Appendix E:
Method 2 BAL Calculations

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Calculated March 26, 2026, 5:43 pm (MDc v.4.9)

Class D Scrub - Upslope/Flat Land

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Fire Danger Index	80	Rate of spread	4.16 km/h
Vegetation Classification	Scrub	Flame length	11.62 m
Understorey fuel load	25 t/ha	Flame angle	53 °, 63 °, 72 °, 76 °, 78 ° & 83 °
Total fuel load	25 t/ha	Elevation of receiver	4.64 m, 5.18 m, 5.52 m, 5.64 m, 5.68 m & 5.77 m
Vegetation height	m	Fire intensity	53,815 kW/m
Effective slope	0 °	Transmissivity	0.878, 0.862, 0.838, 0.814, 0.8 & 0.735
Site slope	0 °	Viewfactor	0.5988, 0.4419, 0.2962, 0.2016, 0.1638 & 0.0446
Flame width	100 m	Minimum distance to < 40 kW/m²	9.6 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	13 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	19.3 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	27.5 m
		Minimum distance to < 10 kW/m²	32.9 m

Rate of Spread - Catchpole et al. 1998

Flame length - Byram, 1959

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

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Calculated December 8, 2025, 5:49 pm (MDc v.4.9)

Class C Shrubland - 5 Degrees

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Fire Danger Index	80	Rate of spread	4.04 km/h
Vegetation Classification	Shrubland	Flame length	9.07 m
Understorey fuel load	15 t/ha	Flame angle	54 °, 64 °, 72 °, 77 °, 79 ° & 84 °
Total fuel load	15 t/ha	Elevation of receiver	3.66 m, 4.07 m, 4.31 m, 4.41 m, 4.45 m & 4.51 m
Vegetation height	m	Fire intensity	31,357 kW/m
Effective slope	5 °	Transmissivity	0.883, 0.869, 0.85, 0.827, 0.8139999999999999 & 0.744
Site slope	0 °	Viewfactor	0.5886, 0.4351, 0.2938, 0.1977, 0.1609 & 0.0441
Flame width	100 m	Minimum distance to < 40 kW/m²	7.6 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	10.3 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	15.2 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	22.3 m
		Minimum distance to < 10 kW/m²	26.9 m

Rate of Spread - Catchpole et al. 1998

Flame length - Byram, 1959

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005



Calculated December 8, 2025, 5:57 pm (MDc v.4.9)

Class C Shrubland - Flat

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Fire Danger Index	80	Rate of spread	2.86 km/h
Vegetation Classification	Shrubland	Flame length	7.73 m
Understorey fuel load	15 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	15 t/ha	Elevation of receiver	3.13 m, 3.47 m, 3.7 m, 3.78 m, 3.81 m & 3.85 m
Vegetation height	m	Fire intensity	22,207 kW/m
Effective slope	0 °	Transmissivity	0.886, 0.874, 0.856, 0.835, 0.823 & 0.75
Site slope	0 °	Viewfactor	0.5861, 0.4341, 0.2914, 0.1967, 0.1593 & 0.0437
Flame width	100 m	Minimum distance to < 40 kW/m²	6.5 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	8.800000000000001 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	13.1 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	19.3 m
		Minimum distance to < 10 kW/m²	23.5 m

Rate of Spread - Catchpole et al. 1998

Flame length - Byram, 1959

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005



Calculated March 26, 2026, 5:41 pm (MDc v.4.9)

Class G Grassland - Downslope 25.4 Degrees

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	82.5 km/h
Vegetation Classification	Grassland	Flame length	16.5 m
Understorey fuel load	4.5 t/ha	Flame angle	53 °, 62 °, 70 °, 74 °, 76 ° & 82 °
Total fuel load	4.5 t/ha	Elevation of receiver	6.59 m, 7.28 m, 7.75 m, 7.93 m, 8 m & 8.17 m
Vegetation height	n/a	Fire intensity	191,824 kW/m
Effective slope	25.4 °	Transmissivity	0.868, 0.848, 0.821, 0.795, 0.782 & 0.723
Site slope	0 °	Viewfactor	0.6008, 0.4488, 0.3036, 0.2061, 0.1679 & 0.0454
Flame width	100 m	Minimum distance to < 40 kW/m²	13.6 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	18.1 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	26.2 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	36.5 m
		Minimum distance to < 10 kW/m²	42.9 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005



Calculated March 26, 2026, 5:32 pm (MDc v.4.9)

Class G Grassland - Downslope 24 Degrees

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	74.9 km/h
Vegetation Classification	Grassland	Flame length	15.73 m
Understorey fuel load	4.5 t/ha	Flame angle	52 °, 62 °, 70 °, 75 °, 76 ° & 82 °
Total fuel load	4.5 t/ha	Elevation of receiver	6.19 m, 6.94 m, 7.39 m, 7.59 m, 7.63 m & 7.78 m
Vegetation height	n/a	Fire intensity	174,160 kW/m
Effective slope	24 °	Transmissivity	0.87, 0.85, 0.824, 0.797, 0.785 & 0.724
Site slope	0 °	Viewfactor	0.6036, 0.4479, 0.3031, 0.2058, 0.1674 & 0.0453
Flame width	100 m	Minimum distance to < 40 kW/m²	12.9 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	17.3 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	25.1 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	35.1 m
		Minimum distance to < 10 kW/m²	41.4 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

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Calculated December 8, 2025, 6:10 pm (MDc v.4.9)

Class G Grassland - 5 Degrees

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	20.19 km/h
Vegetation Classification	Grassland	Flame length	8.16 m
Understorey fuel load	4.5 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	4.5 t/ha	Elevation of receiver	3.3 m, 3.67 m, 3.9 m, 3.99 m, 4.02 m & 4.06 m
Vegetation height	n/a	Fire intensity	46,945 kW/m
Effective slope	5 °	Transmissivity	0.885, 0.872, 0.854, 0.832, 0.82 & 0.748
Site slope	0 °	Viewfactor	0.5915, 0.4337, 0.2918, 0.1968, 0.1599 & 0.0438
Flame width	100 m	Minimum distance to < 40 kW/m²	6.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	9.300000000000001 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	13.8 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	20.3 m
		Minimum distance to < 10 kW/m²	24.6 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

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Calculated December 8, 2025, 6:12 pm (MDc v.4.9)

Class G Grassland - Flat

Minimum Distance Calculator - AS3959-2018 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation Classification	Grassland	Flame length	6.87 m
Understorey fuel load	4.5 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	4.5 t/ha	Elevation of receiver	2.78 m, 3.08 m, 3.28 m, 3.36 m, 3.38 m & 3.42 m
Vegetation height	n/a	Fire intensity	33,247 kW/m
Effective slope	0 °	Transmissivity	0.887, 0.877, 0.861, 0.841, 0.829 & 0.755
Site slope	0 °	Viewfactor	0.5823, 0.4291, 0.29, 0.1946, 0.158 & 0.0434
Flame width	100 m	Minimum distance to < 40 kW/m²	5.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	7.9 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	11.7 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	17.3 m
		Minimum distance to < 10 kW/m²	21.2 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

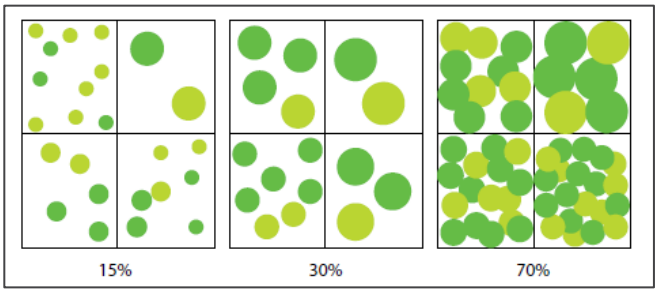
Appendix F:
Asset Protection Zone Technical Requirements (WAPC, 2024b)

The following standards have been extracted from the Planning for Bushfire Guidelines (WAPC, 2024b).

Every habitable building is to be surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements:

- Width: the APZ is measured from the development site, and of sufficient size to ensure the radiant heat impact of a bushfire does not exceed 29 kW/m^2 (BAL-29) in all circumstances.
- Location: the APZ should be contained solely within the boundaries of the lot, except in instances where:
  - the vegetation on the adjoining lot(s) is, and will continue to be, low threat as per Clause 2.2.3.2 of AS 3959 or the APZ technical requirements, or an alternative standard on a local planning scheme, on an ongoing basis in perpetuity; or
  - the adjoining land is and will remain in perpetuity, non-vegetated.
- Management: the APZ is managed in accordance with the APZ technical requirements (below), or an alternative standard in a gazetted local planning scheme.

APZ Technical Requirements

Object	Requirement
Fences within the APZ	• Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter less than 6 mm in thickness)	• Should be managed and removed on a regular basis to be maintained as a low threat vegetation. • Should be maintained at less than two tonnes per hectare (on average). • Mulches should be non-combustible such as stone, gravel, shells, rock or crushed mineral earth or wood mulch more than five millimetres in thickness.
Trees* (more than 6 m in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building. • Branches at maturity should not touch or overhang a building or powerline. • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be less than 15 per cent of the total APZ area. • Tree canopies at maturity should be at least 5 m apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided the total canopy cover within the APZ does not exceed 15 per cent and is not connected to the tree canopy outside the APZ. 

Object	Requirement
	• Tree canopy cover – ranging from 15 to 70 per cent at maturity
Shrub* and scrub* (0.5 m to 6 m in height). Shrub and scrub more than 6 m in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings. • Should not be planted in clumps more than five square metres in area. • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground cover*(less than 0.5 m in height. Ground cover more than 0.5 m in height is to be treated as shrub)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above • Can be located within two metres of a structure but three metres from windows or doors if more than 100 mm in height.
Grass	• Grass should be maintained at a height of 100 mm or less, at all times • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	• Within three metres of each wall or supporting post of a habitable building; the area is kept free from vegetation but can include ground cover, grass and non- combustible mulches as prescribed above.
Liquid petroleum gas cylinders	• Should be located on the side of a building farthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. • The pressure relief valve should point away from the house. • No flammable material within six metres from the front of the valve. • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

* Plant flammability, landscaping design and maintenance should be considered - refer to explanatory notes in the Guidelines.

ADDITIONAL NOTES

An Asset Protection Zone (APZ) is a low fuel area, maintained around a building to increase the likelihood a building will survive a bushfire, by reducing the potential for direct flame contact, radiant heat exposure and ember attack. The APZ allows emergency services access and provides an area for firefighters and homeowners to defend their property.

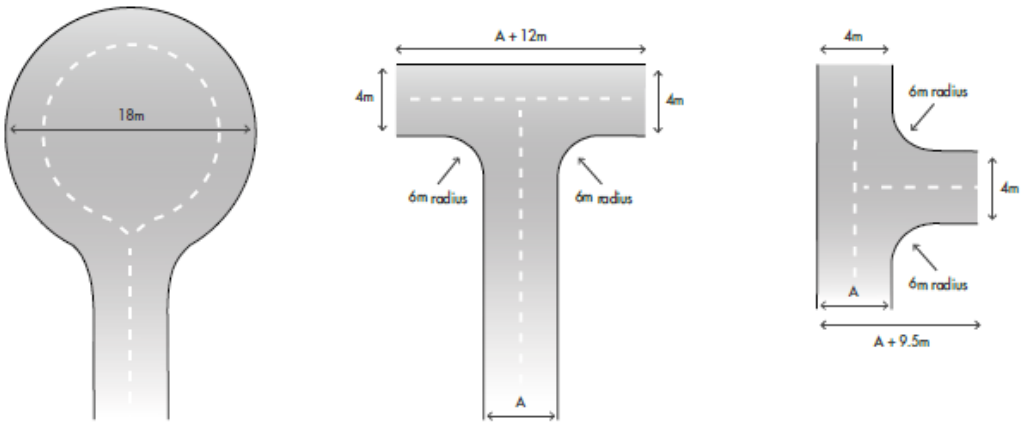
An APZ should be contained within the boundaries of the lot on which the building is situated, except in instances where it is demonstrated the vegetation on the adjoining land is, and will continue to be, low threat as per cl. 2.2.3.2 of AS 3959, or the vegetation on the adjoining lot is, and will remain in perpetuity, non-vegetated. However, it should be noted there is no requirement for a neighbouring landowner or land manager (public or private) to be party to a legal agreement to undertake ongoing management of vegetation as low threat, in perpetuity.

Appendix G: Vehicular Access Technical Requirements (WAPC, 2024b)

Technical requirements	Perimeter Roads		Public Roads		Emergency Access Way[3]		Fire Service Access Route[3]		Battle-Axe and Private Driveways[1]	
Map of Bush Fire Prone Areas Designation	Area 2	Area 1	Area 2	Area 1	Area 2	Area 1	Area 2	Area 1	Area 2	Area 1
Minimum horizontal clearance (m)	12	8	See note 5		10	6	10	6	6	
Minimum vertical clearance (m)	4.5									
Minimum weight capacity (t)	15									
Maximum grade unsealed road[2]	See note 5		See note 5		1:10 (10% or 6 degrees)					
Maximum grade sealed road[2, 4]					1:7 (14.3% or 8 degrees)					
Maximum average grade sealed road					1:10 (10% or 6 degrees)					
Minimum inner radius of road curves (m)					8.5					

NOTES

1. Driveways and battle-axe legs to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision where not required to comply with the widths in this Appendix or the Guidelines.
2. Dips must have no more than a 1 in 8 (12.5% - 7.1 degrees) entry and exit angle.
3. To have crossfalls between 3 per cent and 6 per cent.
4. For sealed roads only the maximum grade of no more than 1 in 5 (20 per cent) (11.3 degrees) for no more than 50 metres is permissible, except for short constrictions to 3.5 metres for no more than 30 metres in length where an obstruction cannot be reasonably avoided or removed.
5. As outlined in the Institute of Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards Main Roads standard, supplement, policy or guideline and/or any applicable or relevant local government standard or policy.



Design requirements for a turnaround area

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