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Subject:	West Wyalong Solar Farm Bush Fire and Fire Response Assessment		

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1 Fire and Bush Fire Issues and Impacts

1.1 Introduction

Bush fire presents a threat to human life and built assets and can have adverse effects on biodiversity values. Bush fire risk can be considered in terms of environmental factors that increase the risk of fire (fuel quantity and type, topography and weather patterns), as well as specific activities (such as hot works) or infrastructure components that increase the risks of combustion or ignition (such as transmission lines and materials stockpiles).

A preliminary assessment of bush fire hazards and risk mitigation requirements was conducted as part of the current investigation. Reference was made to the guideline *Planning for Bush Fire Protection* (or 'PBP'; RFS 2018a) which provides development standards for designing and building on bush fire prone land in New South Wales. The aim of PBP is to limit the potential for bush fires to impact property and provide for the protection of human life, while also giving due regard to development potential, site characteristics and environmental protection. The objectives of PBP are to:

- afford buildings and their occupants protection from exposure to a bush fire;
- provide for a defensible space to be located around buildings;
- provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition;
- ensure that appropriate operational access and egress for emergency service personnel and residents is available;
- provide for ongoing management and maintenance of Bushfire Protection Measures (BPMs); and
- ensure that utility services are adequate.

As the project is State Significant Development (SSD) and therefore not covered by PBP, the requirements for residential subdivisions and developments in rural areas in PBP were used to determine bush fire protection measures for the proposed development. Bush fire protection measures that are relevant to the development at West Wyalong include:

- Minimising the impact of radiant heat and direct flame by separating the asset from the hazard;
- Reducing the rate of heat output by controlling fuel loads;
- Minimising the vulnerability of buildings to ignition from radiant heat and ember attack;
- Enabling safe access/egress for solar farm staff (during construction and operation) and facilitate fire-fighting operations;
- Providing adequate water supply for fire –fighting operations;
- Implementing staff education and training programs focussing on preparedness, including emergency planning and maintenance requirements; and
- Facilitating the maintenance of asset protection zones, fire trails access for fire-fighting and on site equipment for fire suppression.

A full list of potential bush fire protection measures is listed in section 1.2 of PBP (RFS 2018).

1.2 Legislative Requirements

1.2.1 SEARs

In relation to bush fire, the Secretary's Environmental Assessment Requirements (SEARs) for the EIS require the following, under the heading "Hazards and Risks": "an assessment of all potential hazards and risks including but not limited to bushfires". Additionally, the NSW Rural Fire Service, in their SEARs response letter (dated 14 Sep 2018) request that a "bush fire hazard assessment report" be included in the EIS. The bush fire hazard assessment report is to include site specific recommendations for the suitable design of:

- asset protection zones;
- water supply for firefighting;
- fuel load management;
- responder access; and
- landscaping.

1.2.2 NSW Rural Fires Act 1997

The objects of the *NSW Rural Fires Act 1997* are to provide:

- for the prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts, and
- for the co-ordination of bush fire fighting and bush fire prevention throughout the State, and
- for the protection of persons from injury or death, and property from damage, arising from fires, and
- for the protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires, and

- for the protection of the environment by requiring certain activities referred to in paragraphs (a)–(c1) to be carried out having regard to the principles of ecologically sustainable development described in section 6 (2) of the *Protection of the Environment Administration Act 1991*.

For development applications within areas mapped as ‘bush fire prone land’, Section 100b of the *NSW Rural Fires Act 1997*, a bushfire assessment report must be prepared in accordance with Section A1 of *Planning for Bushfire Protection* (RFS 2018a). The bushfire assessment report is part of the permit requirements for the issuing of a ‘bushfire safety authority’ which authorises the development on bushfire prone land.

Importantly, and as discussed in the following sections, the requirements of the *Rural Fires Act* do not apply to SSD projects; moreover, the Project Site at West Wyalong is not mapped as bush fire prone land. Consequently, there is no requirement for a bush fire assessment or bush fire safety authority for the West Wyalong Solar Farm. Notwithstanding, this chapter of the EIS provides an analysis of potential bush fire hazards and risks and identifies suitable mitigation measures for management of bush fire risk for the construction and operation of the project.

1.2.3 EP&A Act

The *Environmental Planning and Assessment Act 1979* (EP&A Act) forms the legal and policy platform for proposal assessment and approval in NSW and aims to ‘*encourage the proper management, development and conservation of natural and artificial resources*’. All development in NSW is assessed in accordance with the provisions of the EP&A Act and EP&A Regulation 2000.

In accordance with Section 10.3 of the EP&A Act, the Commissioner of the NSW Rural Fire Service may designate land within a council area as ‘bushfire prone land’ with consideration to the relevant bush fire risk management plans for that area. Any land designated as bush fire prone land is subject to assessment under Division 8 Part 4 of the *Rural Fires Act*, which contains provisions related to the carrying out of development and bushfire hazard reduction work on bushfire prone land.

The development is deemed to be SSD by virtue of *State Environmental Planning Policy (State and Regional Development) 2011* and pursuant to Division 4.7 of the EP&A Act. Under Section 4.41 of the Act, a bush fire safety authority (issued by the NSW Rural Fire Service under section 100B of the *Rural Fires Act 1997*), is not required for SSD projects.

2 Methodology

The following methodology has been applied in this assessment to determine appropriate APZs and manageable fuel loads:

- Determine vegetation formation in all directions around the asset to a distance of 140 metres. For the current project, this distance has been measured from the outer limit of the solar panel array and out from the proposed substation buildings;
- Determine the effective slope of the land from the building for a distance of 100 metres;
- Determine the relevant Fire Danger Index (FDI) for the council area in which the development is to be undertaken; and
- Match the relevant FDI, vegetation formation and effective slope to determine the APZ required by referring to Appendix A of PBP.

2.1 Vegetation Assessment

According to PBP, the 'predominant vegetation' surrounding the asset (in this case, the solar farm) in all directions for a distance of 140 m must be classified in a 'vegetation formation' according to the categories of Keith (2004). Vegetation mapping conducted as part of the Biodiversity Development Assessment Report (see EIS **Appendix E**) was used to determine predominant vegetation within and adjoining the site, with reference to the vegetation formation listed for each PCT (plant community type) in the online BioNet Vegetation Classification.

2.2 Slope Assessment (Effective Slope)

PBP defines 'effective slope' as 'slope within the hazard that most significantly affects the fire behaviour of a site'. Appendix 1 of PBP requires effective slope to be calculated within the hazard that most significantly affects fire behaviour having regard to the vegetation on the site, measured over a distance of 100 m extending out from the existing site boundary. Effective slope for the areas of bush fire hazard applicable to the site were calculated using GIS software and available topographical data. The measured slope was then assigned to a slope category in PBP.

2.3 Bush Fire Attack Level Assessment

Bush Fire Attack Level (BAL) is determined after the vegetation and slope assessments have been completed. Appendix 1 of PBP requires that the BAL be determined by calculating the distance of the asset to the nearest bush fire hazard.

3 Existing Environment (Bush Fire Hazard)

3.1 Overview

The Project Site occurs within a cleared agricultural landscape, where much of the original native vegetation has been removed for agricultural land uses. Native vegetation within and adjoining the site is limited to small discrete patches of low open woodland or woodland, as well as narrow belts of mallee and woodland along road reserves around the perimeter of the site, interspersed with large expanses of open grassland that is subject to grazing. The native vegetation on the Project Site and in the surrounding area consists of the five Plant Community Types (PCTs) listed in **Table 1**.

Topographical survey of the site identified that the site is generally flat with elevations varying from 228 meters ADH in the south west to 232 meters ADH in the north-east, indicating a gradual fall of around three meters over two kilometres. The slope of the site in the general direction of bushfire hazards is categorized in accordance with PBP (2018) and presented in **Table 2**.

3.2 Bush Fire Prone Land Mapping

Review of the Rural Fire Services Bushfire Prone Land Mapping Tool (RFS 2018c) shows that the subject site is not identified as 'Bushfire Prone Land'.

3.3 Vegetation

The vegetation assessment completed as part of the Biodiversity Development Assessment Report (see **EIS Appendix E**) indicates that the majority of the site and surrounding land is cleared and comprises open grassland of exotic and native grasses, herbs and forbs that is subject to historic and ongoing grazing. Small disjunct stands of woodland and open woodland remain within the central parts of the site and in linear belts along the adjoining road reserves of Blands Lane, Myers Lane and Gordons Lane.

Five plant community types (PCTs) occur within and adjacent to the site. These PCTs are part of two main vegetation formations: semi-arid woodland or grassy woodland. These two vegetation types are classified in PBP as Woodland – General, which covers all vegetation types that contain an open or sparse layer of eucalypts with a sparse shrub layer and diverse ground cover of grasses. This vegetation type is usually found on flat or gently undulating ground. The mapped PCTs and their corresponding vegetation formations are listed in **Table 1**.

The distribution of vegetation formations within and adjacent to the site (extending out to 140 m from the edge of the proposed solar panels) are depicted in **Figure 1**.

Table 1 Vegetation Formations within 140 meters of the asset

PCT Code	PCT Name	Formation [#]	PBP Classification	Location (s) of Hazard ^{##}
PCT 55	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions	Semi-arid Woodlands (grassy sub-formation)	Woodland-general	South-east boundary Central areas of site
PCT 185	Dwyer's Red Gum - White Cypress Pine - Currawang shrubby woodland mainly in the NSW South Western Slopes Bioregion	Semi-arid Woodlands (grassy sub-formation)	Woodland-general	Central areas of site
PCT 177	Blue Mallee - Bull Mallee - Green Mallee very tall mallee shrubland of the West Wyalong region, NSW South Western Slopes Bioregion	Semi-arid Woodlands (grassy sub-formation)	Woodland-general	South-western boundary North-eastern boundary Central areas of site
PCT 76	Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Grassy Woodland	Woodland-general	Central areas of site
PCT 26	Weeping Myall open woodland of the Riverina Bioregion and NSW South Western Slopes Bioregion	Semi-arid Woodlands (grassy sub-formation)	Woodland-general	North-western boundary North eastern boundary

- After definitions of Keith (2004)

- Direction from the centre of the Project Site.

3.4 Effective Slope

Effective slopes calculated in each direction extending out over a 100 m distance from the edge of the proposed solar panel arrays are listed in **Table 2** and shown in **Figure 1**. The results of the slope analysis demonstrate that the land within area of the potential bush fire hazard, extending out from the proposed asset (being the solar panels and substations), is generally flat, with very slight upslope grades in the south west and south east directions and within the central parts of the site. A very slight downslope has been calculated on the north eastern boundary of the site (see **Table 2**).

Table 2 Effective Slope 100 metres from property boundary

Direction	Hazard	Effective Slope (degrees) [#]
North West	Woodland- general	0-5° flat
North East	Woodland- general	0-5° downslope
South West	Grassland	0-5° upslope
South East	Woodland- general	0-5° upslope
Central	Woodland- general	0-5° upslope

- Calculated using the guideline in Appendix 1 of PBP (2018a)

3.5 Fire Weather Area

The site lies within the Bland Shire Council Local Government Area in the Lower Central West Plains region. This area carries a Fire Danger Index (FDI) rating of 80.

3.6 Bush Fire Attack Level

Determination of the bush fire level using the section A1.12.6 of PBP identified that, given the vegetation and slope and the distance to the nearest bush fire hazard the all buildings constructed as part of the development at West Wyalong should be constructed to BAL-12.5 in accordance with *AS 3959 – Construction of buildings in bush fire prone areas* (Standards Australia 1999).

4 Potential Bushfire Hazards

4.1 Existing Bush Fire Hazard

Although the surrounding land is not mapped as 'bushfire prone land' the potential for a bush fire still exists. The Project Site and surrounding area is mostly cleared agricultural land with scattered patches of remnant woodland within the site footprint and adjacent to the site boundary within road reserves. As such, grass fires present a possible bush fire risk to the development at West Wyalong. Potential sources of ignition during construction and operation are detailed in the following sections.

4.2 Construction

Activities associated with the construction of the proposed development that may increase the risk or potentially cause bush fires include:

- Site maintenance activities such as petrol power tools including mowing and slashing;
- Disposal of cigarettes by site staff;

- Hot works, such as soldering or welding activities;
- Operation of motor vehicles around or on areas containing combustible material; and
- Operation of plant around or on areas containing combustible material.

It is recommended that asset protection zones are established prior to construction to decrease the risk of ignition of the adjacent grassland and woodland vegetation during the construction period (see **Section 5.1**).

4.3 Operation

Repairs and maintenance activities during operation have the potential to increase the risk of bush fires occurring within and in the vicinity of the subject site. All electrical components of the solar farm would be designed to minimise the potential for ignition. Ground cover beneath the solar panels would be managed so as to minimise the accumulation of high fuel loads.

APZ's are to be maintained around individual buildings, such as the substation and battery substation, as well as the development site as a whole. A perimeter road with a minimum width of four meters should be constructed and included as part of the APZ, as well as four meter wide internal access tracks to allow for responder access.

Conceptual design of the development at West Wyalong has proposed six meter wide internal access tracks and a six meter wide, sealed perimeter access road (see **Figure 1**). The proposed site layout also proposes two access points to the site from Blands Lane to allow for responder access and staff access/egress (**Figure 1**).

5 Safeguards and Mitigation Measures

The following safeguards and mitigation measures are recommended for the proposed development.

5.1 Asset Protection Zones (APZs)

5.1.1 General

Based on Table A1.12.4 in PBP, and applying the predominant vegetation, effective slope and FDI region noted above, asset protection zones (APZs) and the maximum overall fuel load that would apply to the development on the Project Site have been calculated. The resulting APZ widths and maximum overall fuel loads that would apply to the Project Site are listed in **Table 3** and shown in **Figure 1** and **Figure 2**.

Table 3 Asset Protection Zones (indicative)

Direction of Hazard	Hazard Type	PBP Effective Slope [#]	Minimum APZ (m) ^{##}	Overall Fuel Load (t/ha)	Bush Fire Attack Level
North West	Woodland- general	0-5° flat	11	20.2	BAL-12.5
North East	Woodland- general	0-5° downslope	11	20.2	BAL-12.5
South West	Grassland	0-5° upslope	50 m APZ achievable. No further assessment required	No further assessment required	No further assessment required
South East	Woodland- general	0-5° upslope	11	20.2	BAL-12.5
Central	Woodland- general	0-5° upslope	11	20.2	BAL-12.5

Calculated using the guidelines in Appendix 1 of PBP (RFS 2018a)

As stated in section A1.3 of PBP (RFS 2018a)

The maximum fuel load for each specific vegetation type is presented in **Table 3**. The control of existing vegetation and fuel involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation to be used as wind breaks and ember protection for assets (RFS 2018b). Methods for the management of fuel loads within APZs are detailed in **Section 5.5**.

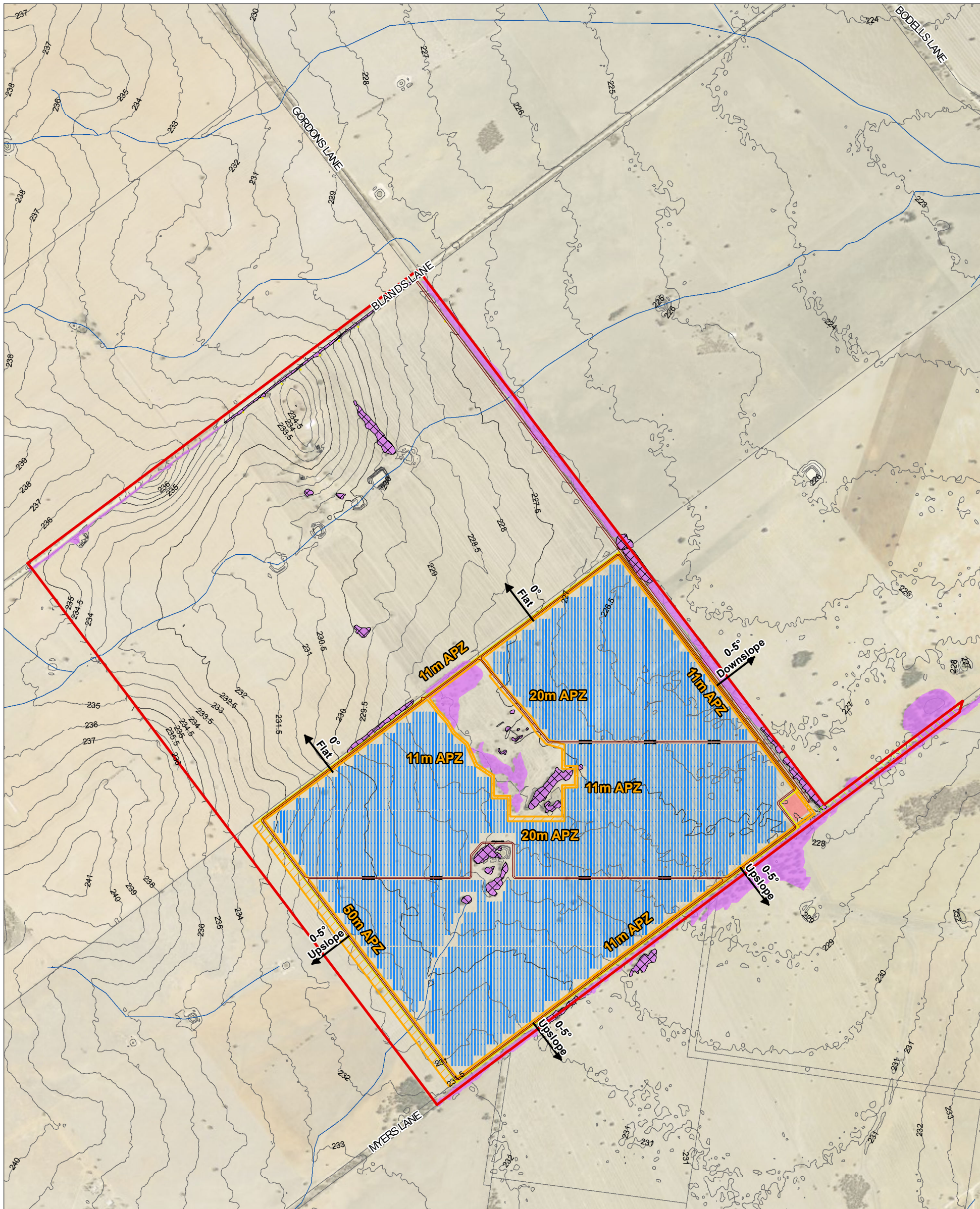
Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 15 % of the APZ area. Site assessment and analysis of aerial imagery of the open woodland patches identified that the canopy cover¹ in the majority of APZ areas is currently less than 15 %, with the exception of the patch of woodland adjacent to the northern site boundary (see **Figure 2**). The required APZ along the northern site boundary will overlap with a patch of Blue Mallee - Bull Mallee - Green Mallee very tall mallee shrubland (PCT 177) with the resulting canopy cover area being over 15% of the total APZ area.

The conceptual development design will require vegetation to be removed along the boundary to allow for construction of the perimeter access road. The conceptual design allows for a 15 m fire break between the solar panels and the site boundary which is inclusive of a six metre, sealed perimeter access road. The proposed 15 m firebreak satisfies the PBP requirement of an 11 m APZ calculated for the adjacent bushfire hazard; accordingly, no additional vegetation will be required to establish a compliant APZ in this area.

The existing canopy cover of the other patches of woodland within and adjoining the site is compliant with the criteria described in *Standards for Asset Protection Zones* (RFS 2018b) and hence there should not be any requirement for additional vegetation removal to establish compliant APZs within the Project Site.

¹ 'Canopy cover' is determined by measuring the area of canopy spread of trees within the APZ then dividing the total area of canopy spread by the total area of the APZ.

Figure 1 Bushfire Analysis



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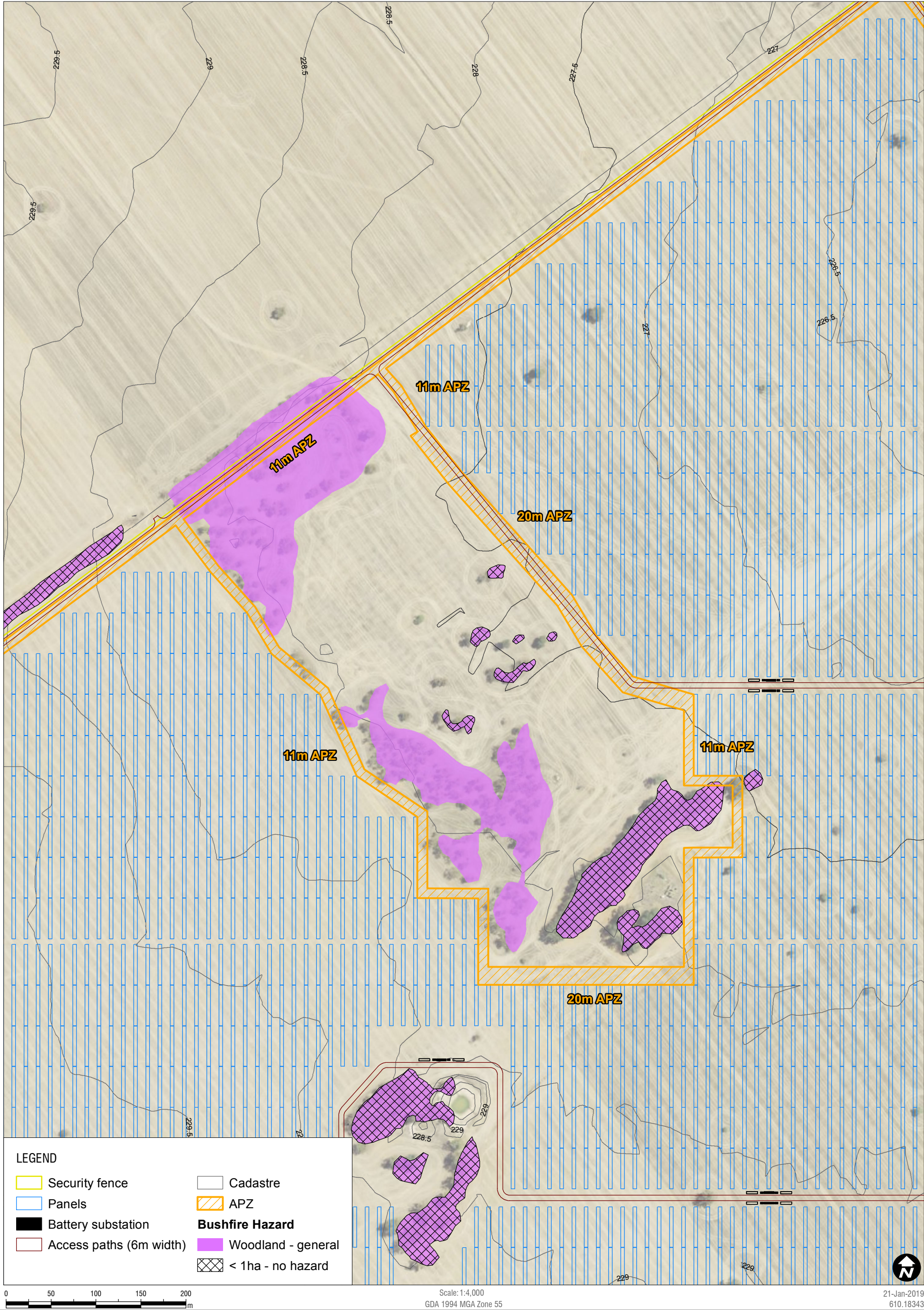
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|-----------------------|-------------------------|------------------------|
| Watercourse | Substation | APZ |
| Project site boundary | Access paths (6m width) | Slope |
| Security fence | Cadastre | Bushfire Hazard |
| Panels | Cable easement | Woodland - general |
| Battery substation | | < 1ha - no hazard |



Scale: 1:16,000
GDA 1994 MGA Zone 55

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Figure 2 Bushfire Analysis – Central Area



5.1.2 Grassland Assessment

In recognition of the different characteristics of grass fires in comparisons to bush fires NSW, RFS developed a simplified approval pathway providing a solution through which any development in an area of grassland is not subject to the assessment requirements in Appendix 1 of PBP. Section A1.3 of PBP outlines the grassland assessment methodology required. As stated in section 7.9 of PBP:

“in the case where a 50 meter APZ can be provided in an area of grassland hazard, no BPM’s [bush fire protection measures] are required”

The grassland assessment applies to the development at West Wyalong, as the western site boundary is adjacent to cleared agricultural land with grass fire potential. The conceptual design of the development at West Wyalong proposes a 15 m firebreak around the perimeter of the site, which is inclusive of the 6 m perimeter access road (see **Figure 1**). The distance from the edge of the solar panels to the south western site boundary is over 100 m, and therefore a 50 m APZ can be achieved, resulting in no further assessment requirements in accordance with Appendix 1 of PBP.

5.2 Building Construction and Design

BAL-12.5 construction and design standards in accordance with Australian Standard AS 3959 are recommended for the outer facades of buildings proposed to be constructed as part of the solar farm development. Relevant design standards for BAL-12.5 include:

- Metal framing and cladding materials;
- Automatic sprinkler systems; and
- Hose reels and hydrants installed at selected locations around the buildings (on the alignment of the perimeter fire trail where possible).

5.3 Responder Access

RFS (2018a) recommends that for new developments, a perimeter access road be designed to allow access for fire fighting vehicles to all sides of the asset that are exposed to the bush fire hazard. Accordingly, it is recommended that the development design allow sufficient space for the construction of a perimeter access road. The perimeter road would form part of the APZ and is required to provide a boundary between the asset and the bush fire hazard. The aims of the perimeter road are to:

- Provide firefighters with easier access to structures (assets);
- Provide a safe retreat (egress) for firefighters; and
- Create a clear ‘control line’ from which to conduct hazard reduction or back burning.
- Section 5 and Appendix 3 of PBP provides design principles for emergency service vehicle access. PBP recommends design of perimeter roads include: All weather material (i.e. sealed);
- Two-way carriageway with a minimum width of 8 m ;
- Allow for parking outside of carriageway width;
- Curves of the roads have a minimum inner radius of 6 m;
- Maximum grade of the road is 15° and the average is 10°;
- Road crossfall does not exceed 3°; and

- Vertical clearance of 4 m above the road surface (for overhanging branches, etc.).

For internal access roads PBP recommends that the road width be a minimum of 5.5 m with parking provided outside of the carriageway. Further design requirements for perimeter roads are listed in PBP. The conceptual design for the West Wyalong Solar Farm includes 6 m-wide internal access roads and 6 m-wide perimeter roads, with a two-lane perimeter road included along the north eastern site boundary (see **Figure 1**). The internal access roads are compliant with the standards outlined in PBP.

The recommended width of perimeter roads for residential subdivisions, as outlined in PBP, is 8 m, presumably to allow adequate room for responders to navigate residential traffic. As the traffic conditions of the solar farm will be vastly different to that of a residential subdivision (limited periodically to one vehicle on site for maintenance activities) the proposed 6 m wide perimeter access road would provide adequate responder access.

5.4 Water Supply for Firefighting

As noted in PBP, adequate water supply is essential for fire-fighting when property protection is involved. The provision of a dedicated static water supply is essential for fire fighting purposes in rural areas located outside of mains water supply, such as at the Project Site at West Wyalong. Where a water supply is provided it must be reliable, adequate and available for the life of the development. The conceptual design includes two water tanks located in the north east of the Project Site, with a combined capacity of 45,000 litres. These water tanks will be available for fire fighting water supply as required.

5.5 Fuel Load Management

The intensity of bush fires can be reduced by limiting the available fuel for burning. As outlined in *Standards for Asset Protection Zones* (RFS 2018b), reduction in fuel load does not necessarily require the removal of all vegetation within an APZ. In regards to the West Wyalong Solar Farm, the recommended fuel load management measures include:

- Strategic grazing of sheep within the Project Site during operation to maintain the length of grass under the solar panels;
- Raking or removal of fine fuels like leaves, twigs and bark on a regular basis;
- Mowing or slashing of grass within APZs and fire breaks, only as required; and
- Pruning of existing trees and shrubs so as to not have a continuous tree canopy leading from the hazard to the asset.

5.6 Landscaping

Landscaping should be designed to minimise the potential of flame contact with buildings, as per Appendix 4 of PBP and Step 6 of *Standards for Asset Protection Zones*. When maintaining vegetation in an APZ the following is recommended:

- Vegetation should not provide a continuous path to the asset;
- All noxious environmental weeds (particularly priority weeds listed under the NSW *Biosecurity Act 2016*) should be removed;
- Vegetation should be cleared or planted in clumps to avoid continuation;

- Prune low branches two meters from the ground to avoid ground fires spreading into the canopy; and
- Locate plants far enough away from the asset so that in the event of a fire there is no direct flame contact or radiant heat emission.

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Authorised by: JP