TECHNICAL REPORT

St Marys Strategic Bush Fire Study

PREPARED FOR
DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT

August 2020

Meridian Urban

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Department of Planning, Industry and Environment

St Marys Strategic Bush Fire Study

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REVISION SCHEDULE

REV NO.	DATE	DESCRIPTION	SIGNATURE OR TYPED NAME (DOCUMENTATION ON FILE)			
			PREPARED BY	CHECKED BY	REVIEWED BY	APPROVED BY
A	24.07.2020	Report	FR / LG	FR	LG	SD
B	10.08.2020	Final Report	FR / LG	FR	SD	SD
C	12.08.2020	Revised Final	FR / LG	FR	LG	SD

FPAA NSW BPAD Accreditation No. 33131

Member Planning Institute of Australia
Member Fire Protection Association of Australia
Member International Association of Wildland Fire
Member Natural Hazard Mitigation Association (USA)

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Executive Summary

This Strategic Bush Fire Study considers the proposed rezoning of Stage 6 of the central precinct of the St Marys Australian Defence Industries (ADI) site located in Western Sydney, referred to as proposed Amendment No. 3 to *Sydney Regional Environmental Plan No. 30* (SREP 30).

The *Planning for Bush Fire Protection 2019* (PBP 2019) statutory guideline introduces a range of strategic planning considerations which are intended to be addressed via strategic planning processes via the preparation of a Strategic Bush Fire Study.

This study assesses the proposed rezoning against the identified strategic principles and assessment requirements of PBP 2019. In terms of satisfaction of these principles with regard to the proposed rezoning, the following is noted:

- the proposed rezoning does not present any substantial strategic issues on balance with the risk profile of the landscape. Whilst hazard and risk is not avoided, the risk is capable of being satisfactorily mitigated. This includes ***the ability to evacuate which is a core facet of minimising risk to life*** in bush fire prone areas;
- this strategic bush fire study identifies the proposed rezoning is ***capable of satisfying the statutory bush fire protection measures*** outlined by PBP 2019. Further detail in relation to this would be required to be submitted as part of future subdivision applications to NSW RFS for integrated development;
- whilst this study cannot fully determine the potential for performance-based solutions as this is dependant upon a final subdivision settlement pattern, it is noted the proposed rezoning is capable of satisfying the majority of ***acceptable outcomes*** as per PBP 2019, as required;
- the study considers the strategic aspects of firefighting capability, relevant to the proposed rezoning. This includes how the proposal supports firefighting ability, and enables ***suppression effort*** to occur. From a strategic perspective, the proposed development does not involve any identifiable challenges or impediments, but rather seeks to establish a formalised road network which connects with informal fire trails, easement and access tracks through the Regional Park to facilitate land management and support suppression, if required;
- the evacuation network including its capacity and connectivity has been assessed and demonstrates the entire central precinct is likely capable, based on assessment of intended road network capacity, of being ***evacuated within one hour*** of evacuation commencing, depending upon the situation of the day, and on the basis of a range of assumptions set out at **Appendix B**; and
- the proposed rezoning is unlikely to introduce any variation to existing or agreed ***land management practices*** for the Regional Park beyond that which would otherwise be required if the land remained zoned for Employment.

Having regard to the strategic principles for the exclusion of inappropriate development contained at Part 4 of PBP 2019, this study does not identify elements of the proposed rezoning which would deem it to be considered inappropriate development pursuant to Part 4 of PBP 2019.

Further detail in relation to the implementation of these measures across Stage 6 are required to be submitted as part of future subdivision applications to New South Wales Rural Fire Service (NSW RFS) for integrated development. The onus is on the bush fire hazard assessments and management plans to demonstrate compliance with the statutory elements of PBP 2019 based upon detailed site layout plans.

CONTENTS

1 Introduction

This strategic bush fire study (the study) has been commissioned by the Department of Planning, Industry and Environment (the Department) in relation to a proposed amendment to *Sydney Regional Environmental Plan No. 30 – St Marys* (SREP 30).

This study considers the strategic planning parameters associated with the rezoning proposal for Stage 6 within the central precinct of the St Marys former Australian Defence Industries (ADI) site. Stage 6 is currently zoned for Employment purposes. The proposal seeks to rezone Stage 6 to Urban (residential) to comprise approximately 514 dwellings.

The intent of this review is to assess the planning proposal against the criteria for strategic planning considerations established by the current 2019 *Planning for Bush Fire Protection* (PBP 2019) released by the New South Wales Rural Fire Service (NSW RFS), the statutory guideline for planning and development in bush fire prone areas across New South Wales (NSW).

PBP 2019 recognises that land use planning is one of the most effective tools in minimising or avoiding the impact of natural hazards such as bush fire. It identifies that from a risk management perspective, the safest approach is always to avoid high risk areas, and local land use strategies should consider and identify land affected by natural hazards and direct development away from inappropriate and constrained lands. Accordingly, PBP 2019 requires the preparation of *a strategic bush fire study* relative to rezoning proposals.

This study satisfies the Section 4 requirements of PBP 2019, assessing the proposed rezoning against the identified strategic planning criteria. This study considers all potential forms of bush fire attack, including the nature and extent of potential bush fire hazard, identifiable elements of risk, the appropriateness and extent of relevant mitigation and management measures which can be applied, and how the proposal can comply with the statutory bush fire protection measures of PBP 2019.

1.1 Assumptions and exclusions

The following assumptions and exclusions apply to this study:

- It focuses on the assessment of the proposed rezoning from a strategic land use planning perspective. It is not a detailed bush fire hazard assessment or management plan. It is expected such detail will be prepared and submitted for assessment at subdivision stage;
- it is based on available data provided by the Department, as well as additional publicly-available information. It is assumed the evidence source utilised to inform this study are accurate can be reasonably relied upon for the purposes of its application;
- it has been undertaken as a desktop analysis only drawing upon previous work undertaken by Bushfire and Environmental Services and Eco Logical Australia. Field investigation / verification of data provided for review does not form part of the scope of this study;
- it is noted this study provides commentary on the interface between bush fire protection measures and the land use planning system;
- this study does not constitute a risk assessment; and
- it has been undertaken using a high-level approach, noting additional investigation and scrutiny of available information from a field-based perspective could be undertaken to enhance accuracy.

2 Background and locality context

The *SREP 30* is the planning instrument which continues to guide the development of the ADI site and has been in place since 2001. It provides key provisions such as zoning, development controls and the requirement for the adoption of precinct plans prepared by Penrith and Blacktown City Councils.

In 2017 a request to the Minister for Planning (the Minister) was submitted, to amend SREP 30 (Amendment No. 3). SREP 30 is deemed a State Environmental Planning Policy (SEPP).

The site is divided into six precincts. The 'central precinct' (also known as Jordan Springs East) is the primary focus of the proposed amendment and is one of the last precincts to be developed. Areas of the central precinct have been previously developed and further stages are currently under construction.

The central precinct comprises two zones under SREP 30, 'Employment' to the north and 'Urban' to the south. SREP 30 was last amended when Employment zoned land was relocated from the western precinct and parts of the Ropes Creek precinct to the central precinct (Department of Planning and Environment, 2018).

More broadly, the ADI site is situated to the east of the centre of Penrith, and is almost entirely surrounded by existing urban development. The land itself comprises corridors of bushland which form part of a broader network of parkland and bushland corridors which extend to the north.

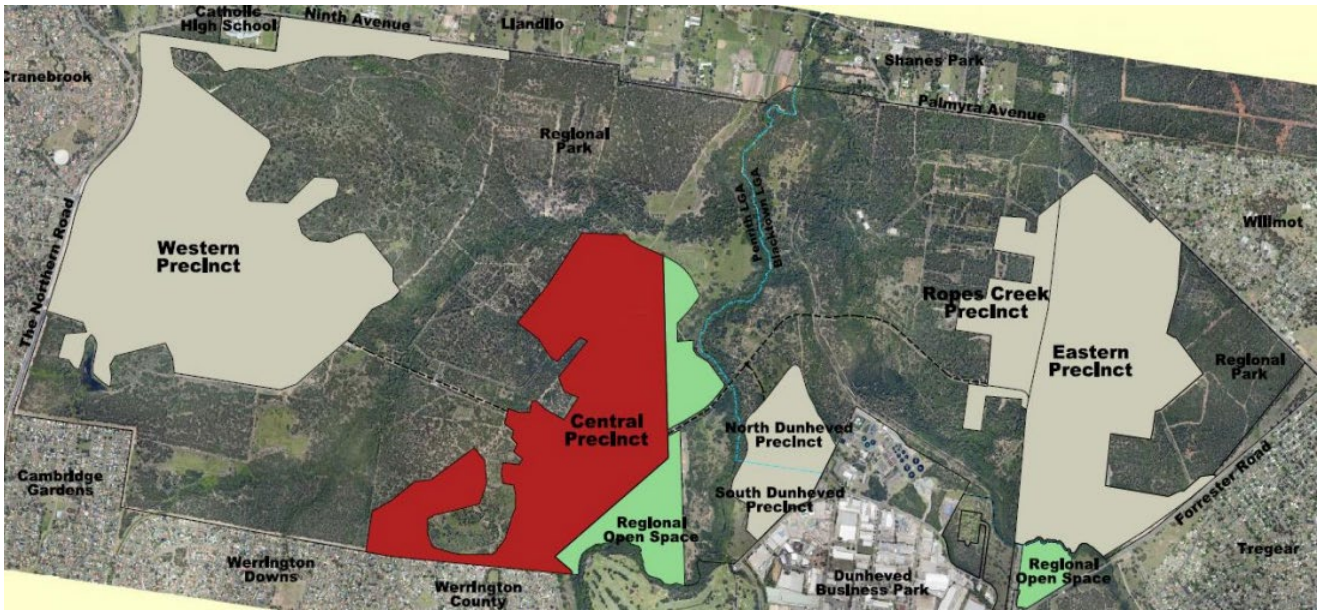

Figure 1 - ADI site precincts (Source: LendLease, 2017)

The three key changes to SREP 30, as per the *Explanation of Intended Effect*, include:

- rezoning approximately 38.4 hectares of land within the central precinct from 'Employment' zone to 'Urban' zone;
- confirming the size and location of all lands zoned 'Drainage' and appropriately zone the land to reflect the proposed relocation of drainage infrastructure including the relocation of a proposed drainage basin. The location of drainage infrastructure will be determined in consultation with Penrith City Council and the (former) Office of Environment and Heritage / National Parks and Wildlife Service; and
- rezoning approximately 1.2 hectares of land within Jordan Springs (western precinct) at St Marys from 'Urban' to 'Regional Park'. The land is currently identified for use as local open

space within the Jordan Springs development (Department of Planning and Environment, 2018).

Figure 2 below illustrates the extent of the central precinct which is sought to be rezoned from Employment to Urban. For the purposes of this report, this area is also referred to as 'Stage 6' of the central precinct.

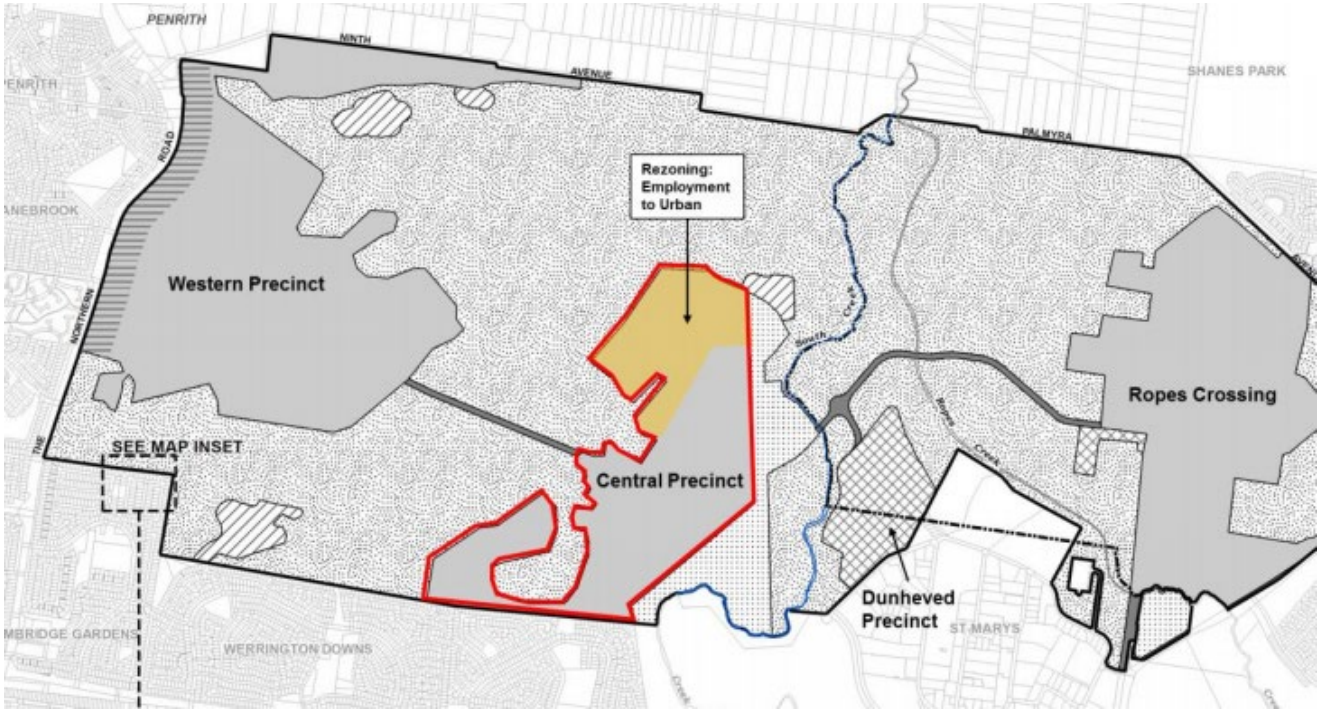

Figure 2 - Proposed rezoning of the northern area of the central precinct from Employment to Urban (Source: Keylan Consulting, 2017)

A planning report and associated technical studies have been prepared in support of the proposed amendment, including a *2009 Bush Fire Protection Assessment* report, and its *update prepared in 2017* via addendum.

The 2017 planning report notes the bush fire addendum prepared as part of the amendment proposal 'confirms the bush fire protection assessment remains relevant to the proposed rezoning as many of the bush fire protection measures are common to both development types' (Keylan Consulting, 2017).

In 2018 the proposal was released for consultation for feedback and submissions. A Response to Submissions Report was further prepared by Keylan Consulting in August 2018.

2.1 Designation of bush fire prone land

The St Marys ADI straddles the Penrith and Blacktown Council areas and as such, is subject two certified Bush Fire Prone Land maps, prepared by each local government. Below is an excerpt of the bush fire prone land extents as per the NSW Planning Portal Spatial Viewer.

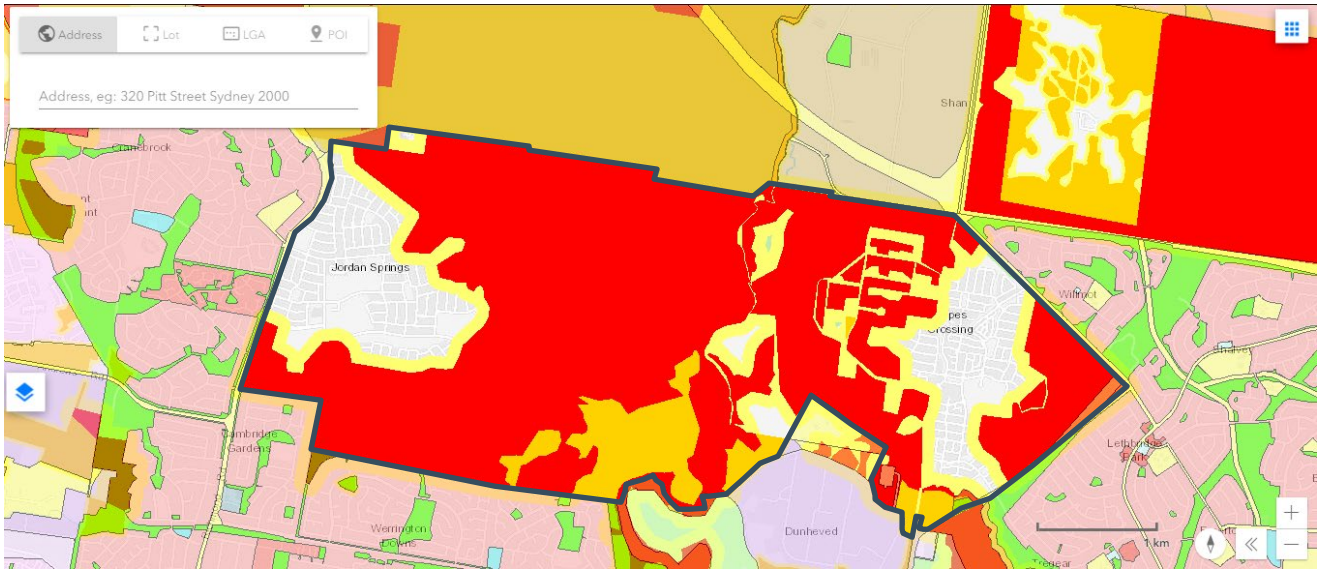

Figure 3 - Excerpt of Bush Fire Prone Land mapping as per the NSW Planning Portal Spatial Viewer (Source: NSW Government, 2020)

2.2 Previous bush fire protection and mitigation activities

Development applications over the western and central precincts of the site have been guided by the 2009 Bushfire Protection Assessment prepared by Bushfire and Environmental Services. The intent of this report was to provide a consolidated document comprising the relevant bush fire protection measures to support design of subsequent stages, subdivision and development applications.

SREP 30 requires Precinct Plans to incorporate fire management elements into development design such as fire protection zones and firefighting infrastructure. Urban development adjoining bushland must incorporate fire protection zones and other fire control measures.

As per legislative requirements, bush fire protection is still required to be addressed at the development application stage, pursuant with the EP&A Act, the E*nvironmental Planning and Assessment Regulation 2000* (EP&A Regulation), Section 100B of the *Rural Fires Act 1997* and the PBP statutory guideline. Bush Fire Safety Authorities from NSW RFS for integrated development will be required as part of applications prepared and submitted at subdivision stage.

Previous reports have been informed in large part by *Planning for Bush Fire Protection 2006* (PBP 2006), which has since been superseded by the current 2019 version.

In 2017 an addendum assessment was undertaken by Eco Logical Australia to ensure the application of bush fire protection measures across the site, pursuant to previous reports, continued to remain relevant. The addendum confirmed the provisions identified by the original report remain applicable, irrespective of the proposed changes from Employment to Urban zoning.

Since this time, a draft revised PBP was released for consultation, and final 2019 PBP was released which came into effect on 1 March 2020.

Beyond amendments to the detailed aspects of bush fire protection measures, the 2019 PBP introduces a suite of strategic planning considerations which are intended to be assessed to inform Local Environmental Plans, or at the planning proposal or rezoning stage, to contemplate hazard and risk earlier in the planning process and ensure strategic land use decisions result in tolerable risk outcomes.

3 Policy and regulatory context

This section provides an overview of the policy and regulatory context and frameworks relating to bush fire protection in NSW.

3.1 National policy instruments

The national policy landscape relating to natural hazard risk management maintains a strong focus on implementation of the United Nations' ***Sendai Framework for Disaster Risk Reduction 2015-2030 (Sendai Framework)*** through improving the understanding of risk across all sectors and all levels of government, stakeholders and the community through a shared responsibility for building resilient communities. In particular:

- given the alignment with the Sendai Framework, there is naturally a focus on understanding risk, sharing risk information and using improved technologies to understand risk;
- there is a focus on understanding risks to the social, built, economic and natural environments;
- there is a strong focus on building 'disaster resilient communities' by improving the community's understanding of risk and their vulnerabilities, and taking a shared responsibility approach in building resilience to natural hazards such as bush fire;
- planning is presented in the ***National Strategy for Disaster Resilience*** as an important element of shaping disaster resilient communities;
- efforts and resources should be targeted to priority disaster risks and mitigation opportunities, and exposure to unreasonable risks from hazards avoided or suitable arrangements to minimise risks implemented;
- with regards to recovery and rebuilding, there is a focus on considering the appropriateness of rebuilding in the same location, or rebuilding to a more resilient standard to reduce future risks;
- many of the ***National Disaster Risk Reduction Framework*** strategies apply to the planning sector;
- the ***National Climate Resilience and Adaptation Strategy*** not only aligns with the premise that resilience building is a shared responsibility and that there is a need for an evidence-base, risk management approach, but also identifies the importance of factoring climate change into decisions through collaborative and values-based choices and the need to revisit decisions and outcomes regularly;
- ***Profiling Australia's Vulnerability*** brings to the forefront the importance of understanding the relationship between community values and vulnerabilities, including the vulnerabilities of systems that communities rely on, to strengthen resilience. It identifies that trade-offs need to be made between social, built, economic and natural environment factors at the local level when making decisions, and that incentives need to be embedded to guide decision making;
- the ***National Emergency Risk Assessment Guidelines (NERAG) Handbook*** produced by the Australian Institute for Disaster Resilience provides a nationally consistent approach to risk assessment and prioritisation to support the implementation of strategy. It provides a contextualised, emergency-related risk assessment methodology consistent with ***AS/NZS ISO 31000: 2018 Risk management – principles and guidelines***;
- pursuant to the ***National Construction Code*** and ***Building Code of Australia***, development on land within a designated Bush Fire Prone Area is required to be assessed against and comply with the construction requirements of ***Australian Standard AS3959-2018 – Construction of Buildings in Bushfire Prone Areas***. A designated Bush Fire Prone Area is

established by the Bush Fire Prone Land Map prepared pursuant to Section 10.3 of the EP&A Act and designated by the Commissioner of the NSW RFS;

- of particular relevance in the incorporation of natural hazards and risk into planning processes, the Australian Institute for Disaster Resilience ***Land Use Planning for Disaster Resilient Communities Handbook*** provides a summary of regulatory instruments, spatial instruments and assessment processes and their role in disaster resilience, aligned with the Planning Institute of Australia's ***National Land Use Planning Guidelines for Disaster Resilient Communities***; and
- the ***Evacuation Planning Handbook*** prepared by the Australian Institute for Disaster Resilience provides a suite of considerations for evacuation planning, using the five nationally-recognised stages of the evacuation process. The Handbook articulates the relevant aspects of community-level evacuation planning which are to be considered as part of evacuation planning processes.

3.2 State-based policy and regulation

The state-wide policy and regulatory environment relating to natural hazard risk management and bush fire protection maintains a strong focus on protection of life, property and the environment. This is aligned with the state's commitment to enhancing the quality of life of the people of NSW. Those aspects of the state-wide policy and regulatory framework which contribute to this includes:

- reducing climate change impacts on health and wellbeing, with a focus on enabling communities and individuals to be better prepared and providing long-term and coordinated efforts to increase the resilience through the ***NSW Climate Change Framework***;
- the principles for emergency management under the ***NSW State Emergency Management Plan*** (EMPLAN) align with national approaches, including those related to continuous improvement, information sharing, understanding an all-hazards approach, building local capacity and ensuring community engagement. EMPLAN articulates the roles and responsibilities as part of the NSW Emergency Management Arrangements. It also includes the bush fire sub-plan;
- the ***Emergency Risk Management Framework*** (ERMF) acknowledges that there is a need for a greater focus on disaster mitigation to reduce expenditure on recovery, and the strengths of existing approaches related to current hazard specific approaches (such as for bush fire);
- one of the guiding principles of the **ERMF** focuses mitigating and effectively responding to risks through emergency risk management to protect the safety and wellbeing of NSW communities, with outcome 3 specifically related to integrating emergency risk management into land-use planning, infrastructure, strategic planning and asset management;
- the ***State Level Emergency Risk Assessment*** (SLERA) undertaken by the former Office of Emergency Management (now Resilience NSW) identifies the vital role of the state and local governments in planning for and managing sustainable development through increasing the resilience of communities through prevention and mitigation with improved land use planning provisions for mitigation, and response and recovery;
- the **State Infrastructure Strategy** includes a strategic direction for resilience which calls for resilience to be embedded in strategic land use planning through a natural hazard policy supported by a broader strategic process to embed resilience in planning;
- the ***NSW Critical Infrastructure Resilience Strategy*** underlines the need to consider the resilience of infrastructure when planning for new development, as early in the process as

possible, which leads to decreased interruptions, reduced recovery times, more rapid restoration and commensurate benefits for the community;

- the ***EP&A Act*** regulates planning in NSW and relates to planning for bush fire protection. This includes regulating mapping for bush fire prone areas, compliance with PBP 2019 and the regulation of integrated development;
- ***Ministerial Direction 4.4 – Planning for Bush Fire Protection*** finds its head of power at section 9.1 of the EP&A Act. It applies where a planning authority prepares a planning proposal that will affect or is close to bush fire prone land. The Direction aims to protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses, and encourage sound management of bush fire prone areas;
- it requires, amongst other things, that a planning proposal must have regard to PBP 2019 and it must introduce controls that avoid placing inappropriate developments in hazardous areas;
- the ***Rural Fires Act 1997*** creates the Bush Fire Coordinating Committee (BFCC), a statutory body representing the Crown which is responsible for planning in relation to bush fire prevention and co-ordinated bush firefighting. The BFCC is responsible for advising the Commissioner on bush fire prevention, mitigation and coordinated suppression. The Act also incorporates the provisions for the ***10/50 vegetation clearing scheme*** pursuant to Section 100R;
- the BFCC must constitute Bush Fire Management Committees (BFMCs) which may prepare a Bush Fire Risk Management Plan. The Act also sets in place the regulatory environment which guides bush fire response, hazard reduction processes, fire danger periods and total fire ban provisions. Division 8 of the Act deals with development of bush fire prone land;
- the Cumberland Zone Bush Fire Management Committee in 2010 produced the ***Cumberland Zone Bush Fire Risk Management Plan*** (Cumberland BFRMP) which relates to the study area. The purpose of this plan is to identify community assets at risk and provide a program of coordinated multi-agency treatments to reduce the risk of bush fire to these assets, having regard to the principles of ecologically sustainable development;
- the ***PBP 2019*** statutory guideline establishes the strategic planning and development assessment requirements which are relevant to bush fire prone land across NSW. It requires strategic planning processes to consider the nature of potential bush fire risk to consider key strategic issues, and to determine if development is inappropriate in its risk context;
- a number of ***SEPPs*** may be relevant, being environmental planning instruments which relate to matters of State or regional planning significance. SEPPs can override LEPs and can allow o prohibit development in certain areas or zones. Relevant SEPPs may include, for example:
    - SEPP (Housing for Seniors or People with a Disability) 2004;
    - SEPP (Affordable Rental Housing) 2009;
    - SEPP (Exempt and Complying Development Codes) 2008 (which includes the Low Rise Medium Density Housing Code); and
    - SEPP (Educational Establishments and Child Care Facilities) 2017.
- several regional-level planning instruments guide the strategic planning approaches adopted by local governments in the Greater Sydney region. These include ***The Greater Sydney Region Plan - A Metropolis of Three Cities*** and the ***Central City*** and ***Western City District Plans*** which the St Marys ADI site straddles.

4 Planning for Bush Fire Protection 2019

In March 2020 the current PBP 2019 came into statutory effect. One of the key additions to the current PBP 2019 which sets it apart from previous editions is a new chapter on strategic planning, which aims to ensure that bush fire hazard and risk is appropriately considered as part of strategic planning activities, having regard to the nature of the hazard and its potential risk rather than mere compliance with bush fire protection measures.

It articulates a range of principles which are intended to be analysed as part of strategic planning processes to ensure future land uses are in appropriate locations to minimise the risk to life and property from bush fire attack.

The broad *strategic principles* which apply include:

- ensuring land is suitable for development in the context of bush fire risk;
- ensuring new development on bush fire prone land 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.

Section 4 of PBP 2019 further establishes *strategic principles for the exclusion of inappropriate development* which guide how the strategic consideration of bush fire risk is to be integrated into strategic planning processes. These include:

- the development area is exposed to a high bush fire risk and should be avoided;
- the development is likely to be difficult to evacuate during a bush fire due to its siting in the landscape, access limitations, fire history and/or size and scale;
- the development will adversely effect other bush fire protection strategies or place existing development at increased risk;
- the development is within an area of high bush fire 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.

In order to assess the above, PBP 2019 requires a strategic bush fire study to assess the matters outlined at the table below, as a minimum. This includes a strategic assessment of the ability for future development to comply with the bush fire protection measures set out by PBP 2019.

PBP 2019 provides that where strategic issues cannot be resolved, the proposal cannot comply with PBP 2019.

This study is assessed against these requirements to determine the appropriateness of the rezoning of Stage 6 of the central precinct, having regard to the nature of bushfire hazard and risk relative to the context of proposed development.

Table 1 - PBP 2019 strategic bush fire study assessment requirements

Issue	Detail	Assessment considerations
Bush fire landscape assessment	A bush fire landscape assessment considers the likelihood of a bush fire, its potential severity and intensity	• The bush fire hazard in the surrounding area, including: o Vegetation o Topography

	and the potential impact on life and property in the context of the broader surrounding landscape.	○ Weather • The potential fire behaviour that might be generated based on the above; • Any history of bush fire in the area; • Potential fire runs into the site and the intensity of such fire runs; and • The difficulty in accessing and suppressing a fire, the continuity of bush fire hazards or the fragmentation of landscape fuels and the complexity of the associated terrain.
Land use assessment	The land use assessment will identify the most appropriate locations within the masterplan area or site layout for the proposed land uses.	• The risk profile of different areas of the development layout based on the above landscape study; • The proposed land use zones and permitted uses; • The most appropriate siting of different land uses based on risk profiles within the site (i.e. not locating development on ridge tops, SFPP development to be located in lower risk areas of the site); and • The impact of the siting of these uses on APZ provision.
Access and egress	A study of the existing and proposed road networks both within and external to the masterplan area or site layout.	• The capacity for the proposed road network to deal with 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 • The potential for development to be isolated in the event of a bush fire.
Emergency services	An assessment of the future impact of new development on emergency services.	• Consideration of the increase in demand for emergency services responding to a bush fire emergency including the need for new stations/ brigades; and • Impact on the ability of emergency services to carry out fire suppression in a bush fire emergency.
Infrastructure	An assessment of the issues associated with infrastructure and utilities.	• The ability of the reticulated water system to deal with a major bush fire 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.
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bush fire management.	• Consideration of the implications of a change in land use on adjoining land including increased pressure on BPMs through the implementation of Bush Fire Management Plans.

5 Study methodology

This study considers a suite of evidence materials which relate to the bush fire hazard context and the planning proposal. A selection of documents which relate to the site-based hazard context and planning proposal have been considered as part of this study including:

- the 2017 planning report for Amendment No. 3 to SREP 30 prepared by Keylan Consulting;
- previous assessment reporting for the western and central precincts of St Marys prepared by Bushfire and Environmental Services;
- the 2017 addendum to the Bushfire Protection Assessment prepared by Eco Logical Australia; and
- the Response to Submissions Report dated August 2018 prepared by Keylan Consulting.

In addition to these documents, other documents relevant to this assessment are considered, many of which establish the legislative and regulatory environment to which the planning proposal relates. These include:

- *EP&A Act;*
- *EP&A Regulation*;
- *Rural Fires Act 1997*;
- SREP 30 – St Marys;
- Explanation of Intended Effect dated March 2018 prepared by the (former) Department of Planning and Environment;
- PBP 2006 prepared by NSW RFS;
- PBP 2019 prepared by NSW RFS;
- Penrith City Council Bush Fire Prone Land Map;
- Blacktown City Council Bush Fire Prone Land Map; and
- Cumberland BFRMP prepared by NSW RFS.

These documents have been considered as part of this review assessment, establishing the evidence base upon which analysis of the planning proposal is assessed against the criteria required by a strategic bush fire study.

6 Strategic assessment and analysis

The following assessment and analysis address the 'strategic issues' identified by the strategic bush fire study requirements at Section 4 of PBP 2019, reproduced at Table 1 of this study report.

6.1 Bush fire landscape assessment

Table 2 - PBP 2019 strategic bush fire landscape assessment requirements

Issue	Detail	Assessment considerations

Bush fire landscape assessment	A bush fire landscape assessment considers the likelihood of a bush fire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape.	• The bush fire hazard in the surrounding area, including:
		  o Vegetation
		  o Topography
		  o Weather
		• The potential fire behaviour that might be generated based on the above;
		• Any history of bush fire in the area;
		• Potential fire runs into the site and the intensity of such fire runs; and
		• The difficulty in accessing and suppressing a fire, the continuity of bush fire hazards or the fragmentation of landscape fuels and the complexity of the associated terrain.

6.1.1 Bush fire hazard context

6.1.1.1 Vegetation communities

In terms of the vegetation communities, it is noted the vegetation communities across the ADI site were mapped by the National Parks and Wildlife Service in 2002 and further ground-truthed and mapped in detail by Cumberland Ecology in 2008. This process confirmed the majority of bush fire hazard relevant to the Regional Park zoned area of the site comprises woodlands and open forest. Parts of the precinct boundaries are also within proximity to alluvial woodland, being alluvial riparian areas within the Regional Park. Previous reports have indicated that irrespective of the woodland status of these alluvial communities, they should be treated as open forest due to the presence of Swamp oak forest and River-flat eucalypt forest.

Table 3 - Predominant vegetation communities relevant to the central precinct

Vegetation	PBP 2019 Formation	Surface and elevated fuel load (t/ha)	Overall fuel load including bark and canopy (t/ha)
Shales Plains Woodland (Cumberland Plain Woodland)	Grassy and semi-arid woodland	10.5	20.2

Alluvial Woodland (including Swamp Oak Forest and River-flat Eucalypt Forest)	Forest (wet and dry sclerophyll)	22	36.1
Shale/ gravel Transition Forest	Forest (wet and dry sclerophyll)	22	36.1

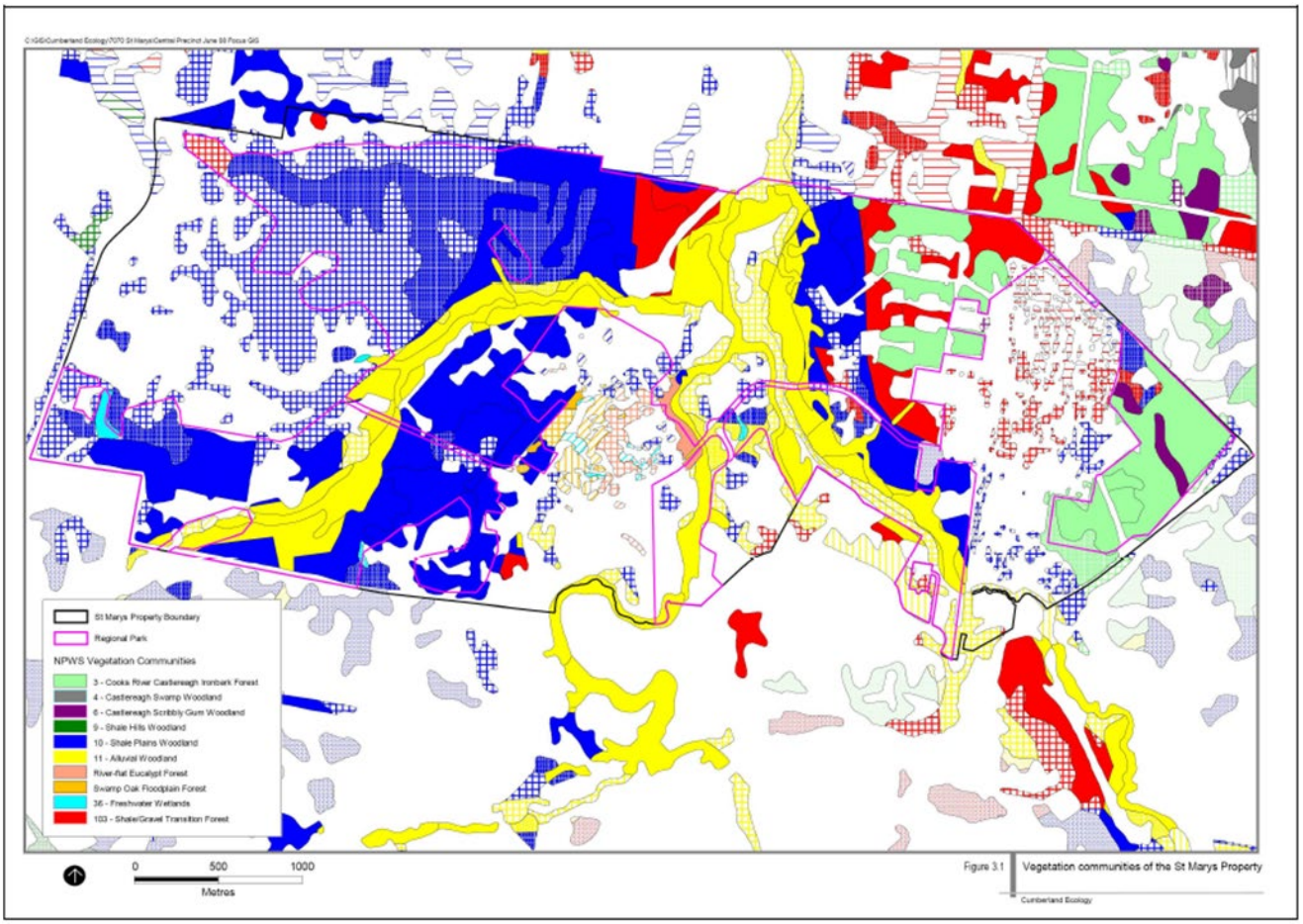

Figure 4 - Vegetation communities of the St Marys ADI site (Source: Cumberland Ecology, 2008)

Based upon current information for the planning proposal, Stage 6 of the central precinct is unlikely to retain any remnant patches of vegetation within the development area. As such, the hazard source remains external to the site. The stage will comprise landscaped areas which will need to satisfy the landscaping and asset protection requirements of PBP 2019 to ensure they do not mature into a source of bush fire hazard.

In the event the above should change over time, any potentially hazardous patches and corridors internal to Stage 6 should be appropriately mapped, with those areas satisfying the low threat vegetation and remnant patch and narrow corridor criteria at A1.10 and A1.11 of the current 2019 PBP, removed from the data set.

Any areas which continue to present potential bush fire hazard should then attract the required bush fire protection requirements relevant to the vegetation community which persists. This process reflects the current expectation of PBP 2019 in determining vegetation communities which are not low threat.

6.1.1.2 Topography

In terms of topography, it is noted that land rises gently from the South Creek channel to the east of the central precinct, the precinct itself being generally level. From a slope class perspective, the land is characterised as either 'upslope' or 'downslope >0-5 degrees'.

6.1.1.3 Fire weather and climate

St Marys forms part of the Greater Sydney region for which PBP 2019 prescribes a Forest Fire Danger Index (FFDI) of 100. The FFDI measures the degree of fire danger for Australian vegetation relative to prevailing weather and climatic conditions which vary across days and seasons.

Pursuant to PBP 2019, the 1:50 year fire weather scenario (based on annual return interval, or an annual exceedance probability of 2 per cent) is adopted for the purposes of informing land use planning approaches. This reflects by the same approach adopted by Australian Standard AS3959-2018 – Construction of buildings in bushfire prone areas.

The nearest Bureau of Meteorology weather stations to St Marys are located at Richmond and Sydney Airport, for which the maximum FFDI recorded over the decades since 1972 are 105 and 116 respectively which were recorded in November 2015 but understood to have only reached this level for a very short period of the day.

The 2019-20 fire weather season was record breaking for NSW. On 12 November 2019, a catastrophic fire danger warning was issued for Greater Sydney, the first of three 7-day State of Emergency declarations were issued for NSW in November, December and January.

In 2020 the Bureau of Meteorology issued a Special Climate Statement detailing the climatic factors which contributed to dangerous fire weather conditions in the 2019-20 fire season, confirming large areas of Australia had their highest accumulated FFDI for December in 2019. It also notes 2019 had the highest December accumulated FFDI for Australia as a whole, continuing the pattern seen in the spring period across NSW.

From a climate perspective, the Metropolitan Sydney Climate Change Snapshot (Office of Environment and Heritage, 2014) which is based on NSW and ACT Regional Climate Modelling (NARCliM) data provides the following:

- maximum temperatures are projected to increase between 2020-2039 by 0.3-1.0 degree Celsius and by 1.6-2.5 degrees Celsius between 2060-2079;
- minimum temperatures are also projected to increase over the above periods;
- the number of hot days will increase and the number of cold nights will decrease;
- rainfall is projected to decrease over spring and winter periods, but projected to increase over summer and autumn periods; and
- both average and severe fire weather days are projected to increase in summer and spring by 2070 (affecting both the peak risk season as well as the prescribed burn periods).

6.1.2 Fire behaviour, fire history and key fire runs

The Cumberland BFRMP) prepared by NSW RFS identified the region experiences an average of approximately 450 bush and grass fires each year, of which only a few are considered to be major fires.

It also notes a history of deliberately lit fires in the immediate area. As such, the probability of ignition within the Regional Park is likely and the probability of resulting bush fire occurring is possible. This would likely depend on a range of climate and weather factors and how quickly the ignition is noticed by adjoining residents and reported to authorities, as to the magnitude to which the ignition grows.

The main sources of ignition identified by the Cumberland BFRMP include:

- ***illegal burning*** – mainly within the rural areas of all three local government areas, where burning is not conducted in accordance with the *Protection of the Environment Operations (Clean Air) Regulation 2010* or *the Rural Fires Regulation 2013*;
- ***car dumping*** – the dumping of cars and setting them alight in bush land areas is a regular occurrence, mainly in the Castlereagh and Londonderry areas;
- ***lightning*** – is generally associated with the summer thunderstorm activity and mainly affects the southern areas of the Zone, however it is known to occur in the northern parts of the Penrith local government area; and
- ***deliberately lit fires*** – there is a high occurrence of deliberately lit fires within the Wilmot / Bidwill, Glenmore Park, Ropes Creek areas, where there are areas of bushland around and within built up areas.

The central precinct, including the area proposed for rezoning, is bound to the north-east, north and west by land zoned for Regional Park which is intended to remain in its natural state. Whilst the vegetation surrounding the central precinct is fragmented from the broader landscape which has transitioned over time to urban uses, the Regional Park itself remains a sufficient size to support and carry fire.

Prevailing fire winds in the Greater Sydney region are typically generated by north to north-westerlies and cooler-air fire wind may be generated by south-westerlies which are prevalent during the State's annual fire season which extends from October to March but varies year-on-year due to macro-climatic conditions.

It stands to reason based on the above, the key fire runs relevant to Stage 6 of the central precinct are likely to occur from the north, north-west or west. Due to the scale of bushland, these fires are capable of reaching maximum rate of spread over a relatively short time and distance in higher fire danger conditions. Even in lower fire danger conditions above FFDI 50, the rate of house loss increases considerably (CSIRO, 2014).

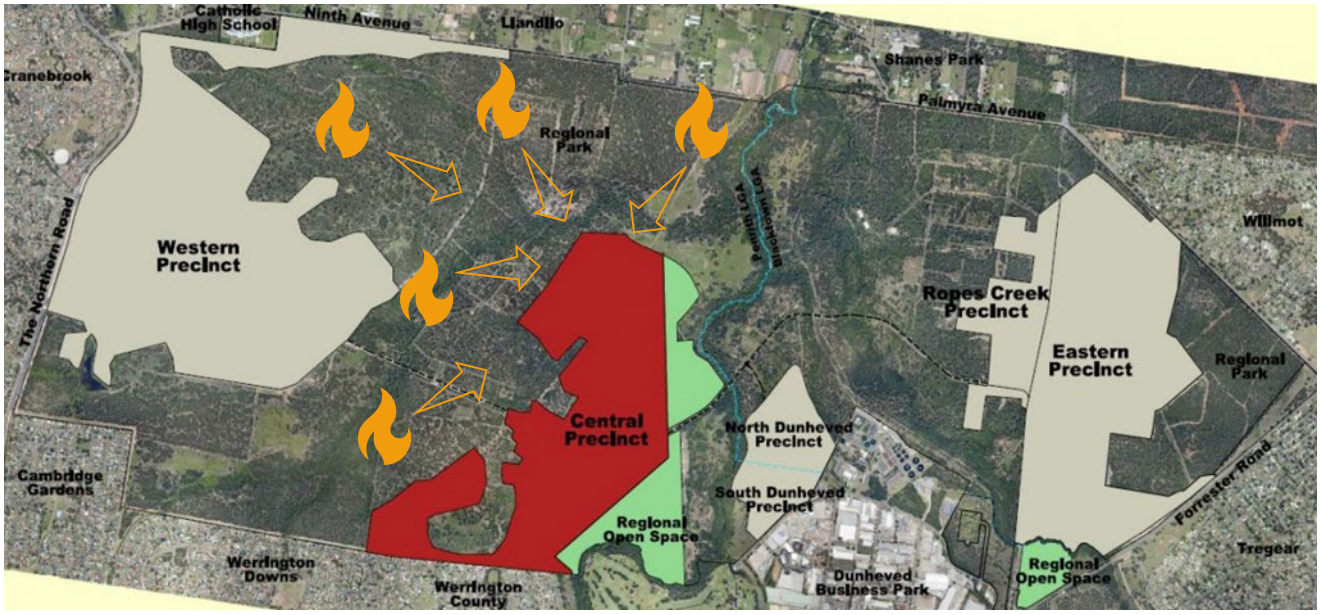

Figure 5 - Indicative key fire runs occurring on westerly fire winds relative to Stage 6

6.1.3 Enabling land management and firefighting suppression

The Regional Park zoned land is traversed by a series of fire trails, access tracks and infrastructure easements which give rise to the ability for land management practices to be implemented. These may include hazard reduction burning, mechanical slashing, chemical treatments for weed infestation removal, fire trail and fire break maintenance.

Existing development within the central precinct and surrounding precincts have been constructed to provide perimeter roads at the interface with hazard, enabling immediate access in case of emergency.

It is noted this is also proposed for Stage 6, which is intended to be almost entirely bound by the provision of a perimeter road interface between the development and the surrounding Regional Park.

The network of perimeter roads which provides access, in certain locations, to established fire trails, infrastructure assets and easements also possibly provides effective control line points for back burning operations if need be, in the event of a bush fire. The network also provides for effective and immediate firefighter fall back to the safety of the urban environment, avoiding potential entrapment.

6.1.4 Bush fire landscape analysis

The table below outlines the summary analysis of the bush fire landscape component of the strategic bush fire study.

Table 4 - Summary analysis of the strategic bush fire landscape requirements of PBP 2019

Issue	Detail	Assessment considerations	Summary analysis

Bush fire landscape assessment	A bush fire landscape assessment considers the likelihood of a bush fire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape.	• The bush fire hazard in the surrounding area, including:
		  o Vegetation
		  o Topography
		  o Weather
		• The potential fire behaviour that might be generated based on the above;
		• Any history of bush fire in the area;
		• Potential fire runs into the site and the intensity of such fire runs; and
		• The difficulty in accessing and suppressing a fire, the continuity of bush fire hazards or the fragmentation of landscape fuels and the complexity of the associated terrain.
			The bush fire landscape analysis notes the likely occurrence of ignition and possible fire in the area, and ability for fire to transition towards Stage 6.
			
			Despite this, the nature of the Regional Park is one which is fragmented. The probability of early identification of ignition is high, with fire resources available in the wider urban area to provide timely suppression.

6.2 Land use assessment

Table 5 - PBP 2019 strategic land use assessment requirements

Issue	Detail	Assessment considerations
Land use assessment	The land use assessment will identify the most appropriate locations within the masterplan area or site layout for the proposed land uses.	• The risk profile of different areas of the development layout based on the above landscape study; • The proposed land use zones and permitted uses; • The most appropriate siting of different land uses based on risk profiles within the site (i.e. not locating development on ridge tops, SFPP development to be located in lower risk areas of the site); and • The impact of the siting of these uses on APZ provision.

6.2.1 Land use risk profile, siting and asset protection

This study focusses on the rezoning of Stage 6 of the central precinct from Employment to Urban (residential). Stage 6 is located at the northern extent of the central precinct and is bound to the north and west by the Regional Park, and to the east by regional open space.

Risk is the function of likelihood and consequence, where consequence is a factor of exposure and vulnerability.

In terms of event likelihood, as established above, over 450 ignitions occur in the broader region each year, with a small number considered to be major events. The Cumberland Zone BFRMP also identifies that deliberate ignition is observed in the area of Ropes Crossing, largely as a result of the interface of urban population with hazard. This translates to an *almost certain probability of higher fire danger* (relevant to historic observed conditions of the Greater Sydney fire weather region), *likely probability of ignition*, and the probability of resulting bush fire occurring is *possible*.

From a risk consequence perspective, the certified bush fire prone land maps identify proposed Stage 6 is *exposed to potential bushfire hazard*, immediately adjoining Category 1 vegetation, and the 100m bush fire buffer following clearing. The vegetation of the Regional Park almost entirely surrounds Stage 6. Thus, exposure to potential flame contact, radiant heat and ember attack is potentially present, unless otherwise mitigated via strategic and / or site-based bush fire protection measures.

Having regard to *vulnerability*, the rezoning of Stage 6 from Employment to Urban alters the nature of the land use, but also the nature of the intended settlement pattern, ultimate built form and density, and construction of buildings. It stands to reason that different considerations apply to residential land uses than employment-related uses. These considerations include that:

- a residential land use is different to an employment-related land use in terms of the nature of residents present 24 hours, compared with building occupants who may only be present for certain periods of the day;
- the demographic profile of potential residents into the future which is almost certain to include persons with disability, the aged, very young persons, persons with a physical or mental illness, and other vulnerable people;
- the varied settlement pattern, where residential subdivisions are subject to smaller allotments which augments the nature of the road network, with more streets and smaller blocks than typically applied in Employment-zoned areas which require larger format allotments to site larger-scale buildings and facilitate heavy vehicle access and egress;

- urban residential built form involves a higher number of smaller buildings in closer proximity to each other than do larger-scale employment-related buildings. There are also key differences in the types of construction methodologies and materials. Employment-related buildings are more likely to be constructed of non-combustible materials, whereas residential dwellings are more likely to incorporate potentially vulnerable materials such as timber, glass, etc.; and
- residential areas may comprise more landscaped areas in proximity to dwellings than experienced in Employment-zoned areas. Employment-zoned areas may comprise higher levels of hardstand to landscaping. Landscaping can increase the level of vulnerability to buildings and occupants in residential areas.

From a strategic planning perspective, having regard to bush fire risk, the following contextual elements are relevant in consideration of the appropriateness of the above dot points:

- the vegetation surrounding the central precinct is fragmented from the broader landscape which has transitioned over time to urban uses. Notwithstanding this, the Regional Park itself remains a sufficient size to support and carry fire;
- the nature of surrounding residential areas, including those areas beyond the central precinct, is likely to translate to quick identification of ignition and reporting to emergency services, in the event an ignition does occur. This largely assists in avoiding the potential for un-reported ignitions building into large fires, and enabling early suppression activities;
- whilst the residential area may be adjacent to hazard, the high-level layout at this stage avoid the intrusion of bushfire hazard within the residential area, avoiding the potential for urban fire intrusion through vegetated corridors;
- the provision of asset protection zones between residential dwellings and adjacent hazard is likely to be an effective measure in mitigating the potential threat of flame contact, radiant heat exposure and to some degree, ember attack in accordance with PBP 2019;
- the provision of a perimeter road as part of the asset protection zone around the entirety of proposed Stage 6 will assist in providing a guaranteed low threat asset protection zone solution, and facilitates interface access for emergency services. An outline of the required APZs is included at **Appendix A**;
- the layout of Stage 6 is capable of providing multiple egress points from the stage, connecting it with the balance of the central precinct to enable emergency evacuation, including the ability for residents to relocate to safety within the broader urban area of the central precinct. This is discussed in more detail at Section 7.3 below; and
- the broad ability to satisfy the statutory bush fire protection measures of PBP 2019 appears likely based upon the high-level layout of Stage 6.

On the basis of the above, whilst the nature of the risk is perhaps high (across a risk spectrum from very low to extreme), the risk profile is moderated by a series of contextual elements which are likely to augment bush fire behaviour, and the intended land use allocation is such that the proposed rezoning is not constrained in any way from achieving the suite of statutory bush fire protection measures outlined by PBP 2019.

Further detail in relation to this would be required to be submitted as part of future subdivision applications to NSW RFS for integrated development.

6.2.2 Land use analysis

The table below outlines the summary analysis of the land use component of the strategic bush fire study.

Table 6 - Summary analysis of the strategic land use requirements of PBP 2019

Issue	Detail	Assessment considerations	Summary analysis
Land use assessment	The land use assessment will identify the most appropriate locations within the masterplan area or site layout for the proposed land uses.	• The risk profile of different areas of the development layout based on the above landscape study; • The proposed land use zones and permitted uses; • The most appropriate siting of different land uses based on risk profiles within the site (i.e. not locating development on ridge tops, SFPP development to be located in lower risk areas of the site); and • The impact of the siting of these uses on APZ provision.	Whilst the nature of the risk is perhaps high (across a risk spectrum from very low to extreme), the risk profile is moderated by a series of contextual elements which are likely to augment bush fire behaviour, and the intended land use allocation is such that the proposed rezoning is not constrained in any way from achieving the suite of statutory bush fire protection measures outlined by PBP 2019.

6.3 Access and egress (evacuation) assessment

Table 7 - PBP 2019 strategic access and egress requirements

Issue	Detail	Assessment considerations
Access and egress	A study of the existing and proposed road networks both within and external to the masterplan area or site layout.	• The capacity for the proposed road network to deal with 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 • The potential for development to be isolated in the event of a bush fire.

6.3.1 Access and evacuation routes

An evacuation traffic analysis has been prepared in conjunction with this study, prepared by PDC Consultants, and is included at **Appendix B**.

This strategic-level analysis responds to the three evacuation assessment considerations identified above, as per PBP 2019.

In summary, the analysis considers the nature of the intended road network, evacuation traffic demand, routeing and destinations. It also undertakes a strategic capacity analysis, by stage, in order to understand the strategic capacity of the road network to facilitate bush fire evacuation, assuming the entire central precinct is evacuated.

In such a situation, it is considered that depending upon the location of the ignition, one of the evacuation routes out of the precinct would likely be closed due to fire threat. This approach will require vehicles to the evacuate the central precinct via that connector road (either east or west) which is not under immediate threat.

Assuming a portion of the vehicles will exit to the south using the bus way, and a percentage will remain within the precinct in the location of the shopping centre and regional park, the balance of the entirety of the central precinct, including Stage 6, is likely to be able to evacuate east or west (assuming one road is closed) within *one hour* of commencing evacuation. Refer to figure over page.

It is also the case that vehicles may be able to queue on the road network within the central precinct in locations where the road network is not exposed to potential flame contact and radiant heat flux.

The approach of emergency services on the day may result in shorter evacuation timeframes, noting this analysis is based entirely on the design capacity of the intended road network only.

The assumptions used are considered to reflect a potential worst-case scenario and is based on the information available at the time this study was prepared.

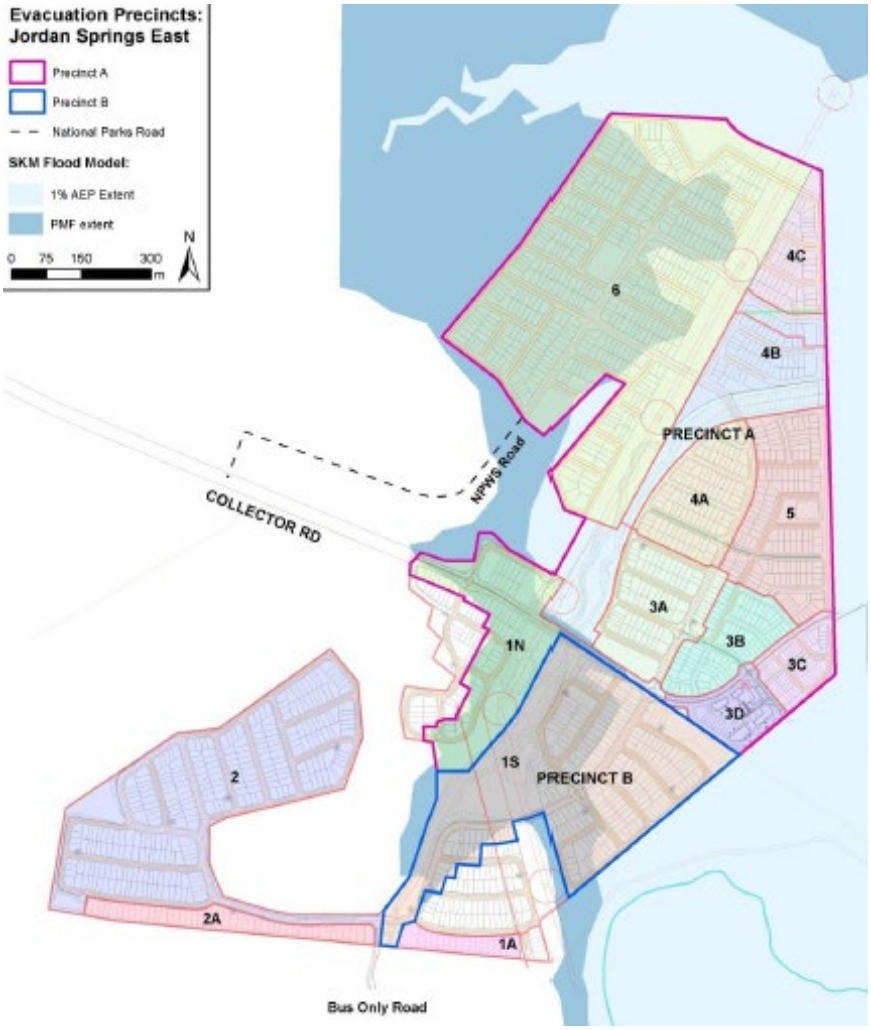

Figure 6 - Indicative staging plan for the Central Precinct (Source: Molino Stewart, 2018)

6.3.2 Access and egress (evacuation) analysis

The table below outlines the summary analysis of the land use component of the strategic bush fire study.

Table 8 - Summary analysis of the strategic access and egress requirements of PBP 2019

Issue	Detail	Assessment considerations	Summary analysis
Access and egress	A study of the existing and proposed road networks both within and external to the masterplan area or site layout.	• The capacity for the proposed road network to deal with 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 • The potential for development to be isolated in the event of a bush fire.	Assuming a portion of the vehicles will exit to the south using the bus way, and a percentage will remain within the precinct in the location of the shopping centre and regional park, the balance of the entirety of the central precinct, including Stage 6, is likely to be able to evacuate east or west (assuming one road

			is closed) within one hour of commencing evacuation. The assumptions used are considered to give rise to a potential worst-case scenario and is based on the information available at the time this study was prepared, and may not consider the full range of information or design elements required to provide a detailed assessment.

6.4 Emergency services assessment

Table 9 - PBP 2019 strategic consideration of emergency services requirements

Issue	Detail	Assessment considerations
Emergency services	An assessment of the future impact of new development on emergency services.	• Consideration of the increase in demand for emergency services responding to a bush fire emergency including the need for new stations/ brigades; and • Impact on the ability of emergency services to carry out fire suppression in a bush fire emergency.

6.4.1 Increase in demand and reliance on emergency services

It could be contemplated that any urban development inherently increases the local resident population, which in turn increases demand or reliance on local emergency services, at least to an extent.

In this regard, it is deemed this is likely to have formed part of the consideration of impact when the original SREP 30 was made, and as part of the original determination to redevelop the ADI site more broadly.

The combined land use, access and egress and infrastructure responses of the proposed rezoning to bush fire hazard and risk, outlined by previous reporting and analysed by this study, seek to limit the potential exposure of persons and property to unacceptable or intolerable bush fire risk. It does this by adopting a measures in combination approach, utilising a suite of bushfire protection measures which satisfy the strategic principles of PBP 2019, which also minimises the potential demand on emergency services in the event of bush fire.

Whilst these measures may not necessarily avoid the need for attendance by emergency services or the need for active suppression on occasion, the measures identified for the protection of future residents and the development do seek to assist emergency services by providing appropriate asset protection zones, facilitates immediate access, as well as immediate and direct fall back to safety.

6.4.2 Ability for suppression

As noted above, existing development within the central precinct and surrounding precincts have been constructed to provide perimeter roads at the interface with hazard, enabling immediate access in case of emergency.

It is noted this is also proposed for Stage 6, which is intended to be almost entirely bound by the provision of a perimeter road interface between the development and the surrounding Regional Park.

The network of perimeter roads which provides access to established fire trails, infrastructure assets and easements also possibly provides effective control line points for back burning operations if need be, in the event of a bush fire. The network also provides for effective and immediate firefighter fall back to the safety of the urban environment, avoiding potential entrapment.

6.4.3 Emergency services analysis

The table below outlines the summary analysis of the consideration of impacts for emergency services component of the strategic bush fire study.

Table 10 - Summary analysis of the strategic emergency services considerations of PBP 2019

Issue	Detail	Assessment considerations	Summary analysis
Emergency services	An assessment of the future impact of new development on emergency services.	• Consideration of the increase in demand for emergency services responding to a bush fire emergency including the need for new stations/ brigades; and • Impact on the ability of emergency services to carry out fire suppression in a bush fire emergency.	The proposed rezoning is designed to respond to the potential threat of bush fire, lessening the threat to persons and property, and also lessening the resultant impost or demand placed on emergency services. Whilst the measures may not necessarily avoid the need for attendance by emergency services or the need for active suppression on occasion, the measures identified for the protection of future residents and the development do seek to assist emergency services.

6.5 Infrastructure assessment

Table 11 - PBP 2019 strategic infrastructure requirements

Issue	Detail	Assessment considerations
Infrastructure	An assessment of the issues associated with infrastructure and utilities.	• The ability of the reticulated water system to deal with a major bush fire 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.

6.5.1 Water supply

It is understood Stage 6 and the central precinct will be serviced by a reticulated water supply. in accordance with Australian Standard AS 2419-2005 'Fire hydrant installations – System design, installation and commissioning' as required by PBP 2019.

Compliance with the above satisfies the PBP 2019 provisions in relation to flow, pressure and integrity of the water supply. PBP 2019 further requires that hydrants are not located within any road carriageway and a ring main system is used for perimeter roads.

6.5.2 Strategic infrastructure proximity and protection

A high voltage power line traverses the central precinct in a south-westerly to north easterly direction. This high voltage electricity easement effectively segregates proposed Stage 6 from the balance of the central precinct, with two road crossings connecting it with the broader central precinct.

It is assumed the infrastructure is constructed and maintained in accordance with industry specifications relating to bush fire protection. Most high voltage easements cannot incorporate bushland, and inherently incorporate asset protection as part of the easement specifications. This is the case in this instance, where the cleared easement traverses the Regional Park to the north of the central precinct, where it meets Ninth Avenue.

In some regards, the easement may provide an effect firebreak in low intensity fires within the Regional Park.

Subsequent to the above, it is not considered the proximity of Stage 6 as an Urban zone presents any tangible difference from Employment zoned land with respect to its proximity to this high voltage power line corridor.

6.5.3 Infrastructure analysis

The table below outlines the summary analysis of the infrastructure component of the strategic bush fire study.

Table 12 - Summary analysis of the strategic infrastructure requirements of PBP 2019

Issue	Detail	Assessment considerations	Summary analysis
Infrastructure	An assessment of the issues associated with infrastructure and utilities.	• The ability of the reticulated water system to deal with a major bush fire 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.	Stage 6 is intended to be connected to a reticulated water supply, and is capable of compliance with the water supply requirements of PBP 2019. A high voltage power line traverses the central precinct. It is assumed the infrastructure is constructed and maintained in accordance with industry specifications relating to bush fire protection. In some regards, the easement may provide an effect firebreak in low intensity fires within the Regional Park. It is not considered the proximity of Stage 6 as an Urban zone presents any tangible difference from Employment zoned land with respect to its proximity to this high voltage power line corridor.

6.6 Adjoining land assessment

Table 13 - PBP 2019 strategic considerations for adjoining lands

Issue	Detail	Assessment considerations
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bush fire management.	• Consideration of the implications of a change in land use on adjoining land including increased pressure on BPMs through the implementation of Bush Fire Management Plans.

6.6.1 Impact on adjoining lands

In terms of adjoining lands and landholders, it is noted the majority of surrounding land comprises existing urban residential development, golf courses and (existing and future) parkland. For land management relating to these uses, the proposed rezoning is unlikely to result in any significant (if any) impact on the need for increased on-site fuel load management to account for the development of Stage 6 for Urban (residential) purposes.

In relation to the management of the Regional Park, the rezoning of Stage 6 from Employment to Urban is unlikely to result in any change to the land and fuel load management of the adjoining Regional Park from that previously identified. It noted this has been previously considered by the former Office of Environment and Heritage by submission lodged during the consultation period in 2018. This matter is addressed in more detail at Section 9 of this study.

6.6.2 Adjoining land analysis

The table below outlines the summary analysis of the consideration of impacts on adjoining lands component of the strategic bush fire study.

Table 14 - Summary analysis of the strategic adjoining lands considerations of PBP 2019

Issue	Detail	Assessment considerations	Summary analysis
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bush fire management.	• Consideration of the implications of a change in land use on adjoining land including increased pressure on BPMs through the implementation of Bush Fire Management Plans.	The rezoning of Stage 6 from Employment to Urban is unlikely to result in any tangible change to the land and fuel load management of adjoining lands from that previously identified or considered by relevant stakeholders, including government agencies.

7 Strategic compliance analysis

This section assesses the performance of the proposed rezoning of Stage 6 of the central precinct against the strategic principles of PBP 2019 outlined at Section 5 of this study, and as per Section 4 of PBP 2019. In terms of satisfaction of these principles with regard to the proposed rezoning, the following is noted:

- the proposed rezoning does not present any substantial strategic issues on balance with the risk profile of the landscape. Whilst hazard and risk is not avoided, the risk is capable of being satisfactorily mitigated. This includes ***the ability to evacuate which is a core facet of minimising risk to life*** in bush fire prone areas;
- this strategic bush fire study identifies the proposed rezoning is ***capable of satisfying the statutory bush fire protection measures*** outlined by PBP 2019. Further detail in relation to this would be required to be submitted as part of future subdivision applications to NSW RFS for integrated development;
- whilst this study cannot fully determine the potential for performance-based solutions as this is dependant upon a final subdivision settlement pattern, it is noted the proposed rezoning is capable of satisfying the majority of ***acceptable outcomes*** as per PBP 2019, as required;
- the study considers the strategic aspects of firefighting capability, relevant to the proposed rezoning. This includes how the proposal supports firefighting ability, and enables ***suppression effort*** to occur. From a strategic perspective, the proposed development does not involve any identifiable challenges or impediments, but rather seeks to establish a formalised road network which connects with informal fire trails, easement and access tracks through the Regional Park to facilitate land management and support suppression, if required;
- the evacuation network including its capacity and connectivity has been assessed and demonstrates the entire central precinct is likely capable, based on assessment of intended road network capacity, of being ***evacuated within one hour*** of evacuation commencing, depending upon the situation of the day, and on the basis of a range of assumptions set out at **Appendix B**; and
- the proposed rezoning is unlikely to introduce any variation to existing or agreed ***land management practices*** for the Regional Park beyond that which would otherwise be required if the land remained zoned for Employment.

Having regard to the strategic principles for the exclusion of inappropriate development contained at Part 4 of PBP 2019, this study does not identify elements of the proposed rezoning which would deem it to be considered inappropriate development pursuant to Part 4 of PBP 2019.

This is of course keeping in mind the extent of risk is not avoided, but rather is sought to be mitigated by the implementation of a suite of bush fire protection measures, intended to function in combination to minimise the exposure of development to the threat of bush fire attack.

Further detail in relation to the implementation of these measures across Stage 6 are required to be submitted as part of future subdivision applications to NSW RFS for integrated development. The onus is on the bush fire hazard assessments and management plans to demonstrate compliance with the statutory elements of PBP 2019 based upon detailed site layout plans.

8 Summary and conclusions

This Strategic Bush Fire Study considers the proposed rezoning of Stage 6 of the central precinct of the St Marys ADI site located in Western Sydney, referred to as proposed Amendment No. 3 to SREP 30.

The PBP 2019 statutory guideline introduces a range of strategic planning considerations which are intended to be addressed via strategic planning processes via the preparation of a Strategic Bush Fire Study.

This study assesses the proposed rezoning of Stage 6 of the central precinct against the identified strategic principles and assessment requirements of PBP 2019.

This study considers the strategic appropriateness of the proposed rezoning. It identifies that based on the detail available, the planning proposal satisfies the strategic principles of PBP 2019, the detailed strategic bush fire study assessment requirements, and is capable of satisfying the statutory bush fire protection measures of PBP 2019, required to be assessed in detail at subdivision stage.

It is noted this study is a strategic assessment only, and further bush fire hazard assessment and management plan are required to be prepared and submitted to NSW RFS for integrated development, as part of future subdivision applications.

APPENDICES

Meridian Urban

Appendix A APZ table for the Central Precinct

Table 15 - APZ calculation location and dimensions for the central precinct pursuant to the 2019 PBP

Precinct boundary location (Figure 5)	Slope class of most influence[1]	Predominant vegetation community[2]	Residential APZ[3]	SFPP APZ[4]	Comment
Central Precinct					
1	Downslope >0-5 degrees	Grassy woodland	16m (OPA not allowed)	50m (OPA not allowed)	
2	Upslope	Grassy woodland	12m (OPA not allowed)	42m (OPA not allowed)	
3	Downslope >0-5 degrees	Grassy woodland	16m (OPA not allowed)	50m (OPA not allowed)	
4	Upslope	Grassy woodland	12m (OPA not allowed)	42m (OPA not allowed)	
5	Downslope >0-5 degrees	Grassy woodland	16m (OPA not allowed)	50m (OPA not allowed)	
6	Upslope	Dry sclerophyll forest	24m (OPA 10m)	67m (OPA not allowed)	Presence of Shale/Gravel Transition Forest as surveyed by Cumberland Ecology (2008b).
7	Upslope	Dry sclerophyll forest	24m (OPA 10m)	67m (OPA not allowed)	Presence of Shale/Gravel Transition Forest as surveyed by Cumberland Ecology (2008b).
8	Downslope >0-5 degrees	Dry sclerophyll forest	29m (OPA 10m)	79m (OPA not allowed)	Presence of Shale/Gravel Transition Forest as surveyed by Cumberland Ecology (2008b).

9	Upslope	Grassy woodland	12m (OPA not allowed)	42m (OPA not allowed)	
10	Downslope >0-5 degrees	Grassy woodland	16m (OPA not allowed)	50m (OPA not allowed)	
11	Downslope >0-5 degrees	Dry sclerophyll forest	29m (OPA 10m)	79m (OPA not allowed)	Presence of Swamp Oak Forest and River-flat Eucalypt Forest along the Regional Park riparian areas as surveyed by Cumberland Ecology (2008b).
12	Detention basin		APZ not required		APZ not required if detention basin is managed. If not managed a 25 m APZ will be required (dry sclerophyll forest; downslope >0 - 5°) within the Precinct or could be offset within the detention basin.
13	Regional Park open space		APZ not required		APZ not required as Regional Park Open Space will be managed.

1 Slope class most significantly influencing fire behaviour where the vegetation (bushfire hazard) is found over 100 m from the Precinct boundary.
2 Predominant vegetation is the most predominant and problematic vegetation over 140 m from the Precinct boundary.
3 PBP required setback for residential subdivision.
4 PBP required setback for Special Fire Protection Purpose (SFPP) development.
*Asset Protection Zones will be further addressed at the DA stage and, depending on the type of DA, in accordance with the requirements to obtain Rural Fire Service approval or to consult with the Rural Fire Service. This will include further consideration of the Asset Protection Zone widths identified in this precinct plan.

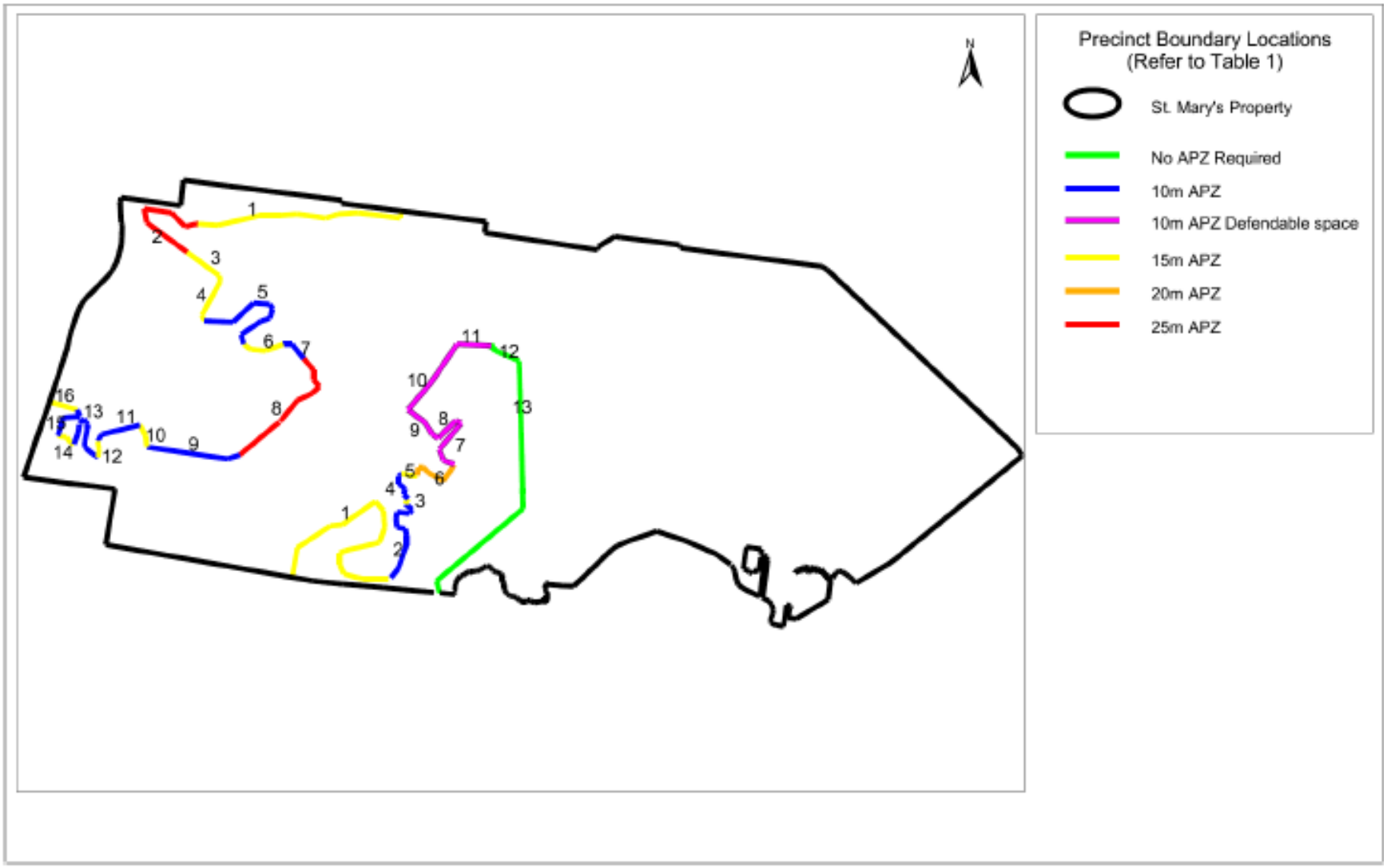

Figure 7 - APZ locations and dimensions for the central precinct (Source: BES, 2009)

Appendix B Strategic evacuation traffic analysis

STAGE 6 CENTRAL PRECINCT, SREP 30

Bush Fire Evacuation Traffic Analysis

PREPARED FOR:
Meridian Urban Pty Ltd

REFERENCE:
0273r01v04

DATE:
13/08/2020

STAGE 6 CENTRAL PRECINCT, SREP 30

Bush Fire Evacuation Traffic Analysis

Prepared for: Meridian Urban Pty Ltd

ABN: 16 621 030 439

Reference: 0273r01v04

Date: 13/08/2020

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Revision History

VERSION	DATE	PREPARED	REVIEWED	APPROVED	SIGNED
01	23/07/2020	Ben Midgley	Paul Corbett	Paul Corbett	Original signed
02	24/07/2020	Ben Midgley	Paul Corbett	Paul Corbett	Original signed
03	6/08/2020	Ben Midgley	Paul Corbett	Paul Corbett	Original signed
04	13/08/2020	Ben Midgley	Paul Corbett	Paul Corbett	

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1. Introduction

1.1. Overview

PDC Consultants has been commissioned by Meridian Urban Pty Ltd (Meridian) to undertake a bush fire evacuation traffic analysis (Traffic Analysis) of Stage 6 of the Central Precinct of the Sydney Regional Environmental Plan Number 30 – St Marys (SREP 30). This follows a proposal put forth in 2017 to rezone the approximate 38 hectares (ha) of land from 'Employment' to 'Urban'.

The rezoning intends to address long-term trends in employment-zoned land developed in Western Sydney, by reflecting current priorities for the area to improve housing affordability, supply and choice.

Several studies were undertaken in 2017 to assess the potential Stage 6 rezoning, which would approximately provide for an additional 512 homes through the rezoning of Employment land use. One such study was a bush fire protection report, which noted that the amended proposal "*confirms the bush fire protection assessment remains relevant to the proposed rezoning as many of the bush fire protection measures are common to both development types*" (Keylan Consulting, 2017).

Given the recent release of the revised Planning for Bush Fire Protection guideline, which came into effect on 1 March 2020, the prior assessment is deemed out of date to the extent where it is of little material relevance. As such, the Department of Planning, Industry and Environment (Department) commissioned Meridian to review the existing bush fire protection and mitigation reporting and align it with current statutory provisions.

To inform this review, Meridian has asked PDC Consultants (PDC) to provide traffic analysis consultancy services to assess the ability of residents in the newly proposed Urban land zoning to evacuate in the event of a bush fire.

1.2. Structure of this Report

This report documents the findings of our Traffic Analysis and is structured as follows:

- Section 2: Identifies the provisions and context in which the Traffic Analysis has been undertaken.
- Section 3: Describes the proposed development.
- Section 4: Presents the objectives of the Traffic Analysis.
- Section 5: Discusses the Traffic Analysis methodology.
- Section 6: Presents the findings of the Traffic Analysis and study limitations.
- Section 7: Presents the overall study conclusions.

1.3. References

In preparing this report, reference has been made to the following documents, guidelines, and standards:

- St Marys Bush Fire Technical Review, Meridian June 2020 (Meridian Review).
- Planning for Bush Fire Protection, NSW Rural Fire Service (RFS) November 2019 (PBP 2019).
- Sydney Regional Environmental Plan Number 30 – St Marys (SREP 30).
- Jordan Springs East Rezoning Detailed Evacuation Analysis, Molino Stewart July 2018 (2018 Flood Analysis).
- Australian Bureau of Statistics Quick Stats 2016 (ABS Quick Stats).
- Community Preparedness and Response to the 2017 New South Wales Bushfires, Whittaker and Taylor February 2018 (Whittaker and Taylor).
- Austroads Guide to Traffic Management Part 3 Transport Study and Analysis Methods, Austroads April 2020 (Austroads Guide).
- RMS[1] Guide to Traffic Generating Development 2002 (RMS Guide).
- RMS[1] Technical Direction TDT 2013/04a - Guide to Traffic Generating Developments, Updated Traffic Surveys (RMS Guide Update).

[1] Roads and Maritime Services (RMS) has joined with Transport for NSW, with reference to RMS now taken legally to automatically mean TfNSW.

2. Study Context: Planning for Bush Fire Protection 2019

2.1. Strategic Planning

The Meridian Review identifies that a significant revision to PBP 2019 from its 2006 predecessor is the introduction of a new section focussed on strategic planning. Section 4.1 of PBP 2019 notes that land use planning can be an effective tool in minimising or avoiding the impact of natural hazards such as bush fire through directing development away from inappropriate and constrained lands.

PBP 2019 also notes that services and infrastructure that facilitate effective suppression of bush fires need to be provided for during the planning stage. It advocates consideration of firefighting access and evacuation potential of traffic volumes generated in the event of a bush fire and the potential for these evacuation routes to be non-trafficable during a bush fire event.

Strategic planning principles are outlined in PBP 2019 along with identification of areas in which inappropriate development should be avoided through strategic planning.

Section 4.2 of PBP 2019 states that strategic development proposals in bush fire prone areas require the preparation of a Strategic Bush Fire Study. This study has been developed by Meridian and forms the overarching document to which this Traffic Analysis is attached. PBP 2019 states that as a minimum, the components outlined in **Table 1** regarding traffic must be included.

Table 1: Bush Fire Strategic Study Components

ISSUE	DETAIL	ASSESSMENT CONSIDERATIONS
Access and egress	A study of the existing and proposed road networks both within and external to the masterplan area or site layout.	• The capacity for the proposed road network to deal with 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 • The potential for development to be isolated in the event of a bush fire.

The components outlined in **Table 1** form the basis upon which this Traffic Analysis has been undertaken.

2.2. Residential and Rural Residential Subdivisions

As in PBP 2019, for the purposes of this Traffic Analysis, subdivision of land is the creation of lots for residential or rural residential properties.

The subdivision stage of land development provides an opportunity for early siting and access for the incorporation of bush fire protection measures. Section 5 of PBP 2019 reiterates the importance of considering access and egress

within the developable land and along the adjoining public road system, as the creation of developments in areas surrounded by bushlands pose significant challenges from a bush fire risk perspective.

Table 5.3b of PBP 2019, repeated below as **Table 2** for reference, identifies several performance criteria and acceptable solutions to provide safe operational access to structures and water supply for emergency services, while residents are seeking to evacuate from an area.

Table 2: Performance Criteria and Acceptable Solutions for Access

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS
Firefighting vehicles are provided with safe, all-weather access to structures. This is achieved where:	• Property access roads are two-wheel drive, all-weather roads; • Perimeter roads are provided for residential subdivisions of three or more allotments; • Subdivisions of three or more allotments have more than one access in and out of the development; • Traffic management devices are constructed to not prohibit access by emergency services vehicles; • 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; • All roads are through roads; • Dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end; • Where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; • Where access/egress can only be achieved through forest, woodland and heath vegetation, secondary access shall be provided to an alternate point on the existing public road system; and • One way only public access roads are no less than 3.5 metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.
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.	• Hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression; • Hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005 - fire hydrant installations system design, installation and commissioning; and • There is suitable access for a category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.
For perimeter roads, access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and	• Are two-way sealed roads; • Minimum 8m carriageway width kerb to kerb; • Parking is provided outside of the carriageway width; • Hydrants are located clear of parking areas; • Are through roads, and these are linked to the internal road system at an interval of no greater than 500m; • Curves of roads have a minimum inner radius of 6m; • The maximum grade road is 15 degrees and average grade of not more than 10 degrees;

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS
emergency management on the interface.	• The road crossfall does not exceed 3 degrees; and • A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.
For non-perimeter roads, access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	• Minimum 5.5m carriageway width kerb to kerb; • Parking is provided outside of the carriageway width; • Hydrants are located clear of parking areas; • Roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m; • Curves of roads have a minimum inner radius of 6m; • The road crossfall does not exceed 3 degrees; and • A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.
For property access, firefighting vehicles can access the dwelling and exit the property safely.	• There are no specific access requirements in an urban area where an unobstructed path (no greater than 70m) is provided between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles. • In circumstances where this cannot occur, refer to the rural property access requirement sets out in the 2019 PBP.

Many of the measures identified in **Table 2** relate to civil design of road infrastructure within the developable land, in this case the Central Precinct. Features such as the provision and location of access roads, geometric considerations such as width and curvature and location of road with respect to the water supply are all to be contemplated during strategic and concept design stages.

This Traffic Analysis does not assess whether the components identified in **Table 2** have been adhered to, as the masterplan is not yet designed to the detail to which assessment can be undertaken. This Traffic Analysis does however recognise the importance of these measures and advocates their implementation in development of the masterplan for the Central Precinct.

3. Proposed Development

3.1. Central Precinct

SREP 30 is the planning instrument which guides the development of the former Australian Defence Industries (ADI) site in St Marys. The site is divided into six precincts, of which the Central Precinct is the focus of this Traffic Analysis. The Central Precinct as identified in the context of the broader SREP 30 precincts is illustrated in **Figure 1**.

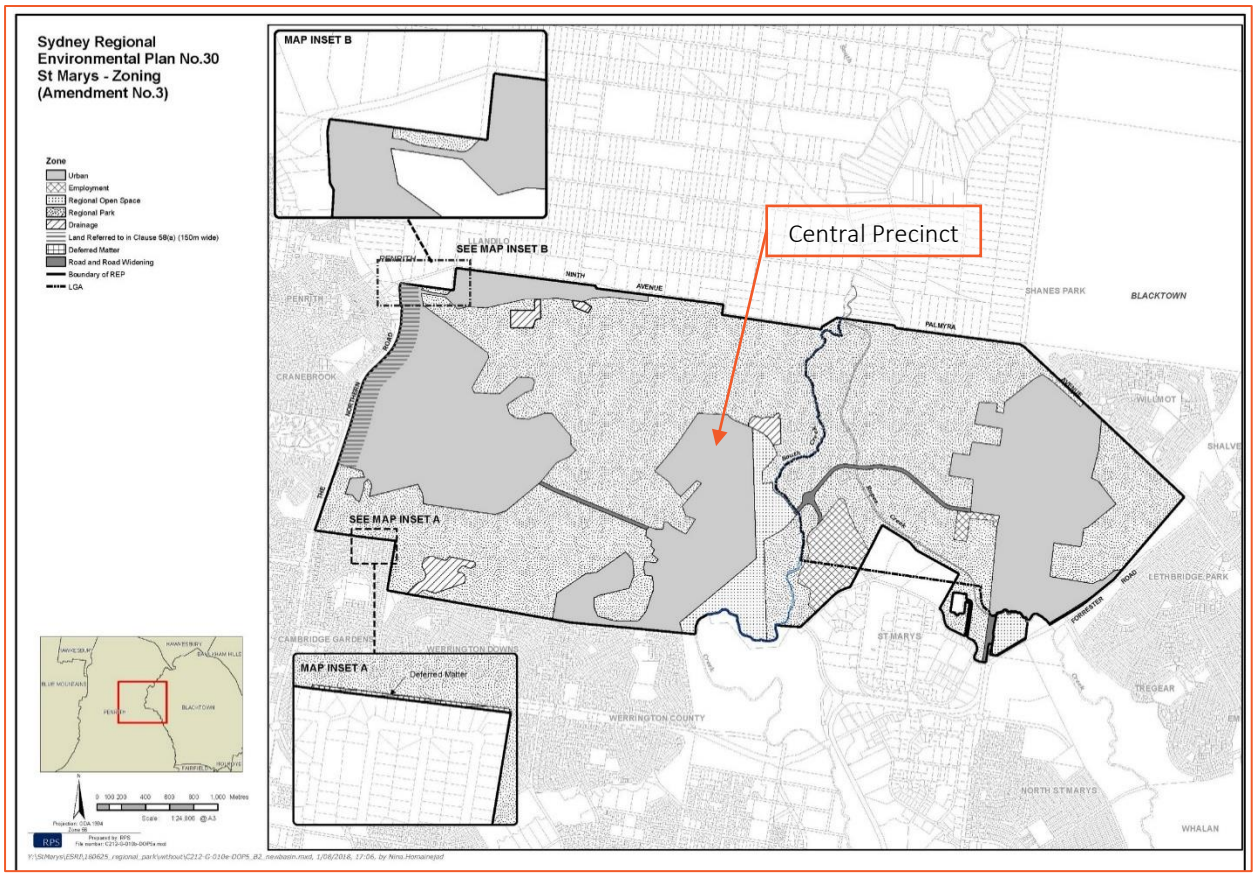

Figure 1: SREP 30 Zoning Map (source: The Department website, accessed 2020)

The Central Precinct formally consisted of two zones: 'Employment' to the north and 'Urban' to the south. Section 1.1 identified that a proposal was put forth in 2017 for the Employment land to be converted to Urban land, in response to more recent requirements for housing in Sydney's West. The site is being developed in stages, identified in Table 6 of the 2018 Flood Analysis as Stages 1 – 6, of which the rezoned Employment to Urban land formed Stage 6.

The number of dwellings proposed per stage of the Central Precinct, as identified in the 2018 Flood Analysis, is as in **Table 3**.

Table 3: Central Precinct Dwellings Per Stage

STAGE	1	2	3A	3B	3C	3D	4A	4B	4C	5A	5B	6	Total
DWELLINGS	436	348	103	87	65	100	93	54	13	119	30	512[1]	1960

[1] *500 dwellings were identified in the 2018 Flood Analysis; however, this has been increased to 512 dwellings following recent advice from the Department.*

A total of 1,960 dwellings are proposed for the Central Precinct, of which 512 are proposed across approximately 38 ha of Stage 6 Urban lands to the north-west of the precinct.

3.2. Road Network

3.2.1. External Connections

The external road connections providing access to and from the Central Precinct are summarised below:

- Wianamatta Parkway: A two-lane, two-way collector road stretching between Stage 1, at the west of the Central Precinct, westwards in an east-west direction to connect with Lakeside Parade in the Western Precinct, also known as Jordan Springs. This road provides direct access to the centre of the Central Precinct and terminates at a roundabout with Armoury Road.

- East West Connector Road: An as yet unnamed two-lane, two-way collector road stretching in an east-west direction between the eastern extent of the Central Precinct at the interface between Stages 3C and 5, across South Creek and Ropes Creek to the Ropes Crossing Boulevard intersection at the Ropes Creek Precinct, also known as Ropes Crossing.

- Leichhardt Avenue: A bus-only two-lane, two-way road running in a north-south direction from the southern side of the Central Precinct at Armoury Road to Werrington County at Henry Lawson Drive. This road will be prohibited for use by general traffic under normal circumstances; however, would be available for use by Central Precinct traffic in the event of a bush fire.

3.2.2. Internal Connections

The Central Precinct contains a network of several local and collector roads which serve the various stages of development, many of which are yet to be constructed and are unnamed. For the purpose of this Traffic Analysis, two internal roads are critical in evaluating bush fire evacuation:

- Armoury Road: A two-lane, two-way collector road stretching between Stage 6 of the Central Precinct to the north in a north-south direction, through its intersection with Wianamatta Parkway to connect with Leichhardt Avenue to the south of the Central Precinct.

- North South Internal Road: An as yet unnamed two-lane, two-way local road stretching between Stage 4C of the Central Precinct to the north in a north-south direction, through its intersection with the East West Connector Road to connect with Stages 3C and 3D to the south-east of the Central Precinct.

4. Objectives

This Traffic Analysis has been undertaken to inform a broader Strategic Bush Fire Study being undertaken by Meridian, as discussed in Section 2.1. The mandatory requirements of this Study are identified in PBP 2019, with those relevant to traffic provided in **Table 1**.

The objectives of this study are a direct response to the requirements of PBP 2019, as follows:

1. Consider the capacity for the proposed road network to deal with residents evacuating from Stage 6 of the Central Precinct, based on the proposed community profile;

2. Consider the location of key access routes and direction of travel; and

3. Consider the potential for development to be isolated in the event of a bush fire.

The methodology in addressing these objectives and findings of the Traffic Analysis are presented in Sections 5 and 6, respectively.

5. Methodology

5.1. Evacuation Traffic Demand

Key to determining the ability of residents of Stage 6 of the Central Precinct to evacuate in the event of a bush fire is determining the number of vehicles, or traffic demand, that would access the road network in such an event. Conventional means of traffic generation, such as the use of trip rates presented in the RMS Guide and RMS Guide Update, are not valid in the event of a bush fire evacuation, as the number of vehicles accessing the road network is inherently atypical and not reflective of usual peak period traffic demands.

Determining the evacuation traffic demand therefore requires a bespoke approach based on the number of dwellings in the study area and several geographic and behavioural influences. The number of dwellings in the study area is presented in **Table 3**, with geographic and behavioural influences discussed herein.

5.1.1. Vehicle Ownership Rate

The vehicle ownership rate is a reference to the average number of vehicles each dwelling in the Central Precinct is expected to own. The 2018 Flood Analysis adopts a value of 1.8 vehicles per dwelling for future dwellings, a number advised by the NSW State Emergency Service (SES).

To confirm the validity of this vehicle ownership rate, those of surrounding suburbs in the vicinity of the Central Precinct were assessed using ABS Quick Stats, with the findings presented in **Table 4**.

Table 4: Vehicle Ownership Rate Validation

AREA	NUMBER OF MOTOR VEHICLES PER DWELLING					
	0	1	2	3[1]	TOTAL	**AVG.**
Penrith Local Government Area (LGA)	3,869	19,705	23,636	14,291	61,501	**1.8**
Castlereagh – Cranebrook Statistical Area (SA) 2	206	1,857	3,127	1,884	7,074	**1.9**
Jordan Springs SA2	24	440	824	268	1,556	**1.9**

[1] *This value is stated as "3 or more" within ABS Quick Stats but is assumed as exactly 3 in the above calculations.*

Three areas of differing scales were assessed to confirm the validity of the vehicle ownership rate. The Central Precinct is located within the broadest catchment of Penrith LGA, and Castlereagh – Cranebrook SA2. Jordan Springs SA2, also known as the Western Precinct, is located immediately west of the Central Precinct within SREP 30 lands.

Assessment of the three areas provided in **Table 4** confirms that the assumed average vehicle ownership rate of 1.8 vehicles per dwelling is generally consistent with the surrounding areas, and thus this value is appropriate for use.

5.1.2. Dwelling Occupancy

The dwelling occupancy is a reference to the number of dwellings within the Central Precinct that are expected to be occupied when a bush fire event occurs.

ABS Quick Stats confirms that the number of private unoccupied private dwellings in the Castlereagh – Cranebrook SA2 during the 2016 census was 5.5 %.

The most conservative assessment of a bush fire evacuation event is to assume that residents of all remaining occupied private dwellings in the Central Precinct will be at home during a bush fire event. For this reason, a 95 % dwelling occupancy is adopted in determining evacuation traffic demand.

5.1.3. Stay and Defend

This assumption considers the proportion of residents who will stay at home to defend their property in the event of a bush fire, as opposed to using their private vehicles to evacuate.

The policy position attached to the national Fire Danger Rating system advocates for individuals to leave early in Catastrophic conditions and recommends it in Extreme conditions. However, there is strong evidence that suggests that despite messaging, the reality of community action is very different from that which fire agencies would like.

Whittaker and Taylor documents research undertaken into protective responses to a bush fire event, that being the proportion who would attempt to stay and defend their property in the event of a bush fire as opposed to departing.

The study found that of survey respondents who were threatened or impacted by bush fire in 2017, 46.7 % stayed or returned to defend their property, although some were not impacted and 6.5 % began defending and then left.

A separate survey asked what respondents would do if a Catastrophic Fire Danger warning were issued next summer, with 27 % indicating they would get ready to stay and defend.

To ensure conservative assessment of road network conditions, a stay and defend proportion of 25 % was adopted for this Traffic Analysis.

5.1.4. Private Vehicle Usage

The Traffic Analysis assumes all private vehicles owned by residents who would depart in the event of a bush fire would be used. This is a conservative assumption, with no reduction applied to reflect the fact that some residents, such as families, may leave one or more of their cars at their residence in the event of an evacuation.

5.1.5. Evacuation Traffic Demand Summary

The assumptions presented within this Section are summarised in **Table 5**.

Table 5: Evacuation Traffic Demand Assumptions Summary

ASSUMPTION DESCRIPTION	ASSUMED VALUE
Vehicle ownership rate	1.8 vehicles per dwelling
Dwelling occupancy	95 %
Stay and defend	25 % stay and defend | 75 % evacuate
Private vehicle usage	100 %

The resultant evacuation traffic demand generated by each stage of the development is presented in **Table 6**.

Table 6: Evacuation Traffic Demand by Stage

STAGE	1	2	3A	3B	3C	3D	4A	4B	4C	5A	5B	6	Total
DWELLINGS	436	348	103	87	65	100	93	54	13	119	30	512	1960
DEMAND (VEH)	559	446	132	112	83	128	119	69	17	153	38	657	2514

Table 6 confirms that a total of 657 vehicles would access the road network to evacuate Stage 6 of the Central Precinct in the event of a bush fire, should the above assumptions be adopted. The total number of vehicles across the Central Precinct would be 2,514.

5.2. Evacuation Routeing

Evacuation in the event of a bush fire involves residents of at-risk properties departing to an area of perceived safety. Such an area is typically urbanised, with a minimum of approximately 100 metres of separation to surrounding bushland frontage.

Within the Central Precinct, evacuating residents may either travel to an area of low risk within the Precinct that is separated by an asset protection zone (a buffer between a bush fire hazard and buildings) or depart the Precinct entirely.

In consultation with Meridian, this Traffic Analysis assumes only one location within the Central Precinct to which residents may evacuate and remain in-situ in relative safety, this being the shopping centre located to the south east of the Central Precinct, in Stage 3D. Though not confirmed, it is estimated this location will provide parking for at least 300 vehicles in a paved, urban area with a relatively large buffer to a potential bush fire hazard.

Aside from this location, there are not considered to be any further areas within the Central Precinct to which residents could travel and remain in-situ in relative safety, and so all remaining residents will be required to evacuate the Central Precinct entirely.

5.3. Evacuation Destinations

Four 'evacuation destinations' have been identified within this Traffic Analysis, as areas to which residents of the Central Precinct would travel in the event of a bush fire. These are listed below:

- WEST: Urban areas west of the Central Precinct such as Cranebrook and Penrith, accessible via Wianamatta Parkway and The Northern Road.
- SOUTH: Urban areas south of the Central Precinct such as Werrington County and Cambridge Park, accessible via Leichhardt Avenue and Henry Lawson Avenue.
- EAST: Urban areas east of the Central Precinct such as Lethbridge Park and Blacktown, accessible via the East West Connector Road and Ropes Crossing Boulevard.
- SHOPPING CENTRE: Located internal to the Central Precinct in Stage 3D, accessible via local roads such as Academy Street.

These four destinations cover all primary options for those residents who will evacuate the Central Precinct in the event of a bush fire, with no other external roads providing access to and from the Precinct beyond those presented above and in Section 3.2.1. The destinations are indicatively illustrated on **Figure 2**.

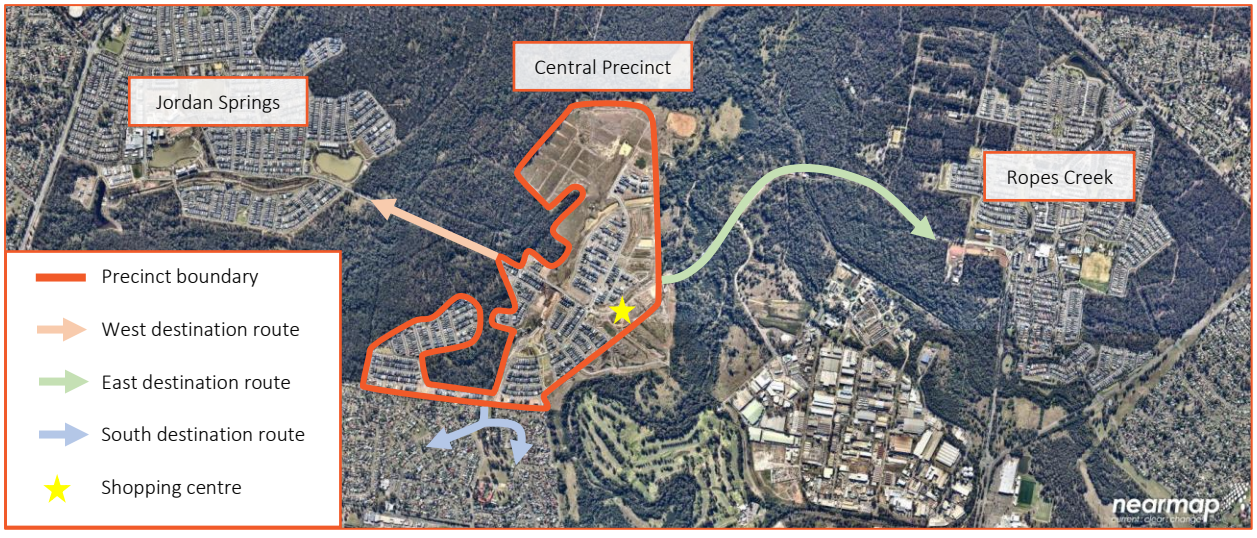

Figure 2: Evacuation routeing destinations (source: Nearmap, accessed 2020)

Figure 2 illustrates that departures west via the Wianamatta Parkway and east via the East West Connector Road necessitate travel along roads fronted with bushlands on either side. As a result, these evacuation routes may potentially be impacted by flames, smoke, or radiant heat in the event of a bush fire.

6. Road Network Performance

6.1. Overview

Section 5 establishes the evacuation traffic vehicle demand and routes via which said vehicles are able to evacuate in the event of a bush fire. This section uses this information to identify the potential traffic demand for each evacuation route and resultant road network performance.

Whilst the scope of this Traffic Analysis is focussed on the rezoning of Stage 6 and potential implications resulting from it, consideration of the entire Central Precinct is required to determine how residents of the rezoned Stage will be able to evacuate in the event of a bush fire.

6.2. Background Traffic

Background traffic in the context of this Traffic Analysis refers to vehicles that would already be on the road at the time a bush fire event occurs. Its consideration is important, as any traffic already on the road network would limit the remaining available capacity for those evacuating from the Central Precinct.

The Central Precinct is in an area with bushland to the north, east and west, with the southern perimeter directly adjacent to urban land zoned primarily as R2 low density residential. The single east-west connection passing through the Precinct, via Wianamatta Parkway and the East West Connector Road, passes through bushland, and runs generally parallel to the Eighth Avenue – Palmyra Avenue corridor to the north and Dunheved Road – Christie Street corridor to the south.

Given the availability of alternative east-west connections in the vicinity of the Precinct, it is anticipated that the vast majority of traffic using east-west connections through the SREP 30 lands, that is Wianamatta Parkway and the East West Connector Road, would be travelling to and from destinations within the SREP 30 lands.

In the event of a bush fire, traffic from the Western Precinct of Jordan Springs is likely to travel westwards to avoid passing through at-risk bushland to its east. Similarly, traffic from the Ropes Creek Precinct to the east is likely to travel eastwards for the same reason.

It is therefore put forth that all traffic on Wianamatta Parkway and the East West Connector Road in the event of a bush fire would solely be associated with the Central Precinct.

Given the assumption presented in Section 5.1.2 that 95 % of all dwellings will be occupied during a bush fire event, and the assumption in Section 5.1.4 that all privately owned vehicles will be departing residences in a bush fire event, the assumption that any traffic associated with the Central Precinct would already be on either Wianamatta Parkway or the East West Connector Road as ‘background traffic’ would be a double-count.

The assessment conservatively assumes all vehicles owned by residents in the Central Precinct will be at and subsequently depart said residences in the event of a bush fire, ensuring that all traffic is travelling in a single

direction, away from the Central Precinct, and thus creating worst-case conditions from a road network performance perspective.

This Section concludes that no background traffic is assumed as being on the external road network of Wianamatta Parkway or the East West Connector Road when a bush fire event and consequent traffic evacuation occurs.

6.3. Evacuation Destination by Stage

The 2018 Flood Analysis assumes Stage 2 and a proportion of Stage 1 would evacuate southwards via Leichhardt Avenue in the event of a flood, routeing which is also considered appropriate within this Traffic Analysis in the event of a bush fire, given geographical proximity of these stages to this road. It is assumed 25 % of Stage 1 residents would evacuate southwards via Leichhardt Avenue.

An illustration of the Precinct development stages, as presented in the 2018 Flood Analysis, is provided as **Figure 3**.

Given the shopping centre has the potential to accommodate approximately 300 vehicles in-situ without the need for broader evacuation of the Central Precinct in the event of a bush fire, it is assumed residents of Stages 3B, 3C and 3D will all evacuate to this location, given proximity of these properties to the shopping centre.

Residents of all remaining stages are assumed as needing to depart the Central Precinct altogether, via either the Wianamatta Parkway to the west or East West Connector Road to the east.

As stated in Section 2.1, PBP 2019 requires consideration of the potential for evacuation routes to be non-trafficable during a bush fire event. **Figure 2** illustrates that the Wianamatta Parkway and East West Connector Roads pass through land which may be impacted by bush fires and thus be non-trafficable during an evacuation.

To ensure a conservative assessment, it has been assumed that one of these east-west departure routes would be non-trafficable in the event of a bush fire, and thus the balance of all remaining residents not departing via Leichhardt Avenue or to the shopping centre would use a single road, either the Wianamatta Parkway or East West Connector Road, to evacuate.

Applying the above assumptions to the evacuation demand presented in **Table 6** results in the evacuation volume by destination presented in **Table 7**.

Table 7: Evacuation Traffic Demand by Destination

STAGE	1	2	3A	3B	3C	3D	4A	4B	4C	5A	5B	6	Total
DEMAND (VEH)	559	446	132	112	83	128	119	69	17	153	38	657	2514
WEST OR EAST	419	-	132	-	-	-	119	69	17	153	38	657	1,604
SOUTH	140	446	-	-	-	-	-	-	-	-	-	-	586
SHOPPING CENTRE	-	-	-	112	83	128	-	-	-	-	-	-	323

Table 7 identifies that a total demand of 586 vehicles from development Stages 1 and 2 would evacuate southwards via Leichhardt Avenue in the event of a bush fire evacuation, with a further 323 vehicles seeking refuge at the shopping centre located in Stage 3D.

All remaining evacuation traffic demand, 1,604 vehicles, would evacuate to the east or west via whichever road is trafficable, assuming one of the two has been impacted by a bush fire and cannot be used.

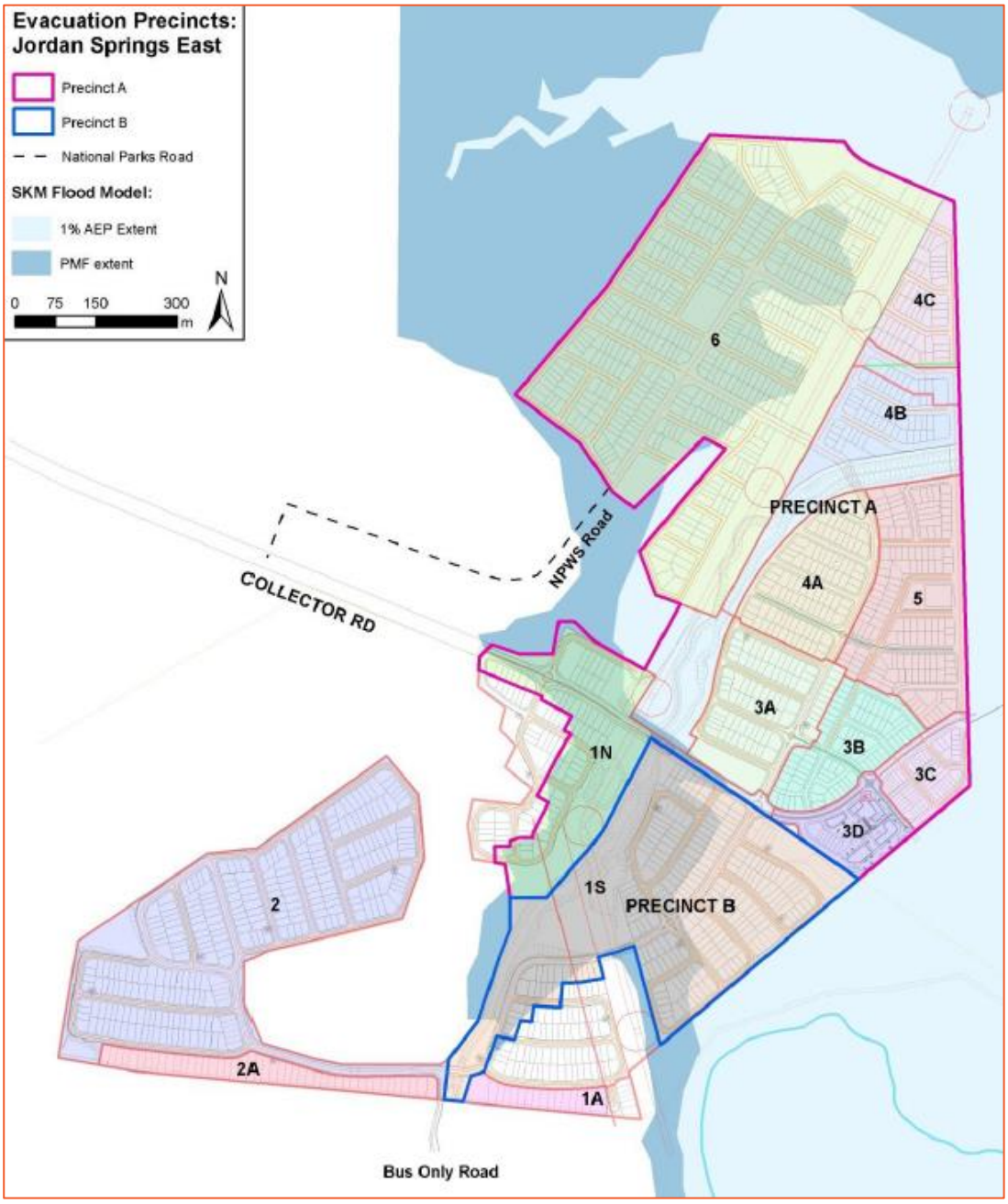

Figure 3: Precinct Development Stages (source: 2018 Flood Analysis)

6.4. Capacity Analysis

6.4.1. Road Capacity

Road network performance has been assessed using typical mid-block capacities for urban roads with interrupted flows, as set out in Section 6.2.1 of the Austroads Guide.

Given design of roads within the Central Precinct is in its early stages, assumptions have been made regarding the nature and layout of the roads to be used for evacuation as follows:

- Internal roads: Local roads internal to Central Precinct are conservatively assumed as kerb lanes with occasional parked vehicles, which have a capacity as stated in the Austroads Guide of 600 passenger cars per hour (pc/h).
- Leichhardt Avenue: As a two-lane, two-way bus-only lane, Leichhardt Avenue is assumed as a kerb lane with clearway conditions, which has a capacity as stated in the Austroads Guide of 900 pc/h.
- Wianamatta Parkway: As a two-lane, two-way road with flaring at major intersections, few crossing traffic locations, assumed absence of parking given the higher order nature of the road and absence of right turn movements at difficult intersections, Wianamatta Parkway is assumed as having a capacity of 1,200 pc/h.
- East West Connector Road: As a two-lane, two-way road with flaring at major intersections, few crossing traffic locations, assumed absence of parking given the higher order nature of the road and absence of right turn movements at difficult intersections, the road is assumed as having a capacity of 1,200 pc/h.

6.4.2. Vehicle to Capacity Performance

Given evacuation traffic demand by destination presented in **Table 7**, the vehicle to capacity ratios (V/C) for the three external evacuation destinations are as presented in **Table 8**.

Table 8: Vehicle to Capacity Ratio of Evacuation Routes

DESTINATION	DEMAND (VEH)	CAPACITY (PC/H)	V/C
West (Wianamatta Parkway) or East (East West Connector Road)	1,604	1,200	1.34
South (Leichhardt Avenue)	586	900	0.65
Shopping Centre	323	600	0.54

West (Wianamatta Parkway) or East (East West Connector Road)

Assessment of all traffic using one of Wianamatta Parkway or the East West Connector Road demonstrates that the number of vehicles evacuating via one of these roads exceeds the hourly capacity. The exceedance is by a factor of 34 %, suggesting that vehicles using one of these roads would require between one and two hours to evacuate.

It is acknowledged that vehicles evacuating via one of these two collector roads are required to first access said collector roads via the network of internal local roads, which will operate at capacities as low as 600 pc/h if they are kerb lanes with occasional on-street parking.

The two main north-south local roads providing access to the east-west collector roads are identified in Section 3.2.2 as Armoury Road and the unnamed North South Internal Road, which will be required to accommodate evacuation traffic demand from Stages 3A, 4A, 4B, 4C, 6 and 6.

The total evacuation traffic demand from these Stages is 1,185 vehicles. Assuming each north-south local road operates with a capacity of 600 pc/h, they will have capacity to accommodate evacuating traffic demand within a one-hour period. This in turn suggests that the pinch point in the event of an evacuation would be the one trafficable east-west collector road being used, given the V/C of 1.34 identified in **Table 8**.

It is therefore surmised that vehicles generated by evacuation of Stage 6 of the Central Precinct will satisfactorily be able to depart the Stage 6 land within one-hour of choosing to do so, via either Armoury Road or the North South Internal Road. These vehicles will however likely experience congestion at the intersections with the east-west collector roads of Wianamatta Parkway or East West Connector Road, in the event one becomes non-trafficable.

These two routes are illustrated on **Figure 2**, labelled 'West destination route' (Wianamatta Parkway towards Jordan Springs) or 'East destination route' (East West Connector Road towards Ropes Crossing).

South (Leichhardt Avenue)

Table 8 demonstrates that residents from Stages 1 and 2 evacuating to the south via Leichhardt Avenue will be able to do so, with a V/C of 0.65 suggesting ample capacity to cater for the traffic demand generated by these Stages over a one-hour period. This route is illustrated on **Figure 2**, labelled 'South destination route' (Leichhardt Avenue towards Werrington).

Shopping Centre

Similarly, **Table 8** demonstrates that residents from Stages 3B, 3C and 3D evacuating to the shopping centre via local roads will be able to do so, with a V/C of 0.54. Whilst these Stages contain a network of local roads which will spread traffic demand, it is conservatively assumed that the shopping centre has a single access which forms the pinch point for evacuation.

It is noted that any physical boundary to entering the car park, such as a boom gate, may restrict vehicles' ability to enter the car park in the quickest possible manner. Should the shopping centre form part of a local or regional strategy for accommodating residents evacuating from a bush fire, it is recommended that engagement occur to ensure any such physical measures are lifted or otherwise disengaged in the event of a bush fire evacuation to expedite entry to the car park. The shopping centre location is illustrated on **Figure 2**.

6.5. Broader Network Impacts

The total potential demand that would depart the Central Precinct in the event of a bush fire is not insignificant and may be departing onto a broader road network on which traffic from other surrounding suburbs is also trying to evacuate, or which have high background traffic volumes.

This Traffic Analysis acknowledges that upon departing the Central Precinct, congestion may be experienced by evacuating vehicles at interfaces with adjacent suburbs, such as in Jordan Springs or at The Northern Road to the west, in Ropes Crossing to the east or on the internal road network in Werrington County to the south. It is noted however that emergency traffic management may be enacted in such an event to assist with traffic evacuation.

The scope of this study has been to assess the ability of the proposed road network to deal with residents evacuating from Stage 6 of the Central Precinct, with Section 6.4 presenting findings accordingly. Broader network implications of a bush fire event may need to be considered in a more regional context to identify whether regional constraints will limit the ability of traffic generated by SREP 30 to evacuate.

6.6. Limitations and Exclusions

Limitations of the Traffic Analysis presented herein are listed below.

- The study assesses the ability of proposed network to deal with residents evacuating from Stage 6 of Central Precinct traffic but does not assess broader regional traffic constraints.
- No traffic modelling or intersection analysis has been undertaken to assess detailed, nuanced capacity constraints that may be present within the Central Precinct.
- The study assumes the shopping centre can accommodate up to 323 vehicles in its car park, though no design or proposal has been referenced to determine whether this is possible. This number was estimated through discussion with Meridian, who in turn liaised with the developer to estimate the value.
- It is assumed no visitors or vehicles belonging to non-residents are in the Central Precinct at the time of an evacuation. It is noted that the conservative assumptions informing resident populations offset any potential lack of visitor traffic demand.
- No businesses or other traffic generators have been considered within the Central Precinct as generating evacuation traffic above and beyond that generated by residential dwellings.
- It is assumed no change in staged dwelling numbers has occurred since July 2018, with those used in this Traffic Analysis informed by the 2018 Flood Analysis.
- This Traffic Analysis has been undertaken as a desktop study only and relies upon data from others. No field investigations or verification has been undertaken on this data.
- The Traffic Analysis does not constitute a comprehensive bush fire traffic analysis of the Central Precinct or SREP 30 lands and makes no comment or judgement on the risk to or safety of residents evacuating in the event of a bush fire.
- Assessment does not comment on the ability of firefighting vehicles to access properties, fire fronts or water supply in the Central Precinct.

7. Conclusion

PDC Consultants has been commissioned by Meridian to undertake a Traffic Analysis of Stage 6 of the Central Precinct of SREP 30. This follows a proposal put forth in 2017 to rezone the approximate 38 ha of land from 'Employment' to 'Urban'.

The report identifies the strategic context within which the Traffic Analysis has been undertaken, that is a requirement of PBP 2019 to consider bush fires during the strategic planning stage of a development or rezoning. As a result of requirements outlined in PBP 2019, the report sets out three objectives:

1. Consider the capacity for the proposed road network to deal with residents evacuating from Stage 6 of the Central Precinct, based on the proposed community profile;

2. Consider the location of key access routes and direction of travel; and

3. Consider the potential for development to be isolated in the event of a bush fire.

The report identifies how the community profile, proposed development and behavioural research informs determination of the number of vehicles expected to evacuate Stage 6 and the broader Central Precinct in the event of a bush fire, and identifies the location of key access routes and travel directions for those within the entire Central Precinct wishing to evacuate.

The capacity of the proposed road network is assessed with respect to the number of residents evacuating from Stage 6 and the broader Central Precinct, identifying that those evacuating southwards from Stages 1 and 2 via Leichhardt Avenue will likely not experience any significant congestion; however those from the northern Stages of the Precinct will likely experience congestion, with evacuation expected to take at least over one-hour should all residents depart their properties at the same time.

It is noted that this report comprises a desktop study to inform a Strategic Bush Fire Study being undertaken by Meridian. It is not a comprehensive bush fire traffic analysis of the Central Precinct or SREP 30 lands and makes no comment or judgement on the risk to or safety of residents evacuating in the event of a bush fire.

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