Rowan Village Strategic Bushfire Study

DevCore Property Group

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au

DOCUMENT TRACKING

Project Name	Rowan Village Strategic Bushfire Study
Project Number	22SYD1368
Project Manager	Geraint Breese
Prepared by	Melinda Losh
Reviewed by	Nathan Kearnes – FPAA BPAD Certified Practitioner: PBAD23575-L3
Approved by	Nathan Kearnes – FPAA BPAD Certified Practitioner: PBAD23575-L3
Status	**Final**
Version Number	**V5**
Last saved on	**19 April 2022**

This report should be cited as 'Eco Logical Australia 2022. *Rowan Village Strategic Bushfire Study*. Prepared for DevCore Property Group.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from DevCore Property Group and Urbis.

Template 2.8.1

Contents

Executive Summary **1**
1. Introduction **2**
1.1 Background 2
1.2 Aims and Objectives 2
1.3 Study Area 2
1.4 Legislative Framework 6
1.4.1 NSW Environmental Planning and Assessment Act (1979) 6
1.4.2 Rural Fires Act 1997 (RF Act) 7
1.5 Assessment Approach 7
1.5.1 Assessment Framework 9
1.5.2 Acceptance Criteria 10
2. Summary of Planning Proposal **11**
3. Bushfire Landscape Risk Assessment **13**
3.1 Bushfire Hazard 13
3.1.1 Vegetation 13
3.1.2 Slope 13
3.1.3 Bushfire Weather 17
3.2 Bushfire Risk Considerations 17
3.2.1 Bushfire History 17
3.2.2 Fire Catchment 17
3.2.3 Potential Fire Behaviour 20
3.2.4 Ignition and Fire Spread Scenarios 20
3.3 Summary of Landscape Bushfire Risk Assessment 21
4. Land Use Assessment **22**
4.1 Risk profile 22
4.1.1 Feasibility of Asset Protection Zones 22
4.1.2 Land use evaluation 25
5. Access and Egress **27**
5.1 Evaluation of Access and Egress 27
5.2 Evacuation 28
6. Emergency Services **31**
7. Infrastructure **32**
7.1 Water 32
7.2 Electricity and gas 32

8. Adjoining Land 34
9. Assessment of Strategic Planning Requirements 35
10. Conclusion & Recommendations 38
11. References 39
Appendix A – PBP Specifications: Subdivision and SFPP Development 41
Appendix B- Services Specifications 43

List of Figures

Figure 1: Location of Rowan Village 3
Figure 2: Bush Fire Prone Land 5
Figure 3: Indicative Layout Plan 12
Figure 4: Vegetation 15
Figure 5: Slope 16
Figure 6: Fire Catchments influencing the subject land 19
Figure 7: Bushfire hazard assessment and indicative APZ 24
Figure 8: Existing Declared Neighbourhood Safer Places 30

List of Tables

Table 1: Subject Land 2
Table 2: Wagga Wagga South Yield Calculations (Source: Devcore Property Group) 4
Table 3: Summary of PBP assessment considerations for a Strategic Bushfire Study (RFS 2019) 9
Table 4: Relationship of proposed development to Planning for Bushfire Protection 11
Table 5: PBP hazard classification and fuel loads for vegetation types in the study area 14
Table 6: PBP APZ requirements 23
Table 7: Land use evaluation 26
Table 8: Existing NSPs in vicinity of study area 29
Table 9: Fire Stations within proximity to the site 31
Table 10: Evaluation of the Structure Plan against the Strategic Planning Principles of PBP (RFS 2019) 36
Table 11: Performance criteria for access for residential and rural residential subdivisions 41
Table 12: Performance criteria for services provision for residential and rural residential subdivisions 43
Table 13: Water supply requirements for non-reticulated developments or where reticulated water supply cannot be guaranteed (Table 5.3d of PBP) 44

Executive Summary

When investigating the capability of Bushfire Prone Land in relation to planning proposals (i.e. rezoning or similar) the NSW Environmental Planning and Assessment Act 1979 prescribes that consent authorities must have regard to s.9.1 (2) Direction 4.4 – 'Planning for Bush Fire Protection'. Direction 4.4 prescribes consultation with the NSW Rural Fire Service (RFS); having regard to 'Planning for Bush Fire Protection 2019' (PBP); and compliance with the provision of bushfire protection measures (RFS 2019).

This Strategic Bushfire Study evaluates the proposed rezoning of the subject land and future development against the strategic planning principles and 'inappropriate development' requirements stated in Chapter 4 Strategic Planning of PBP. The applicable bushfire assessment framework for strategic planning outlined in PBP, was applied to the ILP for Rowan Village.

The bushfire risk assessment undertaken in this study identified that the location of the subject land mitigates bushfire risk due to reduced fire pathways and intensity, including primarily grassland hazard on mostly flat to undulating land along with the presence of road infrastructure and other fuel breaks, potentially impeding fire spread. Further, there is existing urban development to the northwest, north and northeast of the subject land, effectively shielding the site from bushfire attack from the most likely and the directions where elevated bushfire weather conditions generally occur. In addition, the site is surrounded by roads that separate the site from adjoining grassland hazard, significantly mitigating the risk of fire entry into the site.

The key findings of this study are that the site is not exposed to a 'high' bushfire risk, the land uses proposed are not subject to an unacceptable risk, nor does the proposal provide for 'inappropriate development' outcomes that cannot meet the requirements of PBP.

Whilst areas of bushfire risk exist in the broader landscape, the feasibility of bushfire protection measures, and the reduced bushfire risk immediately surrounding the site, means the residual risk can be lowered to an appropriate level. Thus, the planning proposal is considered consistent with the strategic planning principles of PBP in regard to the land use assessment.

As the primary purpose of the rezoning is to facilitate future residential development and a new village centre servicing the surrounding residents and is located in a lower risk setting it is recommended that opportunities for onsite refuge are investigated to increase the overall resilience of the broader community to bushfire. This could be provided by future community facilities or within open space, if adequately separated from areas of bushfire hazard.

1. Introduction

This Strategic Bushfire Study has been prepared with consideration of the Indicative Layout Plan (ILP) provided by DevCore Property Group prepared by URBIS. It is anticipated that this report will supplement the gateway planning submission for the subject land. This study provides an assessment of the ILP for the South Wagga Wagga site in regard to the strategic planning principles outlined in '*Planning for Bush Fire Protection*' (PBP) (RFS 2019). This is the first step in the planning pathway, and finalisation of the design will be an iterative process as the proposal progresses to the development application (DA) stage, where detailed design will be finalised.

1.1 Background

The Rowan Village site (the subject land) (Figure 1) is situated within the Wagga Wagga City Council Local Government Area. It is located south of the city of Wagga Wagga, between existing development along Lloyd Road in the north, Holbrook Road to the west and Rowan Road to the south. The site covers an area of approximately 225.02 ha (Figure 2) The proponent is seeking to rezone the entire study area from land zoned from RU1 Primary Production to R1 General Residential, R5 Large Lot Residential, B2 Local Centre and RE1 Public Recreation, this is to facilitate future residential and rural residential development, as well as seniors living, a village centre, and open space around a central riparian corridor.

1.2 Aims and Objectives

The aim of this study is to review the ILP in relation to the strategic planning requirements of PBP. The key objective is to undertake a Strategic Bushfire Study (SBS) as per the strategic planning principles, 'inappropriate development' exclusions and assessment considerations outlined in PBP.

1.3 Study Area

The subject land (Figure 1) is located approximately 10 km south from Wagga Wagga town centre and is currently primarily composed of rural grassland with some remnant vegetation scattered through the site. The subject land adjoins areas mapped as bushfire prone to the west, south and southeast (Figure 2). Table 1 identifies the land parcels that form the subject land for rezoning.

Table 1: Subject Land

Lot	DP
18	1054800
23	1063399
24, 26, 43, 65, and 66	757246
1 and 2	117189

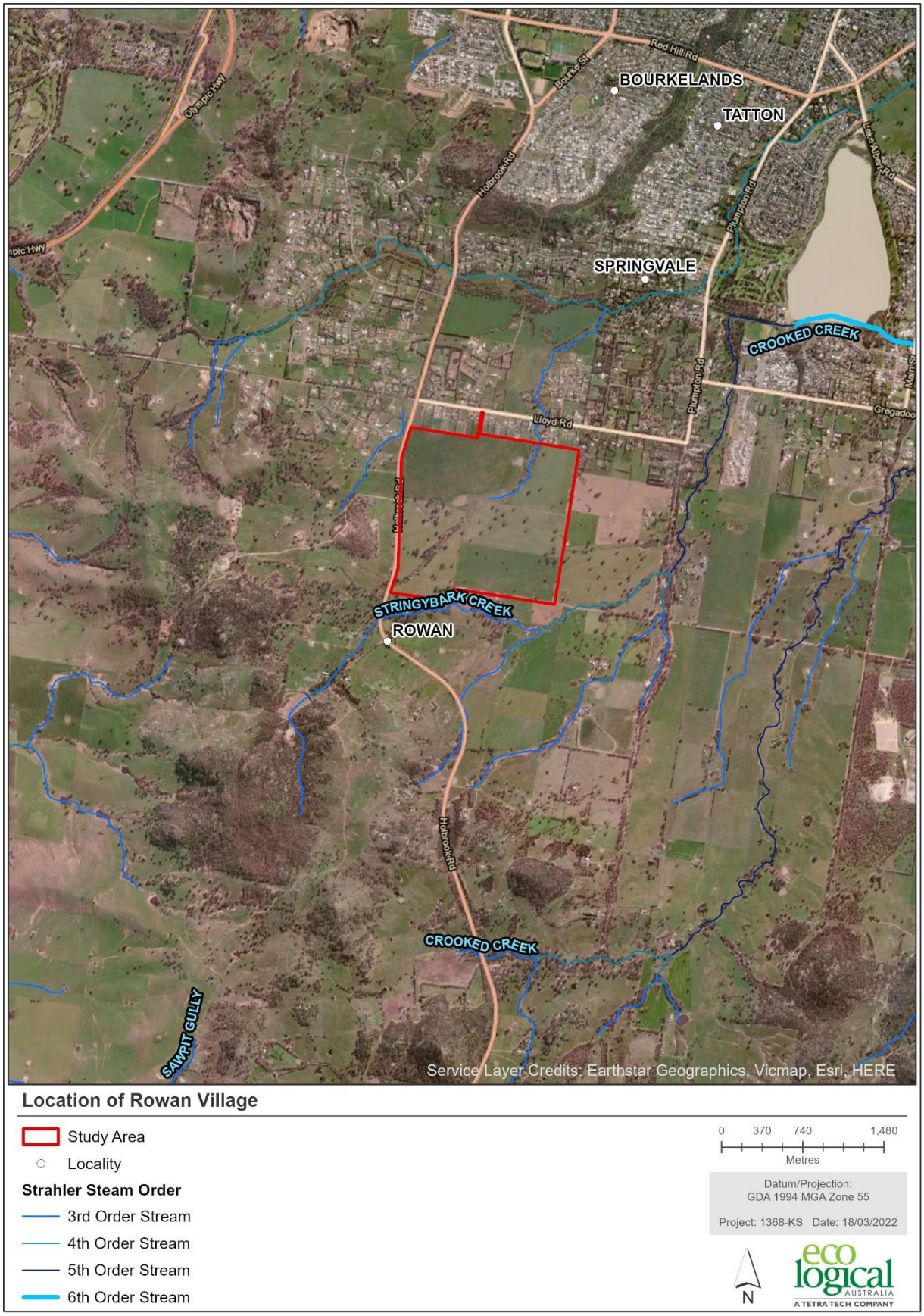

Figure 1: Location of Rowan Village

Table 2: Wagga Wagga South Yield Calculations (Source: Devcore Property Group)

Land use	m^2	Ha	%
Seniors Living	30,868	3.09	1.4%
Total Residential land	1,406,712	140.67	62.5%
Village Centre	15,966	1.60	0.7%
Open Space	356,256	35.63	15.8%
Streets	471,293	47.13	20.9%
Total	2,250,227	225.02	100.0%

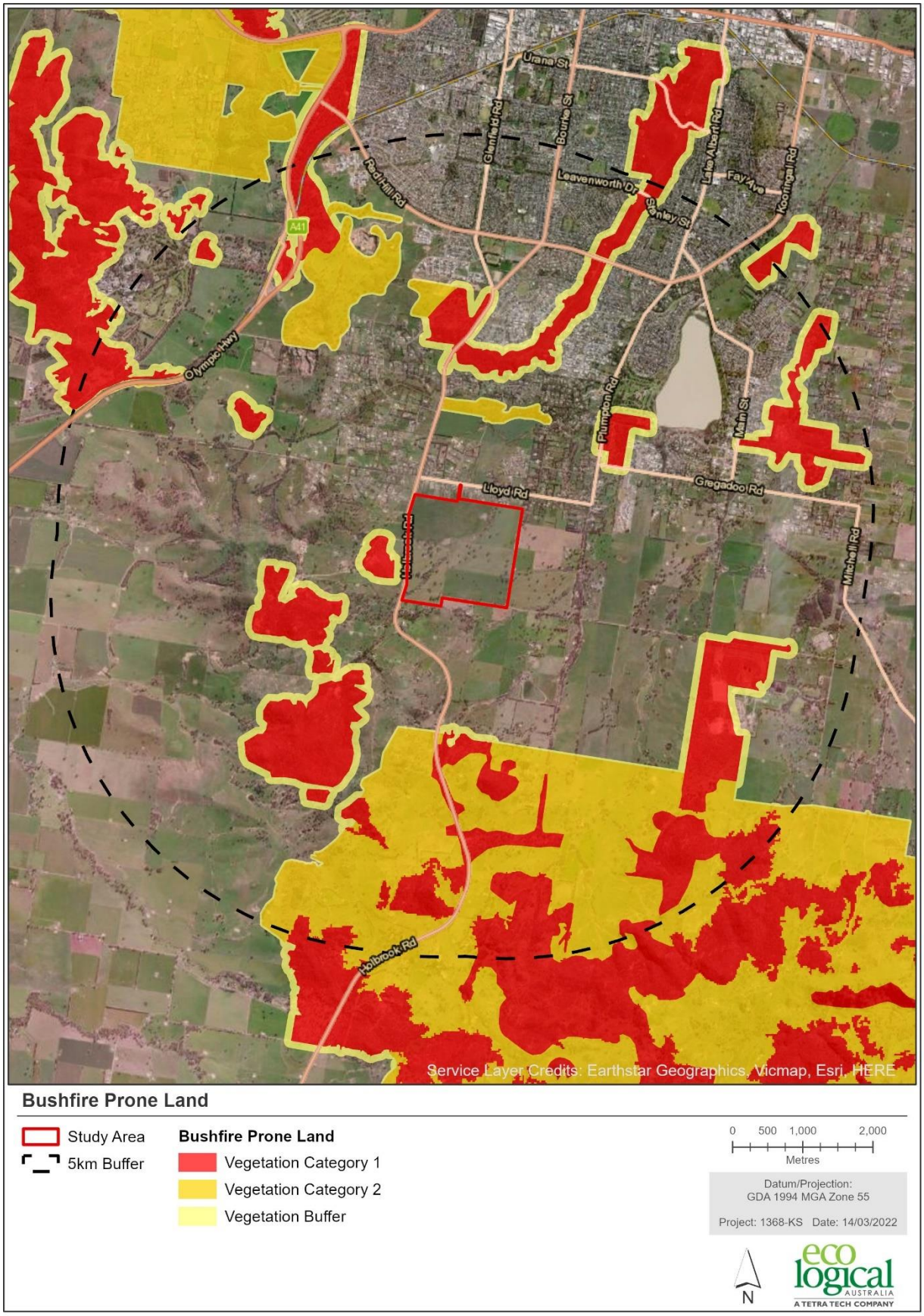

Figure 2: Bush Fire Prone Land

1.4 Legislative Framework

Under the Ministerial Direction 4.4 (Planning for Bushfire Protection) issued under Section 9.1 (2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), where a planning proposal includes or is in close proximity to BFPL, the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service (RFS) following receipt of a gateway determination. Therefore, the assessment detailed in this study seeks to outline how the proposal can adhere to the requirements of PBP. The legislative framework guiding the assessment of bushfire risk and the application of bushfire protection measures at the strategic level, includes the NSW *EP&A Act* and the *Rural Fires Act 1997* (RF Act). Key aspects of these instruments are outlined below.

1.4.1 NSW Environmental Planning and Assessment Act (1979)

The NSW *EP&A* Act is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments are integrated with the *EP&A Act*, including the *RF Act*.

Section 10.3 of the *EP&A Act* requires the identification of BFPL and development of BFPL maps, which act as a trigger for bushfire assessment provisions for strategic planning and development.

When investigating the capability of BFPL in relation to a planning proposal, consent authorities must have regard to s.9.1 (2) Direction 4.4 – 'Planning for Bushfire Protection' of the *EP&A Act*. The objectives of Direction 4.4 are:

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

Direction 4.4 instructs the consent authority on the bushfire matters which need to be addressed with respect to master planning. This includes:

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

Further, there are various provisions within the *EP&A Act* that may be applicable to proposals on BFPL, as outlined below:

- Section 3.29 of the *EP&A Act* relates to the development of State Environmental Planning Policies (SEPPs) and within these policies, bushfire considerations may apply for example:
  - Codes SEPP (Exempt and Complying Development Codes)
    - Clause 34 specifies complying development standards that prescribe compliance with PBP and AS3959, with development on BFPL not permitted within BAL-40 and BAL-FZ.
  - Seniors Housing SEPP (Housing for Seniors or People with a Disability)
    - Clause 27 of the SEPP requires PBP compliance and RFS consultation for development on BFPL.
  - Infrastructure SEPP

  - Clause 16 of the SEPP requires RFS consultation for residential or Special Fire Protection Purpose (SFPP) development on BFPL; and

- Section 4.14 relates to infill and other development.
  - Requires that all development on BFPL conforms to the specifications and requirements outlined in PBP, i.e., the specific requirements for residential infill in Chapter 7; and
  - The consent authority should be satisfied that the development conforms to PBP, or otherwise consult with the RFS Commissioner.
- Section 4.46 relates to integrated development and triggers Section 100B of the *RF Act* and Clause 44 of the *Rural Fires Regulation 2013* (RF Reg):
  - Applicable to subdivision, with specific requirements in Chapter 5 of PBP.
  - Applicable to SFPP developments, with specific requirements in Chapter 6 of PBP; and
  - Requires a bushfire safety authority under Section 100b of the *RF Act*.
- Section 9.1 relates to strategic or local planning.
  - Applicable to land use planning that covers large areas and may include a variety of land uses and longer-term development objectives. Specific requirements are outlined in chapter 4 of PBP.

1.4.2 Rural Fires Act 1997 (RF Act)

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

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

1.5 Assessment Approach

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

The strategic planning principles of PBP are:

- *Ensuring land is suitable for development in the context of bush fire risk;*
- *Ensuring new development on BFPL will comply with PBP;*
- *Minimising reliance on performance-based solutions;*
- *Providing adequate infrastructure associated with emergency evacuation and firefighting operations; and*

- *Facilitating appropriate ongoing land management practices.*

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

> *The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.*
>
> *The objectives are to:*
>
> *i afford buildings and their occupants protection from exposure to a bush fire;*
> *ii provide for a defendable space to be located around buildings;*
> *iii provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition;*
> *iv ensure that appropriate operational access and egress for emergency service personnel and residents is available;*
> *v provide for ongoing management and maintenance of bush fire protection measures; and*
> *vi ensure that utility services are adequate to meet the needs of firefighters.*

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

- *the development area is exposed to a high 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 affect 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.*

This study therefore assesses the proposal in the context of the PBP strategic planning principles, 'inappropriate development' exclusions as well as the assessment considerations identified in Table 4.2.1 of PBP, summarised in Table 3 below.

Table 3: Summary of PBP assessment considerations for a Strategic Bushfire Study (RFS 2019)

Issue	Summary of 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.
Land use assessment	The land use assessment will identify the most appropriate locations within the master plan area or site layout for the proposed uses.
Access and egress	A study of the existing and proposed road networks both within and external to the planning proposal/master plan area and site layout.
Emergency services	An assessment of the future impact of the new development on emergency services provision.
Infrastructure	An assessment of the issues associated with infrastructure provision.
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bush fire management.

1.5.1 Assessment Framework

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

1.5.1.1 Residual risk

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

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

1.5.1.2 Risk to life versus risk to property

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

1.5.1.3 Life protection and evacuation

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

emergency services, and in a strategic planning context, should not adversely impact the demands of the existing emergency service evacuation management.

Early offsite evacuation is the nationally accepted safest means for protection of life and for offsite evacuation to be effective, it should not require the assistance of emergency services. Notwithstanding that early unassisted offsite evacuation is a key risk assessment benchmark in this SBS; experience and research has demonstrated that it is not fail-safe or always feasible. Research and post incident inquiries have also found that providing evacuees options (along with warnings and information) is important to their survival.

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

1.5.1.4 Emergency service response

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

1.5.1.5 Adjoining lands

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

1.5.2 Acceptance Criteria

A clear quantification of an acceptable level of residual risk is important in assessing the appropriateness of a strategic planning proposal, however, PBP does not provide a clear quantification of an acceptable level of residual risk or define 'inappropriate' development with measurable criteria. In response to this limitation, the over-arching acceptance criteria for this study are that:

- The aims, objectives and Performance Criteria in PBP for the protection of life and property are achieved;
- The ILP complies with the strategic planning principles of PBP;
- The "inappropriate" development exclusion requirements of PBP are not triggered by the development proposed by the ILP;
- The Acceptable Solution bushfire protection measures within PBP can be met by the future development envisaged by the ILP;
- Compliance with PBP is not reliant on the intervention/response by emergency services or hazard management on adjoining land;
- The proposed development will not adversely impact the bushfire safety of occupants of nearby existing development and wherever possible will lower that risk; and
- An appropriate level of safety is possible from emergency management arrangements, including 'unassisted' offsite evacuation, along with other measures.

2. Summary of Planning Proposal

The proposed rezoning will facilitate differing land use activities and future constructions across the site, as shown in Figure 3. It presents a plan that incorporates a variety of dwelling topologies as well as non-residential uses. Future land uses enabled by the planning proposal and structure plan would be subject to various aspects of PBP, when occurring on BFPL. These aspects are summarised in Table 4 below.

Table 4: Relationship of proposed development to Planning for Bushfire Protection

Proposed Land Use	Associated Facilities and/or Activities	Key PBP Considerations for future development
Residential Land Use		
Low and medium density residential; large lot and rural residential	Detached homes (large lots, standard lots), townhouse/ duplex, terrace homes	Chapter 5 of PBP outlines the bushfire protection requirements for this type of development, including performance criteria identified for APZs, access and infrastructure.
Special Fire Protection Purpose (SFPP)	Independent living/seniors living	Chapter 6 of PBP outlines the bushfire protection requirements for this type of development, including performance criteria identified for APZs, access and infrastructure.
Non-Residential Land Use		
Commercial	Retail and specialised retail	Section 8.3.10 of PBP (Commercial and Industrial Development) outlines the bushfire protection requirements for this development type. Relevant protection measures to meet PBP aim and objectives are required.

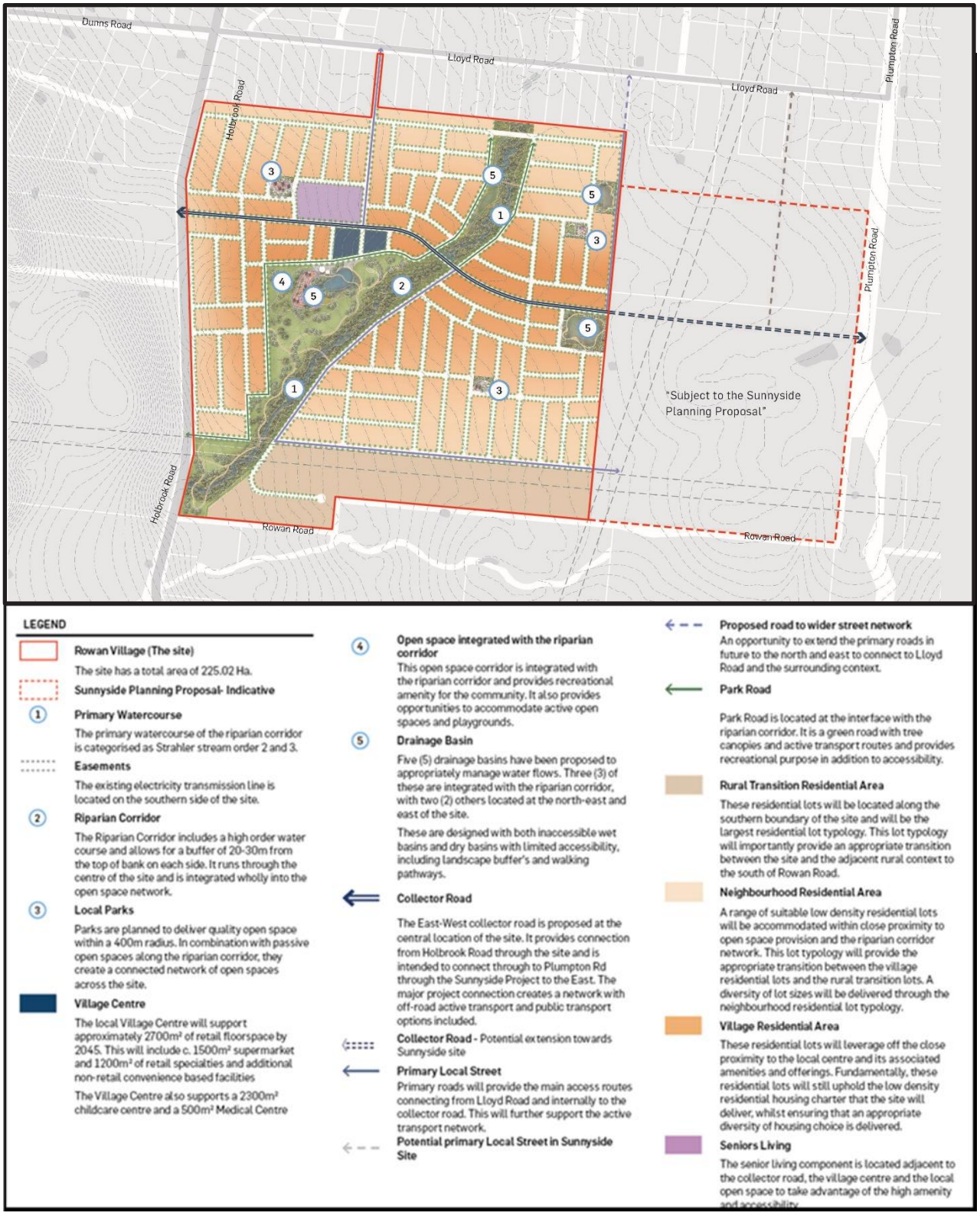

Figure 3: Indicative Layout Plan

3. Bushfire Landscape Risk Assessment

A landscape risk assessment was undertaken for the rezoning proposal and includes assessment of bushfire hazard, potential fire behaviour and bushfire history within a 5 km radius of the subject land.

3.1 Bushfire Hazard

The bushfire hazard has been classified using the methodology prescribed by PBP, through assessment of vegetation, slope and bushfire weather.

3.1.1 Vegetation

Vegetation mapping for the Riverina District was utilised for the broader study area and the subject site from State Vegetation Type Map: Riverina Region v1.2-VIS_ID 4469 (DPIE 2016) with mapping for the subject land prepared by ELA and validated in the field (March 2022). This collated mapping is shown in Figure 4.

The vegetation found on the site is identified as PCT 277 - Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South-western Slopes Bioregion, which classifies as PBP hazard class 'Grassy Woodland'. The vegetation within the site and present within the riparian corridor and proposed open space is a mix of Grassy Woodland and Derived Native Grassland. As the management of the Open space is not yet known it has all been conservatively assessed as a 'Grassy Woodland' hazard for the purpose of this assessment.

The broader vegetated landscape is dominated by grassland vegetation to the west, south and east with disjunct areas of forest and woodland scattered throughout these rural areas mainly on higher elevations. A summary of the relationship between PBP hazard class vegetation formation within the study area is shown in Table 5.

Bushfire hazard vegetation becomes increasingly fragmented from the west to the northeast with existing urban development and large lot residential development present in these directions.

3.1.2 Slope

Slope across the broader study area has been generated from a Digital Elevation Model (DEM) which was established using 2 m contours. The slope raster has been classified into the following slope classes as per PBP: 0° (flat); >0° – 5°; >5° – 10°; >10° – 15°; >15° – 20°; >20°. Figure 5 shows the slope across the broader study area.

As is evident in Figure 5, the surrounding land is mostly flat, progressing to upslopes under the woodland and forest vegetation. Within the subject land the terrain gently slopes down to the proposed riparian and open space corridor with some upslopes on the northwest side of the open space.

Table 5: PBP hazard classification and fuel loads for vegetation types in the study area

PBP Hazard Classification	Fuel Load (t/ha)[1]	Keith Class
Forest	36.1	Western Slopes Dry Sclerophyll Forests
Grassy Woodland	20.2	Western Slopes Grassy Woodlands
Grassland	6	Western Slopes Grassland

[1]From A1.12.8 of PBP

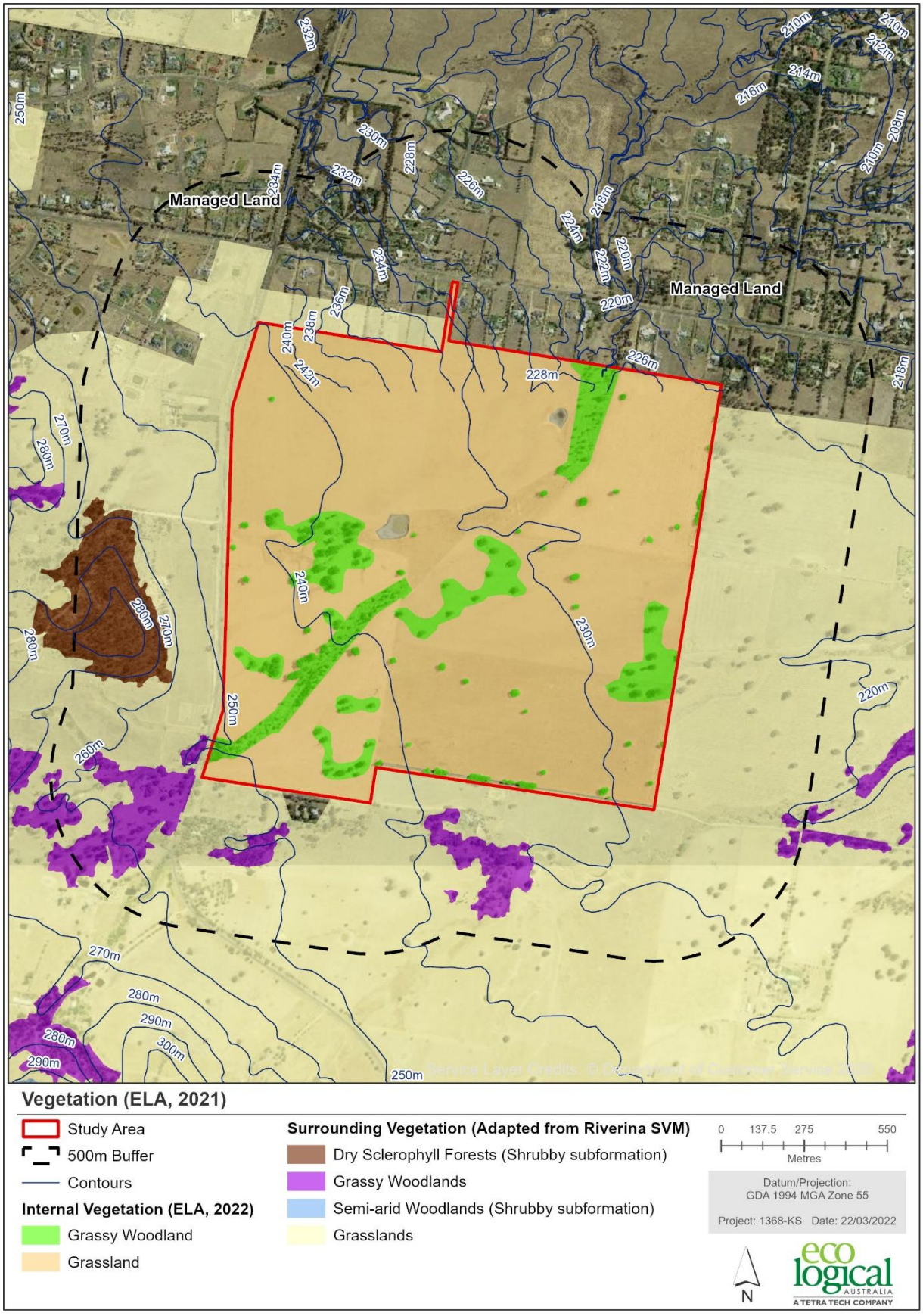

Figure 4: Vegetation

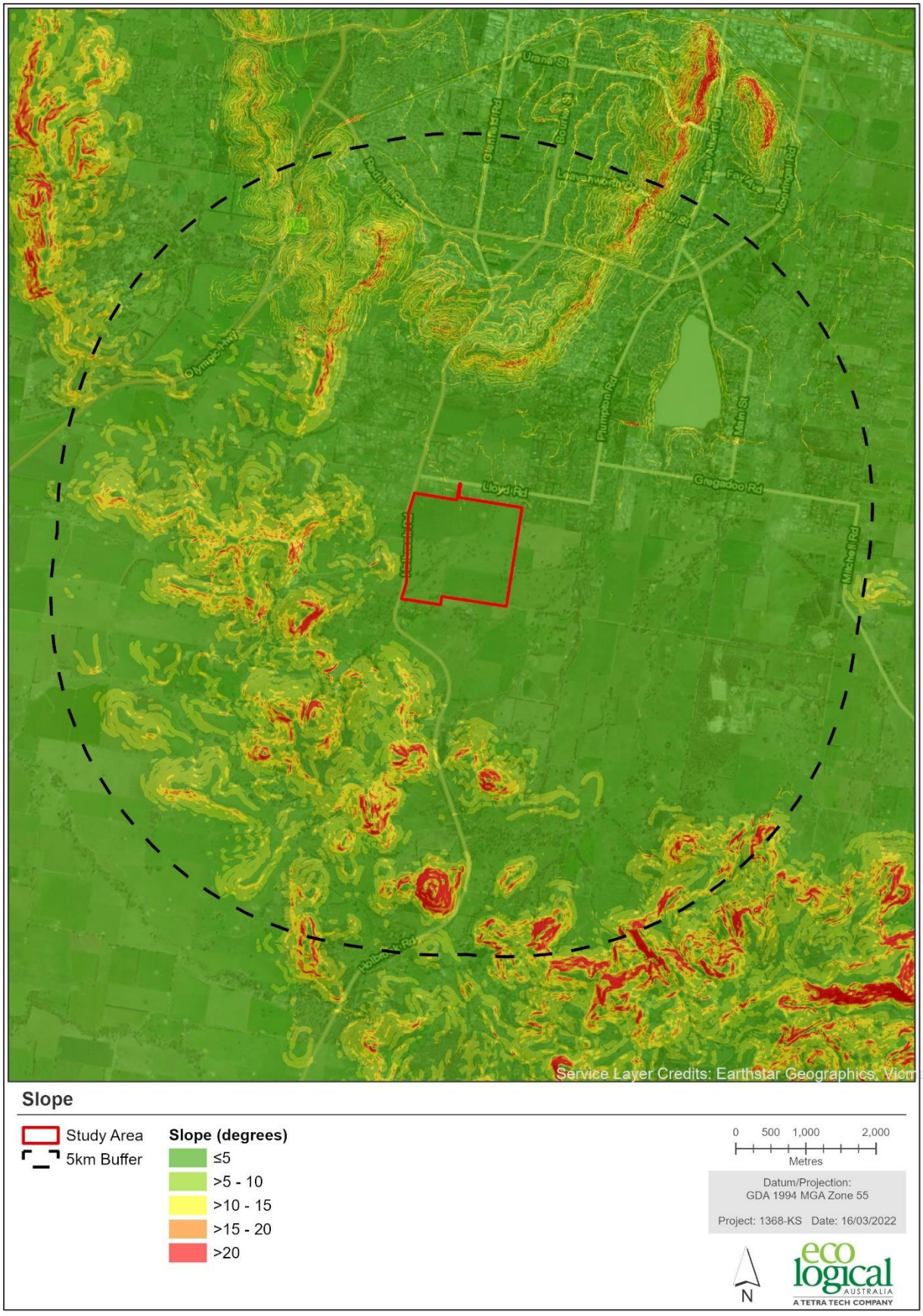

Figure 5: Slope

3.1.3 Bushfire Weather

The Rowan Village site is situated within the Riverina Bush Fire Risk Management Committee (BFRMC) area. The climate throughout the Committee area is generally temperate, with warm to hot dry summers and cool winters. Rainfall predominantly occurs in autumn and winter.

The bushfire season generally runs from October to March, as identified in the Riverina Bush Fire Risk Management Plan (BFRMP), and elevated bushfire weather conditions include north-westerly winds, high daytime temperatures and low relative humidity. Dry summer storms may produce lightning (BFRMC, 2015).

Bushfire weather is often described in terms of the Forest Fire Danger Index (FFDI) and this metric has a direct influence on the intensity of bushfire behaviour, with a higher FFDI corresponding to weather conditions with potential for higher intensity fires.

PBP prescribes the FFDI required to be used for development assessment for the site, as 80, as identified for the Riverina Region which includes the Wagga City Council LGA. The FDI used by PBP influences certain bushfire protection measures including Asset Protection Zones (APZ) and construction standards via the assessment of the Bushfire Attack Level (BAL).

Areas exposed to bushfire attack at higher FFDI are more likely to be impacted by fire as adverse fire weather will occur more often from those directions and a higher fire intensity is more likely as the weather conditions reach higher FFDI values. For the subject site, this is most likely to occur to the northwest, however as shown in the fire catchment map (Figure 6) existing development in this direction significantly inhibits the likelihood of fire runs from this direction.

3.2 Bushfire Risk Considerations

The following sections outline considerations informing the bushfire risk exposure of the subject land.

3.2.1 Bushfire History

According to the Riverina BFRMP, there are on average 200 fire incidents per annum, however only two on average progress to major fires.

A search of the RFS and NPWS fire history mapping dataset (DPIE 2021) shows there have been no mapped fires within the 5 km study area or impacting the subject land. Whilst this dataset would not contain all fires, it indicates that the potential risk posed to the study area for large or frequent wildfire is low.

Further, mixed management of rural land including grazing and cropping lands within proximity to the Rowan Village site, along with fire mitigation advantages from road infrastructure and existing urban development contributes to the low likelihood of fire impacting the site or immediate surrounds.

3.2.2 Fire Catchment

High level analysis of the potential fire catchments influencing the study area was undertaken and the results of this analysis are displayed in Figure 6. Delineation of fire catchments helps to identify the location and size of potential fire runs and therefore bushfire attack scenarios for different locations within the subject land. This informs assessment of the risk profile across the site, with exposure to larger fire catchments potentially resulting in an elevated bushfire risk.

As evident in Figure 6, fire catchments influencing the subject land are more prominent to the southwest, south and east, with potential fire pathways extending over 5 kilometres. However, aerial imagery identifies that rural land enterprises are occurring throughout the study area including cropping and grazing and it is unlikely that areas of grassland hazard are continuous within the study area. This rural land management practice creates fuel breaks which impedes or fragments fire runs. Holbrook Rd provides a fire break that somewhat mitigates fire activity from the west. A similar scenario is also identified to the south of the subject land with Rowan Rd providing a fire break to the south.

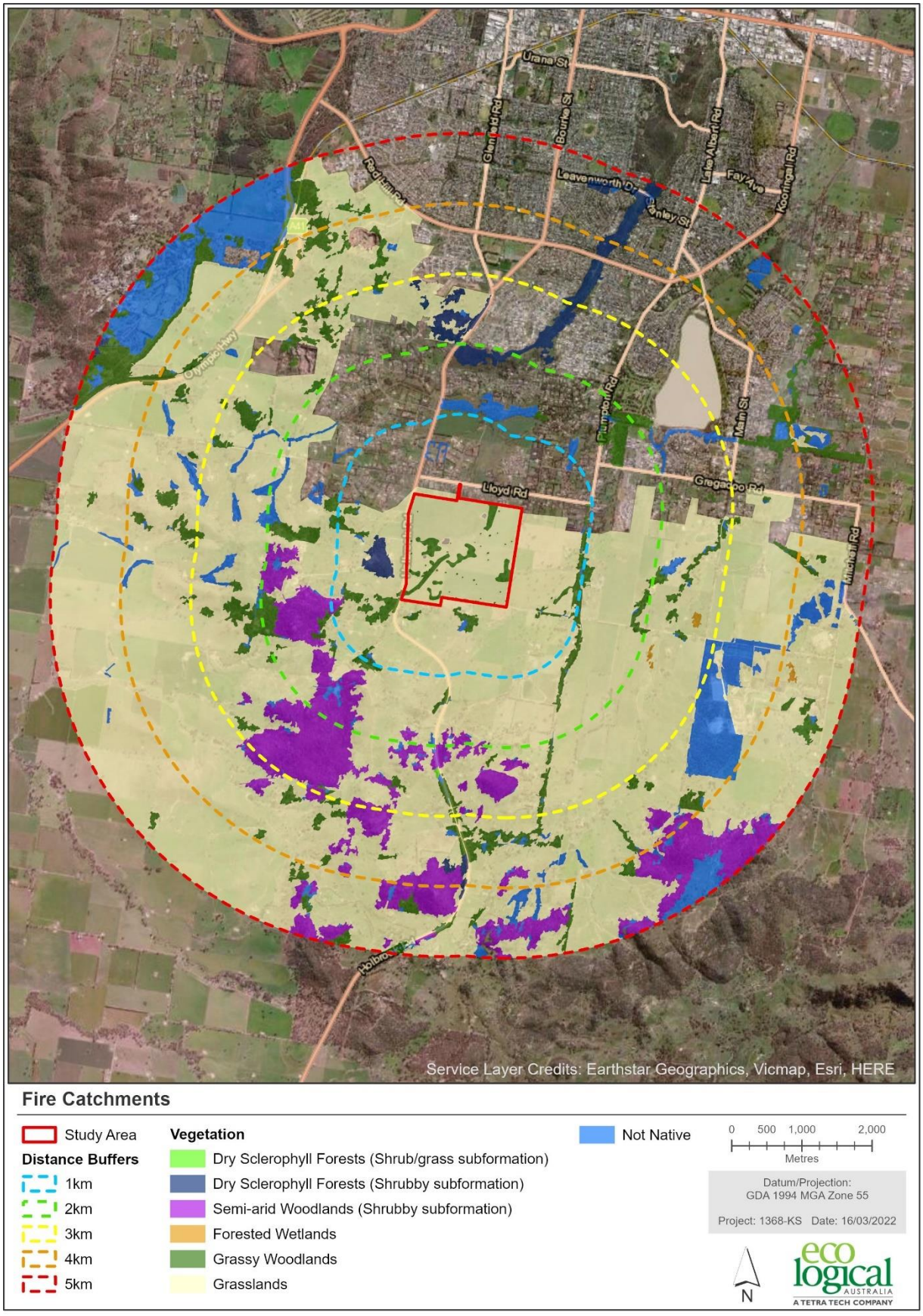

Figure 6: Fire Catchments influencing the subject land

3.2.3 Potential Fire Behaviour

Whilst each bushfire event is different, fire spreads by responding to changes in fuel, terrain, and weather conditions. Therefore, based on weather analysis, landscape conditions and fire history, potential fire behaviour can be determined.

Based on the potential fire runs and direction, the vegetation type being predominantly grassland and the terrain mostly flat and upslope under woodland and forest vegetation relative to the subject land, it is generally anticipated that fire activity in the study area is expected to be mostly moderate, but also patchy (not landscape wide) and temporal (highly dependent on grass growth and curing).

3.2.3.1 Bushfire Intensity

Fire intensity across the study area is expected to vary based on the hazard (vegetation type, fuel load and terrain). Bushfire intensity is a significant determinant of risk to life and property and the controllability of bushfires and therefore important in the consideration of the bushfire risk context, however other factors such as burn duration / residence time are also important considerations.

Based on the vegetation type and terrain, fire activity west and southwest of the site may exhibit short-lived higher fire intensities due to the presence of forest and woodland vegetation with higher fuel loads, however these areas are fragmented by extensive areas of open grassland and the fire mitigation advantages from rural land management such as grazing and cropping enterprises, (identified by aerial imagery and Google Earth), and roads that are likely to reduce fire intensity and disrupt fire pathways from reaching the subject land. These advantages, coupled with the proximity of responding emergency services (Section 5) means, direct exposure of future development within the subject land to high intensity bushfire beyond a level that can be planned for is unlikely.

3.2.3.2 Potential for Extreme Fire Behaviour

The potential for extreme fire behaviour is considered highly unlikely due to the predominance of grassland vegetation on flat to undulating terrain, and other fire mitigation advantages as discussed in Section 3.2.3.1.

3.2.4 Ignition and Fire Spread Scenarios

The Riverina BFRMP identifies the main sources of ignition in the BFRMC area as:

- Lightning, particularly from late spring and summer storms.
- Machinery, particularly agricultural machinery involved in harvesting and haymaking.
- Escapes from legal burning off.
- Incendiarism has been identified as the ignition cause of some bush fires.
- Accidental ignition

Fire management, coupled with the fragmentation of fire paths, as discussed in Section 3.2.2, means direct fire spread to the subject land is significantly mitigated, particularly as opportunity exists for on-site APZs to further increase the available setbacks. Further, while fire spread scenarios vary in each direction, no fires have been recorded as progressing to the subject land and therefore, the above ignition sources and potential fire pathways are not considered an increased risk for the proposed development that cannot be reduced by mitigation.

While potential ignitions and fire spread scenarios vary in each direction, emergency services are close by to respond quickly to any fire activity (Lake albert RFB to the east; Forest Hill RFB to the northeast; F&R NSW Turvey Park to the north). As indicated by the available records (DPIE 2021; RFS 2021) there has been little fire activity in the immediate surrounds, and no recorded fires have progressed into the subject site. Therefore, the above ignition sources and fire spread scenarios are not considered an increased risk for the proposed development.

3.3 Summary of Landscape Bushfire Risk Assessment

The landscape bushfire risk assessment for the subject land and surrounds considered the bushfire hazard including, fire history, fire catchments influencing the site, potential fire behaviour and fire ignition scenarios.

The location of the subject land is afforded mitigation advantages to reduced fire pathways and intensity, including the presence of road infrastructure around the site and existing urban development to the northwest and north.

Fire management activities occurring around the subject land would also help to mitigate fire pathways to the site. With increasing development occurring across the region, further fragmentation of fire pathways is expected, particularly to the east where land parcels are subject to a current planning proposal for large lot residential development.

In evaluating the landscape bushfire risk, the following high-level observations are made:

- The direction of elevated risk from bushfire attack generally occurs to the northwest due to higher FFDI, however this is mitigated by the extensive urban and rural residential development already present.
- There are interruptions to the continuity of bushfire hazard provided by Holbrook Road, which serves to interrupt potential fire pathways from the west and northwest.
- The fragmentation of the fire pathways via mixed land management practices of rural lands immediately south and east of Rowan Rd and Plumpton Rd and to some extent to the west.
- Fire history supports a lower risk of bushfire spread reaching the site from the west, as well as from other directions.
- Existing urban development to the north will also assist in mitigating all forms fire attack, including ember attack from this direction.
- The forest and woodland hazards that would contribute to higher bushfire intensity to the west are disconnected from the site, located between grassland and areas of rural managed land. Combined with large expanses of flat land the likelihood of damaging high intensity bushfires reaching the subject land is low.
- Bushfire hazards to the south and east are generally upslope of the subject land and when combined with lower expected FFDI, indicates a moderated bushfire attack scenario on the site from this direction.

4. Land Use Assessment

PBP outlines broad principles and assessment considerations for strategic planning proposals. It also specifies that bushfire protection measures (BPMs) need to be considered at the strategic planning stage, to ensure that the future development can comply with PBP, as per the specified BPMs in Chapters 5-8 of PBP. This land use assessment therefore considers the risk profile of the proposal, the suitability of proposed land uses and the feasibility of APZ requirements.

4.1 Risk profile

The feasibility of the Planning Proposal to comply with the BPMs identified within PBP is a fundamental consideration of the study. While BPMs and their performance criteria are a benchmark for approval of a development, a strategic level study needs also to evaluate these measures within the landscape risk context. This SBS has therefore considered the following:

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

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

4.1.1 Feasibility of Asset Protection Zones

Based on the bushfire hazard assessment, including assumed areas of planned revegetation along the Riparian Zone, an assessment of the feasibility of PBP compliant APZs has been undertaken. The indicative APZ requirements are shown in Figure 7. The APZ dimensions listed in Table 6 are the minimum required APZs under the Acceptable Solutions of PBP for residential development (i.e., 29 kW/m^2) and SFPP development (i.e. 10 kW/m^2). Figure 7 shows that for both development types, the PBP required APZs can be accommodated within the site and design.

The following considerations and assumptions are made in relation to the mapped APZs:

- Vegetation formation in the assessment is based on mapping prepared by Eco Logical Australia and PCT mapping for the Wagga Wagga LGA (DPIE 2016).
- Vegetation assessment has included the potential for a future bushfire hazard from revegetation in conservation areas, riparian corridors and open space, as identified in the ILP;
- Vegetation north of the northern boundary within urban development lots corresponding to the R2 zoning is primarily considered managed land, however the management extent of grass in some lots may not reduce the grassland hazard and indicative grassland APZ have been assigned along these boundaries. Where it is possible to have an APZ of 20 m to this or other areas of grassland hazard, then the grassland deeming provisions of Table 7.9a of PBP may be applicable.
- Open space management adjacent to proposed Seniors Living and the Village Centre meets the specifications of an APZ, as it is assumed this area would be managed for recreation.

- As detailed design progresses, further site assessment may reveal slopes that are slightly (but not significantly) different to those used to plot the APZ;
- Slope calculations assume no significant level changes resulting from construction earthworks;
- All APZs will be on land less than 18 degrees;
- Additional APZ and/or modification of the APZs in Figure 7 may be required if revegetation occurs beyond those areas identified in the ILP; and
- The APZs shown in Figure 7 can generally be facilitated by the proposal or incorporated into future design iterations as detailed design progresses to the DA stage, this includes the provision of APZs by proposed roads and lot setbacks as well as ongoing open space management.
- It has been assumed that the SFPP APZ within open space will be provided through managed land. It assumed that there will be an agreement with whoever is the future land manager to mange this land in accordance with APZ requirements.

Table 6: PBP APZ requirements

Transect	Slope	Vegetation Formation	Residential APZ (m)[1]	SFPP APZ (m)[2]	Comments
1	>0-5° downslope	Grassland	11	40	APZ provided by internal street and lot setback wholly within subject land.
2	>0-5° downslope	Grassland	11	40	APZ provided by internal street and lot setback wholly within subject land.
3	>0-5° downslope	Grassland	11	40	APZ provided by perimeter road and lot setback within subject land.
4	>0-5° downslope	Grassland	11	40	APZ provided by perimeter road and lot setback within subject land.
5	Upslope/flat land	Grassland	11	36	APZ provided by Holbrook Road and internal perimeter road.
6	Upslope/flat land	Grassland	11	36	APZ provided by Holbrook Road and internal perimeter road
7	Upslope/flat land	Grassy Woodland	11	42	APZ provided wholly within subject land.
8	>0-5° downslope	Grassy Woodland	13	50	APZ provided wholly within subject land.
9	>0-5° downslope	Grassy Woodland	13	50	APZ provided wholly within subject land
10	>0-5° downslope	Grassy Woodland	13	50	APZ provided wholly within subject land.
11	Upslope/flat land	Grassy Woodland	11	42	APZ provided wholly within subject land.
12	>0-5° downslope	Grassy Woodland	13	50	APZ provided wholly within subject land.
13	Upslope/flat land	Grassy Woodland	11	42	APZ provided wholly within subject land.
14	>0-5° downslope	Grassy Woodland	13	50	APZ provided wholly within subject land.
15	>0-5° downslope	Grassy Woodland	13	50	APZ provided wholly within subject land.
16	>0-5° downslope	Grassland	11	40	APZ provided wholly within subject land.

[1] Table A1.12.2 from PBP 2019, [2] Table A1.12.1 from PBP 2019

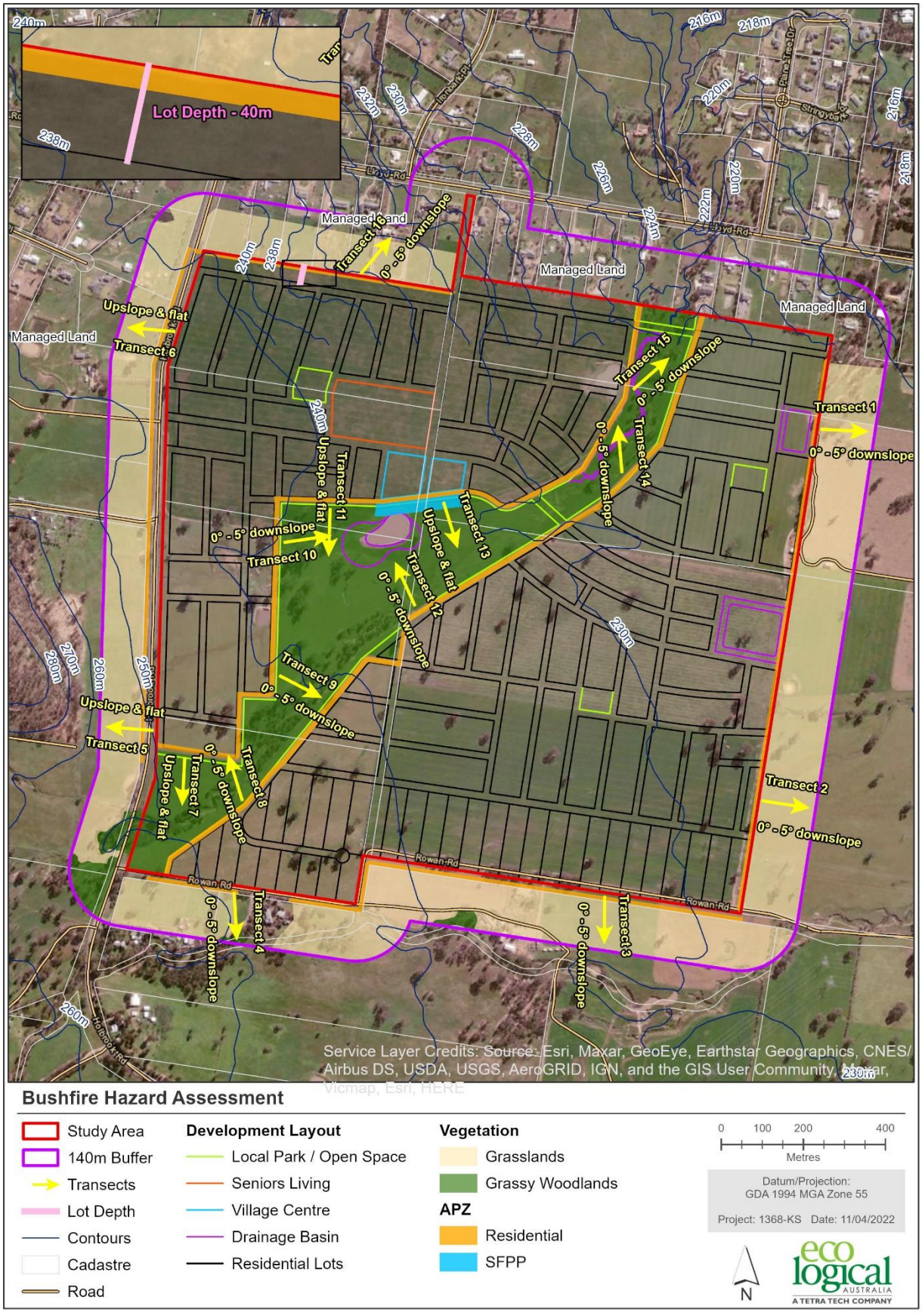

Figure 7: Bushfire hazard assessment and indicative APZ

4.1.2 Land use evaluation

Future development on BFPL will need to satisfy the performance criteria identified in PBP for various land uses. At a precinct level, it is expected that future land uses enabled by rezoning can accommodate the acceptable solutions identified in PBP to minimise reliance on performance solutions at the DA stage.

A summary of these requirements is outlined below and evaluated for the ILP in Table 7.

4.1.2.1 Chapter 5 of PBP – Residential and Rural Residential Subdivision

Much of the ILP area is planned for residential development and therefore will be subject to the requirements outlined in Chapter 5 of PBP. At the DA stage, to demonstrate the suitability of the proposed subdivision, the following provisions will need to be considered:

- Provision of compliant APZs;
- Access and egress within the developable land and along the adjoining public road system shall include safety provisions for attending emergency service vehicles and evacuating residents;
- Subdivision design shall include perimeter roads separating developable lots from hazardous bushland areas;
- Access is to be ensured for maintenance of APZ and other fire mitigation activities;
- Firefighting water supply and associated firefighting equipment (i.e., pump and hose) for each dwelling in addition to any reticulated water supplies; and
- Provision of access and infrastructure requirements according to Table 5.3b of PBP.

4.1.2.2 Chapter 6 of PBP – SFPP Development

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

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

4.1.2.3 Section 8.3.1 of PBP - Buildings of Class 5 to 8 under the NCC /Section 8.3.10 Commercial and Industrial Development

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

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

In meeting the objectives of PBP, best practice is for such developments to meet the requirements of BAL-29 in regard to APZ dimensions. General access and infrastructure requirements listed in Table 7.4a of PBP should also be considered

At BAL-29 and below, no specific BAL requirements are usually placed on such development and general ember protection measures are usually the only recommendations from the RFS in relation to buildings of this development type. However, where such development is placed in areas of BAL-40 or BAL-FZ, the RFS do apply the relevant BAL requirements of AS 3959-2018 or the NASH Standard. General access and infrastructure requirements listed in Table 7.4a of PBP should also be considered.

4.1.2.4 Section 8.3.11 – Public Assembly Buildings

Where a public assembly building has a floor space greater than 500m^2 it is considered an assembly building, and due to the evacuation of a large number of people, this type of development is generally treated as SFPP. This could include future facilities in the planned Village Centre such as a community hall or place of public worship. To meet SFPP requirements, future developments of this nature on BFPL would need provisions for APZs that meet a maximum Radiant Heat Flux (RHF) of 10 kW/m^2 and a construction standard of BAL-12.5, along with other requirements as per Section 4.1.2.2.

Table 7 below provides a summary of the land use evaluation for differing development types.

Table 7: Land use evaluation

Development Type	Assessment Considerations	Suitability
Residential Subdivision		Consideration has been given to the placement of different residential typologies and can comply with PBP
SFPP Development	The land use assessment identifies the most appropriate locations within the ILP area for the proposed land uses with consideration to: • The risk profile of different areas of the development layout • Proposed land use zones and permitted uses • The most appropriate siting for different land uses based on the risk profile • The impact of the siting of these uses on APZ provision	Requirements for SFPP development have been considered and suitable areas are feasible in the ILP
Buildings of Class 5 to 8 under the NCC /Section 8.3.10 Commercial and Industrial Development		No specific requirements apply however the aims and objectives of PBP can be achieved for future land uses. Where ground floor retail occurs in conjunction with residential development, then PBP requirements for residential development should apply.
Public Assembly Buildings		Requirements for SFPP development have been considered and suitable areas are feasible in the ILP

5. Access and Egress

The ILP for the Rowan Village proposal includes provision for perimeter roads adjacent to potential hazards including to the open space and riparian corridor as well as other small local parks. Public roads external to the subject land, being Holbrook Road and Rowan Road, also facilitate perimeter access and includes the provision of multiple access points for evacuation and responding emergency services.

As shown in Figure 3**,** the ILP provides the following access points:

- A collector road that traverses the site between Holbrook Road and a potential connection to Plumpton Road;
- One primary local streets that provide access to the existing public road – Lloyd Rd to the north, and another potential connection to Lloyd Road through property owned by others, north east
- The park road at southern end of development connects to Holbrook Road and provides a link to the collector road.

It must be noted that the eastward connection through to Plumpton Road and the secondary connection to Lloyd Road are 'potential' connections (as the neighbouring site is controlled by others). For the purposes of this assessment, it has been assumed that these connections will be provided in the future.

5.1 Evaluation of Access and Egress

In evaluating access and egress in the current proposal as per the assessment considerations outlined in PBP, the existing and proposed road networks both within and external to the masterplan area should facilitate:

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

Regarding the first assessment consideration, it is considered that the proposed collector road and primary through roads connecting to existing public roads will provide adequate capacity for responding emergency services and ensure that off-site evacuation remains feasible.

In review of the second assessment consideration, the location of access points and direction of travel is considered appropriate, with multiple access/egress points in directions able to avoid areas of elevated risk i.e., to the west of the site.

The potential for development to become isolated during a bushfire is not considered to be a key constraint for the proposal, with proposed ingress and egress routes in three directions, including Lloyd Road to the north, Holbrook Rd to the west and Plumpton Road to the east. These egress routes are linked to a central collector road that runs west to east.

Future development applications will need to address access requirements in more detail as per PBP 2019 (see Appendix A) and achieve:

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

Review of the preliminary road design indicates compliance with the acceptable solutions of PBP is achievable. However, a key aspect as the planning proposal progresses is assessment of the road capacity for emergency egress, particularly if the proposed development is to be staged.

5.2 Evacuation

The safety of emergency responders and occupants/users of the site exposed to potential bushfire attack is paramount. Therefore, this study has evaluated the viability of the three bushfire evacuation options and whether the Proposal is likely to exacerbate the risks associated with these options:

a. Early off-site evacuation (evaluated above);
b. On-site community refuges; and
c. In-situ sheltering (including a decision to stay and defend).

As discussed in Section 5.1, a traffic analysis can provide a detailed assessment on the capacity for full, 'un-assisted' off-site evacuation at all stages of the development, however it is clear from the access and egress outlined above that there are multiple internal and external access routes to facilitate safe, early off-site evacuation. Additionally, with the primary fire risk to the west, should Holbrook Rd be subject to road closure during a fire event, offsite egress via multiple access points to the north and east provide alternate options. Therefore, offsite evacuation is not considered a constraint to the development, provided existing public road capacity is sufficient and access/egress from the subject site is available at all stages of development.

The need for off-site evacuation from the subject site is also not considered high given the lower bushfire risk setting.

While on-site community refuges are currently not formally recognised or encouraged in the planning of new development in PBP; bushfire evacuation patterns (Whittaker *et al.* 2013, Strahan *et al.* 2018, Whittaker 2018, Whittaker 2019) suggest these should be part of best-practice strategic planning consideration as they add options when early evacuation is not feasible (e.g. rapid on-set bushfires) and potentially increase community safety and resilience in a broader range of bushfire attack scenarios.

Community refuge options such as an Evacuation Centre, Community Fire Refuge (as in Victoria) or Neighbourhood Safer Place (NSP) require comprehensive design. The following documents offer some guidance on these approaches:

- Bushfire Coordinating Committee Policy No. 1/2012 Community Safety and Coordinated Evacuations; and
- State Emergency Management Plan Evacuation Management Guidelines, March 2014
- *Neighbourhood Safer Places guidelines for the identification and inspection of neighbourhood safer places in NSW* (RFS, 2017). NSPs can be provided as Open Space or Building NSPs and must be sighted to have a radiant heat exposure of less than 2 kW/m^2 and 10 kW/m^2 respectively.

All three refuge types are acknowledged in the RFS NSP guideline document, but no standards have been established for Evacuation Centres and Community Refuges in NSW. Victoria is the only jurisdiction with a standard for Community Refuges and has already established four Community Refuges in higher bushfire-risk locations. Whilst Evacuation Centres and Community Refuges have not yet been approved in NSW, and processes/standards for these not yet developed, there are compelling reasons for them after the Black Summer bushfire experience.

Neighbourhood Safer Places (NSP) are an option that are suitable as a "refuge of last resort" and, unlike evacuation Centres, do not rely on welfare agencies (under the LEMC) to operate the facility in a bushfire emergency. There are important differences between Evacuation Centres, Neighbourhood Safer Places (NSP) and Community Fire Refuges. A NSP is considered a refuge of last resort and defined as:

> "*a building or a space within the community that has been designated as such by the Commissioner of the Rural Fire Service. It provides for improved protection of human life during the onset and passage of a bush fire. It is a location where people facing an immediate threat to their personal safety or property can gather and seek shelter from the impact of a bush fire.*"

Historically, NSP have been applied to existing communities, but in a Condition of Consent issued by the Independent Planning Commission was applied to a new subdivision in 2020; a precedent that encourages this level of forward thinking and design for new communities on Bush Fire Prone Land.

There are currently six Neighbourhood Safer Places (NSPs) located within close proximity to the Rowan Village Site (Table 8) and two within 10km of the Subject Land (Figure 8).

Table 8: Existing NSPs in vicinity of study area

Neighbourhood Safer Place[1]	Location	Suburb	LGA	Type	Distance (km)	Approx. Travel Time (min)[2]
Apex Park	Lake St, Lake Albert	Lake Albert	Wagga Wagga City Council	Open Space	6.5	8
Jubilee Park	Red Hill Rd and Bourke St	Wagga Wagga	Wagga Wagga City Council	Open Space	8	9
Kapooka Community Centre	Sturt Ave, Kapooka	Kapooka	Wagga Wagga City Council	Building	13.2	14
Uranquinty Park	33-45 Morgan St, Uranquinty	Uranquinty	Wagga Wagga City Council	Open Space	11.9	11
Yarragundry RFS Brigade Station	2-4 Benedict Avenue, San Isidore	San Isidore	Wagga Wagga City Council	Building	13.7	14
Forest Hill Park	Dunn Avenue, Forest Hill	Forest Hill	Wagga Wagga City Council	Open Space	16.4	16

[1] accessed from https://www.rfs.nsw.gov.au/plan-and-prepare/neighbourhood-safer-places; [2] estimate using Google Maps

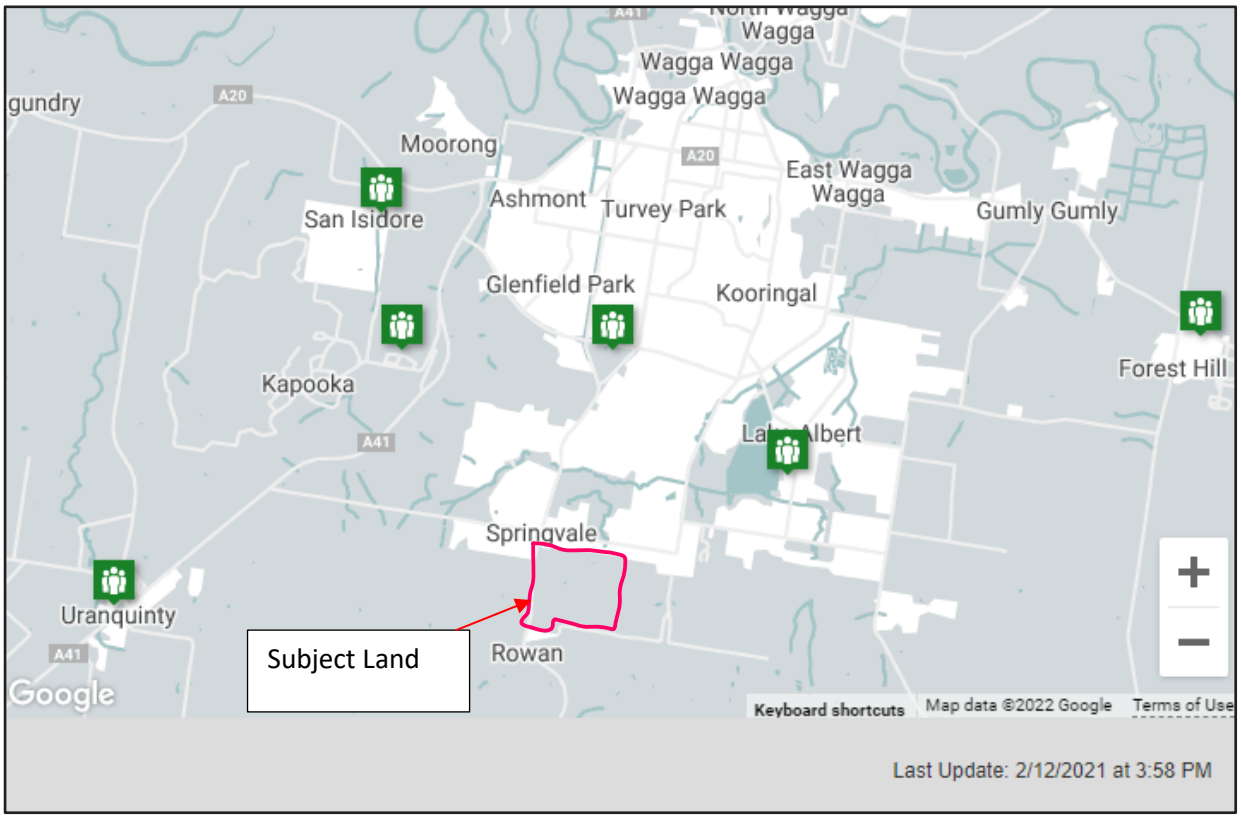

Figure 8: Existing Declared Neighbourhood Safer Places

6. Emergency Services

To gauge the proposals' ability to meet the objectives and strategic planning principles of PBP relating to emergency management, the following aspects were reviewed:

a. Consideration of the increase in demand for emergency services responding to a bushfire emergency including the need for new stations / brigades; and
b. Impact on the ability of emergency services to carry out the suppression in a bushfire emergency.

Regarding the demand for emergency services, ELA has reviewed the existing emergency services in proximity to the site and notes that there are two NSW F&R stations and two RFS Brigades close by as detailed in Table 11.

Table 9: Fire Stations within proximity to the site

Station	RFS/ NSW FR	Distance Km	Time	Direction
Wagga Wagga Fire Station	FRNSW	12.3	16 min	North
Turvey Park Fire Station RFS	FRNSW	9.3	11 min	North
Forest Hill Fire Brigade	RFS	15.5	15 min	Northeast
Lake Albert Fire Brigade	RFS	8	9 min	East

Regarding the impact of the proposed development on the ability of emergency services to carry out fire suppression in a bushfire emergency, the proposal allows for PBP compliant access, including perimeter roads, and water supply and hydrant access will need to comply with PBP at development assessment stage.

As such, there is no part of the assessment of the future impact on Emergency Services that suggests the proposed development should be excluded as inappropriate development under the Strategic Planning Principles or exclusion criteria within PBP.

7. Infrastructure

Future development on the subject land will need to meet the applicable requirements of PBP relating to infrastructure provision. The general requirements for development are discussed below and are considered achievable for this site. Specific requirements for SFPP developments and subdivision are detailed in PBP.

Strategic planning requirements seek to identify issues associated with infrastructure and utilities. Key considerations on suitability of infrastructure to meet the requirements of PBP include the ability of the reticulated water system to deal with a major 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. These aspects are explored below and summarised in Appendix B. Table 5.3 and Table 6.8 of PBP detail the acceptable solution requirements.

7.1 Water

To comply with PBP, future development should be serviced by a reticulated water supply. Fire hydrant spacing, sizing and pressures should comply with AS 2419.1 – 2005 'Fire hydrant installations – Part 1: System design, installation and commissioning (SA 2005). Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Fire hydrants should not be located within any road carriageway. All above ground water and gas service pipes external to any buildings are to be metal, including and up to any taps. Where reticulated water cannot be provided a static water supply for firefighting purposes is required on site for each occupied building in accord with the capacities outlined in PBP.

Further detail regarding water supply requirements is detailed in PBP and acceptable solution requirements for water supply are expected to be achievable for future development within the Subject Site.

7.2 Electricity and gas

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

- Lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; and
- No part of a tree is closer to a line than the distance set out in accordance with the specifications in ISSC3 'Guide for the Management of Vegetation in the Vicinity of Electricity Assets' (ISSC3 2016).

Reticulated or bottled gas is to be installed and maintained in accordance with Australian Standard AS/NZS 1596:2014 'The storage and handling of LP Gas' (SA 2014) and the requirements of relevant authorities (metal piping must be used).

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

8. Adjoining Land

The future development contemplated by the Planning Proposal should not compromise any offsite bushfire management works. Given the adherence to PBP that is required, any future development should also not require a change to the bushfire management practices for retained and/or adjoining bushfire prone vegetation. Additionally, there is capacity for all APZ's to be wholly within subject lands or provided by public roads. Therefore, there are no concerns regarding the impact of this proposal on adjoining land. The planning proposal additionally provides for decreased bushfire risk to adjoining development to the north.

9. Assessment of Strategic Planning Requirements

This section evaluates the rezoning for the Rowan Village site, against the bushfire strategic planning requirements of PBP (detailed in Section 1.5) and based upon the assessment findings in the preceding sections, to determine whether:

- The rezoning poses an unacceptable risk or provides for inappropriate development;
- That future development can adequately respond to the bushfire threat; and
- Adequate bushfire protection measures can be provided to reduce the residual risk to an appropriate level.

The evaluation is based upon PBP Chapter 4 and the Assessment Framework of this Study (Section 1.5) and is summarised in Table 12. In addition to evaluating the Proposal against these matters, the evaluation specifically considers:

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

Table 10: Evaluation of the Structure Plan against the Strategic Planning Principles of PBP (RFS 2019)

PBP Strategic Planning Principle	Evaluation

Ensuring land is suitable for development in the context of bush fire risk	The risk profile of study area is not uniform. Key findings include:
	• The study area is not exposed to high bushfire risk;
	• Areas of elevated bushfire risk beyond the Subject Land are generally associated with wooded vegetation, but exist within a fragmented fire catchment area;
	• The Subject Land does not have exposure to the most problematic directions of bushfire attack, the northwest, which is predominantly developed for residential use;
	• The areas of elevated bushfire risk in the broader locality are outside and separated from the Subject Land;
	• The bushfire hazards immediately adjoining the site are generally of a lower threat type, being:
	  ○ Grassland vegetation that is disconnected from the site by existing and proposed public road infrastructure and APZs
	  ○ Wooded vegetation that is disconnected from the site by open grassland and existing public road infrastructure;
	• The bushfire hazards within the Subject Land are generally:
	  ○ Disconnected from external bushfire hazards; and/or
	  ○ Associated with lower threat vegetation that can be mitigated through the provision of APZs
	This Study has identified that the proposed development is suitable given the bushfire risk context, considering:
	• The lower residual landscape risk exposure of the site;
	• The disconnection of the site from extensive bushfire hazards;
	• Proposed development areas being significantly separated from locations with elevated bushfire risk, with separation from adjoining hazards provided by significant public infrastructure, and mixed rural enterprise and management practices.
	• Positioning of SFPP development to provide for the acceptable solutions of PBP for APZ to be met;
	• The size and location of proposed land uses permits the application of bushfire protection measures that meet or can exceed the Acceptable Solutions of PBP, thus allowing the level of residual risk to be reduced to an acceptable level.
	• Feasible evacuation options to be confirmed by traffic modelling.
	• That none of the 'inappropriate development exclusions' specified in PBP, are triggered by the proposed development

Ensuring new development on BFPL will comply with PBP	The Structure Plan proposes land uses of a type, size and location that complies with PBP and this can be effectively managed in future development designs, at subsequent stages in the planning and development assessment process.
Minimising reliance on performance-based solutions	The compliance of the indicative structure plan to PBP requirements, does not rely on performance-based solutions.

PBP Strategic Planning Principle	Evaluation
Providing adequate infrastructure associated with emergency evacuation and firefighting operations	There are multiple egress points from the site to the existing public road network, providing for off-site evacuation, including four exit points away from the most likely fire pathway from the west. In addition, on-site refuge options are feasible and would offer useful redundancy to reduce the level of evacuation risk. Infrastructure for firefighting operations will include the road network, including perimeter roads and a reticulated water supply, to comply with PBP requirements. Multiple Rural Fire Service and Fire and Rescue Brigades are located within close proximity to the site.
Facilitating appropriate ongoing land management practices	The ILP does not restrict appropriate ongoing land management practices, nor is it reliant on bushfire management of adjoining lands to support its bushfire protection.

10. Conclusion & Recommendations

In evaluating the Rowan Village rezoning proposal against the bushfire strategic planning requirements of PBP, the following observations are made:

- The future development facilitated by the rezoning will not pose or be subjected to an unacceptable risk; or provide for 'inappropriate development' outcomes;
- The rezoning is consistent with the strategic planning principles of PBP;
- Adequate bushfire protection measures can be provided to reduce the residual risk to an appropriate level; and
- Future development resulting from the rezoning will not adversely affect existing development or adjoining landowners and their ability to undertake bushfire management.

In considering these aspects, our assessment of landscape risk demonstrates that the residual bushfire risk influencing the subject land is not unacceptable, and therefore, in combination with the strategic planning principles of PBP being satisfied, the proposed development outcomes are not considered inappropriate. Therefore, the strategic planning requirements of PBP are complied with for the proposed development.

Key recommendations include:

- That staging plans are developed to ensure the level of residual bushfire risk of early stages is not greater than that assessed in this study (i.e. early stages are afforded temporary bushfire protection measures e.g. APZs and access);
- That future design iterations (including revegetation and landscape plans) are undertaken with consideration to bushfire and meet the requirements of PBP;
- Future development considers opportunities for on-site refuge to increase community resilience to bushfire.

11. References

Cheney, P.N., Gould, J.S., McCaw, L.W., & Anderson, W.R. (2012). Predicting fire behaviour in dry eucalypt forest in southern Australia. *Forest Ecology and Management*. 280(2012):120-131.

Department of Planning, Industry and Environment (DPIE). State Vegetation Type Map: Riverina Region v1.2-VIS_ID 4469 (DPIE 2016).

Department of Planning, Industry and Environment (DPIE). 2021. NPWS Fire History - Wildfires and Prescribed Burns, accessed via seed.nsw.gov.au

Douglas G. He Y. Yang X. and Morris E.C. 2014. Use of Extreme Value Analysis in Determining Annual Probability of Exceedance for Bushfire Protection Design. *Proceedings of the 11th International Association of Fire Science*, Christchurch, New Zealand.

Douglas G., He Y. and Kwok K. 2016. Extreme Value Assessment of Forest Fire Behaviour. *Proc. of the Eighth International Seminar on Fire & Explosion Hazards (ISFEH8).* Edited by J. Chao, V. Molkov, P. Sunderland, F. Tamanini and J. Torero Published by USTC Press. China.

Douglas G.B. 2017. *Property protection from Extreme Bushfire Events under the Influence of Climate Change*. Thesis March 2017.

Industry Safety Steering Committee 3 (ISSC3). 2016. *ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets*. ISSC3, Sydney.

Keith, D. 2004. *Ocean Shores to Desert Dunes*. NSW Department of Environment and Conservation, Sydney.

Lucas C. 2010. On developing a historical fire weather dataset for Australia. *Australian Meteorological and Oceanographic Journal*. 60: pp 1-14.

Riverina Bush Fire Management Committee (BFMC). 2018. *Riverina Bush Fire Management Committee Bush Fire Risk Management Plan*. Riverina BFMC, Riverina.

McArthur, A. G. 1967. *Fire Behaviour in Eucalypt Forests. Department of National Development Forestry and Timber Bureau*, Canberra, Leaflet 107.

National Association of Steel Framed Housing Inc. (NASH). 2014. *Steel Framed Construction in Bushfire Areas 2014*. NASH, Melbourne.

NSW Rural Fire Service (RFS). 2021. NSW Fire History.

NSW Rural Fire Service (RFS). 2017. Neighbourhood Safer Places – Guidelines for the identification and inspection of neighbourhood safer places in NSW. RFS, Sydney.

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

Standards Australia (SA). 2005. *Fire hydrant installations – Part 1: System design, installation and commissioning*, AS 2419.1, Fourth edition 2005, SAI Global, Sydney.

Standards Australia (SA). 2014. *The storage and handling of LP Gas*, AS/NZS 1596:2014. SAI Global, Sydney.

Standards Australia (SA). 2018. *Construction of buildings in bushfire-prone areas* (including Amendments 1 – 2), AS 3959-2009. SAI Global, Sydney.

Strahan, K. Whittaker, J. and Handmer, J. 2018. Self-evacuation archetypes in Australian bushfire. *International Journal of Disaster Risk Reduction*. 27: 307-316.

Whittaker, J. 2018. *Community Preparedness and Responses to the 2017 New South Wales Bushfires*. Conference presentation, Bushfire and Natural Hazards CRC & AFAC Conference 2018.

Whittaker, J. 2019. *Ten years after the Black Saturday fires, what have we learnt from post-fire research?* Australian Institute for Disaster Resilience.

Whittaker, J. Haynes, K. Handmer, J. and McLennan, J. 2013. Community safety during the 2009 Australian 'Black Saturday' bushfires: an analysis of household preparedness and response. *International Journal of Wildland Fire*. 22: 841-849.

Appendix A – PBP Specifications: Subdivision and SFPP Development

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

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

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

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation	property access roads are two-wheel drive, all‑weather roads, and perimeter roads are provided for residential subdivisions of three or more allotments; and subdivisions of three or more allotments have more than one access in and out of the development; and traffic management devices are constructed to not prohibit access by emergency services vehicles; and maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient; and all roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end; and where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; and where access/egress can only be achieved through forest, woodland or heath vegetation, secondary access shall be provided to an alternate point on the existing public road system.
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 AS 2419.1:2005; there is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.
access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface	perimeter roads are two-way sealed roads; and 8m carriageway width kerb to kerb; and parking is provided outside of the carriageway width; and hydrants are located clear of parking areas; and there are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and curves of roads have a minimum inner radius of 6m; and the maximum grade road is 15° and average grade is 10°; and the road crossfall does not exceed 3°; and

Performance Criteria	Acceptable Solutions
	a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.
access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating	minimum 5.5m width kerb to kerb; and parking is provided outside of the carriageway width; and hydrants are located clear of parking areas; and roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and curves of roads have a minimum inner radius of 6m; and the road crossfall does not exceed 3°; and a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.
firefighting vehicles can access the dwelling and exit safely	No specific access requirements apply in an urban area where a 70 metre unobstructed path can be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles (i.e. a hydrant or water supply). In circumstances where this cannot occur, the following requirements apply: minimum carriageway width of 4m; in forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m at the passing bay; and a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches; and provide a suitable turning area in accordance with Appendix 3; and curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress; and the minimum distance between inner and outer curves is 6m; and the crossfall is not more than 10°; and maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads; and a development comprising more than three dwellings has formalised access by dedication of a road and not by right of way. Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5m), extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. the gradients applicable to public roads also apply to community style development property access roads in addition to the above.

Appendix B- Services Specifications

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

Intent of measures: provide adequate services of water for the protection of buildings during and after the passage of a bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.

Table 12: Performance criteria for services provision for residential and rural residential subdivisions

Performance Criteria	Acceptable Solutions
The intent may be achieved where:	
a water supply is provided for firefighting purposes	reticulated water is to be provided to the development, where available; a static water supply is provided where no reticulated water is available.
water supplies are located at regular intervals the water supply is accessible and reliable for firefighting operations	fire hydrant spacing, design and sizing comply with the Australian Standard AS 2419.1:2005; hydrants are not located within any road carriageway; reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads.
flows and pressure are appropriate	fire hydrant flows and pressures comply with AS 2419.1:2005.
the integrity of the water supply is maintained	all above-ground water service pipes external to the building are metal, including and up to any taps.
location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings	where practicable, electrical transmission lines are underground; where overhead, electrical transmission lines are proposed as follows: lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; no part of a tree is closer to a power line than the distance set out in accordance with the specifications in ISSC3 Guideline for Managing Vegetation Near Power Lines.
location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used; all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side; connections to and from gas cylinders are metal; polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not used; above-ground gas service pipes are metal, including and up to any outlets.

Table 13: Water supply requirements for non-reticulated developments or where reticulated water supply cannot be guaranteed (Table 5.3d of PBP)

Development Type	Water Requirements
Residential lots (<1000m²)	5000L/lot
Rural-residential lots (1000-10,000m²)	10,000L/lot
Large rural/lifestyle lots (>10,000m²)	20,000L/lot
Multi-dwelling housing (including dual occupancies)	5000L/dwelling

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au