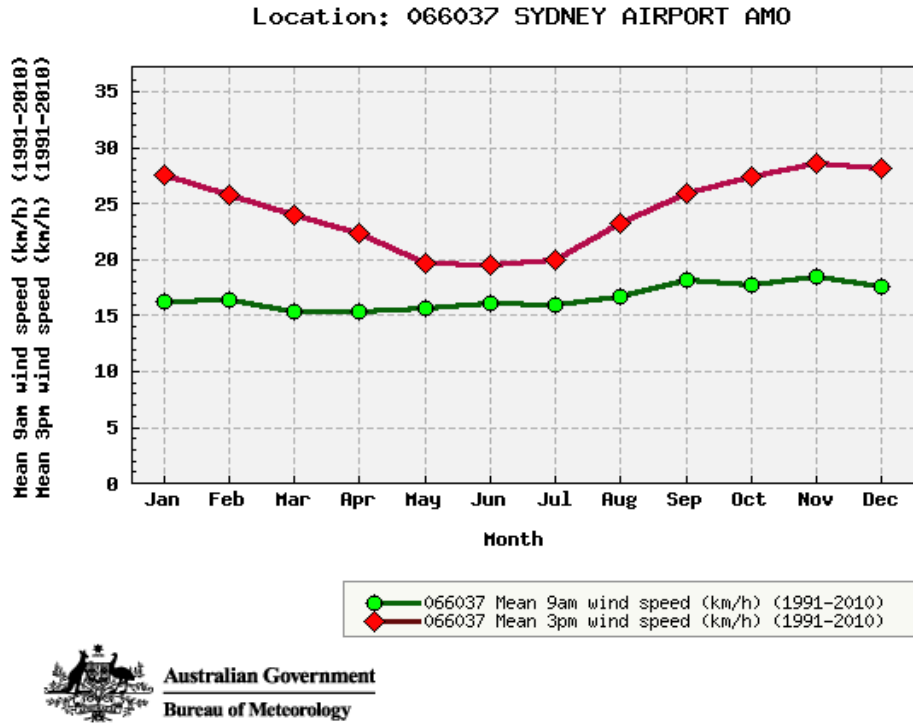


Figure 15: Mean 9am and 3pm wind speed, 1991-2020, Sydney Airport AMO

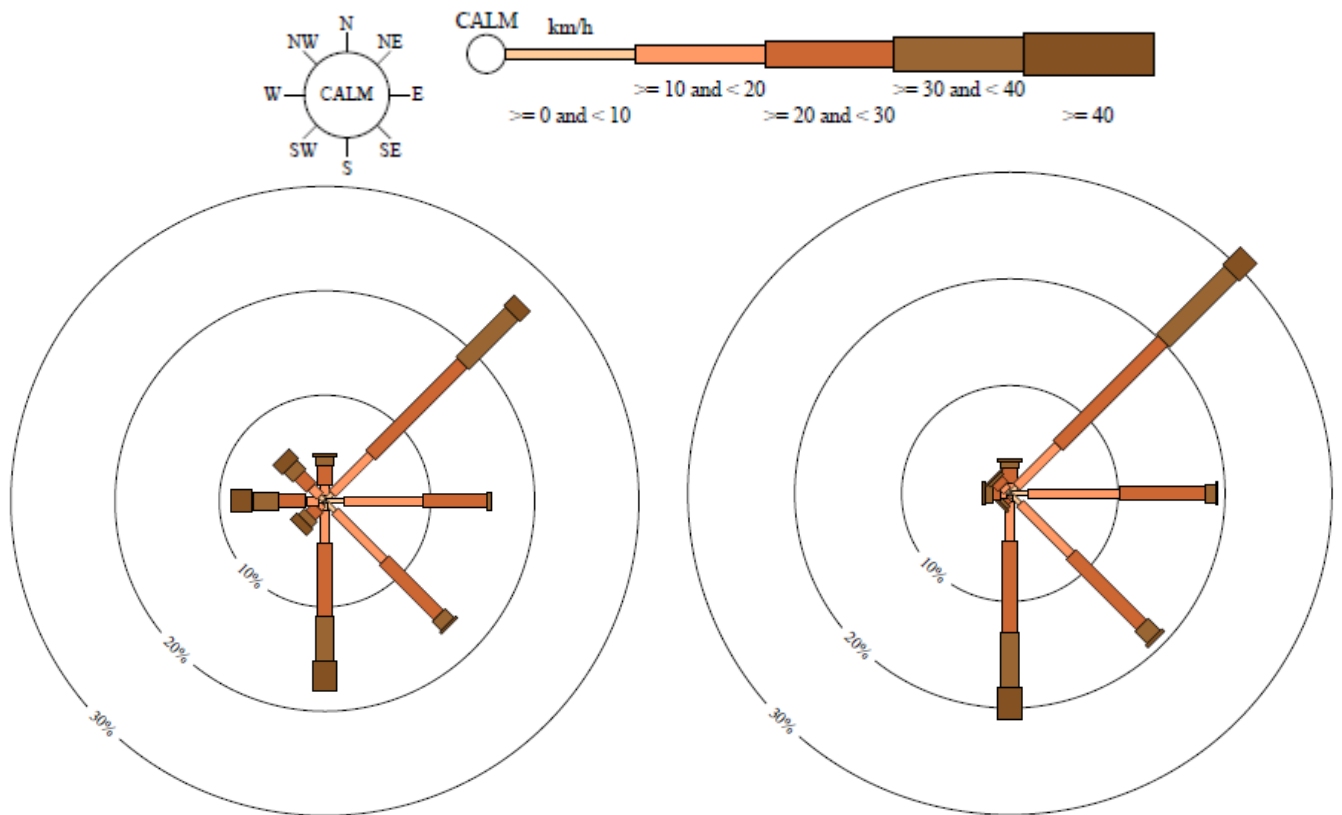


Figure 16: 3pm Wind Rose, Spring (left) Summer (right), 1991 – 2020 Sydney Airport AMO

2.2.2 Potential Bushfire Behaviour and Potential Fire Pathways

Delineation of fire catchments (Figure 18) helps to identify the location and size of potential fire runs and therefore bushfire attack scenarios for different locations within the subject site. This informs assessment of the risk profile across the site, with exposure to larger fire catchments generally resulting in an elevated bushfire risk.

The primary fire catchment influential to the site is situated to the northeast, where forest and tall heath vegetation predominate in Kamay National Park. To the west a smaller fire pathway is present along the foredune. Within the site, biodiversity objectives mean revegetation will result in smaller fire pathways, with some but limited connection to off-site fire pathways. In response, the provision of extended APZs are recommended in strategic locations to mitigate the potential for and severity of any fire spread to the site, particularly that from the east. Additionally, managed setbacks from key evacuation routes have been recommended to achieve a maximum of BAL-12.5 exposure along the primary east-west evacuation route connecting precincts.

Whilst each bushfire event is different, fire spreads by responding to changes in fuel, terrain, and weather conditions. It is generally anticipated that a potential fire within the study area and surrounds, would spread more quickly and have the potential for higher intensities when:

- Burning under the influence of hot, dry and gusty westerly influenced winds;
- Burning in Kamay National Park with strong easterly winds;
- Moving upslope in the steeper vegetated areas of adjacent NPWS lands to the east of the site.

There are existing advantages to fire mitigation in the landscape, and further advantages can be achieved by the provision of appropriate bushfire protection measures within the subject land. In particular, the subject land and proposed site layout can facilitate enlarged APZ's in strategic locations while meeting biodiversity objectives, coupled with safe emergency access and egress.

2.2.3 Fire History

The Sutherland Shire BFRMP (SSBFMC 2016) identifies the main sources of ignition in the BFMC area as:

- Human activity, both deliberate and accidental;
- Occasional lightning strikes, although considered a rare source of fire as most are associated with rainfall.
- Training activities carried out in Department of Defence lands, however given the study area is not located in proximity to Defence Lands, this is not considered a potential ignition source influential to the site.

According to the BFRMP, there are on average 20 bush and grass fires each year, with the average interval of these fires progressing into a significant bushfire being 5 to 7 years. The severity of the fires within a given fire season are primarily affected by drought conditions and other weather conditions related to increased fire danger.

Figure 19 and Figure 20 shows the fire history and fire frequency within the broader study area, with mapping compiled from unplanned fire events (wildfire) since 1965 (NPWS, 2023). As shown, most fires have occurred within the National Park estate to the north and east and some spreading to the Park

boundary, indicating the need for considered bushfire mitigation along this interface, as contemplated (Section 3). Of note, no fires of any size have been recorded to the north and west of the site.

Whilst this data may not contain all bushfires, it does indicate that there have been very few areas outside of the National Park estate that have been subject to repeated wildfire (Figure 20). The recommendation for an enlarged APZ for the eastern interface (Section 3.2.1) will provide significant bushfire mitigation for the whole site and specifically Stage 3 of the development. This enlarged APZ will provide a significant fire attenuation zone resulting in a significant reduction in radiant heat exposure. It will also serve to significantly reduce the likelihood of fire penetration into the site and specifically any fire spread to other areas proposed for development.

2.3 Existing Risk Mitigation

As discussed above, the Kurnell Peninsula is within the Sutherland Shire BFRMP area. While under review, it is noted that the broader Kurnell Peninsula has not been identified as a focus area in the draft Sutherland BRMP (currently on exhibition) (Sutherland Shire BFMC, 2023). The draft plan identifies seven focus areas, determined through an analysis of the quantitative risk assessment data, and with consideration to social vulnerability of the community, access and egress. While this is unlikely to have considered potential future development in the Kurnell Peninsula, it does indicate that existing risk profile of the Kurnell peninsula is not considered significantly elevated. The existing plan (Sutherland Shire BFMC, 2016) identifies various assets within proximity to the site for management (Figure 21).

National Park Estate to the east of the site is also managed by NPWS, with a Fire Management Strategy established for Kamay National Park in 2009. Identified in this strategy are existing mitigation measures and hazard reduction activities (Figure 22). This includes the provision of existing asset protection zones adjacent to the fuel terminal, and also adjacent to Carbon Black land, located northeast of the site. Immediately adjacent to the east of the site is a fire management trail, managed by NPWS, providing firefighting access between the National Park and the proposed development.

2.4 Summary of landscape bushfire risk assessment

The landscape bushfire risk analysis indicates there is potential for bushfire attack on the site from the hazard within the broader study area given the presence of and continuity of the site with BFPV in adjoining areas.

The potential for bushfire attack from the north is considered unlikely, given the predominance of saline vegetation. While foredune vegetation is present to the south, south-west and west, there is a reduced extent of the fire catchment and pathway from these directions, and it is not considered highly fire prone, with no history of bushfire recorded.

The consolidated hazard to the northeast within Kamay National Park presents as the largest fire catchment that may result in fire spread to the site. To provide added resilience to the site for a potential fire that may approach from the northeast, enlarged APZs far beyond the PBP minimum APZs, have been recommended and are feasible on the site. The Masterplan layout provides for PBP minimum APZs for the proposed development area and then an additional APZ area managed to the eastern property boundary. This additional APZ area responds to the bushfire risk from adjoining lands and allows for the residual risk of the development to be reduced to a significantly low level. In particular, along the eastern boundary, the additional recommended APZ would result in a total managed area east of Stage 3a and

3b that ranges from a minimum of 107 metres to maximum of 180 metres. The provision of this additional APZ reduces the radiant heat flux to 2.5 kW/m² for residential development and 3.73 kW/m² for SFPP development (modelled using a 1200K flame temperature), a 91% and 62% reduction respectively¹. The additional eastern APZ thus provides an enormous lessening of residual risk from the primary bushfire attack direction. This also results in a Bushfire Attack Level (BAL) reduction to BAL-12.5 for all development, and most development in fact being exposed to only BAL-Low. This far exceeds the PBP requirement of BAL-29 for residential development.

As an additional design redundancy, the weather analysis detailed in Section 2.2.1 indicates that the maximum FFDI from this direction will be 45% less than the FFDI 100 adopted by PBP, meaning that the any bushfire attack will be less severe than the policy setting adopted by PBP.

Based on this assessment and the provision of required and recommended additional bushfire protection measures, discussed in Section 3.2, the residual risk of the site is not considered inappropriate for development of the typologies contemplated.

¹ AS3959 Method 2 radiant heat flux modelling undertaken using Tall Heath, 10° downslope and 1050K and 1200K flame temperature for residential and SFPP development respectively. PBP minimum APZs (20m for residential and 61m for SFPP) were modelled and compared to the radiant heat from a minimum total setback of 107m.



Figure 17: FFDI Sectors within 5km buffer of the Site

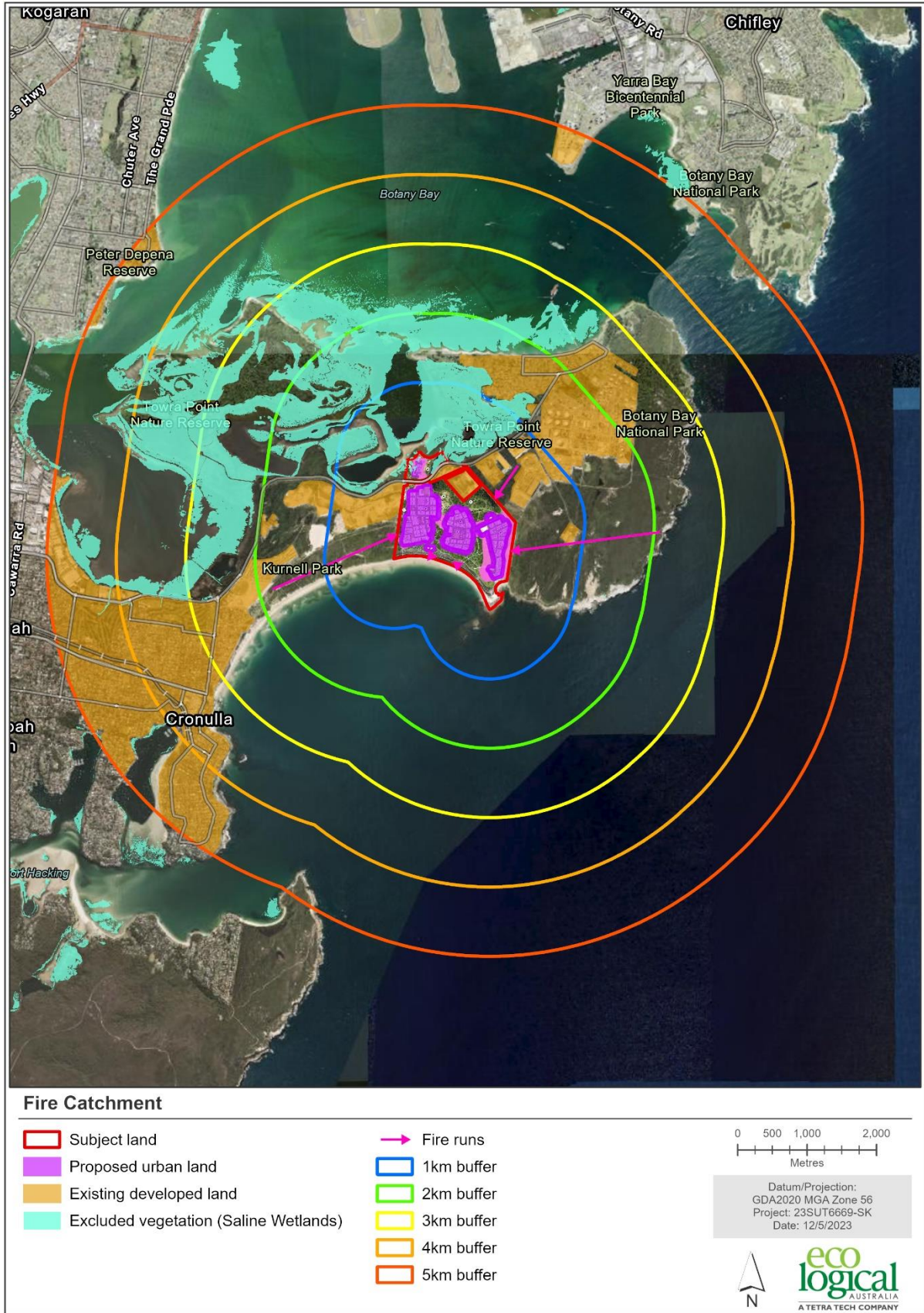


Figure 18: Fire Catchments

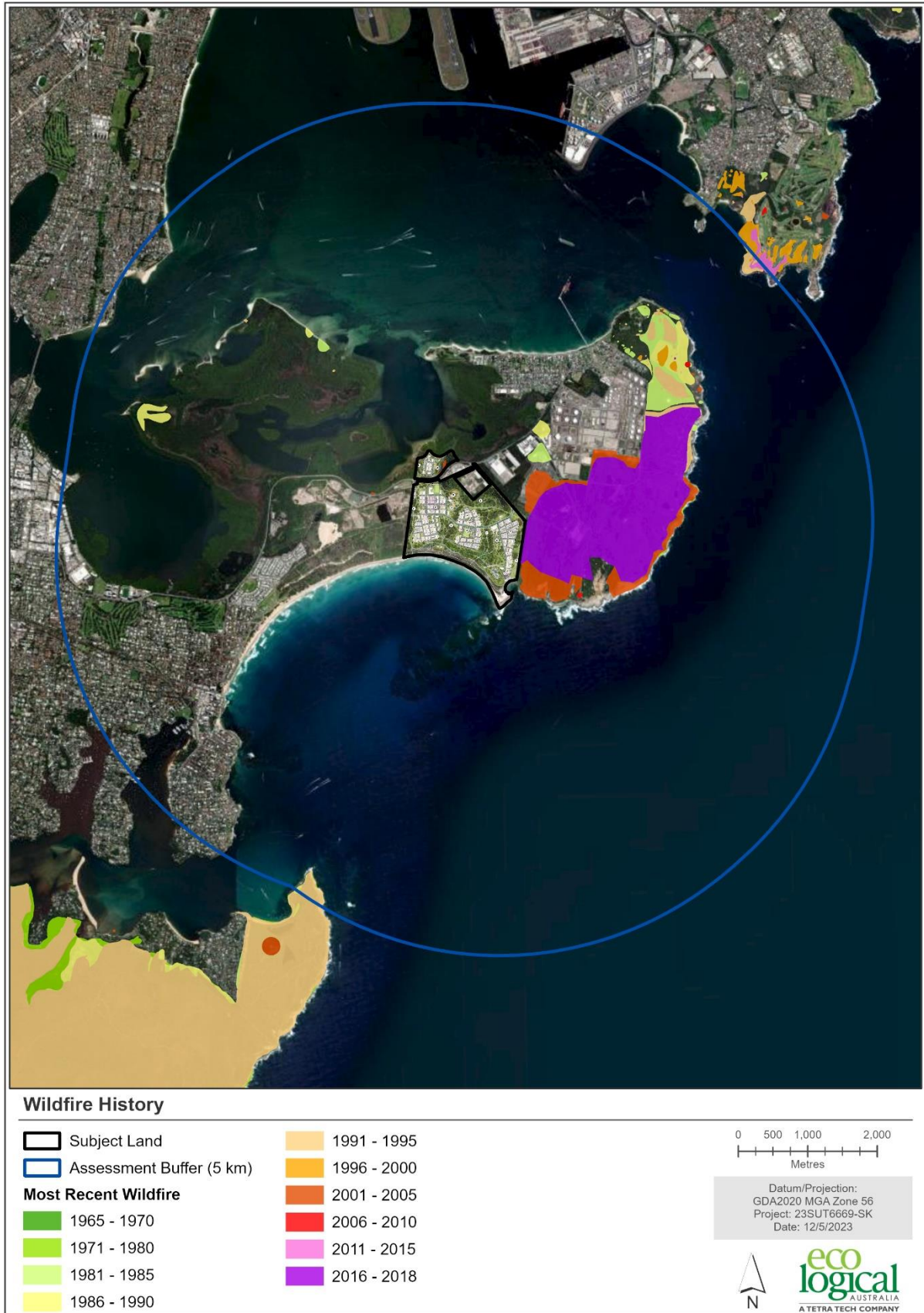


Figure 19: Wildfire history in the study area since 1965 (NPWS, 2023)



Figure 20: Wildfire frequency in the study area since 1965



Figure 21: Extract from the Sutherland Shire BFRMP 2015 – 2020 (SSBFRMC, 2016)



Figure 22: Extract from Kamay NP Fire Management Strategy (NPWS, 2009)

3. Land Use Assessment

The *EP&A Act* and the *RF Act* are the primary legislative instruments relevant to bushfire planning for the site. PBP is called upon by these Acts as the subject land is mapped as bush fire prone land, and it is a critical guide in assessing the bushfire risk suitability of the proposal.

PBP (RFS 2019) outlines broad principles and assessment considerations for strategic planning. It also specifies that bushfire protection measures need to be considered at the strategic planning stage to ensure that the future development can comply with PBP (as specified in Chapters 5-8 of PBP 2019).

The aim and objectives of PBP (RFS 2019) below provide additional guidance for land use assessment within a Strategic Bushfire Study:

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

The objectives are to:

- i afford buildings and their occupants protection from exposure to a bush fire;*
- ii provide for a defensible 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 bush fire protection measures; and*
- vi ensure that utility services are adequate to meet the needs of firefighters.*

3.1 Risk Profile

The feasibility of the proposal to comply with the bushfire protection measures identified within PBP is a fundamental consideration of the study. Whilst bushfire protection measures and their performance requirements are a benchmark for approval of a development, a strategic level study needs also to evaluate these measures within the landscape risk context. This Study has therefore considered the:

- The bushfire landscape risk context in consideration of the protection measures for future development and their potential adequacy;
- The type/s of development proposed, and their suitability given the bushfire risk context;
- The pattern and potential bushfire resilience of the bushland interface; and
- Potential cumulative risk associated with proposed development in the locality.

The feasibility of the subject land to provide for APZ, a key bushfire protection measure, is assessed in the following section. This is followed by an evaluation of the proposed land uses.

3.2 Feasibility of Asset Protection Zones

Based on the bushfire hazard assessment, an initial assessment of the feasibility of PBP compliant APZs has been undertaken. The indicative APZ requirements are shown in Figure 23 which includes the

minimum dimensions required by the Acceptable Solutions of PBP for residential development (i.e. 29 kW/m²) and SFPP development (i.e. 10 kW/m²).

- All APZs can be contained within the developable area of the subject site.
- All APZs will occur on land exhibiting a slope less than 18 degrees in compliance with PBP.
- Additional APZs recommended by ELA (see Figure 23 and Section 3.2.1) are afforded in the Masterplan and provide a significantly lower residual risk outcome to the development.
- The addition or rehabilitation of any vegetation within the site (such as for unmanaged public open space and corridors) will influence APZ requirements. ELA has assessed the current plans for onsite vegetation (GroupGSA, 2023) and accounted for it in the indicative APZ assessment and mapping.
- APZs should be reviewed based on final site topography.

3.2.1 Improved Risk Mitigation Outcomes

The provision of bushfire protection measures based on the acceptable solutions of PBP can be readily achieved by the Masterplan. The provision of additional APZ management as identified in Figure 23 and Table 5 below will result in the following risk mitigation outcomes that exceed the policy setting of PBP:

- Reduced radiant heat exposure, which for Stage 3a and 3b is a 91% for residential and 62% for SFPP development, with a maximum of BAL-12.5, reduced from BAL-29 for residential.
- Restriction of fire spread to and through the site, particularly from the east, being the largest and more likely fire catchment.
- Mitigation to the key egress routes, through the provision of APZ's that will result in a maximum heat exposure of BAL-12.5.
- Low risk development outcomes (BAL-Low) for the majority of the developable area.
- Capacity for onsite refuge locations that can meet or exceed built NSP requirements.

These outcomes result in a considerable reduction in residual risk, achieving a level of bushfire protection that far exceeds the current PBP policy setting.

Table 5: Indicative APZs Applicable to the Proposed Development

| Stage | Direction | Slope | Vegetation Formation ¹ | Residential APZ ² | SFPP APZ ² | Additional Recommendation | Additional Outcome |
|-------|------------------|---------------|-----------------------------------|------------------------------|-----------------------|-----------------------------------|--|
| 1A | N, E, W | N/A | Estuarine Vegetation | N/A | N/A | 12 m APZ | Separation for firefighting purposes. |
| | SE | 0-5 downslope | Tall Heath | N/A | N/A | | |
| | SW (access road) | 0-5 downslope | Tall Heath | | | 36 m APZ adjacent to access road. | Maximum BAL-12.5 exposure for evacuation route to Captain Cook Drive |
| 1B | E | 0-5 downslope | Forest | 29 | 79 | | |
| | S | 0-5 downslope | Tall Heath | 18 | 56 | | |

| Stage | Direction | Slope | Vegetation Formation ¹ | Residential APZ ² | SFPP APZ ² | Additional Recommendation | Additional Outcome |
|-------|------------------------------|------------------|-----------------------------------|------------------------------|-----------------------|--|--|
| 2 | W | 0-5 downslope | Tall Heath | 18 | 56 | | |
| | SW | 0-5 downslope | Tall Heath | 18 | 56 | Additional APZ recommended for refuge building | Capacity to meet NSP radiant heat exposure guidelines based on maximum exposure of 10kW/m ² (FDI120) requirement. |
| | NW | 0-5 downslope | Tall Heath | 18 | 56 | | |
| | NE | 0-5 downslope | Forested Wetland | 12 | 42 | | |
| 3 | SE (primary E-W access road) | 0-5 downslope | Forest | | | 54 m APZ adjacent to E-W access road | Maximum BAL-12.5 exposure for evacuation route to Captain Cook Drive |
| | E, S | 0-5 downslope | Forest | 29 | 79 | | |
| | NW, N | 0-5 downslope | Forest | 29 | 79 | Additional APZ recommended for road connection and for refuge building | Capacity to meet NSP radiant heat exposure guidelines based on maximum exposure of 10kW/m ² (FDI120) requirement. |
| 4 | NE, E, SE | 5 - 10 downslope | Tall heath | 20 | 61 | Additional APZ recommended for increased resilience | BAL-Low exposure |
| | S, SW | 0-5 downslope | Tall Heath | 18 | 56 | Additional APZ recommended for refuge building | Capacity to meet NSP radiant heat exposure guidelines based on maximum exposure of 10kW/m ² (FDI120) requirement. |
| | W | 0-5 downslope | Forest | 29 | 79 | Additional APZ recommended for increased resilience | Low risk development outcomes (i.e. BAL-Low exposure) and maximum BAL-12.5 exposure for evacuation route to Captain Cook Drive |
| | N, W | 0-5 downslope | Tall Heath | 18 | 56 | | |

| Stage | Direction | Slope | Vegetation Formation ¹ | Residential APZ ² | SFPP APZ ² | Additional Recommendation | Additional Outcome |
|-------|-----------------------------|---------------|-----------------------------------|------------------------------|-----------------------|--|--|
| 5 | N | 0-5 downslope | Tall Heath | | | 36 m APZ adjacent to access road to Captain Cook Drive | Maximum BAL-12.5 exposure for evacuation route to Captain Cook Drive |
| | N, E, S, W | 0-5 downslope | Forest | 29 | 79 | | |
| | E (primary E-W access road) | 0-5 downslope | Forest | | | 54 m APZ adjacent to E-W access road | Maximum BAL-12.5 exposure for evacuation route to Captain Cook Drive |

¹ Vegetation assessment based on offsite hazard and future onsite hazard as presented in Landscape Strategy (GroupGSA 2023)

² Assessment according to Table A1.12.1 (SFPP)/A1.12.2 (residential) of PBP 2019.



Figure 23: Indicative Asset Protection Zones

3.3 Land Use Evaluation

Future development on BFPL will need to satisfy the performance criteria identified in PBP for various land uses. At masterplanning, it is expected that future land uses enabled by the proposal can accommodate the acceptable solutions identified in PBP to minimise reliance on performance solutions at the DA stage. A summary of these requirements is outlined below and evaluated for the Masterplan in Table 6.

Under the planning pathway identified in PBP and as legislated, the CDC pathway is not possible for subdivision, SFPP development and where the acceptable solutions of PBP cannot be met. Therefore, it is expected that a variety of future land uses will be assessed against the requirements of PBP following the DA pathway.

3.3.1 Residential Subdivision

Mixed-use residential development is envisaged for much of the masterplan, and therefore it is anticipated that future residential land uses will be subject to the requirements outlined in Chapter 5 of PBP. Following Masterplan approval and as part of the DA process, future development will need to demonstrate compliance of the proposed subdivision with PBP requirements. The following provisions will need to be considered:

- Provision of compliant APZs;
- Access and egress within the developable land and along the adjoining public road system shall include safety provisions for attending emergency service vehicles and evacuating residents;
- Future subdivision design shall include perimeter roads separating developable lots from hazardous bushland areas;
- Access is to be ensured for maintenance of APZ and other fire mitigation activities;
- Firefighting water supply; and
- Provision of access and infrastructure requirements according to Table 5.3b of PBP.

3.3.2 SFPP Development

Special Fire Protection Purpose (SFPP) provisions will be applicable to future uses such as childcare centres, tourist accommodation, education facilities, seniors living, and any other development specified as SFPP under s.100B (6) of the RF Act or Section 46 of the RF Reg. These developments would need to meet the criteria outlined in Chapter 6 of PBP including:

- Increased APZ setbacks as per A1.12.1 of PBP
- Provision of a Bush Fire Emergency Management and Evacuation Plan; and
- Provision of suitable access and utilities according to Tables 6.8a-c of PBP.

These provisions are applicable when seeking the above land uses and will be addressed at future DA stage.

3.3.3 Multi-storey Residential Development

Residential buildings exceeding three storeys in height are considered to be multi-storey buildings by PBP and are required to comply with the performance criteria within Chapter 5, including the requirement for an APZ which meets a threshold of 29 kW/m². In addition, the following issues need to be considered as per Table 8.2.2 of PBP.

- Higher residential densities for evacuation
- Avoiding locating high rise buildings in higher elevations or on ridge tops;
- Increased demand on road infrastructure during evacuation;
- Higher external façade exposed to bushfire attack;
- Additional fuel loading from car and storage facilities;
- Potential for balconies and external features to trap embers and ignite combustible materials;
- Increased exposure to convective heat due to height.

3.3.4 Commercial and Industrial Development

As per the National Construction Code (NCC) building classification system (Buildings of Class 5 to 8 under the NCC) such as offices, shops, factories, warehouses, and other commercial or industrial facilities on BFPL have no specific bushfire requirements, and as such *Australian Standard AS 3959-2018* and the *National Association of Steel-framed Housing (NASH) Standard 'Steel Framed Construction in Bushfire Areas 2014'* (NASH, 2014) are not deemed to satisfy (DTS) provisions. However, such developments still need to meet the aims and objectives of PBP and consider the following:

- Provision of appropriate APZ / defensible space;
- Provision of safe access to/from the public road system for egress and evacuation;
- Provision of suitable emergency and evacuation arrangements for occupants;
- Provision of adequate water supply to protect the building, and the location of gas and electricity supplies so they do not contribute to the bushfire risk; and
- Provision for the storage of hazardous materials away from any hazards.

In meeting the objectives of PBP, these developments can apply the APZ requirements for residential. General access and infrastructure requirements listed in Table 7.4a of PBP should also be considered. Where future mixed-use development includes residential development, the bushfire protection measures requirements outlined in Chapter 5 of PBP (for subdivision) will apply. Where future mixed-use development includes SFPP uses, bushfire protection measures should be consistent with the provisions outlined in Chapter 6 of PBP.

3.3.5 Section 8.3.11 – Public Assembly Buildings

Where a public building has a floor space greater than 500 m² it may be considered an assembly building, and due to the evacuation of a large number of people, this type of development is generally treated as SFPP. This could include future community and recreation facilities. To meet SFPP requirements, future developments of this nature on BFPL would need provisions for APZs that meet a maximum Radiant Heat Flux (RHF) of 10 kW/m² and a construction standard of BAL-12.5, along with other requirements as per Section 4.1.2.2.

3.3.6 Section 6.3.1 – Specific Tourism Uses

There are some specific tourism uses where PBP permits variance from the standard SFPP requirements. Therefore, further bushfire protection assessment is required at development application stage, with consideration to Section 6.3 (Objectives for specific uses) and Table 6.8 (Performance criteria and acceptable solutions for SFPP development) of PBP, which prescribes specific performance criteria related to eco tourism. For example, cabins must be located within 100 m walking distance of a refuge building and detailed design will need to consider water supply, access and landscaping, including

consideration to design of service tracks to meet PBP access requirements. Also required is the preparation of a Bushfire Emergency Management and Evacuation Plan with triggers for closure on days of elevated fire danger rating and procedures for reactive closure and evacuation.

3.4 Summary of Land Use Evaluation

Table 6 below provides a summary of the land use evaluation for the differing development types contemplated by the masterplan.

The location and type of land uses proposed are considered appropriate for the site, given the level of landscape bushfire risk, the nature of the subject land, the characteristics of the land uses, the bushfire protection measures as well as the additional bushfire resilience measures to be provided.

Table 6: Future land use evaluation

| Development Type | Suitability |
|---|---|
| Residential Subdivision | Preliminary analysis indicates differing residential typologies can comply with PBP. Provision of required and recommended APZs will result in low-risk development outcomes for residential development |
| SFPP Development | Requirements for SFPP development have been considered and suitable locations for this typology selected within the masterplan. All SFPP development will be afforded the minimum required SFPP APZ and additional APZ areas have been recommended in strategic locations for increased resilience. |
| Buildings of Class 5 to 8 under the NCC /Section 8.3.10 Commercial and Industrial Development | PBP does not prescribe specific requirements, however the aims and objectives of PBP can be achieved for future land uses. Where ground floor retail occurs in conjunction with residential development, then PBP requirements for residential development should apply. |
| Public Assembly Buildings | Requirements for public assembly buildings to trigger SFPP development have been considered and they can be afforded suitable SFPP APZ and other bushfire protection measures. These matters have been specifically considered around tourism areas and the urban centre where such facilities are anticipated. |
| Multi-storey Residential Development | Future multi-storey residential development is feasible outside of the 29 kW/m ² APZ. Enlarged APZs and other relevant considerations can be addressed at detailed design phase, to provide low risk outcomes for future multi-storey development. Future development of this type will also need to ensure the detailed design complies with the requirements in Section 8.2.2 of PBP. |
| Specific Tourism Uses | Requirements for eco tourism have been considered and the locations proposed within the Masterplan are not considered unsuitable, subject to the provision of a refuge building. Provision of a refuge building with a compliant setback not exceeding 10kW/m ² is considered achievable and along with other refuge options and the additional recommended APZs will facilitate increased resilience. |

3.4.1 Staging

It is assumed that more detailed design work will be undertaken to ensure appropriate staging and implementation, in order to meet or exceed the requirements of PBP. It is achievable for each stage to support the bushfire protection measures (e.g. APZs, access and egress, emergency management) required for varied typologies, without reliance on adjoining areas. However, temporary APZs, access and egress options and emergency management arrangements, should be considered to ensure all stages are afforded adequate bushfire protection measures, until full site development is completed.

4. Access, Egress and Evacuation

Key to this study is the strategic planning criteria as outlined in Chapter 4 of PBP, which requires consideration to the provision of adequate infrastructure for emergency evacuation and firefighting operations. This includes:

- Capacity of the proposed road network for evacuating residents and responding emergency services, based on the existing and proposed community profile;
- The location of key access routes and direction of travel and; and
- The potential for development to be isolated in the event of a bushfire.

These aspects are considered in the sub sections that follow including a detailed overview relating to the delivery of key road infrastructure to support evacuation as Release Areas are activated.

4.1 Access

With the exception of Stage 1A, the Masterplan provides three access/egress points to Captain Cook Drive for all other stages, and an internal road network that provides connections to each of these points (Figure 24). This exceeds the minimum requirements of PBP.



Figure 24: Proposed Road Infrastructure Network (Source: SCT, 2023)

It is understood that Captain Cook Drive will be duplicated (enlarged to 4 lanes) to ensure the capacity of the external road network is sufficient to service the proposed development and existing community.

Traffic analysis undertaken by SCT (2023) indicates that this duplication will facilitate a network that has spare capacity, even with consideration to existing users and proposed users following addition offsite development (Figure 25).

With regard to Stage 1A, it is located in a very low risk landscape setting, which is very unlikely to be exposed to bushfire attack. Furthermore, the access/egress point to Captain Cook Drive will be surrounded by APZ/managed land to ensure that road users would not be at risk during access or egress. It is considered very low risk given it primarily abuts low threat saline 'excludable' vegetation to the north and east. To the west is a pocket of disturbed vegetation classified as Tall Heath but wedged between estuarine vegetation and Captain Cook Drive and therefore not connected to other BFPV that could provide a significant fire run.

Whilst the Masterplan provides a design compliant with PBP, one additional road connection (between the precincts of Boat Harbour south and Bate Bay south) has been identified for investigation (Figure 26) as planning progresses, and in order to provide even greater site resilience.

4.1.1 Perimeter Access

The Masterplan provides for perimeter roads adjacent to all hazards, which meet the requirements set out in Table 5.3b of PBP. As planning progresses, the design of these perimeter roads to the required dimension as per Table 5.3b should be provisioned (e.g. 8 meter carriageway with parking outside).

Future development applications will need to address all access requirements in more detail as per PBP 2019 (see Table 11 Appendix A) including the provision of:

- A road design that facilitates the safe access and egress for residents and emergency service personnel, including multiple access/egress options for each area; and
- A road design with adequate capacity to facilitate satisfactory emergency evacuation.

4.1.2 Staging of Road Infrastructure

As part of development planning, the delivery of the road network should be considered for staged development. At all stages, multiple access routes for evacuation and egress should be provided, with access to Captain Cook Drive achievable in more than one location. If required, the provision of temporary access roads should be considered during staging.

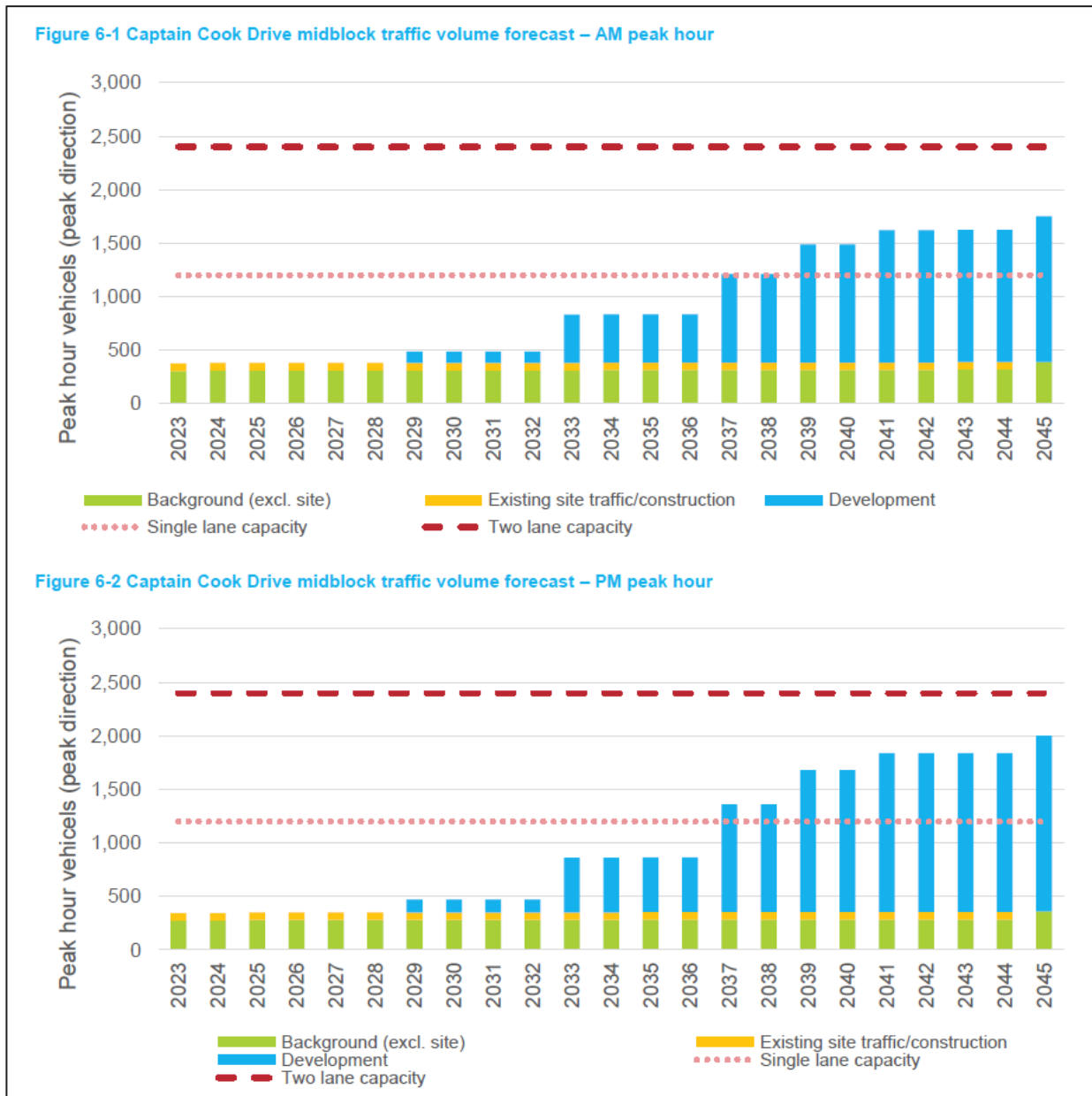


Figure 25: Network capacity following duplication (Source: SCT, 2023)

4.2 Evacuation

While the risk of a significant bushfire necessitating the need for evacuation of the site in its entirety is very low, it is nevertheless important that strategic planning affords the provision of multiple options for evacuation. The planned development of precincts and the duplication of Captain Cook Drive provides an opportunity to increase community resilience to bushfire. Planned development should ensure provision for:

- Early offsite evacuation with multiple options;
- Safe on-site refuge capacity;
- Low risk development outcomes.

These aspects are discussed below in relation to the proposed development contemplated by the masterplan, with consideration to traffic modelling undertaken by SCT (2023).

The implementation of recommendations of additional asset protection zones to achieve a maximum of BAL-12.5 radiant heat exposure along the primary internal evacuation route will mean it is very unlikely that the primary egress route to Captain Cook Drive would be impacted.

4.2.1 Early Offsite Evacuation

Evacuation is a necessary component of bushfire planning for the protection of life. Masterplanning should include adequate provision to support offsite evacuation. Key considerations for offsite evacuation are:

- Early offsite evacuation is critical, with late evacuation considered unsafe;
- Evacuation should occur away from (or across and well before) the path of a fire, but not towards it;
- The road must be suitable to use in an emergency situation;
- Intervention by emergency services should not be relied on for road control or other activities.

Key evacuation route options are shown in Figure 26. While there is potential for fires to start external to the site, or from within the site, the potential for any fire scenario to cut off all evacuation routes is considered extremely unlikely. There are multiple internal access routes through the site to Captain Cook Drive, and once on Captain Cook Drive, there is opportunity to evacuate in an easterly or westerly direction, ensuring that evacuation away from the passage of fire is possible.

Captain Cook Drive itself is considered very unlikely to be cut by fire and given the capacity afforded by the duplication proposed, is anticipated to provide a very reliable evacuation option. Given the predominance of saline vegetation to the north of Captain Cook Drive, it is unlikely that fire would initiate and impact road use in both directions. Similarly, while fire is possible to the west of the site, there is considerable fragmentation between the coastal foredune and Captain Cook Drive, with existing development and industry present, thus significantly hindering the chance of fire spread and impact on the road, particularly that which would affect both directions. Fire spread from this direction would also require a very large wind direction change to the southeast, in order for fire spread towards the road. This is an extremely unlikely scenario. Similarly, while potential fires are more likely to initiate in Kamay National Park (Section 3.4) south easterly winds would be required for a fire to spread and impact Captain Cook Drive. Significant fire development under these conditions is less likely, and fire spread would be interrupted by existing development (i.e. Desalination plant, warehouses and bulky goods facilities). Thus Captain Cook Drive is unlikely to be cut by fire from this direction, but further, the site provides two alternative directions for egress should they be needed.

A key recommendation of this study is the provision of managed land /APZ adjacent to the primary east-west internal evacuation route (Figure 23) to ensure a maximum heat exposure of BAL-12.5 is achieved thus facilitating safe usage of this route. This measure also provides added mitigation against the potential for internal fire spread to impact access to Captain Cook Drive. Further, additional APZs have been recommended around the main site access points to ensure safety of egress onto Captain Cook Drive. The masterplan can afford these additional mitigation strategies.

Initial traffic modelling (STC, 2023) indicates timing for evacuation along Captain Cook Drive for the residential and employment population, based on an assumed vehicle occupancy of 3.5 people and a lane capacity of 1200 vehicles per hour. Single lane egress (based on the assumption that one lane is occupied by evacuating Kurnell residents) is between 1.6 and 2.2 hours (STC, 2023).

Further analysis should be undertaken to consider onsite timings and ensure capacity for early offsite evacuation is feasible during staging, key to this is the recommendation by SCT around the timing of the Captain Cook Drive widening, which is envisaged to occur alongside Stages 2 and 3, to ensure there is capacity for offsite evacuation as the site is activated, along with accommodating the existing Kurnell Village.

Table 7: High Level Evacuation Time Estimates of traffic movement along Captain Cook Drive (Source: SCT, 2023)

| Population component | Total Population | Day evacuation | | | Night evacuation | | |
|----------------------|------------------|----------------|--------------|--------------------------------|------------------|--------------|--------------------------------|
| | | Pop . onsite | Eqv. cars | Minimum clearance time (hours) | Pop . onsite | Eqv. cars | Minimum clearance time (hours) |
| Residents | 8,456 | 4,875 | 1,446 | - | 8,456 | 2,416 | - |
| Employees | 2,048 | 2,048 | 585 | - | 922 | 263 | - |
| Total | 10,504 | 6,922 | 2,031 | 1.6 | 9,378 | 2,679 | 2.2 |

While full site evacuation has been considered and is provided for by the site layout and road network, five on-site refuges have been identified within the masterplan (Section 4.2.2). These refuges have been positioned such that there is a refuge within a 10-minute walk of all the buildings and other public open spaces.

During the initial phase of the project (Stage 1A only) the development minimum clearance time is less than half an hour even if only 25% of Captain Cook Drive capacity is available to the project. With the opening of Stage 1B, the minimum clearance time remains below 1.5 hours if approximately 50% of Captain Cook Drive capacity is available for a westbound evacuation towards Cronulla. For an eastbound evacuation to Kurnell Peninsula, the minimum clearance time is less than 1 hour (based on the 100% availability scenario).

Given the proximity of Stage 1A to Captain Cook Drive, and the distance from any significant hazard, it is expected that early offsite evacuation would be feasible. For Stage 1B, the provision of a minimum of two access points to Captain Cook Drive should be the priority for staged activation, along with the secondary option of on-site refuge, as discussed below.



Figure 26: Potential Evacuation Routes

4.2.2 Capacity for Safe Onsite Refuge

Whilst early offsite evacuation will always be the safest option, research into past bushfire incidents reveals that multiple and varying evacuation and refuge options should be provided to the community (Blanchi et al. 2015, Whittaker 2019). Provision of safe onsite refuge locations is particularly important to support community resilience under rapid onset bushfire attack scenarios, where offsite evacuation may not be able to be undertaken or is unsafe. The provision of onsite safe refuge locations would also reduce the demand for offsite evacuation, particularly unsafe late offsite evacuation.

Consideration of onsite refuge capacity afforded by the Masterplan layout and development types contemplated, reveals that there will be significant opportunity for the provision of safe refuge within buildings onsite. This can be formalised through the provision of Neighbourhood Safer Places (NSP's). Typically, NSPs provide a temporary safer place and can be a *building or an open space that may provide for improved protection of human life* (RFS 2017) should they be needed if early off-site evacuation has not occurred.

The Masterplan provides for a minimum of six potential refuge building locations, associated with tourism development, future potential education facility and commercial development. These locations have been tested for suitability based on the application of NSP setback requirements from the adjacent hazard (Figure 27). While these locations are expected to evolve as planning progresses, a key outcome for this study is demonstration for multiple refuge locations at all stages of development activation within the southern precinct of the site. As demonstrated by the SCT study (SCT, 2023), indicative locations are within a 10-minute walk of all the buildings and other public open spaces. It is also understood that potential to provide a facility for the State Emergency Service on the site is being considered.

The criteria and principles for NSPs (RFS 2017) are included in Appendix B. As NSPs are approved by the NSW RFS and inspected by the regional Bush Fire Management Committee (BFMC), it is recommended that future planning includes consultation with the BFMC, should formalisation of these onsite refuge building opportunities be confirmed by the consent authority.

Table 8: Potential locations for offsite evacuation

| | Type | Location | Distance | Travel Time* | Direction |
|---------------------------------------|------------|--------------------------------|----------|--------------|------------|
| Neighbourhood Safer Places | | | | | |
| Marton Oval | Open Space | Captain Cook Drive, Kurnell | 2.6 km | 3 minutes | North-East |
| Town Centres | | | | | |
| Cronulla CBD | N/A | The Kingsway, Cronulla | 5.6 km | 7 minutes | South-West |
| Woolooware Bay Shopping Centre | N/A | Captain Cook Drive, Woolooware | 6.2 km | 7 minutes | West |

4.2.3 Low Risk Development Outcomes

In combination with the capacity for early off-site evacuation and capacity for safe on-site refuge, the risk level of the proposed development outcomes across the site warrants consideration with respect to evacuation demand. Figure 28 maps a 100 m buffer from the bushfire hazard interface based on the

Masterplan proposed, with 100 m being the statutory distance that bushfire protection measures are applied to development via PBP and AS 3959 (i.e. bushfire prone land). Following the application of required and recommended APZs, a large proportion of the planned development will be greater than 100 m from the closest bushfire hazard and thus not considered bushfire prone land and as a result is not expected to be exposed to significant bushfire attack.

As such, the developments and occupants located greater than 100m from the hazard will only be exposed to a low risk from bushfire and one which diminishes with distance from the hazard. Given this, the evacuation or refuge need is primarily considered to be those occupants within 100m of the bushland hazard interface. When the evacuation or refuge need is considered in this light, it is clear that the Masterplan can result in low bushfire risk outcomes. Further, that the evacuation and refuge capacity is a very conservative response to the risk, and affords a bushfire resilient design.

4.3 Emergency Services

The following is recommended for strategic land use planning to achieve the objectives and strategic planning principles of PBP 2019 relating to emergency management. Strategic emergency management planning is undertaken in collaboration with emergency service organisations within the strategic land use planning process, to establish preferred future outcomes (i.e. emergency evacuation) that have implications for land use planning, including:

- a. Emergency evacuation planning; and
- b. Evacuation adequacy assessment.

The provision of adequate infrastructure for emergency management will largely be considered as a component of broader planning, and it is recommended that any uplift to the existing provision of emergency services is discussed with the relevant agency.

In regard to existing bushfire firefighting resources, there is currently one RFS brigade within close proximity, based at Kurnell, and additional NSW Fire and Rescue resources stationed Cronulla (Figure 29). It is also noted that any fire commencing within Kamay National Park would be supported by NPWS resources.

4.4 Evaluation of Access, Egress and Evacuation

The assessment detailed herein identifies that there is appropriate capacity for early off-site evacuation, coupled with the robust opportunities for safe onsite refuge. These factors in combination with low-risk development outcomes, is considered to result in a low residual risk to the contemplated development that is not considered to be unsuitable for the site and consistent with the bushfire strategic planning requirements of PBP.

There are considerations for future iterations of staging to ensure adequate collector roads and sub-arterial roads are operational to facilitate access and egress for evacuation, however as traffic modelling demonstrates suitability for the early stages of precinct activation, this is not considered a limiting constraint for staged release areas.

Opportunities to include provision of onsite refuge or the like in perpetuity through planning mechanisms such as Development Control Plans (DCP) can be explored where relevant and practical, as

planning progresses. Planning controls for areas subject to low risk development outcomes, in part generated by the recommended enlarged APZs, should also be considered, to ensure bushfire protection measures (such as perimeter roads, BAL-Construction levels, water infrastructure etc), are not inadvertently made redundant. In addition, there is opportunity to establish a site-wide bushfire emergency management and evacuation plan, which can establish an overall consistent framework and procedures to robustly address this matter.



Figure 27: Potential Locations for Onsite Refuge Buildings



Figure 28: Low Risk Development Outcomes



Figure 29: Fire stations and existing NSPs

5. Infrastructure and Adjoining Land

Future development on the Subject Land will need to meet the applicable requirements of PBP relating to infrastructure provision. The general requirements for development are discussed below and are considered achievable for this site. Specific requirements for SFPP developments and residential subdivision are detailed in PBP and compliance will need to be ensured as design and planning progresses.

Strategic planning requirements seek to identify any potential issues associated with infrastructure and utilities. Key considerations on suitability of infrastructure to meet the requirements of PBP include the ability of the reticulated water system to deal with a major bushfire event in terms of pressures, flows, and spacing of hydrants and life safety issues associated with fire and proximity to high voltage power lines, natural gas supply lines, etc. These aspects are explored below and summarised in Appendix C. Table 5.3 and Table 6.8 of PBP detail the acceptable solution requirements in full.

5.1 Water Supply

Future development will be serviced by a reticulated water supply which is compliant with PBP. Fire hydrant spacing, sizing and pressures should also comply with AS 2419.1 – 2021 *'Fire hydrant installations – Part 1: System design, installation and commissioning'* (SA 2021). Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Fire hydrants should not be located within any road carriageway. All above ground water and gas service pipes external to any buildings are to be metal, including and up to any taps. Where reticulated water cannot be provided a static water supply for firefighting purposes is required on site for each occupied building in accord with the capacities outlined in PBP.

Further detail regarding water supply requirements is detailed in PBP. Acceptable solution requirements for water supply are expected to be achievable for future development within the subject land.

5.2 Electricity and Gas

It is expected that future electricity supply to the Subject Land will be underground where possible and compliant with PBP. If existing or future electrical transmission lines to the subject land are above ground, the following requirements apply:

- 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 line than the distance set out in accordance with the specifications in ISSC3 *'Guide for the Management of Vegetation in the Vicinity of Electricity Assets'* (ISSC3 2016).

While it is understood that the development will not include provisions for reticulated gas supply, should any future development utilise bottled gas, then it is to be installed and maintained in accordance with Australian Standard AS/NZS 1596:2014 *'The storage and handling of LP Gas'* (SA 2014) and the requirements of relevant authorities (metal piping must be used).

Further detail regarding electricity and gas requirements is detailed in PBP. The acceptable solution requirements for these services are expected to be achievable for the future development within the study area contemplated by the Masterplan.

5.3 Adjoining Land

Future development contemplated by the Masterplan should not compromise any offsite bushfire management works. Given the adherence to PBP that is required, any future development should also not require a change to the bushfire management practices for retained and/or adjoining bushfire prone vegetation. Additionally, there is capacity for all APZ's to be wholly within the Subject Land or provided by public roads. Therefore, there are no concerns regarding the impact of the proposal on adjoining land.

6. Evaluation

This section evaluates the proposal, against the bushfire strategic planning requirements of PBP and based upon the assessment findings in the preceding sections, to determine whether:

- The proposal poses an unacceptable risk or provides for inappropriate development;
- Future development can adequately respond to the bushfire threat; and
- Future development can provide adequate bushfire protection measures to reduce the residual risk to an appropriate level.

The evaluation is based upon Chapter 4 of PBP and the Assessment Framework of this Study, as summarised in Table 9. In addition to evaluating the proposal against these matters, the evaluation specifically considers:

- Residual risk - the level of residual risk after the application of bushfire protection measures is a key determinant in the strategic assessment of whether proposed development is appropriate;
- Risk to life - an appropriately low residual risk to human life is fundamental;
- Risk to property – the residual risk to property should meet the Acceptable Solutions within PBP;
- Emergency service response - the acceptability of proposed development should not be reliant on emergency service response / intervention;
- Adjoining lands – future development should not be reliant on fuel management on adjoining lands or effect those landowners’ ability to undertake such works

A summary of the evaluation of the Masterplan proposal against the strategic requirements is provided in Table 9, and a summary of recommendations and/or future considerations for detailed design to ensure the residual risk assessed herein, can be achieved in perpetuity, is included in Table 10.

Table 9: Evaluation of proposal against strategic requirements of PBP

| PBP Strategic Planning Principle | Evaluation |
|---|---|
| Ensuring land is suitable for development in the context of bushfire risk | <p>The bushfire risk assessment detailed herein demonstrates that the residual bushfire risk context is not considered inappropriate following evaluation against the strategic planning principles of PBP. The site is not exposed to a high bushfire risk that would preclude appropriate development. There is also significant capacity for bushfire protection measures and added site resilience, including significant mitigation of bushfire attack far beyond the minimum PBP requirements, substantial opportunity for offsite evacuation, safe onsite refuge, and low risk development outcomes, which further moderate bushfire risk.</p> <p>The residual risk is evaluated as low, given the assessment of the landscape bushfire risk, proposed development design and bushfire protection measures, along with additional protection measures recommended to mitigate fire attack on the site.</p> |
| Ensuring new development on BFPL will comply with PBP | <p>The new development on BFPL contemplated by the Masterplan can comply with the requirements of PBP.</p> <p>In addition, given the scale of the development and protection measures, only a small proportion of the development areas will remain as BFPL, meaning that the majority of the development will be considered a low risk development outcome, located greater than 100m from the hazard interface.</p> |

| PBP Strategic Planning Principle | Evaluation |
|--|--|
| Minimising reliance on performance-based solutions | The acceptable solutions of PBP, by way of provision of APZs, access, infrastructure and water supply, can be accommodated for in detailed design, therefore minimising reliance on performance-based solutions. Evaluation of the Masterplan against PBP requirements demonstrates that there is ample capacity for the provision of compliant APZs, access/egress, and perimeter roads for development adjacent to the hazard interface. |
| Providing adequate infrastructure associated with emergency evacuation and firefighting operations | The proponent should liaise with relevant government agencies to understand their contribution to emergency management. |
| Facilitating appropriate ongoing land management practices | It is recommended that future hazards are managed under a vegetation management plan and APZ management within public spaces is guided by a maintenance plan or plan of management for the site. Consideration to a community title to establish management of these areas in perpetuity may be required. |

Table 10: Considerations and Recommendations for Future Planning Phases

| Consideration | Evaluation | Recommendation |
|--|---|---|
| Residual risk - the level of residual risk after the application of bushfire protection measures | <p>The precinct is subject to risk from bushfire. However, this is moderated through the capacity of the site to afford bushfire protection measures, evacuation capacity (offsite and onsite), and the decreasing risk profile. Further, an appropriate bushfire protection response can be afforded future development, specifically:</p> <ul style="list-style-type: none"> • APZ requirements are achievable as demonstrated in this assessment. • Perimeter roads are achievable • Multiple evacuation options are provided • Infrastructure provisions are achievable | <p>Ensure bushfire protection measures are adequately provisioned during detailed design, including temporary measures required until surrounding development is activated. This includes the provision of perimeter roads and APZs adjacent to all hazards. Ensure access/egress, evacuation and refuge capacity is achievable during early development stages.</p> <p>Implement additional protection measures detailed herein (APZ, road connections, onsite refuge, emergency management arrangements).</p> |
| Risk to life - an appropriately low residual risk to human life is fundamental | <p>The residual risk to life is not inappropriate given the ability for the site to provide:</p> <ul style="list-style-type: none"> • access for early off-site evacuation, • on site safe refuge capacity; and • low risk development outcomes. <p>Much of the future development will be located outside of land considered bushfire prone and therefore low risk development outcomes are achievable for much of the precinct.</p> | <p>As staging progresses, the provision of road infrastructure should align with precinct activation, as considered in this assessment, to support early offsite evacuation.</p> <p>Onsite refuge facilities should be established under an appropriate planning mechanism.</p> <p>Mechanisms to ensure bushfire protection measures and additional resilience measures are maintained in perpetuity should be established.</p> |
| Risk to property – the residual risk to property | The acceptable solutions of PBP in relation to property protection measures will be assessed at | Ensure bushfire protection measures are adequately provisioned at all stages of the planning pathway and |

| Consideration | Evaluation | Recommendation |
|--|---|--|
| should meet the Acceptable Solutions within PBP | the DA stage, however property measures are not constrained by the proposal: <ul style="list-style-type: none"> • APZ requirements are achievable as demonstrated in this assessment • Requirements for services are achievable • Access requirements are achievable • BAL-29 / BAL-12.5 construction is achievable | compliant provisions are in place at the DA stage. |
| Emergency service response - the acceptability of proposed development should not be reliant on emergency service response / intervention | Requirement for contributions or provisions in this regard should be explored with relevant agencies / consent authority. | Timeframes for emergency service provisions should complement precinct activation. Engagement with relevant agencies on this issue is recommended. |
| Adjoining lands – future development should not be reliant on fuel management on adjoining lands or effect those landowners’ ability to undertake such works | Future development is not reliant on adjoining lands and will not necessitate change in land management practices due to risk reduction. | Any temporary APZ’s or access provisions should be contained on site. |

7. Conclusion

This strategic bushfire study represents an assessment of a Masterplan proposed to accompany a Planning Proposal. The assessment considered the strategic planning principles and assessment considerations outlined in Chapter 4 of PBP. Based on the assessment undertaken, it is considered the Masterplan meets the strategic planning principles outlined in PBP with future development able to comply with the minimum required bushfire protection measures as well as apply additional conservative mitigation measures to further reduce the residual risk. Key measures include:

- the provision of required APZs, and recommended additional APZs for risk mitigation
- the provision of perimeter roads
- multiple access points to facilitate early offsite evacuation via Captain Cook Drive
- onsite refuge opportunities
- design affords low risk development outcomes

Additional recommendations outlined in this study should be undertaken as planning progresses, including:

- Further traffic modelling that demonstrates off site evacuation capacity at all stages of precinct activation.
- Further traffic modelling that demonstrates appropriate access to potential onsite refuge locations, during each stage of development.
- Investigation into an additional southern access connection between stages 3 and 5.
- Consultation with RFS regarding the suitability of onsite refuge opportunities to be formalised as NSPs.
- Development of a sitewide bushfire emergency management and evacuation plan and development of sub-plans for SFPP facilities as they are developed.
- A plan of management and/or planning mechanism to ensure APZ management in perpetuity.
- Road dimensions compliant with PBP requirements.
- Consideration to DCP controls for added recommended resilience measures.

Subject to the recommendations of this study, the proposal is consistent with Ministerial Direction 4.4 (Planning for Bushfire Protection) issued under section 9.1(2) of the EP&A Act and the requirements of PBP, and opportunities exist to afford future development with a level of residual risk significantly below the policy setting achieved by PBP.

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Appendix A - Access Specifications

The following access specifications are reproduced from PBP (RFS 2019).

Intent of measures: To provide safe operational access to structures and water supply for emergency services while residents are evacuating an area.

Table 11: Performance criteria for access for residential and rural residential subdivisions

| Performance Criteria | Acceptable Solutions |
|---|--|
| The intent may be achieved where: | |
| firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation | <p>property access roads are two-wheel drive, all-weather roads, and</p> <p>perimeter roads are provided for residential subdivisions of three or more allotments; and</p> <p>subdivisions of three or more allotments have more than one access in and out of the development; and</p> <p>traffic management devices are constructed to not prohibit access by emergency services vehicles; and</p> <p>maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient; and</p> <p>all roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end; and</p> <p>where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; and</p> <p>where access/egress can only be achieved through forest, woodland or heath vegetation, secondary access shall be provided to an alternate point on the existing public road system.</p> |
| the capacity of access roads is adequate for firefighting vehicles | the capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/causeways are to clearly indicate load rating. |
| there is appropriate access to water supply | <p>hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression;</p> <p>hydrants are provided in accordance with AS 2419.1:2021;</p> <p>there is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.</p> |
| access roads are designed to allow safe access and egress for medium rigid 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 | <p>perimeter roads are two-way sealed roads; and</p> <p>8m carriageway width kerb to kerb; and</p> <p>parking is provided outside of the carriageway width; and</p> <p>hydrants are located clear of parking areas; and</p> <p>there are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and</p> <p>curves of roads have a minimum inner radius of 6m; and</p> <p>the maximum grade road is 15° and average grade is 10°; and</p> <p>the road crossfall does not exceed 3°; and</p> |

| Performance Criteria | Acceptable Solutions |
|--|---|
| | <p>a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.</p> |
| <p>access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating</p> | <p>minimum 5.5m width kerb to kerb; and parking is provided outside of the carriageway width; and hydrants are located clear of parking areas; and roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and curves of roads have a minimum inner radius of 6m; and the road crossfall does not exceed 3°; and a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.</p> |
| <p>firefighting vehicles can access the dwelling and exit safely</p> | <p>No specific access requirements apply in an urban area where a 70 metre unobstructed path can be demonstrated 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 (i.e. a hydrant or water supply).</p> <p>In circumstances where this cannot occur, the following requirements apply:</p> <p>minimum carriageway width of 4m;</p> <p>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; and</p> <p>a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches; and</p> <p>provide a suitable turning area in accordance with Appendix 3; and</p> <p>curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress; and</p> <p>the minimum distance between inner and outer curves is 6m; and</p> <p>the crossfall is not more than 10°; and</p> <p>maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads; and</p> <p>a development comprising more than three dwellings has formalised access by dedication of a road and not by right of way.</p> <p>Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5m), 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> |

Appendix B - NSP Criteria

Table 12: Assessment Criteria for a Neighbourhood Safer Place (RFS 2017)

| Factor | Performance Criteria | Acceptable Solution |
|---|---|---|
| Radiant Heat | Building is located and constructed to enhance the chance for survival for humans in attendance from the radiant heat of a bush fire. | Building is situated to prevent direct flame contact, material ignition and radiant heat level of 10kW/m ² ; or Provide 139 metres separation distance from a bush fire hazard. |
| | Open Space is located to enhance the chance for survival for humans in attendance from the radiant heat of a bush fire. | Open Space is situated and maintained to prevent direct flame contact, material ignition and radiant heat levels of 2kW/m ² ; or Provide 310 metres separation distance from a bush fire hazard |
| Maintenance of the Site and the Land Adjacent | Area between bush fire hazard and the site is maintained to a level that ensures the radiant heat levels at the Building/Open Space meet the Performance Criteria for Radiant Heat. | The site and land adjacent to the site between the Building/Open Space and the bush fire hazard is managed land or maintained in accordance with NSW RFS document Standards for Asset Protection Zones |

Table 13: Principles for Site Identification (RFS 2017)

| Consideration | Principles |
|-----------------|--|
| Site Selection | An NSP should provide a safer place for the community. |
| | The community should be moving away from the bush fire hazard to access the NSP over short distances where possible. |
| | NSP locations should reflect community need and bush fire risk. |
| Moving to a NSP | An NSP should not be isolated from the community. |
| | The community should not be impeded from reaching the NSP area in a bush fire situation. |
| Capacity | Additional NSPs should be sought where it is likely current or potential NSPs cannot accommodate those likely to use it. |
| | Demand for use of an NSP reflect a community's level of bush fire preparedness. |

Appendix C - Services Specifications

The following services specifications (provision of water, gas and electricity) are reproduced from PBP (RFS 2019).

Intent of measures: 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 14: Performance criteria for services provision for residential and rural residential subdivisions

| Performance Criteria | Acceptable Solutions |
|---|---|
| The intent may be achieved where: | |
| a water supply is provided for firefighting purposes | reticulated water is to be provided to the development, where available; a static water supply is provided where no reticulated water is available. |
| water supplies are located at regular intervals | fire hydrant spacing, design and sizing comply with the Australian Standard AS 2419.1:2021; |
| the water supply is accessible and reliable for firefighting operations | hydrants are not located within any road carriageway; reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads. |
| flows and pressure are appropriate | fire hydrant flows and pressures comply with AS 2419.1:2021. |
| 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. |
| 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 follows: lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; 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. |
| 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; polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not used; above-ground gas service pipes are metal, including and up to any outlets. |

Table 15: Water supply requirements for non-reticulated developments or where reticulated water supply cannot be guaranteed (Table 5.3d of PBP)

| Development Type | Water Requirements |
|---|--------------------|
| Residential lots (<1000m ²) | 5000L/lot |
| Rural-residential lots (1000-10,000m ²) | 10,000L/lot |
| Large rural/lifestyle lots (>10,000m ²) | 20,000L/lot |
| Multi-dwelling housing (including dual occupancies) | 5000L/dwelling |

