Matt Frawley
Landscape Manager
Googong Township Pty Ltd
Matthew.Frawley@peet.com.au

ECO LOGICAL AUSTRALIA PTY LTD
ABN 87 096 512 088
www.ecoaus.com.au

Ref/Job No: 16CAN_4631

13 November 2017

Dear Matt,

RE: Bushfire Constraints Advice – Googong Neighbourhood 2

This constraints advice relates to bushfire design considerations for Googong Neighbourhood 2 (NH2), and in particular the proposed residential development surrounding Nangi Pimble Reserve.

Ongoing discussions between Queanbeyan Palerang Regional Council (QPRC), NSW Rural Fire Service (RFS), Peet Limited and Eco Logical Australia (ELA) have occurred to address potential constraints, and the responses are incorporated into this advice and the assessment approach undertaken.

The analysis of bushfire protection measures included in this letter for development adjoining Nangi Pimble Reserve comprises a detailed hazard assessment, asset protection zone requirements and access for firefighting. This advice also considers the adjacent Essential Energy substation site to the south of NH2, APZ arrangements for Old Comma Road buffer planting, and APZ arrangements for Staging for NH2.

1 Bushfire threat assessment

Previously a Bushfire Protection Assessment (BPA) was undertaken for this neighbourhood by ELA (March 2016) as part of the NH2 Structure Plan preparation. At the time of assessment, although the BPA broadly addressed requirements for open space areas, detailed information was not available and Nangi Pimble Reserve was not specifically addressed. Revegetation plans for the reserve have now been developed with the proposed revegetation consisting of plant species and structure associated with Dry Sclerophyll Forest (**Attachment 1**). The planting for the forest area will consist of *Allocasuarina verticillata* and *eucalyptus spp* with the intent of providing habitat for the Glossy Black Cockatoo.

Figure 1 (extracted from AECOM BMP included as **Attachment 1**) shows the effective slope and predominant vegetation on four (4) transect lines representing the highest bushfire threat posed to the residential development adjoining the Reserve.

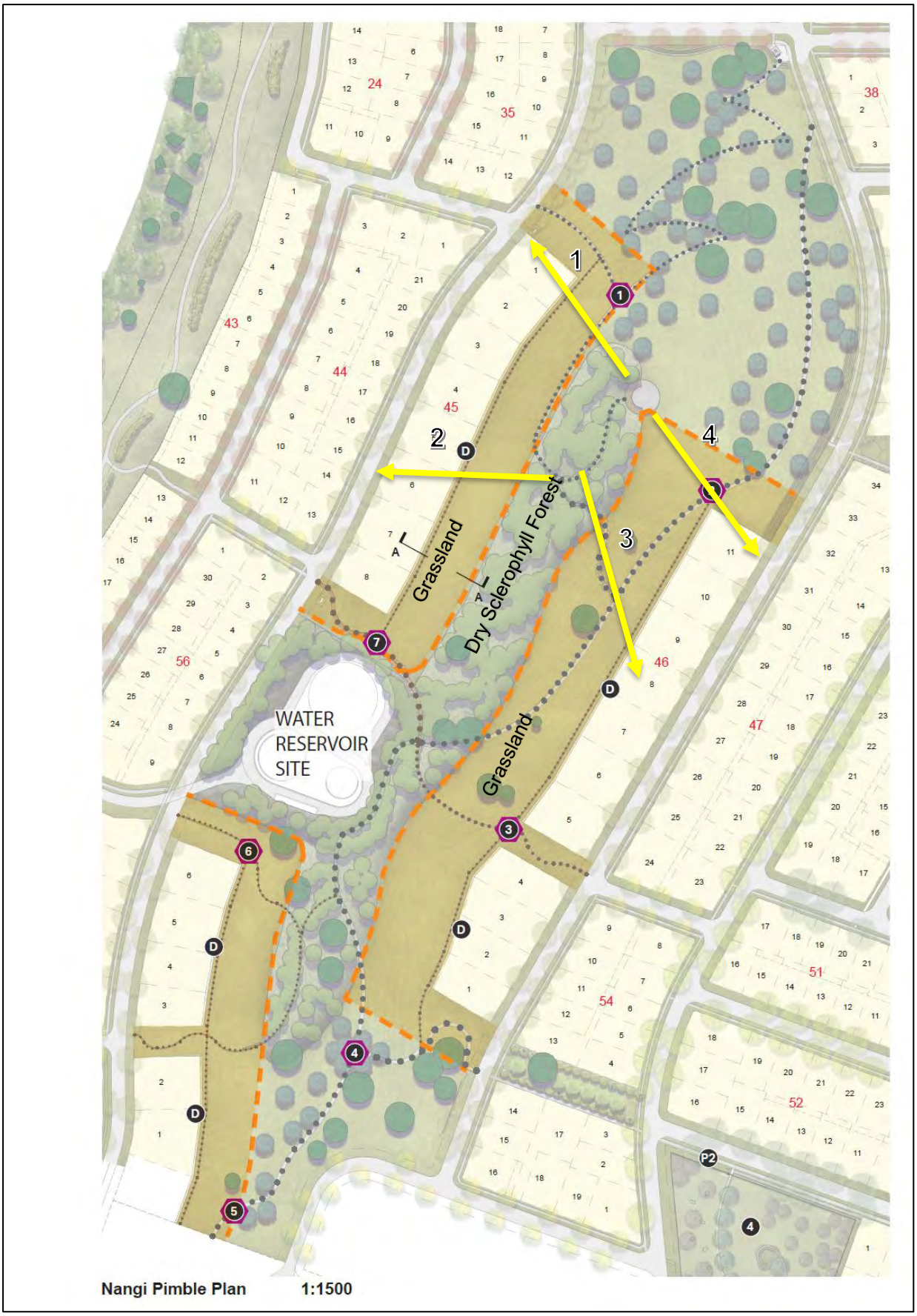


Figure 1: Nangi Pimble Hazard Assessment

2 Bushfire protection measures

2.1 Asset Protection Zones (APZ)

To assess the required APZ dimensions for allotments adjoining the Reserve, a performance based solution using Method 2 of AS 3959-2009 (Standards Australia 2009) was undertaken to determine the radiant heat exposure contour to achieve the residential subdivision threshold of 29 kW/m2. This incorporated site specific inputs including the effective slope and fuel loads for both Grassland (6 t/ha) and Dry Sclerophyll Forest (20/25 t/ha) vegetation classifications as specified in Planning for Bushfire Protection (RFS 2006).

Table 1 (below) shows the dimensions of the Asset Protection Zones (APZ) required in each of the transect line directions, how it was calculated and where relevant, information on how the APZ is to be provided.

The Bushfire Attack Assessment Reports showing the calculations and parameters used are included as **Attachment 2**.

As a performance based solution has been used to determine the complaint APZ dimensions, it is recommended that the Bush Fire Safety Authority incorporate a condition or note that any lot adjoining Nangi Pimble Reserve will require a BPA incorporating a performance based solution to support the construction of a residential dwelling through the Development Application process.

2.2 APZ considerations

Each lot adjoining the Reserve will incorporate a 7 m APZ and separated from the Reserve by a 1.8 m high Colourbond fence. Beyond the fence, a proposed concrete dish drain and kerb of up to 1m width within the Reserve will provide further separation whilst the fence will act as a radiant heat shield therefore providing a level of redundancy to the proposed APZ. The inclusion of the concrete dish drain results in an effective APZ width of 8m made up of the 7m wide APZ within the residential lot and the 1m wide concrete dish drain within the open space. A cross section of the proposed APZ is shown in **Figure 2**.

Further details on APZ implementation and management can be found on the NSW RFS website including:
https://www.rfs.nsw.gov.au/__data/assets/pdf_file/0010/13321/Standards-for-Asset-Protection-Zones.pdf.

Table 1: Bushfire hazard assessment and APZ requirements for Nangi Pimble Reserve

Direction from development boundary	Transect #	Slope	Vegetation	PBP required APZ (PBP 2006)	BAL-29 required APZ (AS 3959-2009)	Separation Distance	Proposed APZ	Comments
North-west	1	11º upslope	Forest	20 m	21 m	39 m	7 m	APZ calculated using a Method 2 (AS 3959-2009) calculation with an effective slope of 11° upslope and PBP fuel loads. The APZ is provided within lots with the concrete dish drain and kerb along the rear fence of the lots providing an effective extra 1m of APZ.
			Grassland	10 m	8 m	7 m		
West	2	9º upslope	Forest	20 m	21 m	49 m	7.3 m	APZ calculated using a 'performance based solution' based on a 9 degree slope and fuel loads from PBP for the forest and grassland. The APZ is provided within lots with the concrete dish drain and kerb along the rear fence of the lots providing an effective extra 1m of APZ.
			Grassland	10 m	8 m	7.3 m		
South	3	12º upslope	Forest	20 m	21 m	52 m	7 m	APZ calculated using a 'performance based solution' based on a 12 degree slope and fuel loads from PBP for the forest and grassland. The APZ is provided within lots with the concrete dish drain and kerb along the rear fence of the lots providing an effective extra 1m of APZ.
			Grassland	10 m	8 m	7 m		
South-east	4	14º upslope	Forest	20 m	21 m	52 m	7 m	APZ calculated using a 'performance based solution' based on a 14 degree slope and fuel loads from PBP for the forest and grassland. The APZ is provided within lots with the concrete dish drain and kerb along the rear fence of the lots providing an effective extra 1m of APZ.
			Grassland	10 m	8 m	7 m		
All other directions	Managed land – existing development							

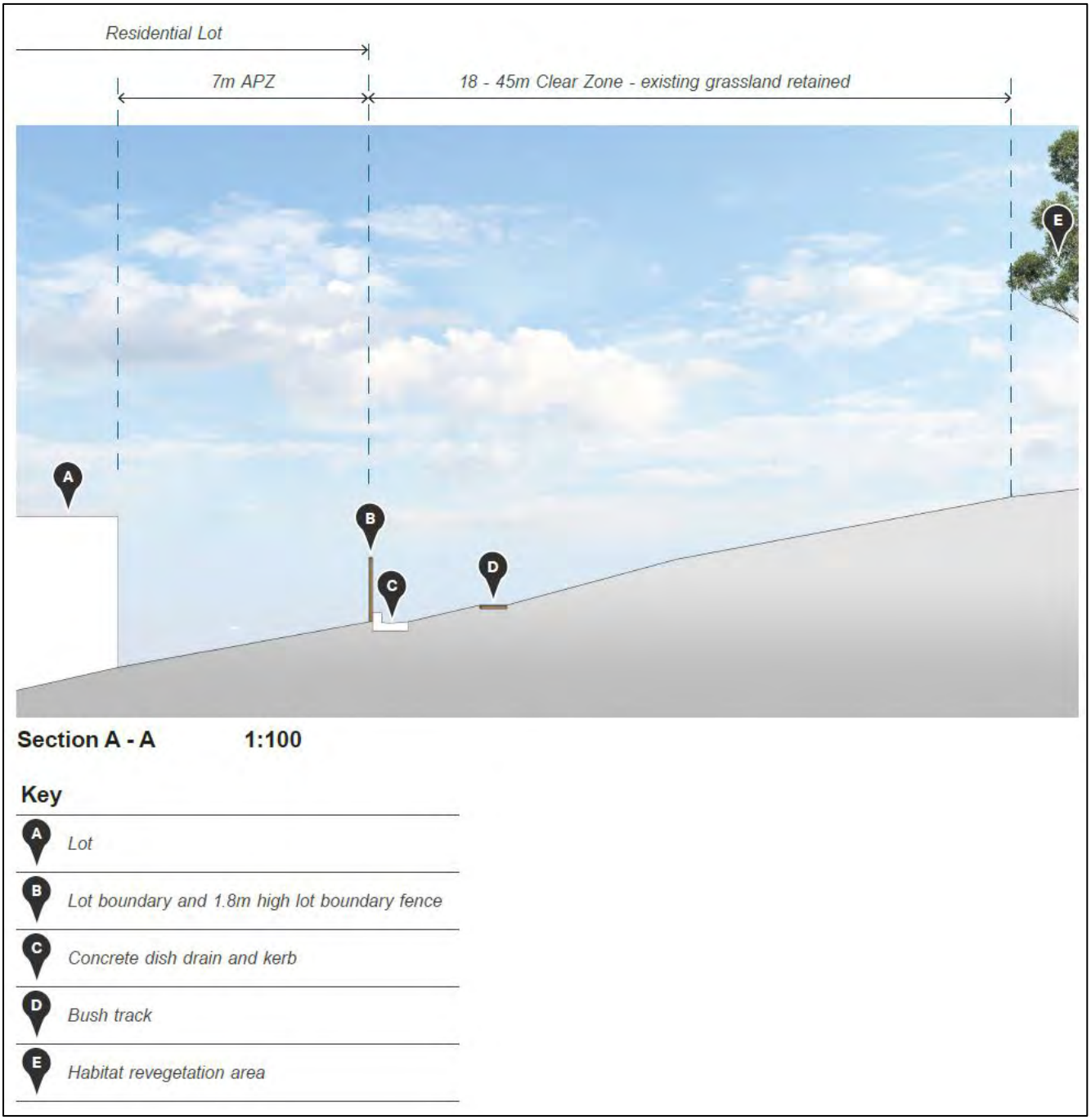


Figure 2: APZ cross section

2.3 Access for firefighting

Seven 'anchor points' have been identified in the Reserve and adjoining areas (see **Attachment 1**) based on discussions held with the RFS that will provide access for firefighting appliances and personnel in a bushfire event. These anchor points will be within 70 m of hydrant locations and provide a safe point to undertake firefighting activities. A summary of each anchor point is provided in **Table 2**.

The anchor points are connected to a network of pathways (predominantly sealed) throughout the Reserve and residential areas. All paths will have an accessible verge in addition to the formed surface (either concrete or earth) of approximately 0.9 m either side because of regular maintenance (up to 15 mowing events per year) to assist with access.

There will be a 0.75 m bush track located to the rear of allotments adjoining the reserve that provides pedestrian access and a further break in fuel continuity.

It should also be noted that where there are no lots backing onto Nangi Pimble the edge condition is that of a road reserve. To the west of Nangi Pimble the street reserve is 23.5m, identifying this street as higher order suburban access street type and to the east of Nangi Pimble the street reserve is 18m, identifying this as a lower order suburban circulation street type. These street reserves provide direct access to Nangi Pimble for firefighting access as well as provide a significant break in fuel continuity prior to urban development.

Table 2: Assessment of identified anchor points for firefighting.

Anchor point #	Grade and formation	Width Formed/including accessible verge (0.9 m each side)	Section/Lot #'s accessed
1	18% sealed	1.5 m / 3.3 m	45, Lots 1 - 4
2	5% sealed	2 m / 3.8 m	46, Lots 8 - 11
3	14% unsealed	1.5 m	46, Lots 1 - 8
4	5% sealed	2 m	46, Lots 1 - 2
5	5% sealed	2 m	45, Lots 1 - 2
6	14% unsealed	0.75 m	45, lots 3 - 6
7	14% unsealed	2 m	45, Lots 1 - 4

3 Essential Energy substation management

Questions were raised about vegetation management surrounding the Essential Energy substation to the south-west of Googong NH2. Contact with Essential Energy has identified a Vegetation Management Plan that details the requirements and methodology of vegetation control near powerlines, as well as a site-specific vegetation plan. The site specific plan includes the specification for a bushfire buffer zone (**Figure 3**) consisting of a 10 m fuel free zone and a 20 m bushfire fuel reduction zone. This effectively provides a 30 m APZ surrounding the substation.

Although PBP does not provide a specific APZ requirement for this development type, the provided 30 m APZ separating the grassland hazard and substation is considered appropriate subject to on ongoing maintenance and will be continued to be applied by Essential Energy in the protection of their asset.

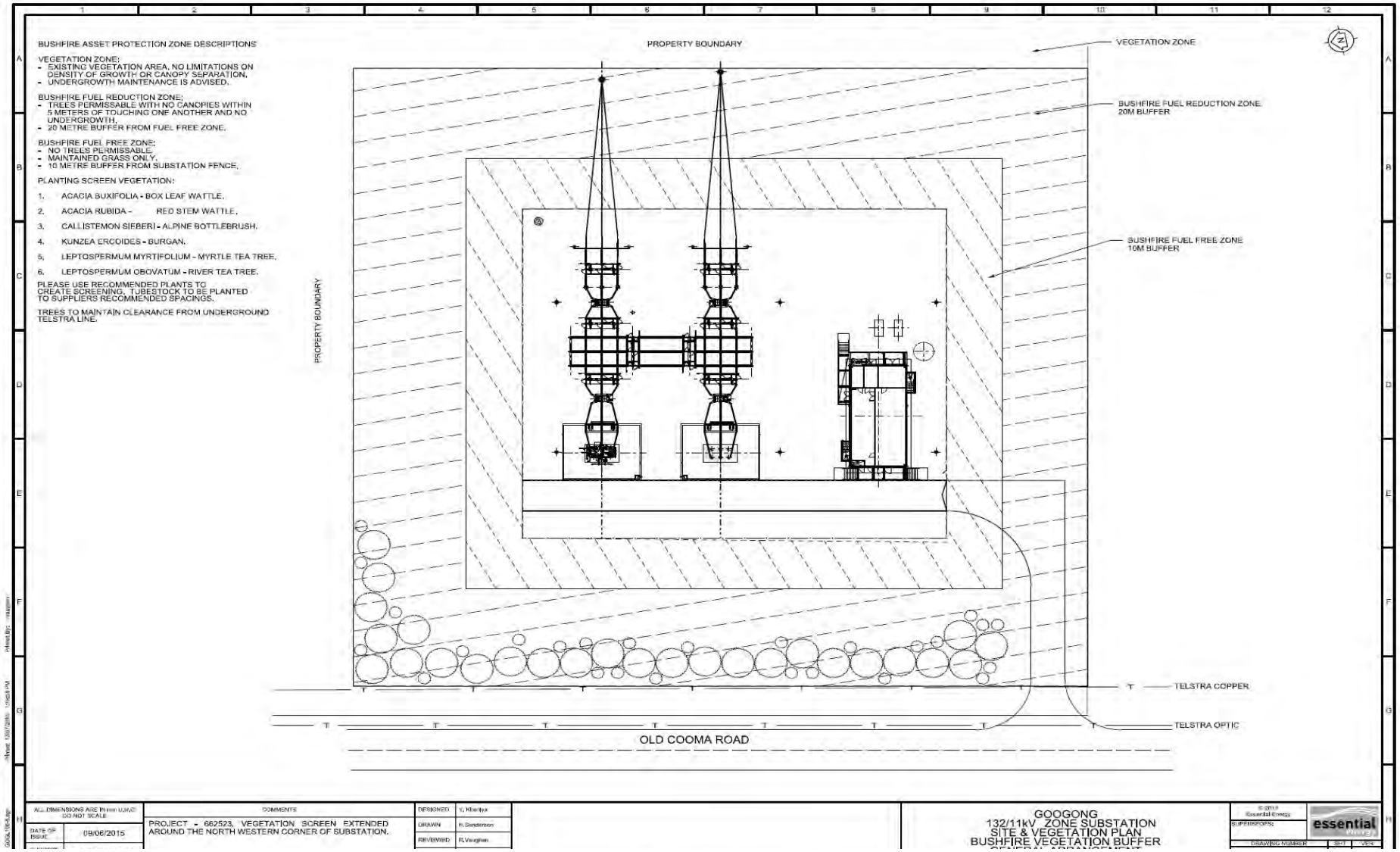


Figure 3: Essential Energy Site Plan

4 Old Cooma Road buffer planting

The buffer planting located along Old Comma Road to the west of Googong NH2 will retain Woodland vegetation within the road reserve which is typical of the area. Additional woodland tree species are located between the road reserve and the edge of a 35 m wide electricity easement (**Figure 4**). The main body of this easement is the retained grassland **Table 3** (below) shows the dimensions of the APZ required and information on how the APZ is to be provided.

Table 3: Bushfire hazard assessment and APZ requirements for Old Cooma Road

Direction from development boundary	Slope	Vegetation	PBP required APZ (PBP 2006)	BAL-29 required APZ (AS 3959-2009)	Proposed APZ	Comments
West	All upslopes and flat land	Woodland	10 m	16 m	10 m	The APZ is provided by 35 m electrical easement between Old Comma Road and proposed development. Ongoing management is ensured by applying Essential Energy guidelines for the management of easements.

5 Staging APZ

Temporary APZs for NH2 for grassland hazard areas to a minimum distance of 50 metres from the perimeter of the stage being released will to be provided and managed as an inner protection area (IPA) as outlined within 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' for Googong NH2.

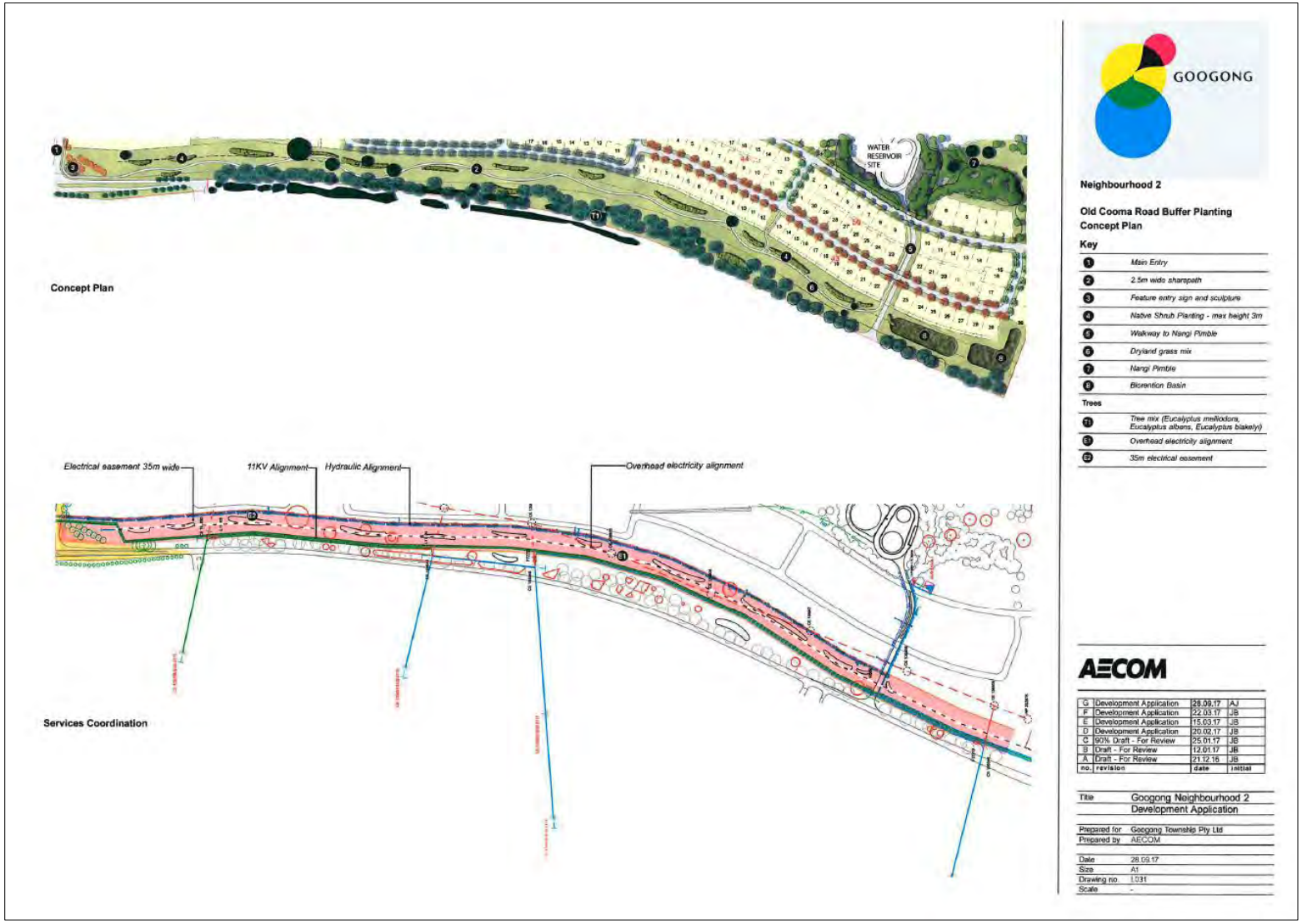


Figure 4: Old Cooma Road

6 Conclusion

A performance based solution using Method 2 of AS 3959-2009 (Standards Australia 2009) was undertaken to determine the radiant heat exposure contour to achieve the residential subdivision threshold of 29 kW/m2 based on QPRC requirements for the APZ not to be located within Nangi Pimble Reserve. Using the site specific inputs including the effective slope and fuel loads for both Grassland (6 t/ha) and Dry Sclerophyll Forest (20/25 t/ha) vegetation classifications as specified in Planning for Bushfire Protection (RFS 2006) a 7 m APZ at the rear of the residential lots achieves the 29kW/m2 threshold, while also achieving the desired environmental outcomes for the Reserve.

In addition to the required 7m APZ the proposal details other methods that will assist in mitigating the bushfire threat to urban development in the vicinity of Nangi Pimble including:

1. 1m wide concrete dish drain to the open space side of rear boundaries backing onto the open space to break fuel continuity;
2. 0.75m wide bush track running parallel to the residential lots backing onto the open space to provide maintenance access and a break in fuel continuity;
3. 18-45m deep clear zone between the rear of residential lots and any proposed dry sclerophyll forest regeneration planting on Nangi Pimble where the existing grassland & spotted existing trees will be retained; and
4. the identification of anchor points within Nangi Pimble to allow access for firefighting appliances and personnel in the event of a fire within the reserve.

Due to the slope of the site, maintenance of the path system and limited fire runs these arrangements are considered suitable.

The existing management regime for the Essential Energy substation provides an effective APZ for that site, and this will compliment arrangements to be put in place for NH2.

7 Recommendations

5. APZ as detailed in **Table 1** for all lots adjoining Nangi Pimble Reserve;
6. The Bush Fire Safety Authority incorporate a condition or note that any lot adjoining Nangi Pimble Reserve will require a BPA incorporating a performance based solution to support the construction of a residential dwelling through the Development Application process;
7. APZ for Old Comma Road to be provided within the electrical easement, and managed to APZ standards and in accord with Essential Energy management requirements; and
8. Temporary APZs for grassland hazards of 50 m for each Stage of development.

Mick George
Senior Bushfire Consultant

Bruce Horkings
Senior Bushfire Consultant
FPAA BPAD-A Certified Practitioner No. BPAD29962-L3

References

Essential Energy. 2017. *Operational procedure - Vegetation Management Plan, Issue 9.* www.essentialenergy.com.au/content/vegetation-management

Industry Safety Steering Committee 3 (ISSC3). 2016. *ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Supply Infrastructure*. November 2016. NSW.

NSW Rural Fire Service (RFS). 2006. *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners* including the 2010 Appendix 3 Addendum. Australian Government Publishing Service, Canberra.

Standards Australia. 2005. *Fire hydrant installations - System design, installation and commissioning*, AS2419.1, Fourth edition 2005, SAI Global, Sydney.

Standards Australia. 2009. *Construction of buildings in bushfire-prone areas, AS 3959-2009*. SAI Global, Sydney.

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

Attachment 1: Landscape plans

Nangi Pimble Plan **1:1500**

Key

1	*Northern entry point with signage, shelter, seating, bubbler and bike racks*
2	*Trees to be retained*
3	*Feature planting with seating*
4	*Local Park 9*
5	*Old Cooma Road buffer*
6	*Lookout area with shade structure, seating and interpretive signage*
7	*Glossy black cockatoo habitat revegetation areas. Tree canopy with shrub storey including Allocasuarina verticillata planted in groups. Weed control and re-establishment of ground storey where required*
8	*Screen planting including trees and larger shrubs*
9	*Scattered trees mainly located to provide shade to paths. Weed control and re-establishment of disturbed edges*
10	*900mm high gabion terraces, 3m apart planted with native grasses and groundcovers*
11	*Dryland grass - weed control of existing areas, establishment of new areas where earthworks are required*
12	*Substations - Indicative location*
13	*Concrete dish drain and kerb to rear of lots*
P1	*2m key path - concrete - accessible*
P2	*2m key path - concrete - not accessible*
P3	*1.5m path - concrete - accessible*
P4	*2m bush track - not accessible*
P5	*1.5m bush track - not accessible*
P6	*0.75 bush track - not accessible*
T1	*Allocasuarina verticillata planted in clumps with Eucalyptus polyanthemos, nortonii, meliodora & mannifera*
T2	*Eucalyptus polyanthemos, nortonii, meliodora & mannifera*

Northern Entry and Green Link Plan **1:750**

GOOGONG

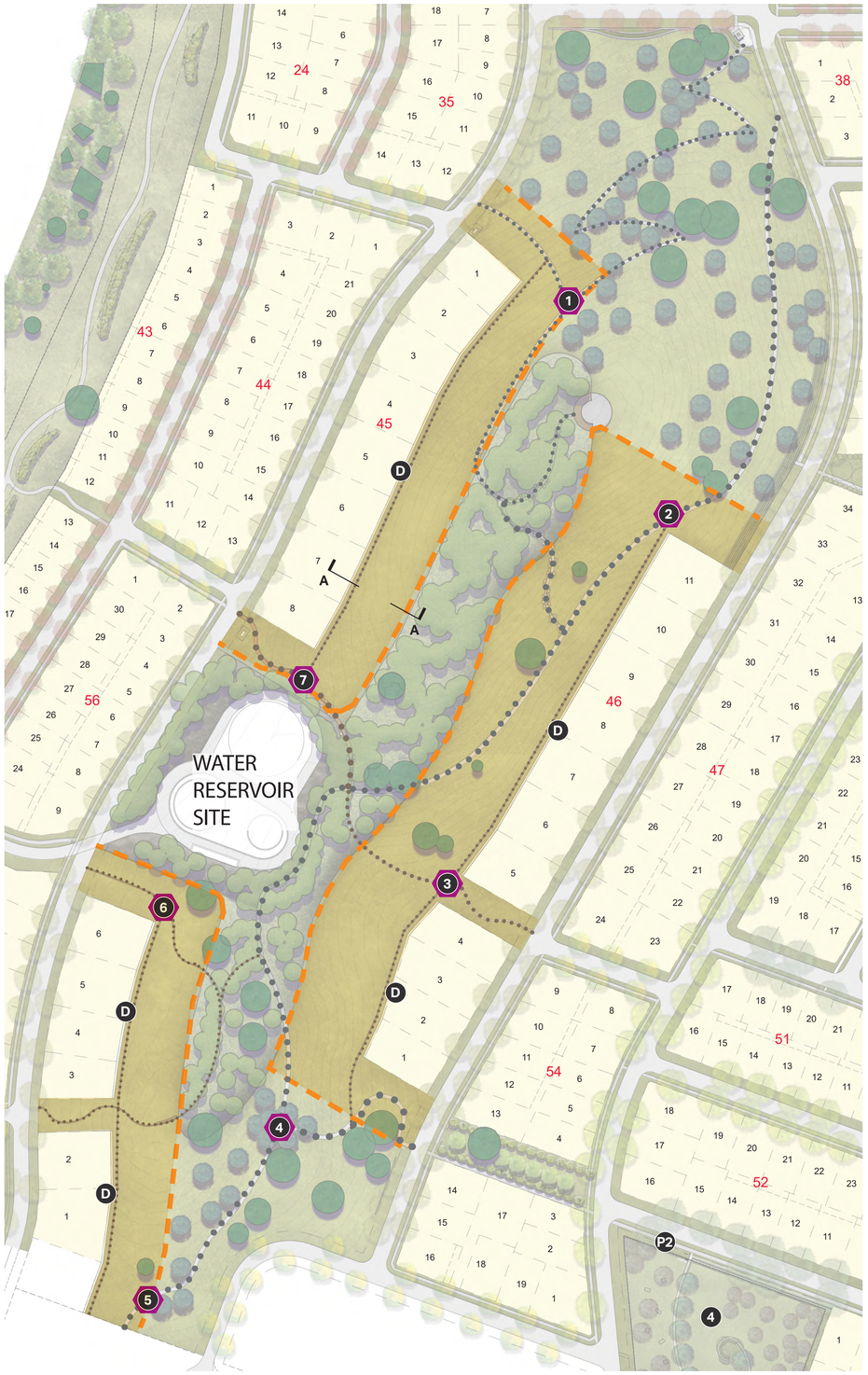
Neighbourhood 2

Nangi Pimble - Concept Plan

AECOM

no.	revision	date	initial
H	Development Application	09.11.17	JB
G	Development Application	27.09.17	AJ
F	Development Application	22.03.17	JB
E	Development Application	15.03.17	JB
D	Development Application	20.02.17	JB
C	90% Draft - For Review	25.01.17	JB
B	Draft - For Review	12.01.17	JB
A	Draft - For Review	21.12.16	JB

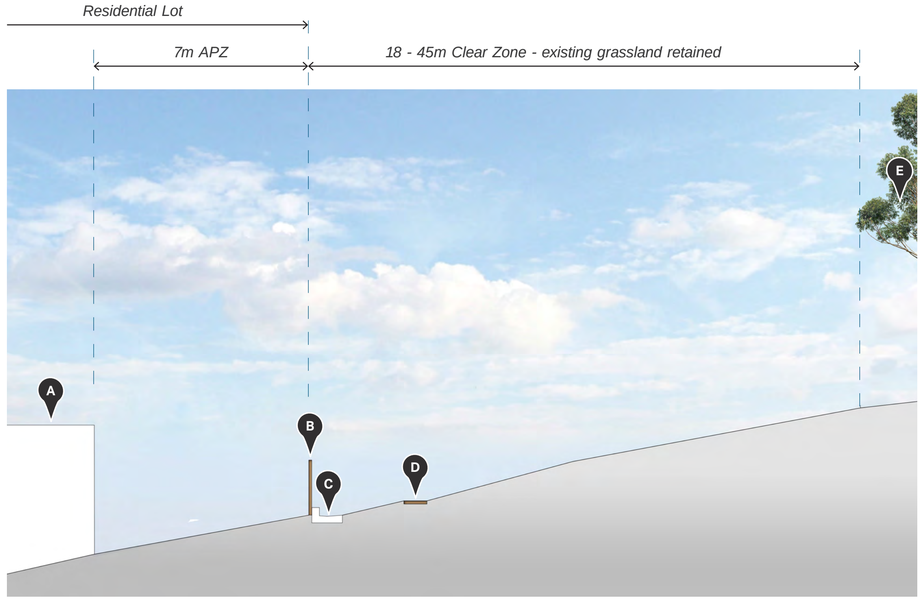
Title	Googong Neighbourhood 2 Development Application
Prepared for	Googong Township Pty Ltd
Prepared by	AECOM
Date	09.11.17
Size	A1
Drawing no.	L021
Scale	1:1,500@A1



Nangi Pimble Plan **1:1500**

Key

1	*Anchor Point 1: 18% sealed*
2	*Anchor Point 2: 5% sealed*
3	*Anchor Point 3: 14% unsealed*
4	*Anchor Point 4: 5% sealed*
5	*Anchor Point 5: 5% sealed*
6	*Anchor Point 6: 14% unsealed*
7	*Anchor Point 7: 14% unsealed*
D	*Concrete dish drain and kerb to rear of lots*
●●●●●	*2m key path - concrete*
●●●●●●	*1.5m key path - concrete*
●●●●●	*2m bush track*
●●●●●●	*1.5m bush track*
●●●●●●●●	*0.75m bush track*
– –	*Extent of Clear Zone: 18-45m (13m at sides adjacent to water tanks) - no new planting proposed*



Section A - A **1:100**

Key

A	*Lot*
B	*Lot boundary and 1.8m high lot boundary fence*
C	*Concrete dish drain and kerb*
D	*Bush track*
E	*Habitat revegetation area*

GOOGONG

Neighbourhood 2

Nangi Pimble -

Bushfire Management Pla

AECOM

no.	revision	date	initial
H	Development Application	09.11.17	JB
G	Development Application	27.09.17	AJ
F	Development Application	22.03.17	JB
E	Development Application	15.03.17	JB
D	Development Application	20.02.17	JB
C	90% Draft - For Review	25.01.17	JB
B	Draft - For Review	12.01.17	JB
A	Draft - For Review	21.12.16	JB

Title	Googong Neighbourhood 2 Development Application
Prepared for	Googong Township Pty Ltd
Prepared by	AECOM
Date	09.11.17
Size	A1
Drawing no.	L039
Scale	1:1,500@A1

Attachment 2: Bush Fire Attack Assessor Report

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 8/11/2017 **Assessment Date:** 8/11/2017

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

Site Street Address: Nangi Pimble Reserve, Googong

Assessor: Bruce Horkings; Ecological Australia

Local Government Area: Queanbeyan **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: 1 - DSF

Vegetation Information

Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	11 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	39

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100

Program Outputs

Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	5.07
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	14512
Radiant Heat(kW/m2):	7.05	**Flame Angle (degrees):**	80
Flame Length(m):	10.3	**Maximum View Factor:**	0.118
Rate Of Spread (km/h):	1.12	**Inner Protection Area(m):**	39
Transmissivity:	0.788	**Outer Protection Area(m):**	0

Run Description:	1 - Grassland		
Vegetation Information			
Vegetation Type:	Grassland	**Vegetation Group:**	Grassland
Vegetation Slope:	11 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	7
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130
Program Outputs			
Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	2.68
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	24526
Radiant Heat(kW/m2):	28.2	**Flame Angle (degrees):**	65
Flame Length(m):	5.9	**Maximum View Factor:**	0.421
Rate Of Spread (km/h):	7.91	**Inner Protection Area(m):**	7
Transmissivity:	0.88	**Outer Protection Area(m):**	0

Run Description:	2 - DSF		
Vegetation Information			
Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	9 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	49
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	5.62
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	16660
Radiant Heat(kW/m2):	5.64	**Flame Angle (degrees):**	81
Flame Length(m):	11.38	**Maximum View Factor:**	0.096
Rate Of Spread (km/h):	1.29	**Inner Protection Area(m):**	49
Transmissivity:	0.771	**Outer Protection Area(m):**	0

Run Description:	2 - Grassland		
Vegetation Information			
Vegetation Type:	Grassland	**Vegetation Group:**	Grassland
Vegetation Slope:	9 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	7.3
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130
Program Outputs			
Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	2.84
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	28155
Radiant Heat(kW/m2):	28.95	**Flame Angle (degrees):**	64
Flame Length(m):	6.32	**Maximum View Factor:**	0.433
Rate Of Spread (km/h):	9.08	**Inner Protection Area(m):**	7
Transmissivity:	0.88	**Outer Protection Area(m):**	0

Run Description:	3 - DSF		
Vegetation Information			
Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	12 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	52
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	4.86
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	13545
Radiant Heat(kW/m2):	4.45	**Flame Angle (degrees):**	82
Flame Length(m):	9.82	**Maximum View Factor:**	0.076
Rate Of Spread (km/h):	1.05	**Inner Protection Area(m):**	52
Transmissivity:	0.766	**Outer Protection Area(m):**	0

Run Description:	3 - Grassland		
Vegetation Information			
Vegetation Type:	Grassland	**Vegetation Group:**	Grassland
Vegetation Slope:	12 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	7
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130
Program Outputs			
Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	2.6
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	22890
Radiant Heat(kW/m2):	27.24	**Flame Angle (degrees):**	66
Flame Length(m):	5.7	**Maximum View Factor:**	0.407
Rate Of Spread (km/h):	7.38	**Inner Protection Area(m):**	7
Transmissivity:	0.88	**Outer Protection Area(m):**	0

Run Description:	4 - DSF		
Vegetation Information			
Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	14 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	52
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	4.44
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	11799
Radiant Heat(kW/m2):	4.04	**Flame Angle (degrees):**	83
Flame Length(m):	8.94	**Maximum View Factor:**	0.069
Rate Of Spread (km/h):	0.91	**Inner Protection Area(m):**	52
Transmissivity:	0.766	**Outer Protection Area(m):**	0

Run Description:	4 - Grassland		
Vegetation Information			
Vegetation Type:	Grassland	**Vegetation Group:**	Grassland
Vegetation Slope:	14 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	7
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130
Program Outputs			
Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	2.47
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	19940
Radiant Heat(kW/m2):	25.4	**Flame Angle (degrees):**	68
Flame Length(m):	5.32	**Maximum View Factor:**	0.38
Rate Of Spread (km/h):	6.43	**Inner Protection Area(m):**	7
Transmissivity:	0.879	**Outer Protection Area(m):**	0