Bushfire Constraints and Management

South Jerrabomberra Planning Proposal Area

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Executive Summary

The South Jerrabomberra study area is an extension of the newly rezoned area of South Tralee within the Queanbeyan City Council local government area. Council has received Gateway Approval to proceed with an amendment to the *Queanbeyan Local Environmental Plan (South Tralee) 2012* to rezone the study area for urban (residential) development. The study provides Council with an understanding of the bushfire constraints and required management practices to be applied to future development within the study area. The recommendations inform a Planning Proposal to consider the suitability of the site to be rezoned in accordance with Section117 (2) Direction 4.4 – 'Planning for Bush Fire Protection' of the *Environmental Planning and Assessment Act 1979*.

The study area is bounded by South Tralee to the north and northeast, Hume Industrial Estate to the west and Tralee Hills to the south and southeast. Totalling approximately 111 hectares, the study area is largely cleared as a result of past agricultural activities. As a result the study area supports predominantly exotic grassland and features small and scattered remnants of woodland improving in size and condition in the elevated southern parts of the study area on the base of the Tralee Hills where the primary bushfire threat to the study area lies. It is these wooded areas that are mapped as 'bushfire prone vegetation' on the Queanbeyan Bush Fire Prone Land Map.

The bushfire hazard (a combination of predominant vegetation and effective slope) to future development will ultimately depend on the retention of conservation areas as determined by the *Biodiversity Study - South Jerrabomberra* (ELA 2014). Asset Protection Zones (APZs) between the hazard and development have been specified in accordance with *Planning for Bushfire Protection 2006* in **Table 4** and **Figure 3**, however these are indicative only as the future hazard may be altered depending on the retention or offset of conservation areas such as lower value areas, smaller remnants or along drainage lines.

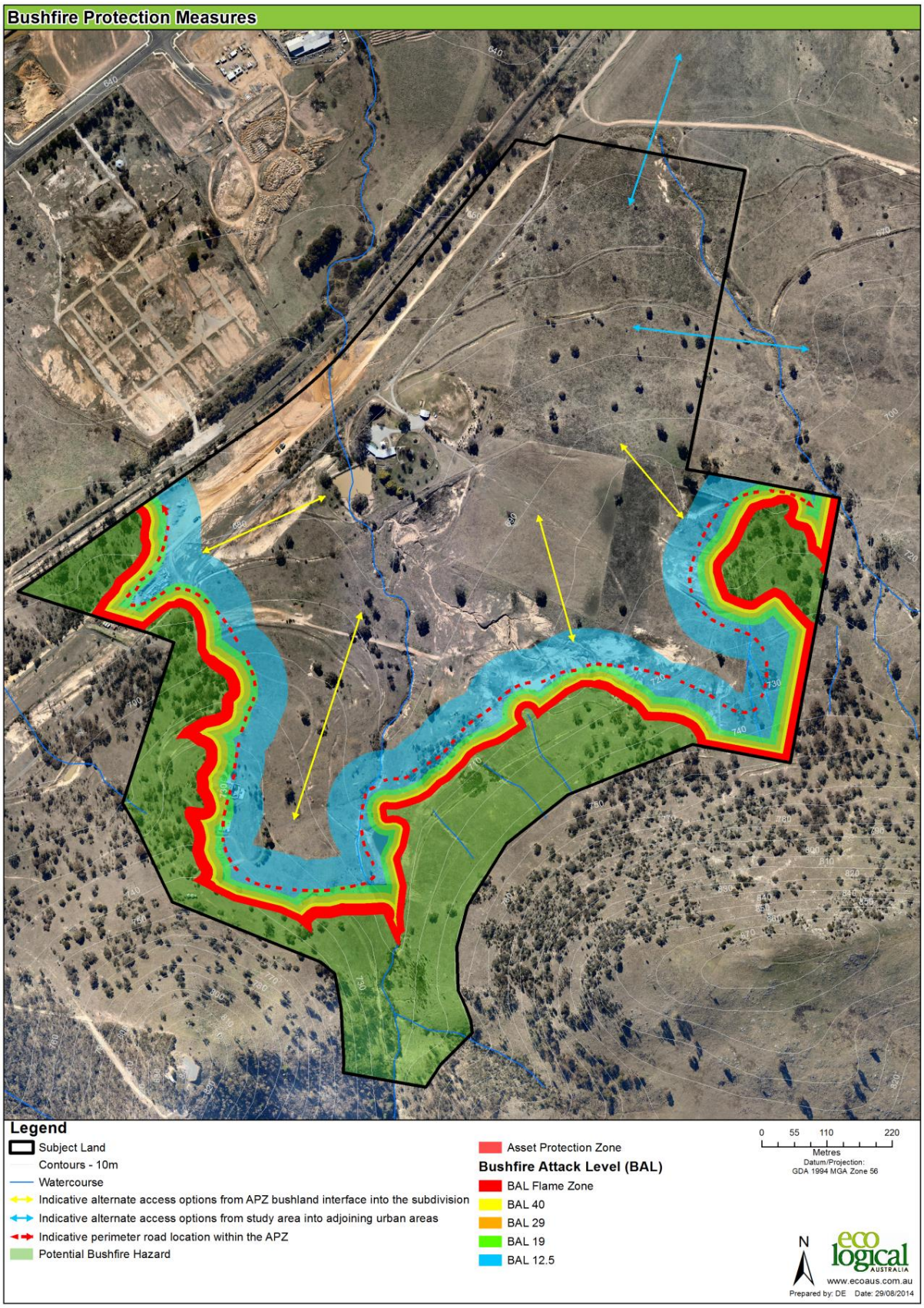
Other bushfire protection measures have been recommend for the study area in compliance with the Acceptable Solutions of *Planning for Bushfire Protection 2006* such as building construction standards, appropriate access and the provision of water supply and other utilities. A full summary of the recommendations are listed within the table on the following page and the primary protection measures are mapped following the table.

In conclusion, the study area can support future residential development outside of the conservation areas and any Asset Protection Zone required to the conservation areas. In summary, the study area can accommodate all required bushfire protection measures and achieve the Direction 4.4 objectives and RFS requirements.

Future studies and assessment of bushfire protection will be required based on a development layout whether conceptual as part of a structure plan or detailed as part of a subdivision application.

Replication of Table 7 (Section 6.2)

Bushfire Protection Measure	Recommendation summary with report reference
Asset Protection Zones (APZs)	• Provide an APZ between development and the bushfire hazard of a dimension listed in Table 4 and mapped on Figure 3. Dimensions will differ depending on the hazard type, development type (e.g. SFPP development attracts wider APZs) and the final location and spatial coverage of conservation areas (Section 5.1.1; Figure 3). • The relationship between conservation remnant size and juxtaposition with other nearby hazards or remnants should be considered as APZ constraints are required for some smaller remnants in proximity to other hazards (Section 5.1.1; Figure 3). • Consideration should be given to increasing the APZ from the minimum required in order to achieve a maximum construction standard of BAL-29 (Section 5.1.1). • The APZ is to be maintained to meet fuel management specifications, be located outside of any conservation area, and feature a perimeter road (Section 5.1.2).
Building construction standards	• Future buildings are to be constructed in accordance with the relevant BAL as per *AS 3959-2009 Construction of buildings in bushfire-prone areas* (Section 5.2; Figure 4).
Access	• All development areas within 100m of the bushland interface requiring an APZ are to have an alternate access and egress option (Section 5.3.1; Figure 4). • More than one access point should be provided between the study area and adjacent (future) residential lands to the north and northeast (Section 5.3.1; Figure 4). • Depending on the bushfire risk, all bushland interface areas containing an APZ for a significant bushfire hazard should feature a perimeter public road within the APZ (5.3.2; Figure 4). • Road design is to comply with the PBP acceptable solutions as listed in Table 5 and 6 (Section 5.3.3).
Water supply and other utilities	• Future residential lots are to have a reticulated water supply and hydrants located in accordance with *AS 2419.1 – 2005 Fire Hydrant Installations - System Design, Installation and Commissioning* (Section 5.4.1). • Future dwellings on larger rural residential lots not within the required distance of a hydrant, they will require a static water supply at time of development application (Section 5.4.1). • Electricity supply should be underground wherever practicable. • Any gas services are to be installed and maintained in accordance with *AS/NZS 1596-2008 The storage and handling of LP gas*



Replication of Figure 4 – Bushfire Protection Measures

1 Introduction

1.1 Background

This study was commissioned by Queanbeyan City Council (QCC) to assist in the preparation of a Planning Proposal which will consider the suitability to rezone land known as South Jerrabomberra for future urban development, namely residential subdivision.

South Jerrabomberra lies adjacent to the south of the newly rezoned area of South Tralee and has received Gateway Approval to proceed with an amendment to the *Queanbeyan Local Environmental Plan (South Tralee) 2012*. A bushfire assessment of the proposal is now required before finalisation and public exhibition. This technical report has been prepared to inform the Planning Proposal.

1.2 Study Area

The South Jerrabomberra study area is an extension of South Tralee and is located in **Figure 1**. The study area is bounded by South Tralee to the north and northeast, a disused railway line and Hume Industrial Estate to the west and Tralee Hills to the south and southeast.

Ownership of the study area is comprised of two parties which together cover an area of approximately 111 hectares. Both lands are similar in form and land-use in that they are largely cleared as a result of past and current grazing, quarrying and general agricultural and rural activities. As a result the study area supports predominantly exotic grassland and features small and scattered remnants of woodland improving in size and condition in the elevated southern parts of the study area on the base of the Tralee Hills where the primary bushfire threat to the study area lies.

1.3 Purpose and Tasks of Bushfire Assessment

The purpose of the study is to provide Council with an understanding of the bushfire constraints and proposed management practices within the Planning Proposal area. The findings and recommendations are to inform a Planning Proposal to consider the suitability of the site to be rezoned, and are also likely to inform a subsequent Development Control Plan which will be applied at the development stage.

The required tasks were:

1. Provide a bushfire assessment for the Planning Proposal area including identifying constrained areas, bushfire protection measures, proposed management including suggested planning controls, recommendations and maps.
2. Review the bushfire report for Tralee Station by Eco Logical Australia (2010) to assist with establishing existing conditions and developing recommendations.
3. Prepare a bushfire assessment in accordance with the requirements of Planning for Bushfire Protection 2006 (NSW Rural Fire Service 2006) and any other NSW legislative requirements.
4. Liaison with NSW government agencies as required.
5. Provide recommendations for the size of Asset Protection Zones required for residential and other urban development and provide other bushfire mitigation measures.

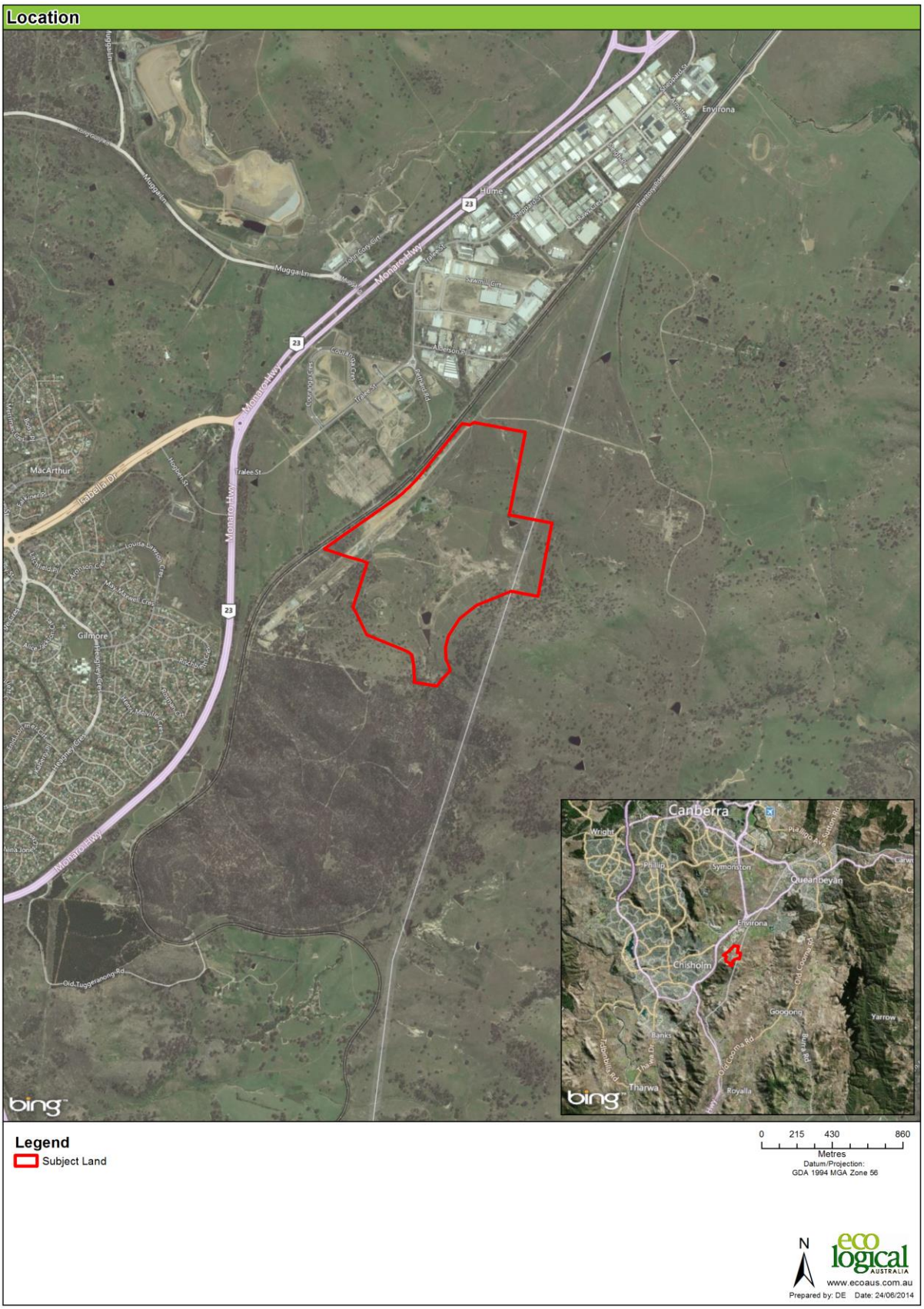


Figure 1: Location of South Jerrabomberra Planning Proposal Area

2 Assessment Requirements

The study area has been identified as containing bushfire prone land as mapped by Queanbeyan City Council and certified by the NSW Rural Fire Service (RFS) under a requirement of the *Rural Fires Act 1997*. The bushfire prone land mapping is shown in **Figure 2**. In NSW, bushfire prone lands are those identified that could support a bushfire or are potentially likely to be subject to bushfire attack and are generally lands that contain or are within 100 m of significant areas of bushland.

When investigating the capability of bushfire prone land to be rezoned for residential purposes, local councils must have regard to Section117 (2) Direction 4.4 – 'Planning for Bush Fire Protection' of the *Environmental Planning and Assessment Act 1979*. 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 councils on the bushfire matters which need to be addressed when drafting LEPs. This includes:

- Consultation with the Commissioner of the RFS under s.62 of the EPA Act, and take into account any comments so made;
- Draft LEPs shall have regard to *Planning for Bushfire Protection 2006* (PBP)*;* and
- Compliance with numerous bushfire protection provisions where development is proposed.

After the rezoning stage, future subdivision of land and the construction of buildings also require an assessment against PBP. These assessments are based on a final development application for these uses.

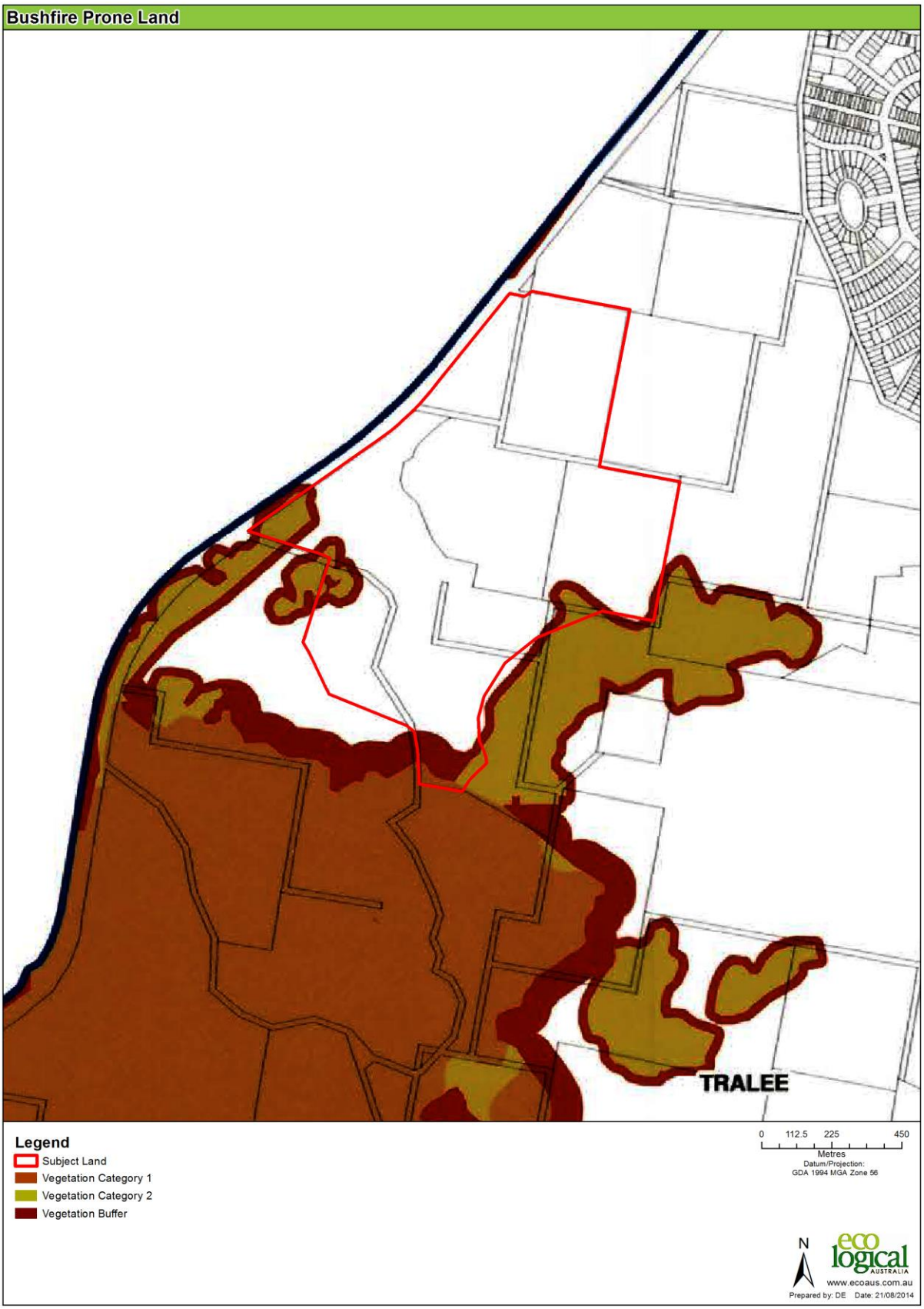


Figure 2: Bushfire Prone Land

3 Methods and Approach

This bushfire assessment followed the methods and approach outlined in **Table 1** below.

Table 1: Methods and approach

Method and Approach	Task	Considerations
Review	A literature review of relevant reports and studies occurred.	• Queanbeyan Bush Fire Prone Land Map; • Lake George Zone Bushfire Risk Management Plan; • Tralee Station Bushfire Assessment – Rezoning Proposal for the South Jerrabomberra Lands (ELA 2010a); • Bushfire Assessment – Proposed Rezoning, South Tralee (ELA 2010b); • Biodiversity Study – South Jerrabomberra (ELA 2014).
Desk top analysis	Review and analysis of all available mapping layers in GIS relevant to bushfire hazard.	GIS layers include: satellite imagery; vegetation mapping (ELA 2014); topographical data (e.g. contours).
Client meeting	Meet QCC staff to discuss project objectives	The meeting clarified planning matters such as the link with South Tralee to the north and proposed treatments within the study areas such as noise buffer along the western boundary.
Site inspection	An inspection of the study area occurred on 23rd May 2014.	The inspection ground-truthed the results of the desk-top analysis, particularly in regards to vegetation classification and slopes that influence the overall bushfire hazard and Asset Protection Zone calculations.
Ecological consultation	Consultation with ecologist to enable integrated design	A meeting and subsequent discussions took place on matters such as the conversion of ecological community classification into fuel load groups for the purpose of Asset Protection Zone calculation, and the likely retention and enhancement of remnant bushland and riparian zones for the protection and maintenance of biodiversity (e.g. threatened species habitat and endangered ecological communities). The ELA 2014 conservation values were first presented on which to base an initial assessment of the possible Asset Protection Zones required. These conservation values may be refined as part of later planning stages as offsets may be considered in some instances.
Constraints analysis	Produce a preliminary	Key primary constraints (Asset Protection Zones and

Method and Approach	Task	Considerations
	constraints analysis prior to report preparation	access) were identified and discussed with Council.
Assessment	Determine all relevant bushfire protection measures.	Assessment in accordance with PBP methodology, Direction 4.4 of EP&A Act and RFS requirements.
Reporting	Preparation of bushfire assessment.	Carry out all necessary reporting required for rezoning and Planning Proposals for development of bushfire prone land.

4 Bushfire Hazard

An assessment of the bushfire hazard is necessary to determine the application of bushfire protection measures such as Asset Protection Zone location and dimension. The following sub-sections provide a detailed account of the vegetation communities (bushfire fuels) and the topography (effective slope) that combine to create the bushfire hazard that may affect bushfire behaviour impacting on the study area.

This assessment is based on the possible future vegetation coverage as determined by the *Biodiversity Study - South Jerrabomberra* (ELA 2014). The future vegetation is discussed in Section 4.1 below. Some of the current bushland areas will contribute to the future bushfire hazard, however this hazard may be extended, particularly in the way of retention of conservation areas and connectivity between remnants and along drainage lines to achieve biodiversity and riparian environmental objectives. The increase in hazard is not significant enough to preclude development or pose a future hazard that cannot be addressed by typical bushfire protection planning precautions as outlined within PBP.

The hazard may also be reduced in response to areas that are pursued for offset as guided by the ELA 2014 Biodiversity Study. For example, future development should be concentrated within areas of low conservation value however there is the potential for smaller and isolated patches of medium and high conservation value areas to be removed and offset potentially reducing the location of the hazard and altering the hazard perimeter.

The *Lake George Bushfire Risk Management Plan* (Lake George Zone Bushfire Management Committee 2010) is the document that guides bushfire risk management for existing development across the region that includes the study area. The plan also maps hazard, risk parameters and identifies assets at risk requiring specific action to treat the risk. However, the concept of bushfire risk as influenced by fire history and current bushfire hazard and assets has little bearing on the determination of bushfire protection strategies for rezoning and future development in bushfire prone lands or NSW. This is due to a different future vegetation layer and the fact that PBP assesses bushfire protection based purely on vegetation and slope (i.e. hazard and not risk), making the assumption that a fire may occur in any patch of bushland at a worst-case scenario (based on a set design fire).

Notwithstanding this, the *Lake George Bushfire Risk Management Plan* was reviewed to gain a greater understanding of the bushfire environment, hazard and risk issues that affect the study area. The plan does not specifically mention the study area or adjacent lands as an asset at risk, however this is most likely because there is yet to be development in the area in order to make an assessment. The study area has not had a recorded bushfire event and the closest fire was approximately 1.5 km to the south on the southern fringes of the wooded area of Tralee Hills.

4.1 Vegetation Communities Influencing Bushfire

The ‘predominant vegetation’ influencing fire behaviour approaching future developable areas has been assessed strictly in accordance with the methodology specified within PBP.

Comprehensive and site specific vegetation assessment and mapping has occurred as part of the biodiversity study (ELA 2014). Site assessment by the consulting bushfire practitioner and workshopping with the consulting ecologist has allowed the mapped vegetation communities to be classified into fuel groups in accordance with PBP. The fuel groups consist of the following:

1. Woodland: For boundary locations including retained conservation areas in the south and southeast of the study area where woodland currently exists and has the potential to regenerate. The woodland areas correspond with the lower slopes of the Tralee Hills.
2. Low Hazard: For small patches of woodland within the study area that are less than 1 hectare or form corridors less than 50 m in width.
3. Managed Land: For boundaries in the north and northeast adjacent South Tralee as well as along the western boundary with the Hume Industrial Estate.

Figure 3 displays the fuel groups and potential future coverage of vegetation based on environmental objectives and constraints presented within the biodiversity study (ELA 2014). Adjustments made to the conservation layer will require consideration in a future hazard assessment. The effect on altering the conservation (hazard) layer on the bushfire assessment is discussed in more detail in Section 5.1.

4.2 Slopes Influencing Bushfire

The ‘effective slope’ influencing fire behaviour approaching the developable area has been assessed strictly in accordance with the methodology specified within PBP. This is conducted by measuring the worst-case scenario slope where the vegetation occurs over a 100 m transect measured outwards from the development boundary. The possible slope classes are listed in **Table 2** below.

Three slope classes are represented at the development interface within the study area, being the upslopes of the Tralee Hills, to the moderate (i.e. 5-10 degrees) and gentle (i.e. 0-5 degrees) downslopes throughout. The location of the relevant slope classes are displayed in **Figure 3**. The effective slope class in combination with the predominant vegetation assessment (Section 4.1) results in an APZ dimension specified by PBP.

Table 2: Planning for Bushfire Protection (PBP) slope classes

Upslope or Downslope	PBP Slope Class
Upslope / Flat Land	Flat land and all upslope land leading away from the development
Downslope	>0-5 degrees downslope leading away from the development
	>5-10 degrees downslope leading away from the development
	>10-15 degrees downslope leading away from the development
	>15-18 degrees downslope leading away from the development

5 Bushfire Protection Measures

PBP requires the assessment of a suite of bushfire protection measures that in total afford an adequate level of protection. The measures required to be assessed for rezoning are listed in **Table 3** below and are discussed in detail in the remainder of this section. This section demonstrates that the study area can support future residential development outside of the conservation areas and any Asset Protection Zone required to the conservation areas. In summary, the study area can accommodate all required bushfire protection measures and achieve the Direction 4.4 objectives and RFS requirements.

Table 3: Planning for Bushfire Protection (PBP) bushfire protection measures

Bushfire Protection Measure	Considerations
Asset Protection Zones (APZ)	Location and dimension of APZ setbacks from vegetation including prescriptions of vegetation management within the APZ.
Building construction standards	Provide a guide on the application of construction standards for future buildings.
Access	Assessment to include access and egress in and out of a developable area such as alternate access, operational response and evacuation options. APZ perimeter access to be considered as is design standards of public roads and any fire trails.
Water supply and other utilities	List requirements for reticulated water supply and hydrant provisions, and any static water supplies for fire fighting.

5.1 Asset Protection Zones

5.1.1 APZ Location and Dimension

Using the vegetation and slope data discussed in Section 4, APZs suitable for residential subdivision adjacent all potential boundaries and around potentially environmentally constrained lands have been calculated. These have been mapped and identified on **Figure 3** and described in **Table 4**.

The same APZ dimensions should be used for other urban development such as commercial and industrial development associated with employment zones. Care is required in the placement of development defined (Section 100B (6) of the Rural Fires Act 1997) as Special Fire Protection Purpose (SFPP) development (which includes schools, child care centres, hospitals, retirement villages, tourist accommodation and group homes) as these types of developments require APZs much larger than residential development (e.g. at least 3 times wider). The required APZ distances for SFPP development within the study area are also included in **Table 4**.

Table 4 lists the minimum required APZ accepted by PBP. The current accepted minimum APZ dimension prescribed by PBP allows for a BAL-40 construction standard under *AS 3959-2009 Construction of buildings in bushfire-prone areas*. Increasing the separation (APZ) between the asset and the hazard to achieve a BAL-29 construction standard ensures that future home owners are not impacted by the additional costs associated with construction of a dwelling at BAL-40 (e.g. BAL-40 prevents the use of external timber and requires fire-rated glazing or fire shutters for windows). It is worthwhile to consider an APZ dimension that achieves BAL-29 at more detailed development stages.

Table 4 also lists the APZ that would achieve a BAL-29 standard. Construction standards and BALs are presented in Section 5.2.

It is important to note that PBP was under review at time of report preparation and may be released for public comment during 2014 however at this time no exhibition has commenced. It is foreseeable that the minimum APZs specified by the current PBP could be increased to align with AS 3959, such as with BAL-29 as discussed above and listed in **Table 4**. Regardless of the nature and extent of changes to APZ dimensions, any future development proposal such as subdivision will need to comply with the standards of the day which currently provide for a BAL-40 standard.

Table 4: Asset Protection Zone (APZ) calculation

Location	Predominant Vegetation	Effective Slope	Residential APZ	SFPP APZ
South	Woodland	Upslope	10 m (16 m will achieve BAL-29)	40 m
		Downslope 0-5º	15 m (21 m will achieve BAL-29)	50 m
		Downslope 5-10º	20 m (26 m will achieve BAL-29)	60 m
Throughout	Low Hazard	Upslope	10 m (11 m will achieve BAL-29)	30 m
		Downslope 0-5º	10 m (14 m will achieve BAL-29)	40 m
North and West	Managed Land	Upslope to Downslope 5-10º	APZ not required. Assumed managed as adjoining development or open space.	

An APZ has not been buffered around the conservation areas identified along drainage lines or smaller patches within the middle of the study area. This is because the final spatial coverage of these patches is not yet determined. The following information should be noted in identifying APZs for conserved remnant patches:

- Patches 1 hectare in size or greater will be mapped as bushfire prone and will require assessment including the application of an APZ based on a woodland classification. The APZ size is likely to be 10 to 15 m for an upslope and downslope respectively (as listed in **Table 4**);
- Patches less than 1 hectare in size will not be considered bushfire prone unless they are within 100 m of another area mapped as bushfire prone. **Figure 3** shows two areas where patches less than 1 hectare may be mapped as bushfire prone as they could be within 100m of another area mapped. If mapped accordingly, areas less than 1 hectare would require a 10 m APZ (as listed in **Table 4**).

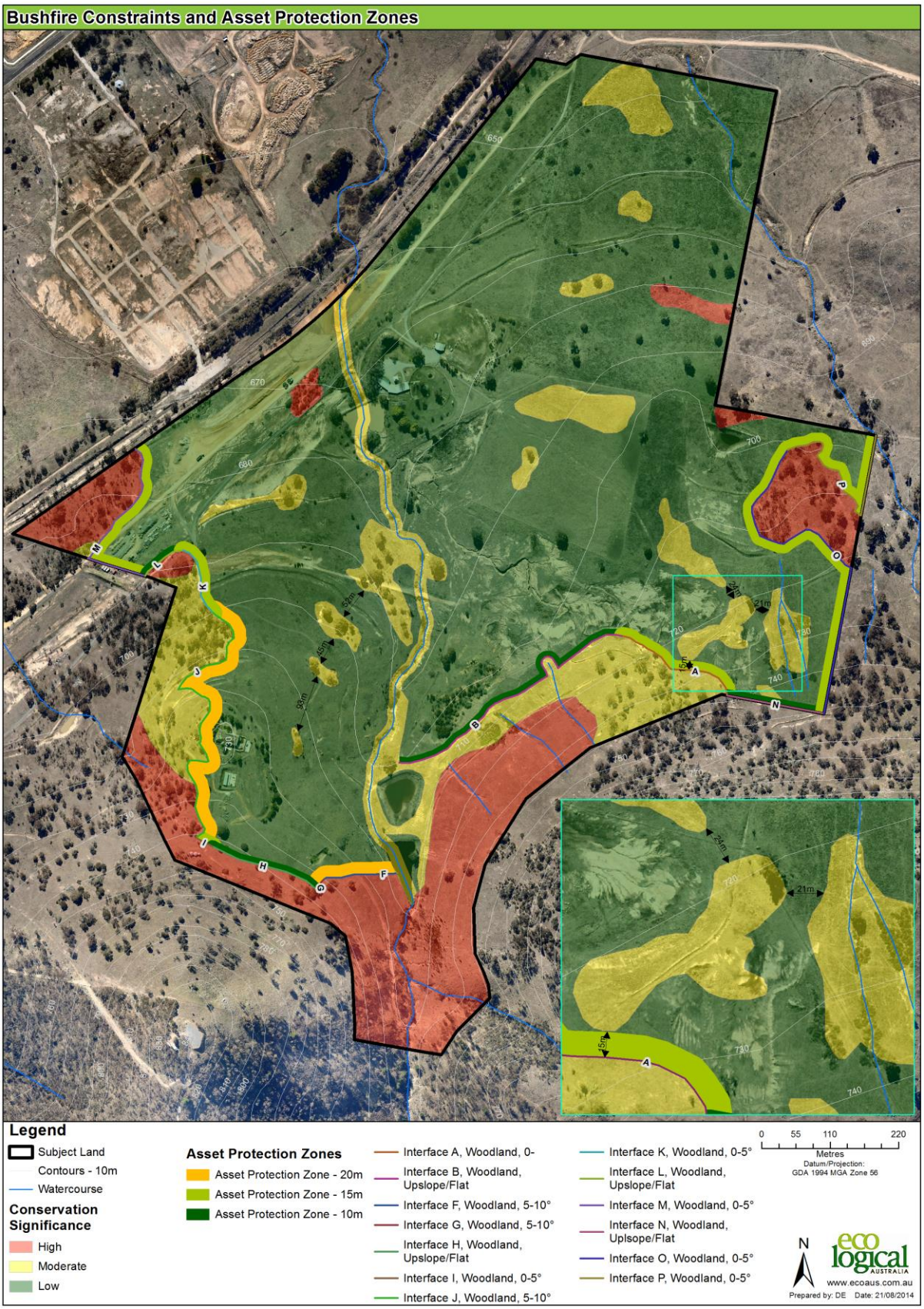


Figure 3: Asset Protection Zones (APZ)

5.1.2 APZ Management

The management of an APZ is to be considered in three ways: firstly, the separation of a dwelling from the bushfire source, secondly the provision of access or defendable space between the dwelling and bushfire source, and thirdly the continual maintenance of fuels within the APZ.

Appropriate landscaping and vegetation and fuel management is started at the planning phase and carried through construction to occupation of dwellings and future maintenance. APZs can contain managed vegetation and can be utilised as areas of public open space, recreational areas such as parks, sportsgrounds, access ways such as roads, and ancillary parts of development such as yards and car parks.

The management of vegetation within the APZ is to achieve the performance objectives of an Inner Protection Area (IPA) as described by PBP. The fuel specifications listed below are a guide on how to achieve the performance requirements:

- No tree or tree canopy is to occur within 2 - 5 m of future dwelling rooflines;
- The presence of a few canopy trees in the APZ is acceptable provided that they are well spread out, do not form a continuous canopy, and are located far enough away from future buildings so that they will not ignite the buildings by direct flame contact or radiant heat emission;
- Shrubs and understorey vegetation should not be within the APZ. Landscaping in well-defined and maintained garden beds are acceptable providing they are not located adjacent vulnerable components of a dwelling and do not provide a direct transfer of fire through the APZ from the hazard to the dwelling; and
- The ground fuel is to be maintained to less than 4 tonnes per hectare of fine fuel (4 t/ha is equivalent to a 1 cm thick layer of leaf litter and fine fuel means any dead or living vegetation of less than 6 mm in diameter, e.g. twigs less than a pencil in thickness).

Due to the required fuel management specifications listed above, the APZ should be located outside of any areas retained for conservation purposes. Furthermore, PBP does not permit a division of the APZ between an Inner Protection Area (more intensely managed fuels) and an Outer Protection Area (tolerance for more fuels, particularly within the canopy) for woodland hazards. Therefore there is not the opportunity to place an Outer Protection Area within a conservation area or ecological buffer to a riparian area.

The placement and management of built landscaping structures within the APZ also requires consideration as there is the potential for structures to ignite and significantly add to the radiant heat output of a fire front. Sheds are permitted within the APZ and should be constructed to meet the assessed BAL or as otherwise required by PBP and *AS 3959 Construction of buildings in bushfire prone areas*. The assessment of sheds and the like will be made at the time of a development application (if applicable) for that structure.

The management responsibility of the APZ is to be designated to a responsible party or parties. For example, this would typically consist of:

- The individual allotment owners or managers (if leased) for those portions of the APZ within private residential allotments; and/or
- Queanbeyan City Council where an APZ occurs within a road reserve, parkland or open space.

An APZ may require a perimeter road between the hazard and development depending on the significance of the bushfire threat. The assessment of perimeter access is provided in the following Section 5.3.

5.2 Dwelling Construction Standard (BAL)

The application of building construction standards for bushfire protection under *AS 3959-2009 Construction of buildings in bushfire-prone areas* (AS 3959) is to be considered at the development application stage for individual dwellings and buildings. An assessment under AS 3959 is not required at the Planning Proposal stage, however the BALs have been mapped for the study area based on the APZ layout (**Figure 4**). The following is a brief introduction on AS 3959.

AS 3959 contains six Bushfire Attack Levels (BALs) each with a prescribed suite of design and construction specifications aimed at preventing ignition during the passing of a bushfire front. The BALs are introduced below:

- BAL-Low: The threat does not warrant application of construction standards. Developments with BAL-Low are generally not within bushfire prone land (greater than 100 m from a bushfire hazard)
- BAL-12.5: Addresses background radiant heat at lower levels and ember attack
- BAL-19: Addresses mid-range radiant heat and ember attack
- BAL-29: Addresses high range radiant heat and ember attack
- BAL-40: Addresses extreme range of radiant heat, potential flame contact and ember attack
- BAL-FZ: Addresses construction within the flame zone. Lots are to be planned so as to avoid new dwellings from being placed within the flame zone.

NSW has a minor variation to AS 3959 which requires consideration in future development applications. The variation is contained within the document 'PBP Appendix 3 Addendum' (RFS 2010).

Section 5.1.1 discusses the relationship between APZ dimension and the impacts of BAL-40 or BAL-29 on restrictions to construction and impacts to construction costs.

5.3 Access

PBP requires an access design that enables safe evacuation away from an area whilst facilitating adequate emergency and operational response to the area requiring protection. The following sections present the bushfire planning requirements for the study area.

5.3.1 Safe Access and Egress

All bushfire prone areas should have an alternate access or egress option. This is usually achieved by providing more than one public road into and out of areas of development within 100 m of the bushland interface. The need for an alternative road and its location depends on the bushfire risk, the density of the development, and the chances of the road being cut by the effects of fire for a prolonged period. The study area should allow for an alternative public access road within the study area as indicated on **Figure 4**.

Similarly, more than one access point should be provided between the study area and adjacent (future) residential lands to the north and northeast (**Figure 4**). This is the most logical point of access and egress as the lands to the north are managed and under development, and the bushfire hazard lies in the opposite direction to the south and southeast across the Tralee Hills. The railway line and industrial estate to the west prevents formal access in that direction.

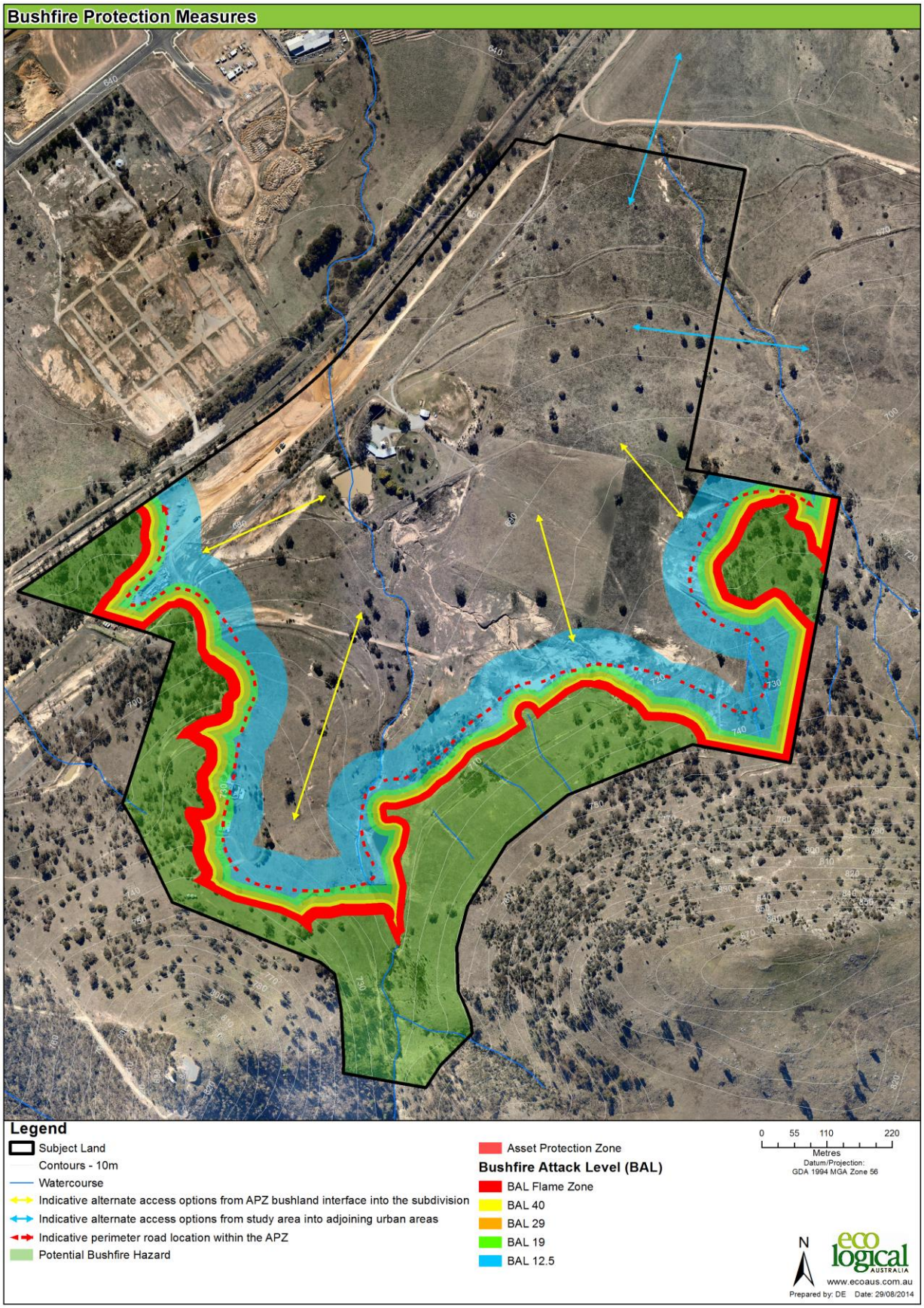


Figure 4: Bushfire protection measures

5.3.2 Perimeter Roads

Depending on the bushfire risk, all bushland interface areas containing an APZ for a significant bushfire hazard should feature a perimeter public road within the APZ. It is acceptable for some areas not to have a perimeter road or have a perimeter trail instead. These include areas of lower bushfire risk (such as adjoining low hazard areas), rural residential areas with large lot sizes whereby perimeter access can be provided within each lot, or areas where it may not be feasible to provide a continuous road due to the shape of the interface or the terrain. These areas should have some other access strategy such as trails or regular access points including access to a hydrant network.

The design details (PBP acceptable solutions) of public perimeter roads and fire trails are listed in Section 5.3.3 below and an indicative location of a perimeter road within the APZ for the study area is mapped on **Figure 4**.

5.3.3 Road Design and Construction Standards

Public roads and perimeter fire trails are to comply with the PBP acceptable solution design standards as listed in **Table 5** and **Table 6** respectively. Future residential subdivision within the study area will be able to comply with these standards.

Table 5: PBP design and construction for public roads

<table>
<tr><th>Performance Criteria</th><th>Acceptable Solutions</th></tr>
<tr><td>• Firefighters are provided with safe all weather access to structures (thus allowing more efficient use of firefighting resources)</td><td>• Public roads are two-wheel drive, all weather roads</td></tr>
<tr><td>• Public road widths and design that allows safe access for firefighters while residents are evacuating an area</td><td>• Urban perimeter roads are two-way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb), allowing traffic to pass in opposite directions. Non perimeter roads comply with PBP Road widths for Category 1 Tanker (Medium Rigid Vehicle) as follows:
<table>
<tr><th>Inside edge curve radius</th><th>Swept Path</th><th>Single lane</th><th>Two way</th></tr>
<tr><td><40m</td><td>3.5m</td><td>4.5m</td><td>8.0m</td></tr>
<tr><td>40-69m</td><td>3.0m</td><td>3.9m</td><td>7.5m</td></tr>
<tr><td>70-100m</td><td>2.7m</td><td>3.6m</td><td>6.9m</td></tr>
<tr><td>>100m</td><td>2.5m</td><td>3.5m</td><td>6.5m</td></tr>
</table>
• The perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas
• Traffic management devices are constructed to facilitate access by emergency services vehicles
• Public 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 direct traffic away from the hazard</td></tr>
</table>

Performance Criteria	Acceptable Solutions
	• *Curves of roads (other than perimeter roads) are a minimum inner radius of six metres* • *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* • *There is a minimum vertical clearance to a height of four metres above the road at all times*
• *The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles*	• *The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 15 tonnes for areas with reticulated water, 28 tonnes or 9 tonnes per axle for all other areas). Bridges clearly indicated load rating*
• *Roads that are clearly sign posted (with easy distinguishable names) and buildings / properties that are clearly numbered*	• *Public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression* • *Public roads between 6.5 metres and 8 metres wide are No Parking on one side with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression*
• *There is clear access to reticulated water supply*	• *Public roads up to 6.5 metres wide provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression* • *One way only public access roads are no less than 3.5 metres wide and provide parking within parking bays and located services outside of the parking bays to ensure accessibility to reticulated water for fire suppression*
• *Parking does not obstruct the minimum paved width*	• *Parking bays are a minimum of 2.6 metres wide from kerb to kerb edge to road pavement . No services or hydrants are located within the parking bays* • *Public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of the road*

Table 6: PBP design and construction for fire trails

Performance Criteria	Acceptable Solutions
• *The width and design of the fire trails enables safe and ready access for firefighting vehicles*	• *A minimum carriageway width of four metres with an additional one metre wide strip on each side of the trail (clear of bushes and long grass is provided* • *The trail is a maximum grade of 15 degrees if sealed and not more than 10 degrees if unsealed* • *A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches is provided* • *The crossfall of the trail is not more than 10 degrees* • *The trail has the capacity for passing by:* *- Reversing bays using the access to properties to reverse fire tankers, which are six metres wide and eight metres deep to any gates, with an inner minimum turning radius of six metres and outer minimum radius of 12*

Performance Criteria	Acceptable Solutions
	metres; and / or *- A passing bay every 200 meters, 20 metres long by tree metres wide, making a minimum trafficable width of seven metres at the passing bay* *Note: Some short construction in the access may be accepted where they are not less than the minimum (3.5m) and extend for no more than 30m and where obstruction cannot be reasonably avoided or removed*
• *Fire trails are trafficable under all weather conditions. Where the fire trail joins a public road, access shall be controlled to prevent use by non authorised persons*	• *The fire service is accessible to firefighters and maintained in a serviceable condition by the owner of the land* • *Appropriate drainage and erosion controls are provided* • *The fire trail system is connected to the property access road and / or to the through road system at frequent intervals of 200 metres or less* • *Fire trails do not traverse a wetlands or other land potentially subject to periodic inundation (other than a flood or storm surge)* • *Gates for fire trails are provided and locked with a key / lock system authorized by the local RFS*
• *Fire trails designed to prevent ween infestation, soil erosion and other land degradation*	• *Fire trail does not adversely impact on natural hydrological flows* • *Fire trail design acts as an effective barrier to the spread of weeds and nutrients* • *Fire trail construction does not expose acid-sulphate soils*

5.4 Water Supply and other Utilities

5.4.1 Water Supply and Hydrants

Future lots are to be serviced by reticulated water infrastructure suitable for fire fighting purposes. With the exception of rural residential subdivision, the furthest point from any future dwellings to a hydrant is to be less than 90 m (with a tanker parked in-line) in accordance with *AS 2419.1 – 2005 Fire Hydrant Installations - System Design, Installation and Commissioning* (Standards Australia 2005). The reticulated water supply is to comply with the following acceptable solutions within Section 4.1.3 of PBP:

- Reticulated water supply to use a ring main system for areas with perimeter roads
- Fire hydrant spacing, sizing and pressures comply with AS 2419.1 – 2005
- Hydrants are not located within any road carriageway
- All above ground water and gas service pipes external to the building are metal, including and up to any taps
- The PBP provisions of parking on public roads are met.

Should future dwellings on larger rural residential lots not be within the required distance of a hydrant, they will require a static water supply at time of development application.

5.4.2 Electrical and Gas Supplies

In accordance with PBP, electricity should be underground wherever practicable. Where overhead electrical transmission lines are installed:

- Lines are to be installed with short pole spacing, unless crossing gullies

- No part of a tree should be closer to a powerline than the distance specified in the 'ISSC 3 Guideline for Managing Vegetation Near Power Lines' (Industry Safety Steering Committee 2005).

Any gas services are to be installed and maintained in accordance with *AS/NZS 1596-2008 The storage and handling of LP gas* (Standards Australia 2008).

6 Conclusion

6.1 Statement of Capability

This bushfire assessment demonstrates that the study area is capable of accommodating future subdivision and land development with the appropriate bushfire protection measures including Asset Protection Zones and the appropriate access provisions.

The bushfire protection measures listed throughout this study area based on the Acceptable Solutions of PBP, meaning they are compliant. As such, consultation with the NSW Rural Fire Service has not occurred during the preparation of this study, however an application to amend the LEP must be referred to NSW Rural Fire Service for comment in accordance with s.117 (2) Direction 4.4 – 'Planning for Bush Fire Protection'.

6.2 Recommendations and Conclusion

The hazard has been assessed as the woodlands across the Tralee Hills to the south extending downhill into the southern and south eastern margins of the study area. This potential bushfire hazard is generally proposed to be formally established within the study area as potential conservation areas. Asset Protection Zones between the vegetation hazards and development is achievable and will range from 10 to 20 m. Asset Protection Zones around smaller retained remnants or corridors throughout the study area may be required depending on the size and spatial distribution of the remnants. Perimeter access within the Asset Protection Zone, where required and feasible, will improve access and egress for the community and provide access to the development-bushland interface for fire fighting operations if required.

The recommendations of this bushfire assessment are located within Section 5 – Bushfire Protection Measures and mapped in **Figure 4**. They include the provision of Asset Protection Zones, building construction standards for future dwellings, adequate access, water supply for fire fighting, and the safe installation of utilities. **Table 7** below summaries the recommendations.

Table 7: Summary of recommendations

Bushfire Protection Measure	Recommendation summary with report reference
Asset Protection Zones (APZs)	• Provide an APZ between development and the bushfire hazard of a dimension listed in Table 4 and mapped on Figure 3. Dimensions will differ depending on the hazard type, development type (e.g. SFPP development attracts wider APZs) and the final location and spatial coverage of conservation areas (Section 5.1.1; Figure 3). • The relationship between conservation remnant size and juxtaposition with other nearby hazards or remnants should be considered as APZ constraints are required for some smaller remnants in proximity to other hazards (Section 5.1.1; Figure 3). • Consideration should be given to increasing the APZ from the minimum required in order to achieve a maximum construction standard of BAL-29 (Section 5.1.1). • The APZ is to be maintained to meet fuel management specifications, be located outside of any conservation area, and feature a perimeter road

Bushfire Protection Measure	Recommendation summary with report reference
	(Section 5.1.2).
Building construction standards	• Future buildings are to be constructed in accordance with the relevant BAL as per *AS 3959-2009 Construction of buildings in bushfire-prone areas* (Section 5.2; Figure 4).
Access	• All development areas within 100m of the bushland interface requiring an APZ are to have an alternate access and egress option (Section 5.3.1; Figure 4). • More than one access point should be provided between the study area and adjacent (future) residential lands to the north and northeast (Section 5.3.1; Figure 4). • Depending on the bushfire risk, all bushland interface areas containing an APZ for a significant bushfire hazard should feature a perimeter public road within the APZ (5.3.2; Figure 4). • Road design is to comply with the PBP acceptable solutions as listed in Table 5 and 6 (Section 5.3.3).
Water supply and other utilities	• Future residential lots are to have a reticulated water supply and hydrants located in accordance with *AS 2419.1 – 2005 Fire Hydrant Installations - System Design, Installation and Commissioning* (Section 5.4.1). • Future dwellings on larger rural residential lots not within the required distance of a hydrant, they will require a static water supply at time of development application (Section 5.4.1). • Electricity supply should be underground wherever practicable. • Any gas services are to be installed and maintained in accordance with *AS/NZS 1596-2008 The storage and handling of LP gas*

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