



## APPENDIX 5

Bushfire Risk Assessment



## **BUSHFIRE RISK ASSESSMENT**

### **PLANNING PROPOSAL AMENDMENT TO KLEP 2011 TO REZONE LAND**

17 Dido Street, Kiama  
Lot 3 DP 1018217

8<sup>th</sup> December 2017  
Reference: L103410



*This page has been intentionally left blank to allow the document to be printed double sided.*

# SET Consultants Pty Ltd

## NOWRA

51 Graham Street  
Nowra 2541  
Tel: (02) 4421 4500

## KIAMA

44 Manning Street  
Kiama 2533  
Tel: (02) 4233 2006

Email: [mail@setconsultants.com.au](mailto:mail@setconsultants.com.au)

### Document Control Table:

Prepared By	Reviewed By	Revision Number	Date
<b>David Cannon</b>  <i>M.Env.Eng.Sc, Grad Dip (Bushfire Protection), B.Env.Sc.Adv (Hons 1)</i>	<b>Peter Dowse</b>  <i>B.Sc</i>  <b>Environmental Planner</b>	Ver 0.1 – Draft	8 <sup>th</sup> December 2017
<b>Environmental Engineer</b>  BPAD-A (Level 3) Certified Practitioner BPAD 23829  <b>Corporate Member - PIA</b>		Ver 1.0 Final Issue	8 <sup>th</sup> December 2017

The assessment has been prepared in accordance with Planning for Bushfire Protection - A Guide for Councils, Planners, Fire Authorities and Developers, 2006, NSW Rural Fire Service (RFS) and Planning NSW.

This report should only be used for the purpose for which it was expressly prepared and shall not be reproduced by any third party in part or full without the permission of SET Consultants Pty Ltd.

Liability limited by a scheme approved under Professional Standards Legislation.

# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>1.1</b>	<b>Site Inspection and Statutory Requirements .....</b>	<b>2</b>
<b>1.2</b>	<b>OBJECTIVES .....</b>	<b>3</b>
<b>1.3</b>	<b>PROPOSAL .....</b>	<b>4</b>
<b>2</b>	<b>PROPERTY DETAILS .....</b>	<b>5</b>
<b>2.1</b>	<b>DESCRIPTION OF PROPERTY .....</b>	<b>5</b>
<b>2.2</b>	<b>CLASS OF VEGETATION .....</b>	<b>8</b>
<b>2.3</b>	<b>ASSESSMENT OF SLOPE .....</b>	<b>9</b>
<b>2.4</b>	<b>SIGNIFICANT ENVIRONMENTAL FEATURES.....</b>	<b>10</b>
<b>3</b>	<b>PURSUANT TO SECTION 117 (2) DIRECTION 4.4 PLANNING FOR BUSHFIRE PROTECTION .....</b>	<b>11</b>
<b>4</b>	<b>PROPERTIES ADEQUACY FOR BUSHFIRE PROTECTION .....</b>	<b>12</b>
<b>4.1</b>	<b>ASSESSMENT METHODOLOGY.....</b>	<b>12</b>
<b>4.2</b>	<b>PERFORMANCE BASED SOLUTION .....</b>	<b>13</b>
<b>4.3</b>	<b>SPECIFICATIONS FOR ASSET PROTECTION ZONE.....</b>	<b>14</b>
<b>4.4</b>	<b>ASSESSING THE BUSHFIRE RISK.....</b>	<b>15</b>
<b>4.5</b>	<b>SITING AND ADEQUACY OF WATER ELECTRICITY AND GAS SUPPLIES .....</b>	<b>17</b>
<b>4.6</b>	<b>CAPACITY OF THE PUBLIC ROADS TO HANDLE INCREASED VOLUME OF TRAFFIC IN THE EVENT OF AN EMERGENCY .....</b>	<b>19</b>
<b>4.7</b>	<b>ADEQUACY OF ACCESS AND EGRESS FROM SITE FOR EMERGENCY REPOSSES .....</b>	<b>21</b>
<b>4.8</b>	<b>PROVISIONS FOR FIRE TRAILS.....</b>	<b>22</b>
<b>4.9</b>	<b>ADEQUACY OF BUSHFIRE MAINTENANCE PLANS FOR EMERGENCY.....</b>	<b>23</b>
<b>4.10</b>	<b>LANDSCAPING.....</b>	<b>24</b>
<b>5.</b>	<b>CONCLUSION AND RECOMMENDATIONS .....</b>	<b>24</b>

## **Table of Figures**

Figure 1: Kiama Municipal Council Bushfire Prone Land Mapping, subject site outlined in blue. ....	2
Figure 2: Zoning map showing the rezoning in relation to the surrounding land use types.....	4
Figure 3: Concept subdivision plan showing the extent of BAL 29 in red .....	5
Figure 4: Location of subject site.....	6
Figure 5: Aerial photo of the subject site.....	6
Figure 6: (A) Depicting the subject site from the Kiama Bypass (B) Near Map Image of the site, both images highlight the existing managed land located to the south of the site over Lot 2 DP 1018217 as a result of ongoing agricultural and land management practices. ....	7
Figure 7: Aerial photo depicting vegetation posing a threat to the subject site. ....	9
Figure 8: View from Dido Street looking at the prevailing bushfire threat to the south. ....	10
Figure 9: Diagrammatic representation of an Asset Protection Zone.....	16
Figure 10: Street hydrant requirements in accordance with AS 2419.1 – 2005.....	18

## **Attachments**

Attachment 1	Concept Subdivision Plan
Attachment 2	Site Photographs

*This page has been intentionally left blank to allow the document to be printed double sided.*

## 1 INTRODUCTION

This Bushfire Risk Assessment has been prepared by SET Consultants Pty Ltd for the land owner to accompany a planning proposal to amend the Kiama Local Environmental Plan 2011 (**KLEP**) to rezone Lot 3 DP 1018217 from RU1 Primary Production to R2 Low Density Residential in accordance with the Kiama Urban Strategy (**KUS**) to permit subdivision and low density residential development of this land.

Kiama Municipal Council's Bushfire Prone Land Map (Figure 1) indicates that the subject site is bushfire prone. Pursuant to Section 117 (2) of the Environmental Planning and Assessment Act (1979) (**EPA Act**) the preparation or altering of an environmental planning instrument must have regard to the directions issued by the Minister for Planning. Direction 4.4 '*Planning for Bushfire Protection*' (2006) applies in the preparation of a planning proposal that will affect or is in proximity to land mapped as bushfire prone. Furthermore, Under Section 56 of the EPA Act the relevant planning authority must consult with the commissioner of the NSW Rural Fire Service following receipt of a gateway determination, prior to undertaking community consultation, taking into consideration any comments made.

Pursuant of Ministerial Direction 4.4 '*Planning for Bushfire Protection*' in the preparation of a planning proposal the following matters must be addressed:

- a) *Have regard to Planning for Bushfire Protection 2006,*
- b) *Introduce controls that avoid placing inappropriate developments in hazardous areas, and*
- c) *Ensure that bushfire hazard reduction is not prohibited within the APZ.*

*A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:*

- a) *Provide an Asset Protection Zone (APZ) incorporating at a minimum:*
  - (i) *an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and*
  - (ii) *An Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,*
- b) *For infill development (that is development within an already subdivided area), where an appropriate APZ cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire Protection Purposes (as defined under section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with,*
- c) *Contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks,*
- d) *Contain provisions for adequate water supply for firefighting purposes,*
- e) *Minimise the perimeter of the area of land interfacing the hazard which may be developed, and*



- Section 117 of the Environmental Planning and Assessment Act (1979) Ministerial Direction 4.4 'Planning for Bushfire Protection' (2009).

*NOTE: that the 'Planning for Bushfire Protection, A Guide for Council, Planners, Fire Authorities, and Developers (NSW Rural Fire Service (RFS) in cooperation with the Department of Planning (NSW) (2006) mentioned above, will herein be referred to as the 'PBP 2006'.*

## **1.2 OBJECTIVES**

*All development on Bushfire Prone Land must satisfy the aim and objectives of PBP 2006. PBP 2006 states:*

*"The aim of PBP is to use the NSW development assessment system to provide for the protection of human life (including firefighters) and to minimise impacts on property from the threat of bushfire, while having due regard to development potential, on-site amenity and protection of the environment.*

*More specifically, the objectives are to:*

- a) afford occupants of any building adequate protection from exposure to a bushfire;*
- b) provide for a defensible space to be located around buildings;*
- c) provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;*
- d) ensure that safe operational access and egress for emergency service personnel and residents is available;*
- e) provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the asset protection zone (APZ); and*
- f) ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bushfire fighting").*

This assessment includes an analysis of the potential hazard persisting and affecting the subject site and the standards and bushfire mitigation measures that should be introduced to address the objectives of the PBP 2006 and AS3959-2009. The mitigation measures have been derived from the provisions (performance criteria and acceptable solutions) as outlined within the PBP 2006 and AS3959-2009.

### 1.3 PROPOSAL

The objective of this planning proposal is to amend the Kiama Local Environmental Plan (LEP) 2011 to Lot 3 DP 1018217 from RU1 Primary Production to R2 Low Density Residential in accordance with the Kiama Urban Strategy (**KUS**) to permit subdivision and low density residential development of this land. The proposed rezoning has been shown in relation to the surrounding land uses in Figure 2 below.

The intended outcome will be achieved by amending Kiama LEP 2011 as follows:

1. Amend the Land Zoning Map – Sheet LZN\_012 applying to Lot 3 DP 1018217 from zone RU1 to zone R2;
2. Amend the Lot Size Map – Sheet LSZ\_012 applying to Lot 3 DP 1018217 from minimum lot size of AB 40ha to G 450 sqm;
3. Amend the Floor Space Ratio Map – Sheet FSR\_012 applying to Lot 3 DP 1018217 to apply a FSR of C 0.45:1; and
4. Amend the Height of Buildings Map – Sheet HOB\_012 applying to Lot 3 DP 1018217 to apply a maximum height of I 8.5m.

The planning proposal will change the minimum lots size to 450m<sup>2</sup>. Constraints of the site will limit future subdivision yields to 9 to 10 lots with some potential for dual occupancy.

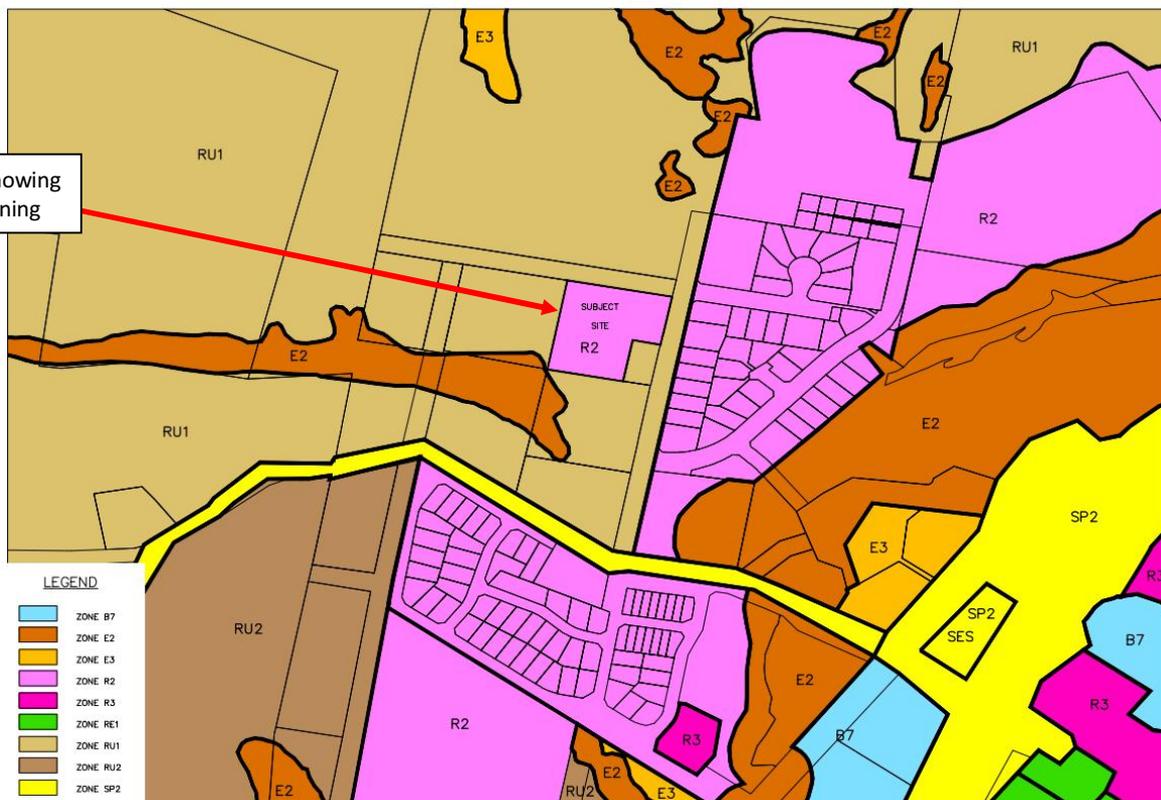
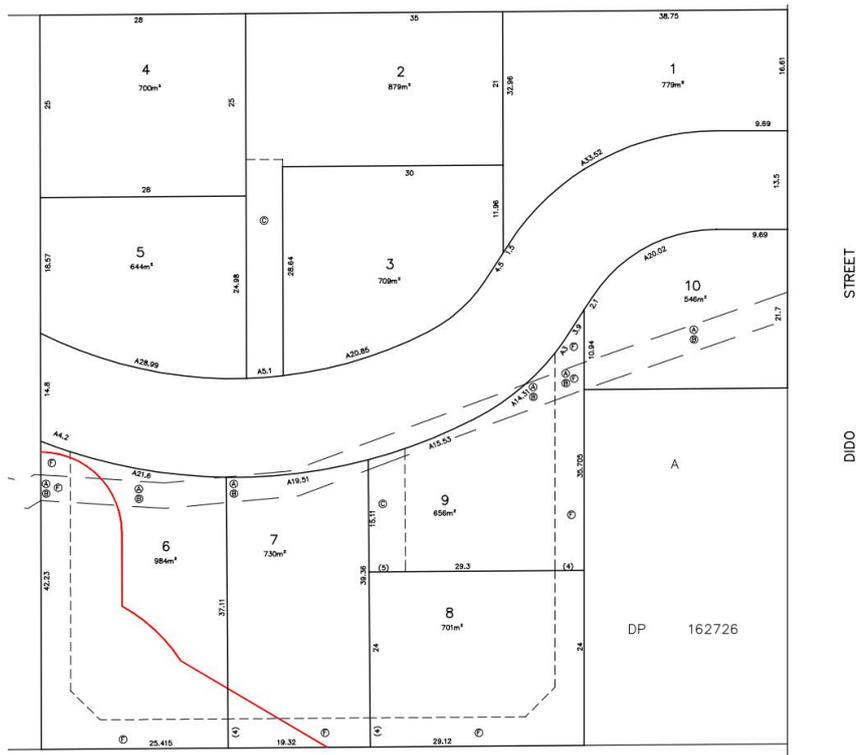


Figure 2: Zoning map showing the rezoning in relation to the surrounding land use types

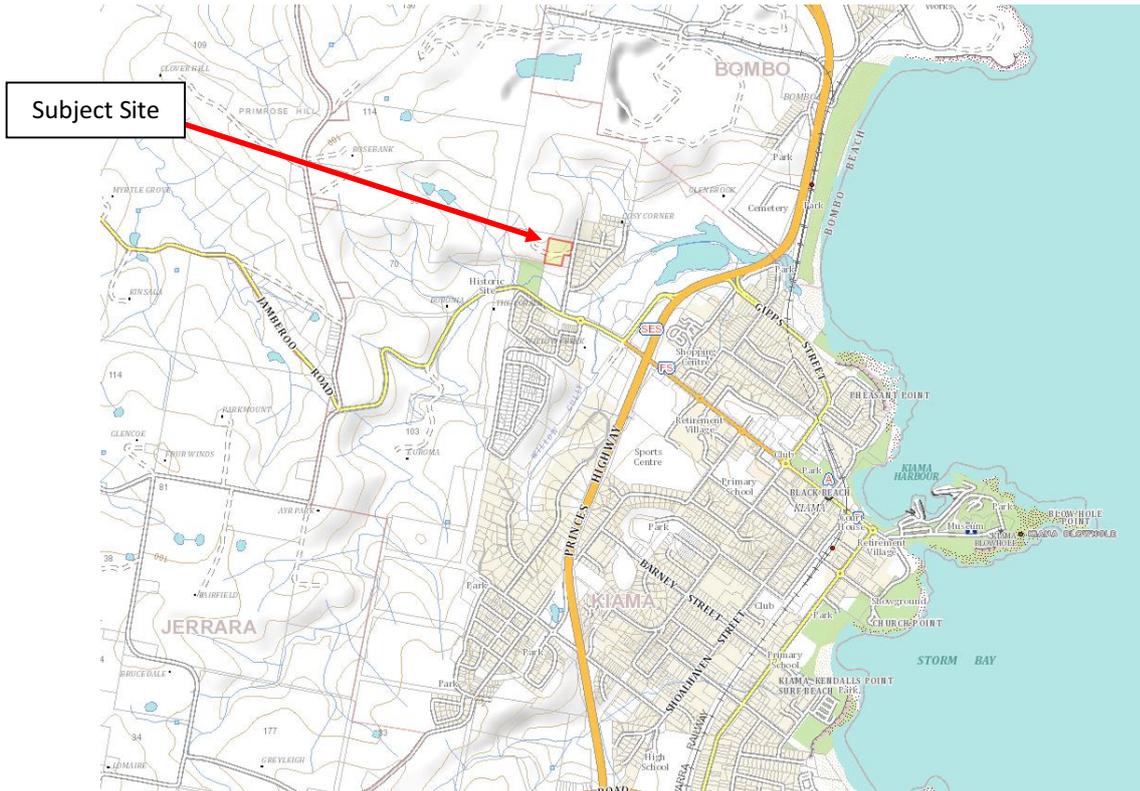


**Figure 3: Concept subdivision plan showing the extent of BAL 29 in red**

## 2 PROPERTY DETAILS

### 2.1 DESCRIPTION OF PROPERTY

The study area is approximately 0.94 hectares and is defined as Lot 3 DP1018217, Dido Street Kiama. The study area is within Kiama Local Government Area (LGA). The surrounding land use includes low density residential dwelling to the east, rural land to the west and south, and a large lot dwelling to the north. Dense growing vegetation, surrounded by open rural land extends across the study area and to the west for approximately 500 metres. This area is isolated from other vegetation patches by rural land and low density residential development to the north and south east.



**Figure 4: Location of subject site**

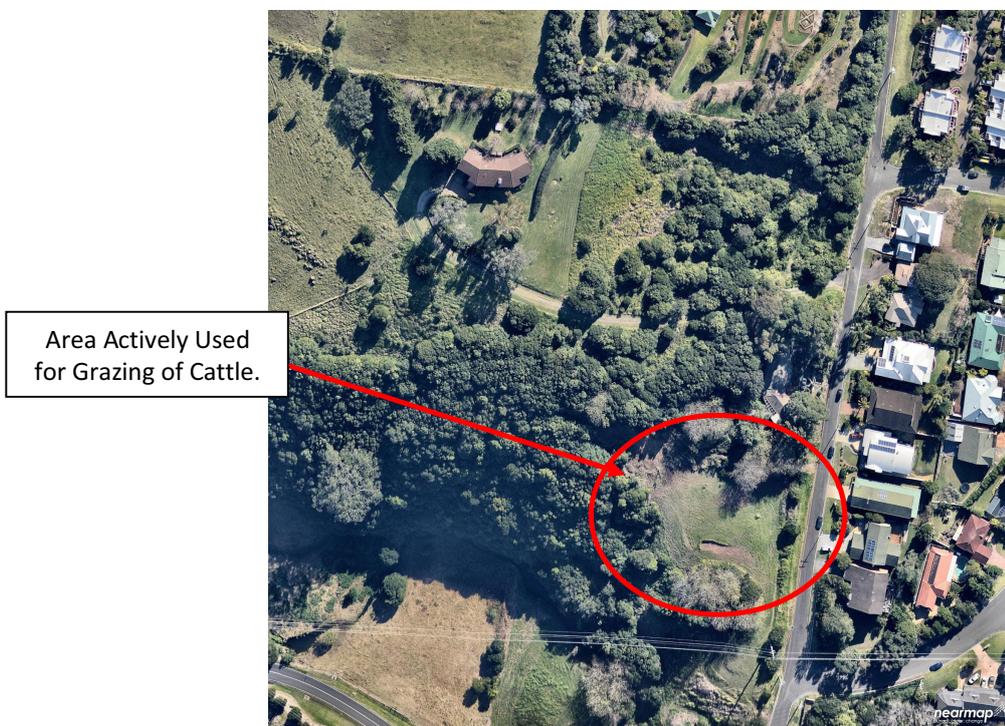


**Figure 5: Aerial photo of the subject site**

Land located directly to the south of the site was found to support ongoing agriculture uses which involve the running of cattle over. Sites that support ongoing agricultural uses to the south of the site include Lots 1 & 2 DP 1018217 and Lot 701 DP 1026775 and can be seen in Figure 5. In this regard, it is apparent that the existing grassland located over lot 2 DP 1018217 supports a large area of managed grassland that leads up to the southern boundary of the site (Figure 6 A and B). With the combination of ongoing agricultural activities and land management practices part of lot 2 DP 1018217 has been considered to be managed land for this assessment



(A)



(B)

**Figure 6: (A) Depicting the subject site from the Kiama Bypass (B) Near Map Image of the site, both images highlight the existing managed land located to the south of the site over Lot 2 DP 1018217 as a result of ongoing agricultural and land management practices.**

## **2.2 CLASS OF VEGETATION**

The vegetation types have been classified using the formations and sub-formations provided in Table A2.1 of the bushfire guideline. Vegetation descriptions are as per Keith D, 2004 in Keith (2004) “Ocean Shores to Desert Dunes” published by DECC (except heathlands which is provided two sub-formations rather than one based largely on vegetation height) the main categories are as follows:

- Forests (wet sclerophyll forests and dry sclerophyll forests);
- Woodlands;
- Forested wetlands;
- Tall heaths;
- Freshwater wetlands
- Short heaths;
- Alpine complex;
- Semi-arid woodlands;
- Arid shrublands;
- Rainforests; and
- Grasslands.

Where a mix of vegetation types exist, the type providing the greater bushfire hazard has been used. Vegetation that is to be cleared as part of the development has not been included in this assessment. It should also be noted that remnant vegetation (a parcel of vegetation < 1 ha or fire run of < 50m) and Riparian vegetation are considered a low hazard and APZ setbacks and building construction standards for these will be the same as for rainforests.

As part of this assessment, the following are not considered a hazard or as a predominant vegetation class/formation and can be included within an asset protection zone:

- a) non-vegetated areas including roads, footpaths, cycleways, waterways, buildings, rocky outcrops and the like; and
- b) reduced vegetation including maintained lawns, golf course fairways, playgrounds or sports fields, vineyards, orchards, cultivated ornamental gardens and commercial nurseries.

The details of the predominant vegetation in all directions, to a distance of 140m from the proposed dwelling envelope are provided in **3.2**.

The vegetation on site had been cleared previously and the majority of vegetation was regrowth forming a ‘Closed Exotic Shrubland’ of Broad-leaved Privet *Ligustrum lucidum* and African Olive *Olea europaea* var. *cuspidata*, with an occasional Sweet Pittosporum *Pittosporum undulatum* or Maiden’s Wattle *Acacia maidenii*.

Vegetation posing a threat to the site comes from the vegetation located to the south and west over Lot 2 and 4 of DP1018217 and Lot 701 DP 1026775. In accordance with, Kevin Mills and Associates (2006) 'The Natural Vegetation in the Municipality of Kiama NSW', this vegetation is a community of Complex Subtropical Rainforest.



**Figure 7: Aerial photo depicting vegetation posing a threat to the subject site.**

In accordance with Keith D, 2004 the vegetation posing a threat to the proposed development (Figure 7) would be classified as rainforest, which when converted to the AUSLIG Pictorial Analysis system in AS3959-2009 would be classified as rainforest.

### **2.3 ASSESSMENT OF SLOPE**

The slope in all directions over a distance of 100m from the existing property boundary or building footprint has been assessed in terms of the following classes:

- (i) all upslope vegetation (considered 0°)
- (ii) >0 to 5° downslope vegetation
- (iii) >5 to 10° downslope vegetation
- (iv) >10 to 15° downslope vegetation
- (v) >15 to 18° downslope vegetation.

During the assessment of the slope, if it was found that there were a number of different slope classes present over the 100m in any one direction, the slope of the area, which will most significantly influence the fire behavior, has been adopted.

In general, the site slopes down towards Dido Street to the east and Springs Creek to the south. Slopes in a southerly direction is subject to a steep embankment which adjoins Spring Creek.



**Figure 8: View from Dido Street looking at the prevailing bushfire threat to the south.**

During the assessment of the proposed rezoning the following slope categories were considered to most significantly influence the fire behavior;

- South – 20° Downslope;
- South West – 20° Downslope; and
- West – 9° Upslope.

## **2.4 SIGNIFICANT ENVIRONMENTAL FEATURES**

Based on the field investigations, the site supports a small area of Illawarra Subtropical Rainforest an Endangered Ecological Community. The area of Illawarra subtropical rainforest found on the site is 0.013ha and clearing is unlikely to result in a significant impact. The rainforest onsite is proposed to be removed as part of the proposed subdivision works.

No threatened fauna was recorded within the study area during site investigations and based on a number of factors considered the assessment found only a low likelihood of impact on the threatened nomadic fauna species which were specifically considered based on habitat values present.

### 3 Pursuant to Section 117 (2) Direction 4.4 Planning for Bushfire Protection

Pursuant of Section 4.4 (4) Planning for Bushfire Protection;

‘In the preparation of a planning proposal, the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service following receipt of a gateway determination under Section 56 of the Act, and take into consideration any comments made.

In doing so the planning proposal must demonstrate compliance with all matters of the direction as shown in Table 1 below.

**Table 1: Directional Requirements under Section 4.4 (4) Planning for Bushfire Protection**

Direction	Comment
<p>4.4.5 - A planning proposal must:</p> <ol style="list-style-type: none"> <li>a. Have regard to Planning for Bushfire Protection 2006,</li> <li>b. Introduce controls that avoid placing inappropriate developments in hazardous areas, and</li> <li>c. Ensure that bushfire hazard reduction is not prohibited within the APZ.</li> </ol>	<p>The planning proposal seeks to revise Kiama Councils Zoning Map to Lot 3 DP 1018217 from RU1 Primary Production to R2 Low Density Residential in accordance with the KUS to permit subdivision and low density residential development of this land.</p> <p>This report takes into consideration the requirements for ‘Residential Subdivision’, upon rezoning of the site an application for subdivision will be required. Future subdivision of the site will trigger an assessment under Section 100B of the Rural Fires Act.</p> <p>The proposal will not place inappropriate development in hazardous areas, the site is appropriate for residential development given compliance with the recommendations of this report.</p> <p>The APZ’s on the site are partially in place, future owners will have the legal ability to maintain APZ’s upon approval of future development.</p>
<p>4.4.6 - A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:</p> <ol style="list-style-type: none"> <li>a) provide an Asset Protection Zone (APZ) incorporating at a minimum: <ol style="list-style-type: none"> <li>i. an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the</li> </ol> </li> </ol>	<p>This report demonstrates that the planning proposal can support low density residential development which complies with the requirements of Direction 4.4.6.</p> <p>The site will have legal ability to establish and maintain APZ’s. APZ’s will need to be maintained in accordance with this report or the recommendations made under a future subdivision application.</p>

<p>land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and</p> <p>II. an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,</p> <p>b) For infill development (that is development within an already subdivided area), where an appropriate APZ cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire Protection Purposes (as defined under section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with,</p> <p>c) Contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks,</p> <p>d) Contain provisions for adequate water supply for firefighting purposes,</p> <p>e) Minimise the perimeter of the area of land interfacing the hazard which may be developed.</p>	<p>The site has the ability to comply with the requirements for public roads. The attached Concept Subdivision Plan found as attached 1 demonstrates the site can facilitate a road that complies with the requirements of Public Roads, as outlined in Section 4.1.3 (1) of PBP 2006.</p> <p>Hydrants will be required to be located at regular intervals within the road reserve and can be supported on the site.</p> <p>Future detail will be required upon submission of an application for subdivision to Kiama Council.</p> <p>The prevailing threat to the proposed rezoning is considered low and comes from an isolated area of remnant rainforest. The likelihood of this vegetation supporting a fully developed crown fire is low. Some sites will be located at the interface with the prevailing hazard, though can support a design that provide adequate APZ's onsite.</p> <p>The site is capable of providing two-way access roads linked to a fire trail network. Given the size and scale of the development a perimeter road is not achievable on the site, a fire trail is therefore proposed to facilitate access to the interface for firefighters.</p>
--	---

## 4 PROPERTIES ADEQUACY FOR BUSHFIRE PROTECTION

### 4.1 ASSESSMENT METHODOLOGY

A site inspection was conducted to determine the direction and scale of any potential bush fire event based on an analysis of slope, aspect, vegetation type and density, current fuel loading and evidence of past fire history.

The information contained in the appendices of the PBP 2006 has been used to categorise vegetation type and slope class in the locality, as discussed in Sections 2.2 and 2.3 of this report. Following from this the Short Fire Run Methodology was used in determining the vegetation fuel loading (University of Western Sydney), and required APZ's, as outlined in, *NSW Rural Fires Service document entitled 'Short Fire Run – Methodology for Assessing Bushfire Risk for Low Risk Vegetation (2017)*.

Details of the Short Fire Run method can be found in Section 4.2 below, which provides a performance based solution supporting the methodology used in the assessment.

## **4.2 PERFORMANCE BASED SOLUTION**

Planning for Bush Fire Protection 2006 (PBP) uses the methodology identified within AS3959-2009 Method 2 to determine the potential bush fire impact on a site. AS3959-2009 Method 2 requires the fire head width and flame length to be calculated so that the level of radiant heat likely to impact an asset can be estimated. The SFR adopts a similar methodology, however, introduces modifications from other accepted science to calculate the reduced fire head width and flame height attributed to lower threat bush fire hazards.

To determine a SFR head width (the first dimension) site specific information needs to be compiled. The site-specific information is then substituted into an equation to determine the fire's length/breadth ratio using the forward rate of spread and wind speed. The shape and growth (forward rate of spread) of the 'design fire' can then be determined mathematically and presented as an ellipse. The method for determining the SFR flame height (the second dimension) varies depending on the vegetation formation. For forest and woodland vegetation formations the findings from CSIRO Project Vesta 3 are used to calculate the flame height using surface, near surface and elevated fuels only. There is no allowance for bark and canopy fuels as the SFR is not expected to support a crown fire.

The proposed SFR model relies on a number of assumptions to calculate the modified fire shape and flame height, these are:

- Wind direction and speed is constant in the direction of fire spread.
- Slope is considered relatively flat and uniform throughout the length of the fire run.
- Fuel load is distributed equally and is continuous for the entire fire run length.
- The shape of the fire is based on a uniform slope.
- The fire develops from a single ignition point and does not consider time of ignition or fire growth.
- Flaming is restricted to surface, near surface and elevated fuels.
- The fire does not become a crown fire (scorching and intermittent involvement of the canopy fuels permitted, no sustained crown fire).
- Fire run is measured perpendicular to contours.
- No allowance for ember showers has been considered.

**Table 2: Parameters for Short Fires Run**

Lot	Effective slope	Site Slope	Measured Short Fire Run	Flame Breadth (SFR)	Flame Height (SFR)	APZ	Radiant Heat	View Factor
	Inputs			Outputs				
South	20° Downslope	10° Downslope	70m	25.62m	31.70m	22.5m	28.32kW/m <sup>2</sup>	0.435
South West	20° Downslope	10° Downslope	73m	26.72m	31.70m	22.5m	28.90kW/m <sup>2</sup>	0.444
West	15° Downslope	5° Downslope	52m	19.03m	10.06m	11m	28.35kW/m <sup>2</sup>	0.424

**Note:**

- <sup>1</sup> Vegetation formations and fuel loads for the assessment have been formulated via University of Wollongong for Rainforest with a surface and elevated fuel loading of 10t/ha and an overall fuel loading of 13.2t/ha.
- <sup>2</sup> Elevated Receiver has been set to default.
- <sup>3</sup> FFDI of 100
- <sup>4</sup> Assumed flame length is not to be considered as a partial or intermittent flame immersion for radiant heat calculations. This is due to the low inherent risk associated with the short fire run.
- <sup>5</sup> Elevated fuel height of 2m.
- <sup>6</sup> Flame temperature 1090.

Vegetation posing a threat to the site cannot support a fully developed fire due to limited fire runs and is considered a low threat bushfire hazard. For this reason, this vegetation would not support a fully developed fire which is defined by AS3959 to have a head width of 100m. Furthermore, it is believed that the short fire run methodology currently provides the most accurate representation of the fire behavior relating prevailing bushfire hazard impacting on the subject site.

### **4.3 SPECIFICATIONS FOR ASSET PROTECTION ZONE**

The aim of APZs is to ensure there is a progressive reduction in flammable material towards any building. The intent of the measures are to provide sufficient space and maintain reduced fuel loads, so as to ensure radiant heat levels at buildings are below critical limits and to prevent direct flame contact with the building. The performance criteria and acceptable solutions for asset protection zones for subdivisions in accordance with PBP 2006 are provided in Table 3.

**Table 3:** Provides the performance criteria and acceptable solutions for APZ for residential subdivisions in accordance with PBP 2006.

Performance Criteria	Acceptable Solutions	Compliance
The intent may be achieved where:		
Radiant heat levels at any point on a proposed building will not exceed 29 kW/m <sup>2</sup>	<ul style="list-style-type: none"> <li>An APZ is provided in accordance with Table A2.4 of Appendix 2 of PBP 2006.</li> <li>The APZ is wholly within the boundaries of the development site.</li> </ul>	<p>The proposal complies with the APZ requirements of Appendix 2 of PBP 2006.</p> <p>APZ's are contained within the site.</p>
APZs are managed and maintained to prevent the spread of a fire towards the building.	APZs are managed and maintained in accordance with the requirements of Standards for Asset Protection Zones (RFS, 2005).	Approval to establish APZ's will be required as part of a future subdivision application.
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is negated	The APZ is located on lands with a slope less than 18 degrees.	The site does not contain areas with slopes greater than 18°.

#### 4.4 ASSESSING THE BUSHFIRE RISK

The main factors directly affecting the behavior of fire are:

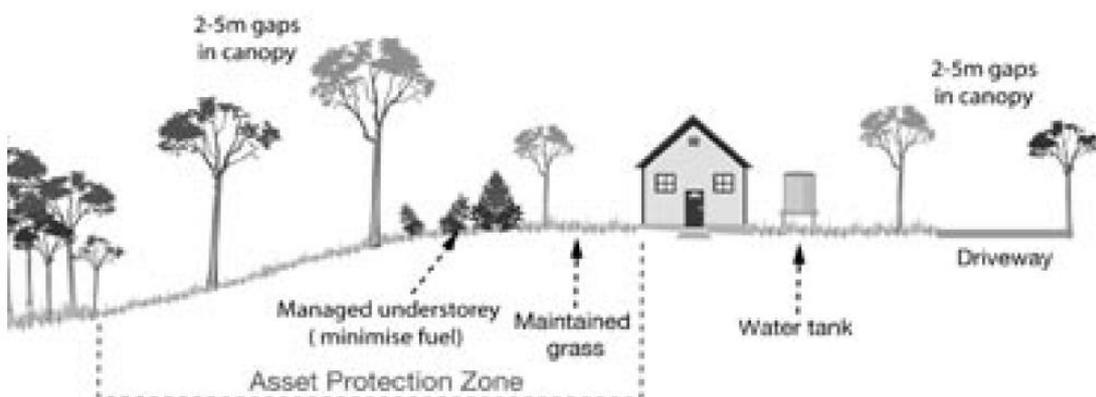
- Wind (strength and direction);
- Fuel Moisture and content (how dry it is, relative humidity);
- Type quantity and arrangement of fuel (vegetation density); and
- Slope (fire spreads quicker upslope due to preheating).

The prevailing weather conditions associated with the bushfire season in the Illawarra (Kiama) region are strong north westerly winds, low relative humidity and high temperatures. With the combination of the current vegetation and slope, the overall bushfire risk associated with the proposed rezoning range from **Low** to **High**, with the foremost bushfire risk coming from the Rainforest vegetation to the south of the site. The site can support a subdivision layout that can support APZ's onsite, as shown in the Concept Subdivision Plan (Attachment 1). Approval for vegetation removal will be sort at the subdivision application stage.

It is recommended that the entire property be maintained as Inner Protection Zone (Figure 9) for the life of the development and comply with section 4.1.3 and Appendix 5 of Planning for Bush Fire Protection 2006 and the NSW Rural Fire Service's document 'Standards for asset protection zones', as outlined below:

- Existing larger trees (at least 150mm in diameter measured at chest height) may remain within the APZ provided that:
  - They do not occur within 4m of a building;

- Lower limbs are removed;
- Shrubs beneath the trees are removed; and
- Crowns do not form a continuous canopy.
- Smaller trees, shrubs, fallen trees, tree limbs and stumps are to be removed
- The presence of a few shrubs is acceptable provided that they are at least 10m from the structure, are well spread out, do not form a contiguous pathway to the dwelling and do not constitute more than 5% of the total APZ area.
- Vegetable gardens or fruit trees may be located within the APZ. Any other gardens should not occupy more than 5% of the APZ and only contain low flammability species.
- A minimal ground fuel is to be maintained to include either mowed grass, paving, concrete, bare ground or less than 4 tonnes per hectare of fine fuel.
- Any structures within the APZ are to be non-combustible
- Any structures storing combustible materials such as firewood must be sealed to prevent entry of burning debris.
- Gutters, roofs and roof gullies shall be kept free of leaves and other debris.



**Figure 9: Diagrammatic representation of an Asset Protection Zone**

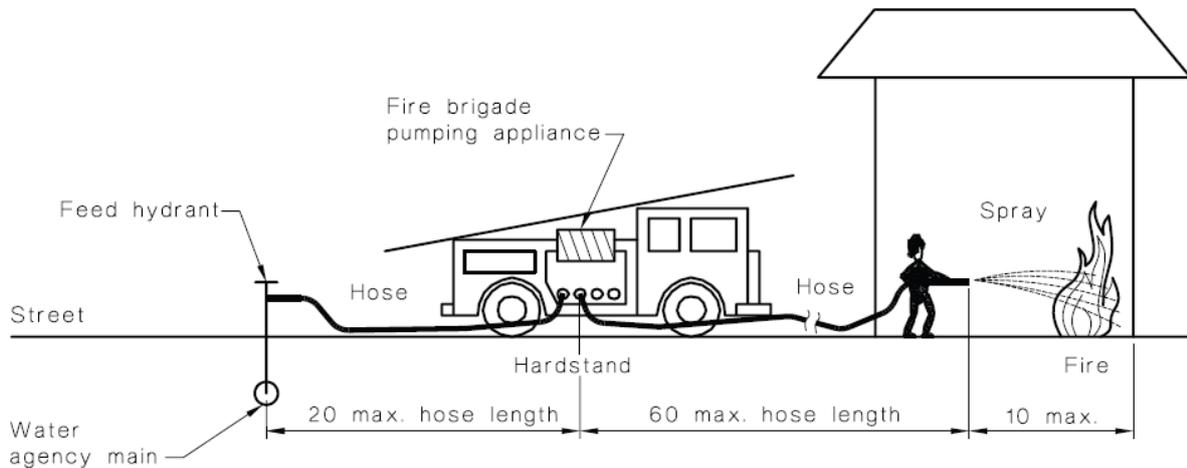
#### **4.5 SITING AND ADEQUACY OF WATER ELECTRICITY AND GAS SUPPLIES**

The performance criteria and acceptable solutions for water, electricity, and gas for residential subdivisions in accordance with PBP 2006 are provided in Table 4. The intent of the measures is to provide adequate water services 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 4: Provides the performance criteria and acceptable solutions for water, electricity, and gas for residential in accordance with PBP 2006**

<b>Performance Criteria</b>	<b>Acceptable Solutions</b>	<b>Compliance</b>
<p><u>Reticulated water supplies</u></p> <p>Water supplies are easily accessible and located at regular intervals</p>	<ul style="list-style-type: none"> <li>reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads.</li> <li>fire hydrant spacing, sizing and pressures comply with AS 2419.1 – 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.</li> <li>hydrants are not located within any road carriageway.</li> <li>all above ground water and gas service pipes external to the building are metal, including and up to any taps.</li> <li>the provisions of parking on public roads are met.</li> </ul>	<p>The subject site is connected to local reticulated town water supply. The size and pressure of the town water supply main servicing the subject development site has not been determined as part of this report.</p> <p>The exist hydrant network will be required to be extended to service a future subdivision on the site. Hydrants will need to be designed and installed to meet the requirements set out in AS 2419.1 – 2005 and is located so that all portions of the building are within reach of a 10m hose stream, issued from a nozzle at the end of a 60m length of hose laid on the ground from a pumping appliance which is connected to feed fire hydrant by a 20m hose (Refer to Figure 10).</p>
<p><u>Electricity Services</u></p> <ul style="list-style-type: none"> <li>Location of electricity services limits the possibility of ignition of surrounding bushland or the fabric of buildings</li> <li>Regular inspection of lines is undertaken to ensure they are not fouled by branches.</li> </ul>	<ul style="list-style-type: none"> <li>where practicable, electrical transmission lines are underground.</li> <li>where overhead electrical transmission lines are proposed: <ul style="list-style-type: none"> <li>lines are installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas; and</li> <li>no part of a tree is closer to a power line than the distance set out in accordance with the specifications in 'Vegetation Safety Clearances' issued by Energy Australia (NS179, April 2002).</li> </ul> </li> </ul>	<p>No information on the provision of electricity services was provided as part of this assessment, however, where practicable, electrical transmission lines should be underground or comply with the acceptable solutions for overhead transmission lines.</p>
<p><u>Gas services</u></p>	<ul style="list-style-type: none"> <li>reticulated or bottled gas is installed and maintained in accordance with AS 1596 and</li> </ul>	<p>Reticulated piped gas is not available to the subject site.</p>

Performance Criteria	Acceptable Solutions	Compliance
<p>Location of gas services will not lead to ignition of surrounding bushland or the fabric of buildings</p>	<p>the requirements of relevant authorities. Metal piping is to be used.</p> <ul style="list-style-type: none"> <li>• all fixed gas cylinders are kept clear of all flammable materials to a distance of 10 metres and shielded on the hazard side of the installation.</li> <li>• if gas cylinders need to be kept close to the building, the release valves are directed away from the building and at least 2 metres away from any combustible material, so that they do not act as a catalyst to combustion.</li> <li>• Connections to and from gas cylinders are metal.</li> <li>• polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not used.</li> </ul>	<p>Any future piped or bottled gas shall be installed and maintained in accordance with AS 1596. Gas cylinders are to be positioned in accordance with the acceptable solution outlined in this table.</p> <p>From the site inspection, there is no reason why the installation of gas cylinders for future development cannot comply with the acceptable solution outlined in this table.</p>



(a) Street hydrant used as feed hydrant

**Figure 10: Street hydrant requirements in accordance with AS 2419.1 – 2005.**

## **4.6 CAPACITY OF THE PUBLIC ROADS TO HANDLE INCREASED VOLUME OF TRAFFIC IN THE EVENT OF AN EMERGENCY**

The performance criteria and acceptable solutions for Public Roads for residential and rural subdivisions in accordance with PBP 2006 are provided in Table 5. The intent of the measures are to provide safe operational access to structures and water supply for emergency services, while residents are seeking to evacuate from an area.

**Table 5: Provides the performance criteria and acceptable solutions for Public Roads for residential subdivisions in accordance with PBP 2006.**

Performance Criteria	Acceptable Solutions	Compliance																				
Firefighters are provided with safe all weather access to structures (thus allowing more efficient use of firefighting resources)	Public roads are two-wheel drive, all weather roads.	Future subdivision of the site will require a public road similar to that shown on the concept subdivision plan (Figure 3 and Attachment 1). Given the size and scale of the development a perimeter road is not achievable on the site, a fire trail is proposed to facilitate access to the interface for firefighters. The arrangement would need to be addressed in any future application for subdivision.																				
Public road widths and design that allow safe access for firefighters while residents are evacuating an area.	<ul style="list-style-type: none"> <li>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 Road widths for Category 1 Tanker (medium Rigid Vehicle):</li> </ul> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th style="background-color: #00838f; color: white;">Curve radius (inside edge (m))</th> <th style="background-color: #00838f; color: white;">Swept Path (Width (m))</th> <th style="background-color: #00838f; color: white;">Single lane (Width (m))</th> <th style="background-color: #00838f; color: white;">Two way (Width (m))</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>&lt;40</b></td> <td style="text-align: center;">3.5</td> <td style="text-align: center;">4.5</td> <td style="text-align: center;">8.0</td> </tr> <tr> <td style="text-align: center;"><b>40-69</b></td> <td style="text-align: center;">3.0</td> <td style="text-align: center;">3.9</td> <td style="text-align: center;">7.5</td> </tr> <tr> <td style="text-align: center;"><b>70-100</b></td> <td style="text-align: center;">2.7</td> <td style="text-align: center;">3.6</td> <td style="text-align: center;">6.9</td> </tr> <tr> <td style="text-align: center;"><b>&gt;100</b></td> <td style="text-align: center;">2.5</td> <td style="text-align: center;">3.5</td> <td style="text-align: center;">6.5</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>the perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas.</li> <li>traffic management devices are constructed to facilitate access by emergency services vehicles.</li> <li>public roads have a cross fall not exceeding</li> </ul>	Curve radius (inside edge (m))	Swept Path (Width (m))	Single lane (Width (m))	Two way (Width (m))	<b>&lt;40</b>	3.5	4.5	8.0	<b>40-69</b>	3.0	3.9	7.5	<b>70-100</b>	2.7	3.6	6.9	<b>&gt;100</b>	2.5	3.5	6.5	<p>Future subdivision of the site will be required to provide a public road.</p> <p>A public through road is unachievable on the site, access to the urban bushland interface could be achieved through the formation of a fire trail, as shown in Figure 3 and <b>Attachment 1</b>).</p>
Curve radius (inside edge (m))	Swept Path (Width (m))	Single lane (Width (m))	Two way (Width (m))																			
<b>&lt;40</b>	3.5	4.5	8.0																			
<b>40-69</b>	3.0	3.9	7.5																			
<b>70-100</b>	2.7	3.6	6.9																			
<b>&gt;100</b>	2.5	3.5	6.5																			

Performance Criteria	Acceptable Solutions	Compliance
	<p>3 degrees.</p> <ul style="list-style-type: none"> <li>• 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 direct traffic away from the hazard.</li> <li>• 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.</li> <li>• the minimum distance between inner and outer curves is six metres.</li> <li>• 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.</li> <li>• there is a minimum vertical clearance to a height of four metres above the road at all times.</li> </ul>	
<p>The capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles.</p>	<p>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 indicate load rating.</p>	<p>Dido St has been constructed to Kiama Council requirements. Any future roads will need to be constructed to support a medium rigid vehicle.</p> <p>No Bridges are proposed.</p>
<p>Roads that are clearly sign-posted (with easily distinguishable names) and buildings/properties that are clearly numbered.</p>	<ul style="list-style-type: none"> <li>• public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression.</li> <li>• 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.</li> </ul>	<p>The site can support a road network that supports hydrants outside of parking areas.</p> <p>Hydrants may be required to be located along the fire trail.</p>

Performance Criteria	Acceptable Solutions	Compliance
There is clear access to reticulated water supply.	<ul style="list-style-type: none"> <li>public roads up to 6.5 metres wide provide parking within parking bays and locate services outside the parking bays to ensure accessibility to reticulated water for fire suppression.</li> <li>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 the parking bays to ensure accessibility to reticulated water for fire suppression.</li> </ul>	Fire hydrants will be required to be located within the road reserve outside of parking bays. The site can support a hydrant network that provides clear access to water.
Parking does not obstruct the minimum paved width.	<ul style="list-style-type: none"> <li>parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within the parking bays.</li> <li>public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of the road.</li> </ul>	No dedicated parking bays are provided within the road reserve.

#### **4.7 ADEQUACY OF ACCESS AND EGRESS FROM SITE FOR EMERGENCY REPONSES**

The intent of measures is to provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupants faced with evacuation. PBP states (as the acceptable solution for normal property access);

*"No specific access requirements apply in an urban area where a 70 metres 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 fire fighting vehicles (i.e. a hydrant or water supply)".*

Future subdivision of the site will require the construction of a public road. Future residential lots are capable of supporting dwellings which have a 70 metre unobstructed path between the most distant external part of the dwelling and the nearest part of the public access road. The public access roads will be supported by a reticulated water supply system. hydrants will be required to be set out in accordance with the requirements of AS 2419.1 – 2005.

Access from Dido Street is considered adequate to facilitate entry to the site for fire suppression.

## 4.8 PROVISIONS FOR FIRE TRAILS

The intent of measures is to provide suitable access for fire management purposes and maintenance of APZ's. In suburban subdivisions they may function as a strategic control line around the hazard side of the IPA, if they are connected to the public road system at frequent intervals.

At the time of subdivision, if a fire trail is formed as part of the development, consideration should be given to dedicating the fire trail to Council. If this is not achievable a Right of Way will be required.

**Table 6: Provides the performance criteria and acceptable solutions for Fire Trails for residential subdivisions in accordance with PBP 2006.**

Performance Criteria	Acceptable Solutions	Compliance
The intent may be achieved where:		
The width and design of the fire trails enables safe and ready access for firefighting vehicles	<p>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.</p> <p>The trail is a maximum grade of 15 degrees if sealed and not more than 10 degrees if unsealed.</p> <p>A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches is provided.</p> <p>The crossfall of the trail is not more than 10 degrees.</p> <p>The trail has the capacity for passing by:</p> <ul style="list-style-type: none"> <li>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 metres; and/or</li> <li>A passing bay every 200 metres, 20 metres long by three metres wide, making a minimum trafficable width of seven metres at the passing bay</li> </ul> <p>Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5m) and extend for no</p>	<p>Future subdivisions can accommodate a fire trail that complies with the acceptable solutions</p> <p>A fire trail is proposed in this instance as a perimeter road is not achievable due to the size of the site.</p>

	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.	<p>The fire trail is accessible to firefighters and maintained in a serviceable condition by the owner of the land.</p> <p>Appropriate drainage and erosion controls are provided.</p> <p>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.</p> <p>Fire trails do not traverse a wetlands or other land potentially subject to periodic inundation (other than a flood or storm surge).</p> <p>Gates for fire trails are provided and locked with a key/lock system authorized by the local RFS.</p>	<p>If a fire trail is proposed in a future subdivision application arrangement for maintenance will be required.</p> <p>Potential options are dedication to Council as a reserve area or through the creation of ROW over the affected sites.</p> <p>The fire trial will need to incorporate gates/bollards with a key/lock system authorized by the local RFS.</p> <p>Design will be needed to address drainage and sediment control at the subdivision stage.</p>
Fire trails designed to prevent weed infestation, soil erosion and other land degradation	<p>fire trail design does not adversely impact on natural hydrological flows.</p> <p>fire trail design acts as an effective barrier to the spread of weeds and nutrients.</p> <p>fire trail construction does not expose acid-sulphate soils.</p>	<p>The fire trail will be located within the Inner Protection Area of the subdivision and will need to be managed in perpetuity of future subdivision.</p>

#### **4.9 ADEQUACY OF BUSHFIRE MAINTENANCE PLANS FOR EMERGENCY**

Illawarra Rural Fire District (Fire Control Centre No. 37 Airport Road, Albion Park) currently administers bushfire maintenance plans and fire emergency procedures in this particular area. currently administers bushfire maintenance plans and fire emergency procedures in this particular area. In addition, the Kiama Fire Station is located approximately 1 kilometre away at No. 210 Terralong Street, Kiama.

Legislation requires occupants of land to immediately extinguish fires or notify fire-fighting authorities, on becoming aware of fire during fire danger period. The most appropriate course of action is to telephone “000” and report the fire.

## **4.10 LANDSCAPING**

The performance criteria is for landscaping to be designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind driven embers to cause ignitions. PBP 2006 states that "*the principles of landscaping for bushfire protection aim to:*

- *Prevent flame impingement on the dwelling;*
- *Provide a defensible space for property protection;*
- *Reduce fire spread;*
- *Deflect and filter embers;*
- *Provide shelter from radiant heat; and*
- *Reduce wind speed".*

It is recommended that landscaping be maintained in accordance with the following practices:

- Maintaining a clear area of low cut lawn or pavement adjacent to the house;
- Keeping areas under fences, fence posts and gates and trees raked and cleared of fuel;
- Utilising non-combustible fencing and retaining walls;
- Breaking up the canopy of trees and shrubs with defined garden beds;
- Organic mulch should not be used in bushfire prone areas and non-flammable material should be used as ground cover, eg Scoria, pebbles, recycled crushed bricks.
- Planting trees and shrubs such that:
  - The branches will not overhang the roof; and
  - The tree canopy is not continuous.

## **5. CONCLUSION AND RECOMMENDATIONS**

This Bushfire Risk Assessment has been prepared by SET Consultants Pty Ltd for the land owner to accompany a planning proposal to amend the KLEP to rezone Lot 3 DP 1018217 from RU1 Primary Production to R2 Low Density Residential in accordance with the KUS to permit subdivision and low density residential development of this land.

The proposed planning proposal meets the requirements of Section 117 (2) of the EP& A Act by satisfying the requirements of ministerial direction 4.4 '*Planning for Bushfire Protection*' (2006). The report examines the measures required to be addressed in the future subdivision of the land to comply with the deem-to-satisfy of PBP 2006.

If future development resulting from the proposed rezoning is undertaken in accordance with the recommendations outlined in this report it will comply with performance requirements provided in *Planning for Bushfire Protection* (2006) and will provide adequate provision for fire fighting strategies.