

ABN 47 857 816 658

Building Construction in Bush Fire Prone Areas

Preliminary Bushfire Hazard Assessment Report

REF No. 13.11.157A

Address

Lot 1 DP 120436
631 Bells Line of Road,
Kurrajong, NSW 2758

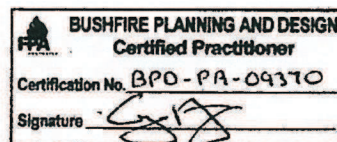
For

W. Karam

The site was inspected on 2nd December, 2013

Report Preparation

Craig Burley

Grad Dip Design for Bushfire Prone Areas
FPAA Certified BPAD-A Practitioner

Executive Summary

We have been engaged by W. Karam the owner of the subject land to prepare a preliminary bush fire hazard assessment report to be a supplement for inclusion in a Rezoning Application to Hawkesbury City Council.

The site has been identified as being bushfire prone land and therefore the legislative requirements for any future proposed development would be applicable.

The purpose of this report was establish if there are any major constraints from a bushfire regulatory perspective for the subdivision of lands (subject to rezoning) and then the construction of residential dwellings upon the created allotments.

This report has found that concept subdivision layout plan can adequately provide for areas of asset protection zone distances required arising from the application of *Planning for Bush Fire Protection 2006*.

The subject area of rezoning is in close proximity to other service supplies ie electricity, water etc and therefore compliance to the requirements of *Planning for Bush Fire Protection 2006* should be easily achieved.

The proposed subdivision plan identifies Lot 1 as being community property for the purposes of providing an access road.

Planning for Bush Fire Protection 2006 does state that where access is provided to more than three dwellings this must be undertaken by formalised dedication of a road compliant to section 4.1.3 of *Planning for Bush Fire Protection 2006* and whilst detailed the design is not required to be considered within the context of this Rezoning Application it would appear that the actual site conditions will allow for compliance..

1.0 Introduction

We have been engaged by W. Karam the owner of the subject land to prepare a preliminary bush fire hazard assessment report to be a supplement for inclusion in a Rezoning Application to Hawkesbury City Council over the subject land.

The site has been identified as being bushfire prone land and therefore the legislative requirements for the proposed development would be applicable at the time of development application for both subdivision and any future construction.

This preliminary report has concluded that the proposed subdivision plan can achieve compliance with *Planning for Bush Fire Protection 2006*.

1.1 Purpose of Report

- To determine the vegetation type, the expected fire behaviour and the threat to the subject lands; and
- To assess the proposal with reference to *Planning for Bush Fire Protection 2006*; and
- To assess the proposed construction with reference to the Building Code of Australia Volume 2; and
- To determine the level of construction with reference to AS 3959-2009 *Construction of buildings in bushfire prone areas*; and
- To identify any other such measures as to improve the chances of building survival during a bushfire event; and
- To assist the consent authority Hawkesbury City Council in the determination of the rezoning application subject to this proposal.

1.2 Scope of Report

The scope of this report is limited to the Bushfire Hazard Assessment for the proposed development site and only contains recommendations for the subject property. Where reference is made to adjacent or adjoining lands, this report does not purport to assess those lands; rather it may discuss bushfire progression on and through those lands with the possible bushfire impact to the subject property and the proposed rezoning.

1.3 Regulatory Controls

The preparation of this report has given consideration to the various legislative and regulatory requirements including the *Rural Fires Act 1997*, *Environmental Planning and Assessment Act 1979*, the Building Code of Australia, *Planning for Bush Fire Protection 2006* and AS 3959-2009 *Construction of buildings in bushfire prone areas*.

1.4 Methodology

A site inspection for the purpose of assessing bushfire related matters affecting this site was conducted on the 2nd December, 2013 and a review of the proposed subdivision plan (dated 03.03.14) prepared by McKinlay Morgan & Associates has been undertaken.

An assessment of slope was conducted out to a distance of 100 metres and assessment of vegetation to a distance of 140 metres from the proposed rezoning land.

The findings were related and assessed with reference to *Planning for Bush Fire Protection* 2006 Addendum to Appendix 3 and section 2 of AS 3959-2009 *Construction of buildings in bushfire prone areas* for the formulation of the preliminary bushfire hazard assessment.

1.5 The Proposal

The overall development site is located to the southeast from the intersection of Bells Line of Road and Old Bells Line of Road, to the east of Mason Lane and northwest of other private land holdings.

The concept proposal has been identified on the plans supplied and this shows the subject land to be subdivided into 10 individual rural/residential allotments ranging in size from 5600m² to a maximum of 1.94 hectares.

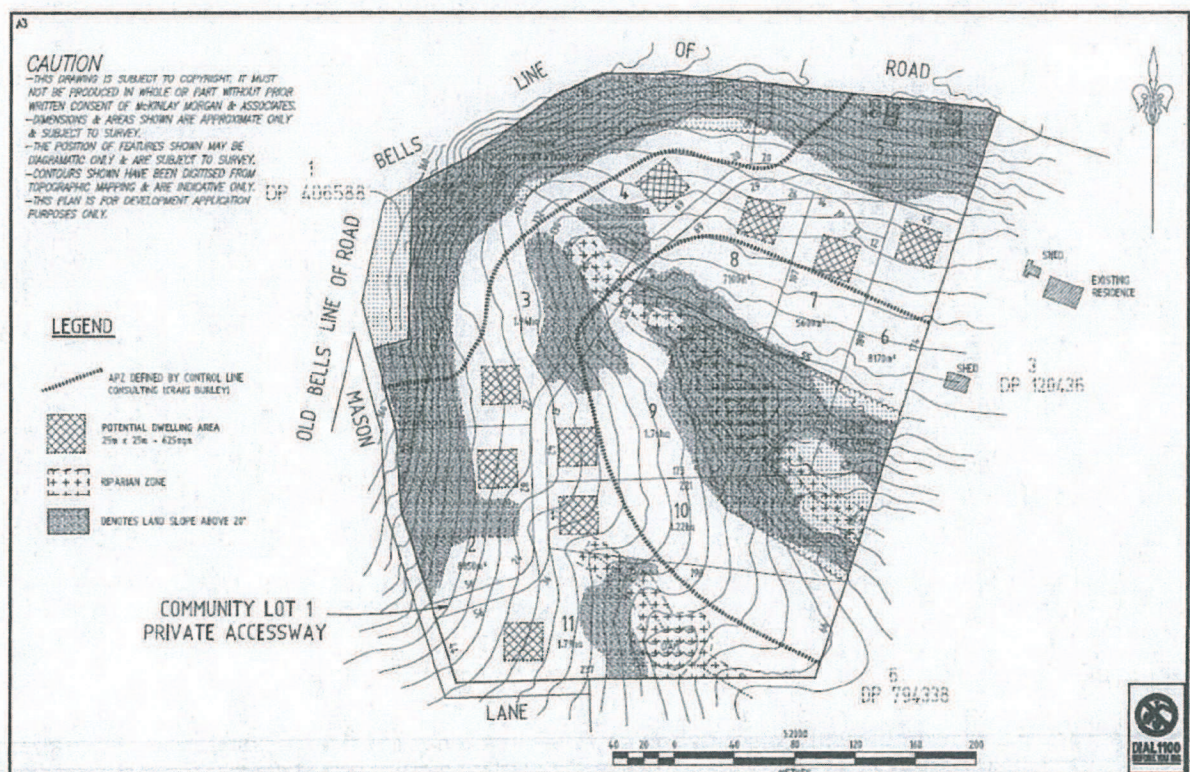


Figure 1; Extract of Concept Subdivision Layout ex McKinlay Morgan & Associates (dated 03.03.14)

Additionally Lot 1 of the subdivision is shown to be "community private accessway" for the proposed development. It is noted that Lot 5 has direct road frontage to Bells Line of Road and further access provision for this particular allotment would not be required.

In terms of building allowances potential dwelling areas being nominally 625m² have been located upon each proposed allotment with the exception of Lot 5 which has an existing Class 1a dwelling positioned directly adjacent to the Bells Line of Road boundary.

The site inspection together with further site analysis determined the areas of existing standing vegetation and without removal of any of this vegetation the extent and location of required asset protection zones.

Subsequent to that analysis the positioning of the proposed building envelopes were formulated across the subject allotment within areas that achieve compliance to the requirements of *Planning for Bush Fire Protection 2006*.

2.0 Site and Adjacent Developments

The following seeks to describe the site, the adjoining lands and land uses effective upon the development proposal.

2.1 Site Description

The site is identified as Lot 1 DP 120436
 631 Bells Line of Road,
 Kurrajong, NSW 2758
 LGA Hawkesbury City Council

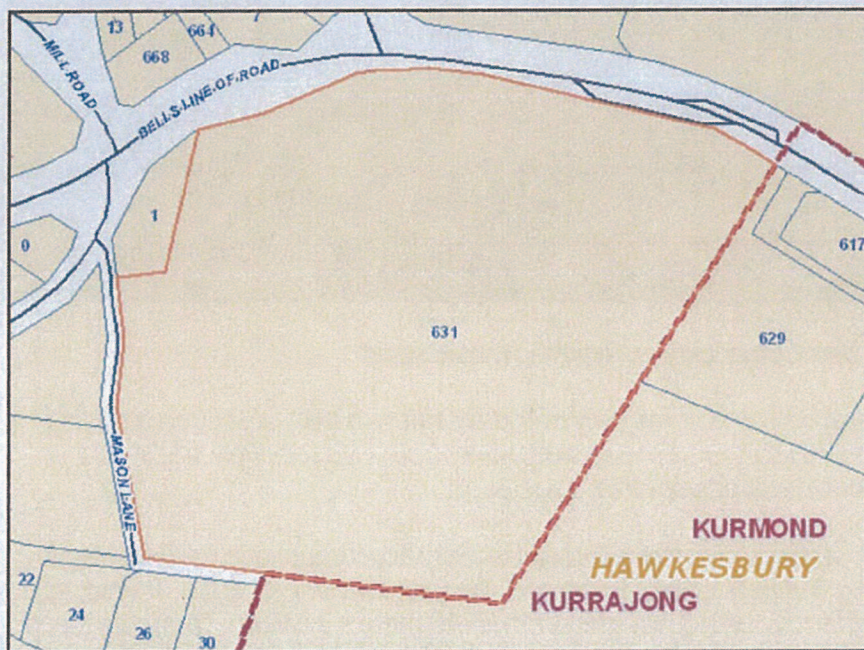


Figure 2: Address validation ex Dept of Lands

The site is at present a rural allotment of approximately 12.5 hectares located to the southeast from the intersection of Bells Line of Road and Old Bells Line of Road, to the east of Mason Lane and northwest of other private land holdings.

This site is positioned approximately 500 metres to the northeast of the existing residential development associated with the village of Kurrajong.

The area in which the proposal is located is generally residential, rural/residential and rural developments that have been established for many years.

Provision of mains reticulated water supply, electricity and phone is available to the proposed area of development from services located within Old Bells Line of Road and the Bells Line of Road.

At present the site has no structural improvements.



Figure 3: Subject development site ex Nearmap (not to scale)

In terms of vegetation the vast majority of the allotment is best described as being open grasslands with scattered shade trees apart from two relatively small (but of substantial influence) sections of forest vegetation.

The first of these sections of forest is located directly adjacent to the road frontage boundaries along the Bells Line of Road and the Old Bells Line of Road. This section of forest is quite narrow being not greater than 40 metres in width. There is a steep downslope within this vegetation from the road which would prevent further vegetation reduction.

The second section of forest vegetation is located within the southeast section of the overall subject allotment and progresses in a north westerly direction along a naturally occurring topographic gully to a point being essentially central in development site.

This section of vegetation also contains slopes in excess of 20 degrees and as such will be not suitable for the establishment of asset protection zones or creating areas of increased vegetation separation from potential dwelling areas.

Particularly this area of the site is weed infested and there is a noticeable amount of lantana along with other invasive species present which should be removed.

The balance of the site is open grasslands with scattered shade trees and this type of vegetation is located across the vast majority of the site. Identified on the proposed subdivision plan are some sections of the terrain that are excess of 20 degrees.

It was observed during the site inspection that nearly all areas of the grassland have been recently slashed and whilst the consent authorities would not normally support asset protection zones upon lands in excess of 20 degrees the objective of being adequately able to achieve land management without compromising soil stability is clearly demonstrated.

The site is shown upon the Hawkesbury Bushfire Prone Land Map (Figure 2) to be wholly within category 1 vegetation forest (shown orange).

However the site inspection and interpretation of aerial photography for the allotment confirms that the area of category 1 vegetation is significantly overstated.

As previously noted this forest vegetation is limited to the northwest corner of the allotment and an occluded section within the south eastern section of the development site although recognising that this section forest vegetation does continue for a short distance into the eastern neighbouring allotment.

The vast majority of the site would be more accurately described as being category 2 vegetation which encapsulates grassland.

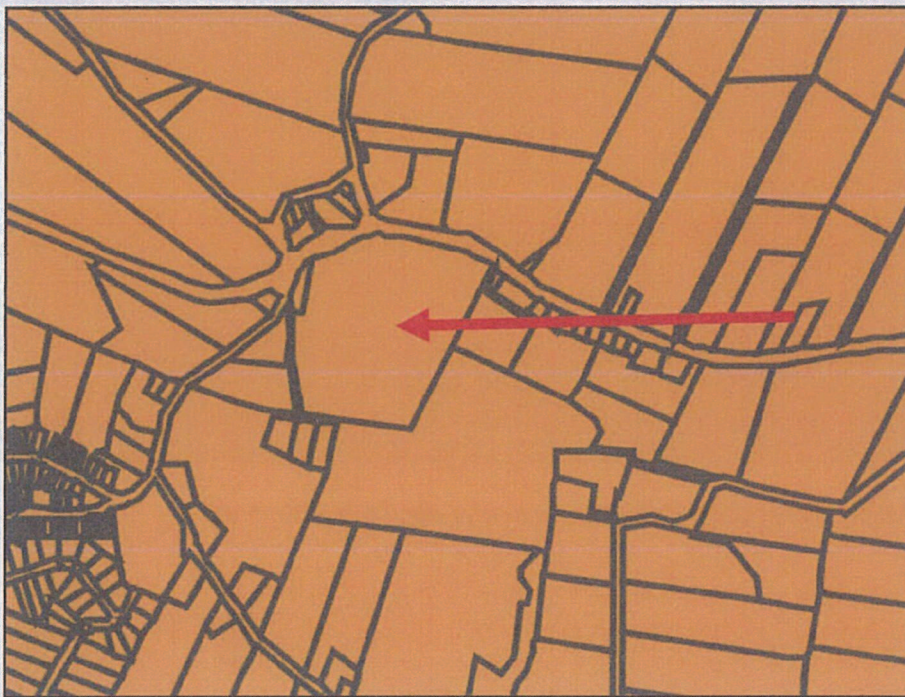


Figure 4; Section Hawkesbury LGA Bushfire Prone Land Map

There is mains reticulated water supply, overhead electricity main supply and telephone cabling located within the carriageway of Old Bells Line of Road and Bells Line of Road.

2.2 Description of Adjoining Lands

In all directions away from the subject allotment the lands are dominated by rural residential lifestyle developments to the north and south of the Bells Line of Road.

The rural residential developments are almost entirely grasslands with scattered shade trees although there is a reasonably significant section of forest located to the north of the subject development site beyond Roxana Road approximately 140 metres from the site.

There is a single strip of residential dwellings along the southern side of the road frontage to Bells Line of Road to the east of the subject allotment and a much larger section residential dwellings to the southwest within the actual village of Kurrajong.



Figure 5: Aerial photo depicting localised terrain and adjoining allotments

3.0 Environmental Considerations

The scope of this report has not been to provide an environmental survey.

As previously noted there are areas of slope constraint which are in excess of 20 degrees and these have been identified upon the concept subdivision plan supplied for perusal.

However as discussed previously there is clearly a demonstrated ability to manage these areas without compromising soil stability and all areas of asset protection zones can be adequately provided without standing vegetation removal and ongoing maintenance by tractor slashing or regular mowing is all that is required.

The proponent has engaged the services of UBM Environmental Consulting Services to provide comments on the broader environmental matters although it is my understanding that any bushfire related protection measures have no environmental constraints.

4.0 Bushfire Hazard Assessment

The bushfire hazard assessment was conducted for the proposed development, using the procedures as outlined in *Planning for Bush Fire Protection 2006*, Addendum to Appendix 3 and section 2 of AS 3959-2009 *Construction of buildings in bushfire prone areas* procedure to determine the bushfire attack level (BAL) likely upon the development.

The assessment was conducted on the assumption of the allotments being positioned as described in section 1.5 The Proposal of this report and the site plan.

4.1 Classification of Vegetation, Distance from Proposed Development

The vegetation was assessed for a distance of 140 metres from the proposed development in each of the following directions. To the northwest, northeast, southeast and southwest being the general direction adjacent and away from the proposed development site.

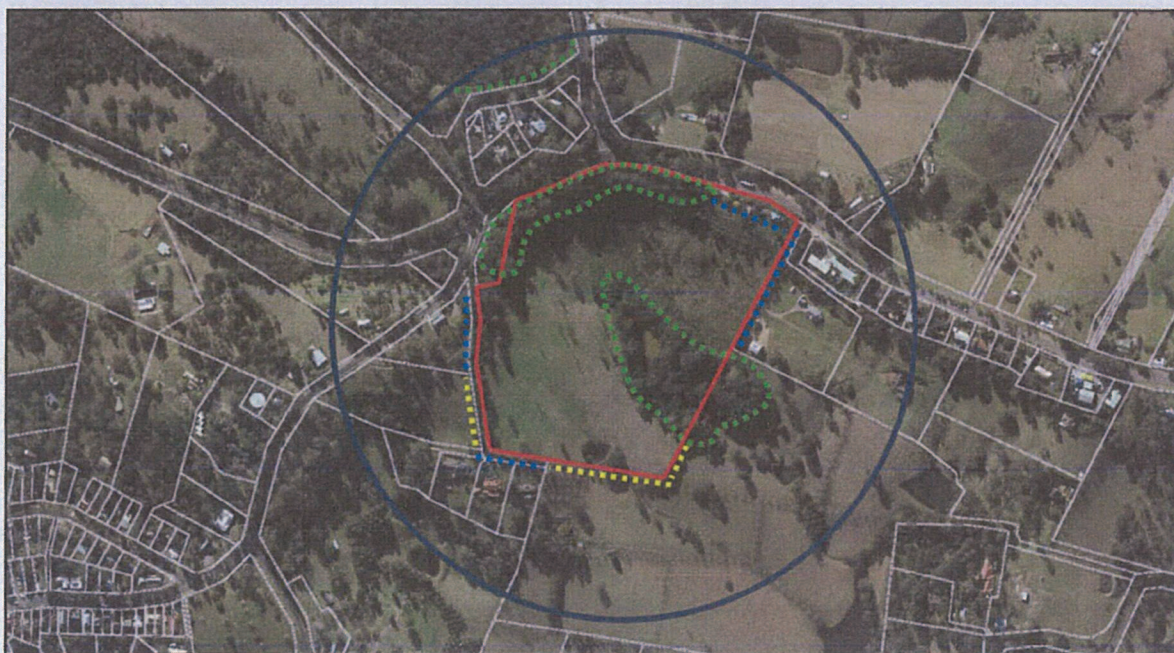


Figure 6: Vegetation study area 140 metre approx. buffer

Developed lands Grassland Forest

The image above (figure 6) depicts the areas of forest vegetation within the subject development site and upon adjoining lands.

The balance of the subject site is entirely encompassed by open grasslands vegetation.

Additionally this image depicts the type of vegetation or areas of developed lands adjacent to the various sections of the allotment boundaries.

4.2 Slope Assessment

The slope was assessed for a distance of 100 meters within the bushfire hazardous vegetation and reference to slope classifications has been undertaken considering the procedure specified within appendix 2 of *Planning for Bush Fire Protection* 2006.



Figure 7; Subject allotment showing areas slope assessed ex Nearthmap

The **effective slope** of the land (that is, the slope of the land most likely to influence bushfire behaviour for the purposes of calculating the Category of Bushfire Attack and Asset Protection Zones) has been assessed by deriving the slope information from the concept plan developed by McKinlay Morgan & Associates and the actual site inspection.

As shown above the areas of forest hazard and the slopes within are shown above within figure 7 and these slopes have been used to ascertain the required areas of asset protection zone.

The balance of the development site and potential dwelling areas are affected by a variation slopes ranges up to approximately 15 degrees although some limited areas of grasslands are indicated to have slopes greater than 20 degrees although to satisfy the subdivision requirements of *Planning for Bush Fire Protection* 2006 slope is not a variant for grassland exposures less than 18 degrees but is considered at the construction stage and this is discussed within the asset protection zone section of this report.

4.3 Category of Bushfire Attack

The bushfire attack level (BAL) for the proposed development was determined by using the information gathered with respect to the separation distances, the classification of the vegetation, the effective slope and provision of asset protection zones specified in this report.

The separation distances nominated have been determined by reference to Appendix 2 Table A2.4 of *Planning for Bush Fire Protection 2006* – Minimum Specifications for Asset Protection Zones for Residential and Rural Residential Subdivision Purposes (for Class 1 and 2 buildings) in Fire Danger Index (FDI) 100 Fire Areas to achieve less than 29kW/m² radiant heat exposure on any building element.

This maximum permissible level of radiant heat exposure is a baseline requirement of the NSW Rural Fire Service within the subdivision approval process.

It is also referred to within AS 3959-2009 *Construction of buildings in bushfire prone area* as Bushfire Attack Level (BAL) 29 but when assessed under the standard has slightly increased separation distance requirements.

It is best advice that compliance to AS 3959-2009 is a sensible approach so as to ensure compliance and reduced construction costs for the future purchasers.

The concept subdivision layout can achieve compliance to both *Planning for Bush Fire Protection 2006* Appendix 2 and AS 3959-2009 Table 2.4.2 for Bushfire Attack Level 29.

5.0 Assessment of the extent to which the development potentially conforms or deviates from Chapter 4 of *Planning for Bush Fire Protection 2006*

5.1 Asset Protection Zones

The provision of asset protection zones for any future subdivision, subsequent to a rezoning, must be fully provided for onsite to satisfy the requirements of Appendix 2 of *Planning for Bush Fire Protection 2006*.

I would also suggest, as stated in the previous section, that where feasible asset protection zone distances also satisfy BAL 29 of AS 3959-2009 Table 2.4.2.

The following table summarizes the above specifications for a forest exposure;

Slope range (degrees)	PBP 2006 (APZ)	AS3959-2009 (APZ)
Upslope/Level	20	25
Downslope >0 to 5	25	32
Downslope >5 to 10	35	39
Downslope >10 to 15	50	49
Downslope >15 to 20	60	61

Clearly from the perspective of the forest sections of hazard a separation distance of not less than 61 metres needs to be provided from the south eastern section of forest and not less than 25 metres from the north western section of forest having consideration for the effective slopes.

There are variations for asset protection zone requirements for grassland exposures again from *Planning for Bush Fire Protection 2006* and AS 3959-2009.

PBP 2006 merely requires that the grassland is not located on slopes above 18 degrees and development should provide for an asset protection zone of not less than 10 metres.

However there are incremental increases for distances of asset protection zones arising from the application of BAL 29 of AS 3959-2009 at construction stage and consideration is advisable at the subdivision planning stage.

The following table summarizes the above specifications for a grassland exposure;

Slope range (degrees)	PBP 2006 (APZ)	AS3959-2009 (APZ)
Upslope/Level	10	9
Downslope >0 to 5	10	10
Downslope >5 to 10	10	11
Downslope >10 to 15	10	13
Downslope >15 to 20	10	15

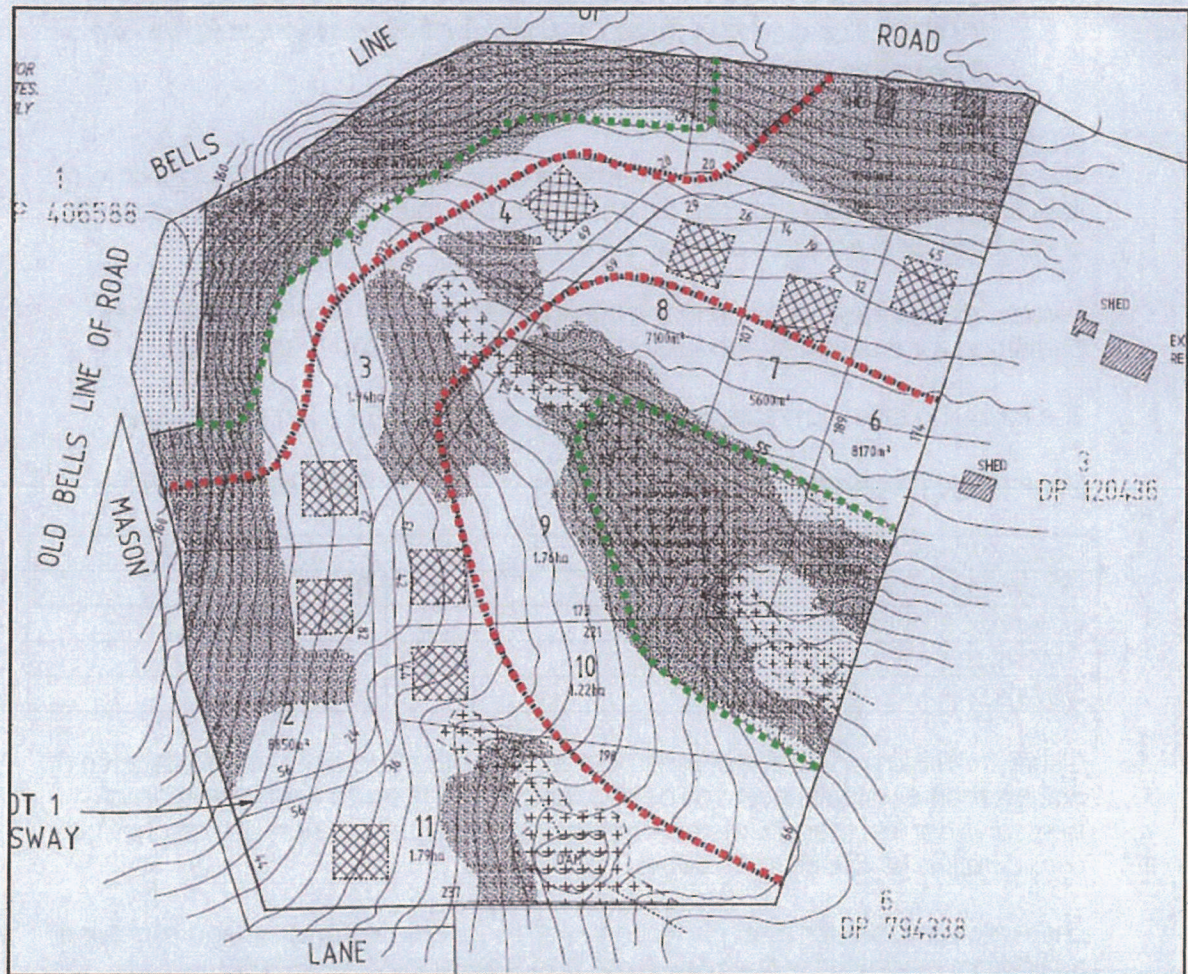


Figure 8; Subdivision plan with highlighted forest vegetation and required setback areas adapted ex McKinlay Morgan & Associates

NB; The above illustrates the required setbacks for APZ requirements for forest is quite adequately achieved

The following is a summary of the requirements for an asset protection zone inner protection area as described within the documents *Planning for Bush Fire Protection 2006* and *NSW RFS Standards for Asset Protection Zones*.

Inner Protection Area

An IPA should provide a tree canopy cover of less than 15% and the tree canopy should be located greater than 2.0 metres from any part of the roof line of a dwelling. Garden beds of flammable shrubs should not be located under trees and should be located not closer than 10 metres from an exposed window or door. Trees should have lower limbs removed up to a height of 2.0 metres above the ground.

Ground fuels such as fallen leaves, twigs (less than 6mm in diameter) and branches should be removed on a regular basis, and grass needs to be kept closely mown and where possible green.

The site inspection undertaken for the purposes of the rezoning application noted the site is primarily dominated by grassland vegetation which by mowing will easily satisfy the provisions for an asset protection zone.

5.3 Construction Level

The Building Code of Australia contains both the performance requirements and the 'deemed to satisfy' provisions relating to construction of class 1, 2 & 3 buildings that are proposed for *construction in bushfire prone areas*. To satisfy the performance provision P2.3.4 of the Building Code of Australia Vol. 2, a Class 1a building that is constructed in a designated bushfire prone area must be designed and constructed to reduce the risk of ignition from a bushfire while the fire front passes.

Australian Standard 3959-2009 *Construction of buildings in bushfire prone areas* is referenced by the BCA as the deemed to satisfy construction standard for residential dwellings in designated bushfire prone areas with the exception that the requirements shall be varied to comply with the Addendum to Appendix 3 of *Planning for Bushfire Protection 2006*.

As noted previously any construction of dwellings or proposed buildings footprints should not be exposed to greater than BAL 29 and compliance to this is clearly achievable and demonstrated within the context of a subdivision layout plan.

5.4 Access / Egress

5.4.1 To the Proposed Development

The access to the area of subject development site is currently from the Bells Line of Road and the Old Bells Line of Road which are sealed two lane roads in a well maintained condition.

However in reality to the bulk of the development site needs access from Mason Lane which runs directly adjacent to the south western section of the subject allotment and may not satisfy the provisions for a public road as contained within *Planning for Bush Fire Protection 2006*.

Mason Lane is essentially a single lane all weather surface in a well maintained condition. From the intersection with Old Bells Line of Road there is an approximate distance of 320 metres along Mason Lane to the point where the access for the development site commences.

With respect of subdivisions section 4.1.3 Access (1) – Public Roads of *Planning for Bush Fire Protection 2006* sets out the performance criteria and acceptable solutions.

The performance criteria for the property access are as follows;

- Fire fighters are provided with safe all weather access to structures (thus allowing more efficient use of firefighting resources)
- Public road widths and design that allow safe access for firefighters while residents are evacuating an area
- The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles

- Roads that are clearly sign-posted (with easily distinguishable names) and buildings/properties that are clearly numbered
- There is clear access to reticulated water supply
- Parking does not obstruct the minimum paved width

The acceptable solutions for property access are as follows;

- Public roads are two wheel drive, all weather roads
- 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 Table 4.1 (PBP 2006 see below) - Road Widths for Category 1 Tanker (Medium Rigid Vehicle).
- The perimeter road is linked to the internal road system at an interval no greater than 500 metres in urban areas.
- Traffic management devices are constructed to facilitate access by emergency service vehicles
- Public roads have a cross fall not exceeding 3 degrees.
- 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 metre outer radius turning circle, and are clearly sign posted as a dead end and direct traffic away from the hazard.
- Curves of roads (other than perimeter roads) are a minimum inner radius of six metres and minimal in number to allow for rapid access and egress
- The minimum distance between inner and outer curves is 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 (approximately 15 tonnes for areas of reticulated water, 28 tonnes or 9 tonnes per axle for all other areas). Bridges clearly indicate load rating.
- 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 8.0 metres wide are No Parking on one side with the services located on this side to ensure accessibility to reticulated water for fire suppression
- Public roads up to 6.5 metres wide provide parking within parking bays and locate services outside of 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 locate services outside of parking bays to ensure accessibility to reticulated water for fire suppression
- Parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within parking bays
- Public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of road.

Additionally section 4.1.3 Access (2) – Property Access of *Planning for Bush Fire Protection* 2006 states

- Access to a development comprising more than three dwellings have formalised access by dedication of a road and not by a right of way.

Table 4.1 provides the minimum widths for public roads that are not perimeter roads for safe access of fire vehicles in urban areas ex *Planning for Bush Fire Protection* 2006

Curve radius (inside edge metres)	Swept path (metres width)	Single lane (metres width)	Two way (metres width)
< 40	3.5	4.5	8.0
40 – 69	3.0	3.9	7.5
70 – 100	2.7	3.6	6.9
> 100	2.5	3.5	6.5

Whilst a detailed and engineered design is not included within the Rezoning Application it would appear likely that the subject development can achieve the required access provisions.

5.5 Utility Supplies

5.5.1 Water

This section of Kurrajong is serviced by a mains reticulated water system and the site inspection noted that this system is within the carriageway of Bells Line of Road and Old Bells Line of Road.

The provisions of *Planning for Bush Fire Protection* 2006 will require that if the mains water is integrated within any future development it should be undertaken to satisfy AS 2419 – 2005 *Fire hydrant installations*.

If mains reticulated water to that specification is not achieved individual Static Water Supplies (SWS) will need to be provided at individual residences at the time of future development.

5.5.2 Electricity

The preferred methodology for the connection of electricity is by underground cabling as stated within *Planning for Bush Fire Protection* 2006.

5.5.3 Gas

At the time of report preparation it was not proposed to connect gas supply to the subject allotments. However any future connection to either mains or portable gas supply should be undertaken and maintained to the provisions of AS 1596-2002 *Storage and handling of LP Gas*. All piping associated with the installation must be metal.

For each of the above service supplies compliance to *Planning for Bush Fire Protection* 2006 appears to easily achievable.

5.6 Landscaping

A formal landscaping plan was not supplied for perusal at the time of formulating this report however this must be undertaken to satisfy Appendix 5 of *Planning for Bushfire Protection 2006*.

Given that the compliance to provision of asset protection zones will be achieved by mowing of existing grasslands the requirement for landscaping should be easily satisfied.

6.0 Conclusion

After consideration of the aims and objectives of *Planning for Bush Fire Protection 2006* in the context of the Rezoning Application and the Subdivision Plan for future development of the subject allotment it is my professional opinion that the provisions of bushfire regulatory requirements could be achieved and that the consent authorities would be likely to approve the indicated development.



Craig Burley

Grad.Dip. Building in Bushfire Prone Areas (UWS)
FPA Australia Certified BPAD-A Practitioner

Caveat

Quote from *Planning for Bush Fire Protection 2006*, 'notwithstanding the precautions adopted, it should always be remembered that bushfire burn under a wide range of conditions and an element of risk, no matter how small always remains.'

Quote from Standards Australia, 'Although the standard is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any one building will withstand bushfire attack on every occasion.'

References

Planning for Bush Fire Protection 2006 Planning NSW in conjunction with NSW Rural Fire Service

Building Code of Australia Volume 2 2005 Australian Building Codes Board

AS 3959 –2009 Construction of buildings in bushfire prone areas Standards Australia & Australian Building Codes Board

Landscape and building Design for Bushfire Areas Ramsay C. & Rudolph L. CSIRO 2003

Quantifying bushfire penetration into urban areas in Australia Keping Chan & McAneney J. Geophysical Research Letters, Volume 31, L12212, doi:10.1029/2004GL020244,2004

Bushfires in Australia Luke R.H. & McArthur CSIRO 1978

Performance of Building Elements in Bushfire Prone Areas Poon S.L. & England J.P. Warrington Fire Research Australia

Address Validation Search Department of Lands www.maps.nsw.gov.au

Standards for Asset Protection Zones NSW Rural Fire Service 2005

Ocean Shores to Dessert Dunes Keith D. Department of Environment and Conservation Sydney 2004