

# SMOKY CREEK SOLAR POWER STATION BUSHFIRE MANAGEMENT PLAN

Edify Energy



202204

Smoky Creek Solar Power  
Station Bushfire Management  
Plan

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Prepared by:	Prepared for:
Terra Solutions Pty Ltd	Edify Energy Pty Ltd
Anton Fitzgerald Environmental Scientist	Claire Driessen Project Manager
44 Hindley Street Currajong QLD 4812	Level 1 33 35 Palmer Street South Townsville QLD 4810
T +61 435 752 239 E enquiries@biomonitoring.com.au	T +61 408 084 900 E claire.driessen@edifyenergy.com

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# 1 EXECUTIVE SUMMARY

Terra Solutions were engaged by Edify Energy Pty Ltd to undertake a Bushfire Hazard Assessment (BHA) and prepare a Bushfire Management Plan (BMP) for a proposed solar farm on land located at 460 Dodsons Road, off the Burnett Highway, approximately 15 km south-east of the township of Dixalea (Figure 1). The Smoky Creek Solar Power Station will consist of solar photovoltaic panels, battery energy storage system (BESS), electrical substation, new overhead powerline connecting to the 275 kV Calvale to Stanwell transmission line, transmission infrastructure, site buildings and storage areas, laydown and construction compound and associated access tracks.

The BMP is a requirement to illustrate compliance with the Banana Shire Council Planning Scheme (2021) and State Planning Policy state interest guidance material – Natural hazards, risk and resilience – Bushfire (SPP guidance) in accordance with the assessment and reporting requirements within State Planning Policy July 2017 - Bushfire resilient communities (SPC).

Assessment in accordance with SPP is provided in sections 1-5, compliance with Banana Shire Council Planning Scheme (2021) and SPP guidance in sections 5 and Appendix B.

A variety of access, water and separations have been recommended to mitigate bushfire risk to acceptable levels. Provided in the Conclusion and Recommendations in **section 6**.

***The implementation of the adopted measures and recommendations forwarded within this report are based on a thorough assessment under the Banana Shire Council Planning Scheme (2021) and State Planning Policy state interest guidance material – Natural hazards, risk and resilience – Bushfire (SPP guidance) to manage the risk caused by bushfire to people, property and public safety. The recommended bushfire protection measures will contribute to the amelioration of the potential impact of any bushfire upon the development estate, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.***





Figure 1 Property Location (Terra Solutions, 2022)



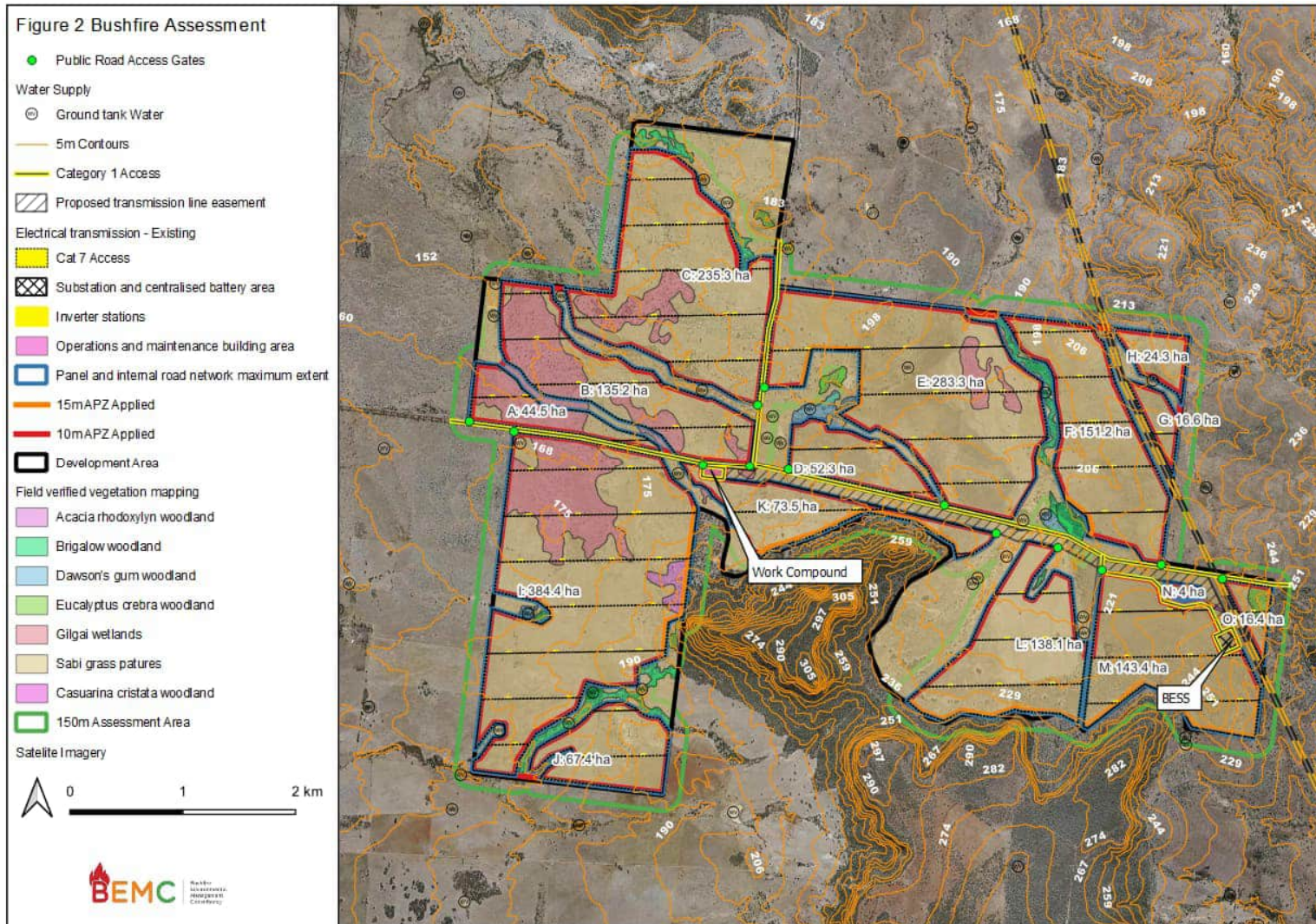


Figure 2 Bush fire Assessment

## 2 INTRODUCTION

Terra Solutions (Terra) were engaged by Edify Energy Pty Ltd to undertake a Bushfire Hazard Assessment (BHA) and prepare a Bushfire Management Plan (BMP) for a proposed solar farm on land located at 460 Dodson's Road, off the Burnett Highway, approximately 15 km south-east of the township of Dixalea (Figure 1).

The BMP is a requirement to illustrate compliance with the Banana Shire Council Planning Scheme (2021) and State Planning Policy state interest guidance material – Natural hazards, risk and resilience – Bushfire (SPP guidance) in accordance with the assessment and reporting requirements within State Planning Policy July 2017 - Bushfire resilient communities (SPC).

This BMP considers the level of bushfire risk and recommends protection measures to mitigate the risk for the proposed future use of the subject site. The purpose of this BMP is to assess the bushfire risk at the site, provide protection measures to manage mitigate risks associated with bushfire, provide for the protection of human life (including fire-fighters) and minimise impacts on property from the threat of bushfire.

It is clear from the investigation and assessment that the subject site is located within bushfire prone land.

### 2.1 Description of proposed development

The Project site is located approximately 37 km north-northwest of Biloela and 13 km northeast of Goovigen in the Banana Shire Council Local Government Area in central Queensland (Figure 1). The total development footprint may be up to 1,823 ha.

The Project site consists of six freehold lots ranging from 129.2 ha to 1,563.7 ha. Four of the allotments are entirely contained within the project area and the remaining three allotments extend beyond the project boundary.

The maximum extent of the project area may incorporate up to seven properties, including Lot 39 on RN395; Lot 28 on RN211; Lot 18 on RN271; Lot 37 on RN1147; Lot 29 on RN210; Lot 32 on RN194; Lot 33 on RN210.

The Smoky Creek Solar Power Station will consist of solar photovoltaic panels, battery energy storage system (BESS), electrical substation, new overhead powerline connecting to the 275 kV Calvale to Stanwell transmission line, transmission infrastructure, site buildings and storage areas, laydown and construction compound and associated access tracks. Surrounding land is utilised for grazing and is undeveloped apart from isolated farmhouses and associated infrastructure. The proposed location of the development is provided in Figure 1.

**Table 1 Description of Proposed development**

Element	Description
<b>Boundaries</b>	Rural grazing lands in all directions
<b>Topography</b>	Undulating plains
<b>Type of development</b>	Solar Farm and associated infrastructure
<b>Construction</b>	Solar panels, BESS, and associated infrastructure
<b>Landscaping plan provided</b>	Yes (Accent Environmental 2022)
<b>Bush fire Prone Land</b>	Yes



## 2.2 Objectives of Assessment

The objective of this BMP is to apply the assessment and reporting requirements of SPP to quantify the bushfire threat and provide a range of Bushfire Protection Measures (BPMs) that satisfy the requirements of Banana Shire Council Planning Scheme (2021) and SPP guidance.

The BPMs recommendations within this report will provide certainty to the approval authorities that bushfire risks can be managed to acceptable levels in accordance with the core concepts identified within SPP guidance and include:

- Identification of bush fire prone area.
- Application of adequate asset protection zone.
- Siting of appropriate building envelope.
- Protection of community infrastructure and essential services.
- Establishment of an acceptable development footprint.
- Integration of fire trails and working area.
- Management of hazardous materials.
- Identification of highly hazardous vegetation.
- Identification of impact buffer.
- Consideration of community resilience, and
- Added considerations for vulnerable developments.

The broad strategies to manage bushfire risk within this BMP include:

- Identification of highly hazardous vegetation and bushfire prone areas.
- Establish defensible spaces and asset protection zones (impact buffer) through vegetation management and creating separation between the built environment and bush fire hazard.
- Establish appropriate landscaping and landscaping design within the impact buffer to minimising opportunities for ignition and fire spread within the proposed development.
- Establish appropriate development area outside the impact buffer with design, siting and construction standards applied to mitigate risk to acceptable levels.
- Siting and capacity of adequate bush fire suppression advantages such as water, fire trails and firefighter working areas to facilitate emergency management and evacuation.
- Siting and protection of hazardous materials and ignition potential such as electricity, gas and hazardous materials.
- Siting and design of the developments to improve community resilience to bushfire events, and
- Establish appropriate land-use to reduce the exposure of vulnerable community to bush fire events.

## 2.3 Specific Objectives of Solar Farm Developments

Solar farms require special consideration and should be provided with adequate clearances to combustible vegetation as well as firefighting access and water. The following should be provided for wind and solar farms:

- A minimum 10m APZ for the structures and associated buildings/infrastructure, and
- The APZ must be maintained to the standard of an IPA for the life of the development.

Infrastructure for the purposes of requiring APZ excludes:

- Road access to the site, and
- Power or other services to the site and associated fencing.

Essential equipment should be designed and housed in such a way as to minimise the impact of bushfires on the capabilities of the infrastructure during bushfire emergencies. It should also be designed and maintained so that it will not serve as a bushfire risk to surrounding bush.

A Bush Fire Emergency Management and Operations Plan should identify all relevant risks and mitigation measures associated with the construction and operation of the solar farm.

## 2.4 Suitably Qualified Person

This BMP was prepared by Duncan Scott-Lawson. Duncan has over 20-years' experience in the bushfire industry through his previous employment with NSW government land management agency (National Parks). Duncan holds national accreditation in Prescribed burn planning and conduct, level 1 and 2 Incident Controller and recognised burn plan assessor when employed with NPWS. Duncan has undertaken a range of incident management roles during wildfire suppression that includes but not limited to planning, operations, divisional command, taskforce leader and aviation specialist (Aire Observer and Air Attack Supervisor). Duncan has been deployed interstate on several occasions to assist in wildfire suppression operations.

Duncan is top tier level 3 Bushfire Planning and Design (BPAD) fully accredited through Fire Protection Association Australia, completing tertiary education in Environmental Sciences (Hons) and Graduate Diploma in Bushfire Protection. Duncan has an extensive experience in bushfire planning in accordance with NSW RFS Planning for Bushfire Protection 2019, Australia Standard 3959:2018 Construction of buildings in bushfire prone area from strategic landscape planning, industrial, commercial, Special Fire Protection Purpose and residential developments.

### 3 BUSHFIRE HAZARD ASSESSMENT

#### 3.1 Bushfire Hazard Assessment Reliability Assessment

The purpose of the reliability assessment is to verify the reliability of existing bushfire prone area mapping and streamline the detailed BHA process. A reliability assessment is undertaken for the site and all land within 150 metres.

Regional scale bushfire hazard mapping drawn from the State Planning Policy (SPP) Interactive Mapping System shows patches of medium and high potential bushfire intensity areas within and adjacent to the project area (Figure 3).

The classification of hazardous vegetation will be supported by ecological surveys completed by Terra Solutions (2022).

On a landscape scale surrounding the site, low potential bushfire intensity areas (grasslands) predominate with patches of medium and high potential bushfire intensity areas to the south. As the vegetation within and surrounding the site has the potential to create a bushfire hazard, it is considered prudent to demonstrate that the development will manage fire risks effectively to an acceptable level.

The proposed solar will potentially remove the small sections of medium potential bushfire intensity vegetation within the potential development area.

Site visit has confirmed that the area is bushfire affected, slopes are accurate, and the reliability of existing bushfire prone area mapping is appropriate to apply.

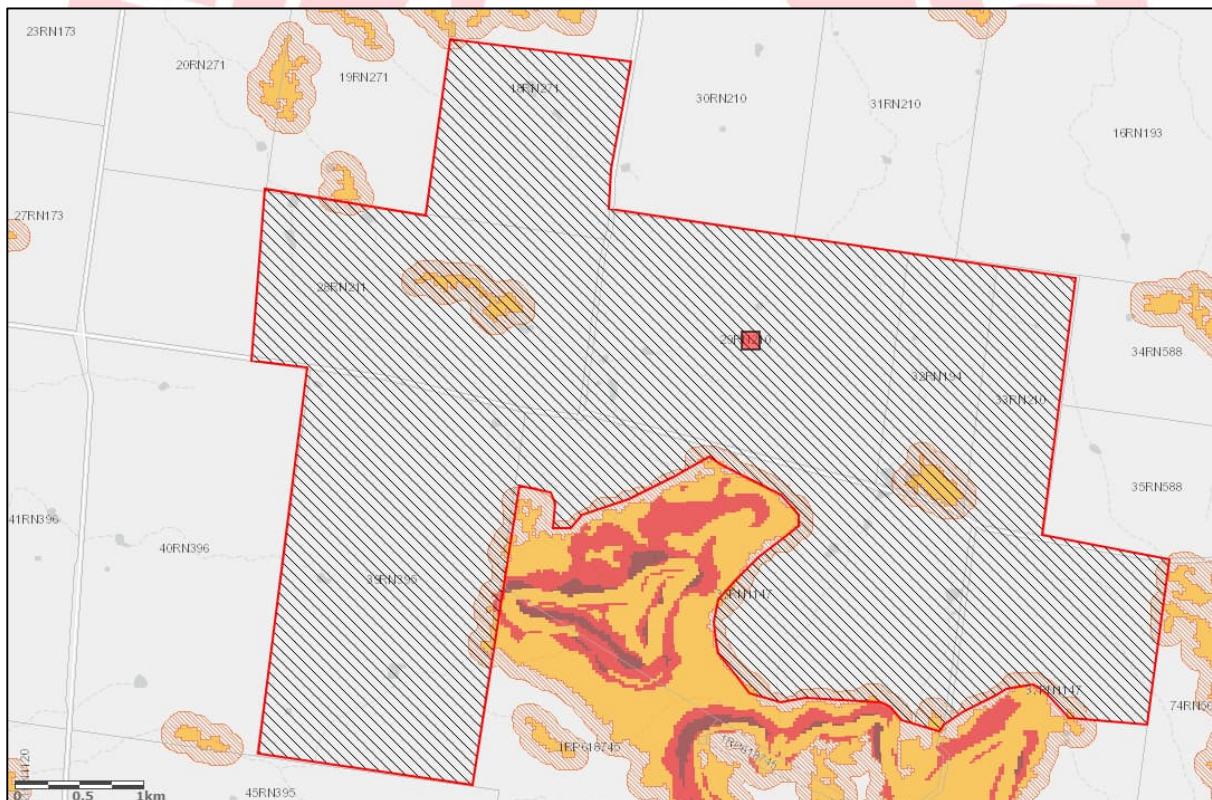


Figure 3 Bushfire Hazard Mapping (Extract SPP Interactive Mapping, 2022)



## 3.2 BHA Assessment Methodology

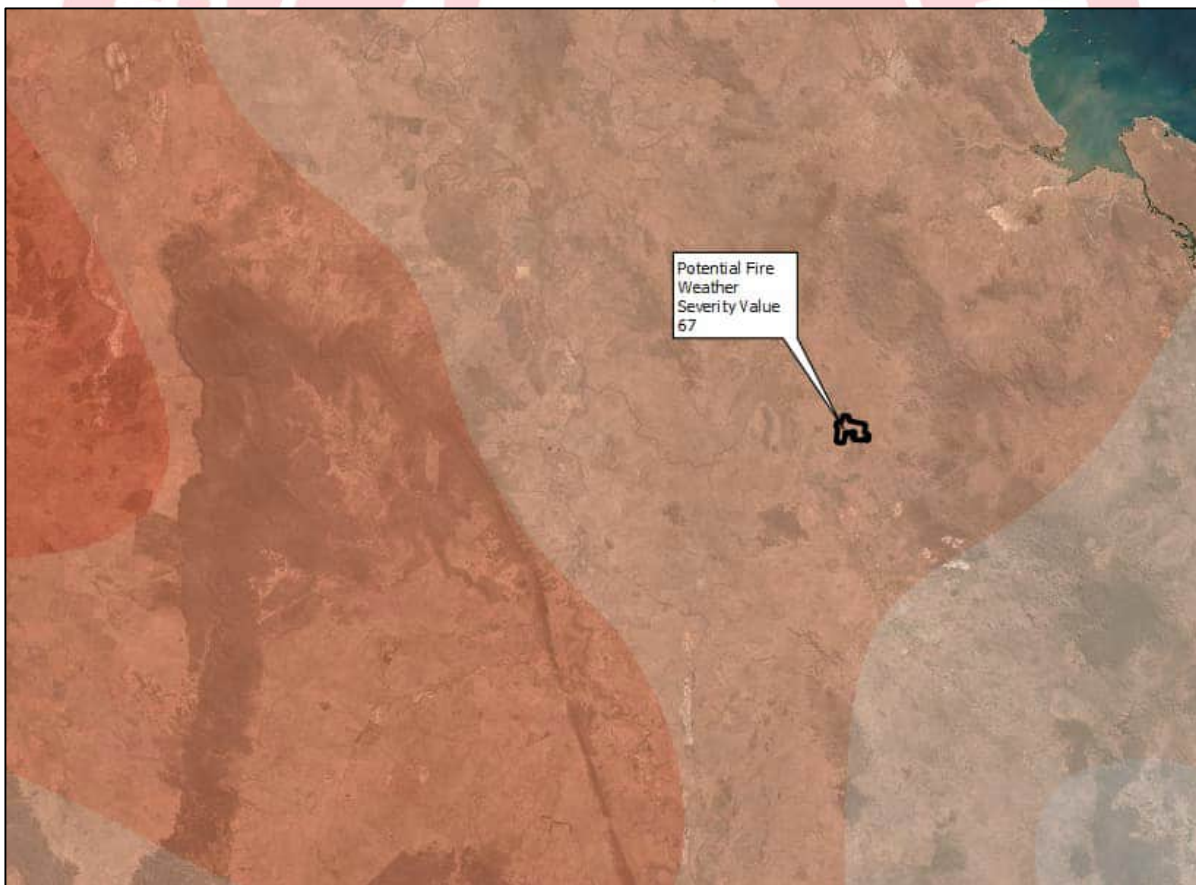
The assessment of the vegetation, slope and other bush fire characteristics within and surrounding the site has been carried out with the aid of the following:

- Nearmap and QLD Globe aerial photograph interpretation
- Photo theodolite application supported by contour and LiDAR DEMs terrain profiles
- Bushfire Overlays
- Reference to regional vegetation community mapping
- Site assessment (Terra Solutions) in October 2022

## 3.3 Fire Severity

Potential severe fire weather mapping indicates the regional variation across Queensland of a particularly hot, dry and windy day with little preceding rainfall. Fire weather severity maps developed for Queensland by CSIRO are based on the Forest Fire Danger Index (FFDI) (McArthur 1973). The maps show an FFDI that is expected to be exceeded about once every 20 years, with a 5% chance of being exceeded in any single year (DILGP 2016). While more severe fire weather events are possible, these conditions are considered suitable for setting the level of bushfire risk mitigation measures (Rural Fire Service 2014).

The potential severe fire weather mapping dataset presents values ranging from 67 in and around the site increasing to the west as illustrated in Figure 4.



**Figure 4 Potential severe fire weather (Extract QSpatial, 2022)**

### 3.4 Vegetation Assessment

Habitat assessment conducted by Terra Solutions (2022) identifies seven vegetation communities within the site (Figure 5; Appendix A). The vegetation communities identified were converted into Regional Ecosystems (RE) and then into the Vegetation Hazard Class (VHC) accordance with BRC (Table 2).

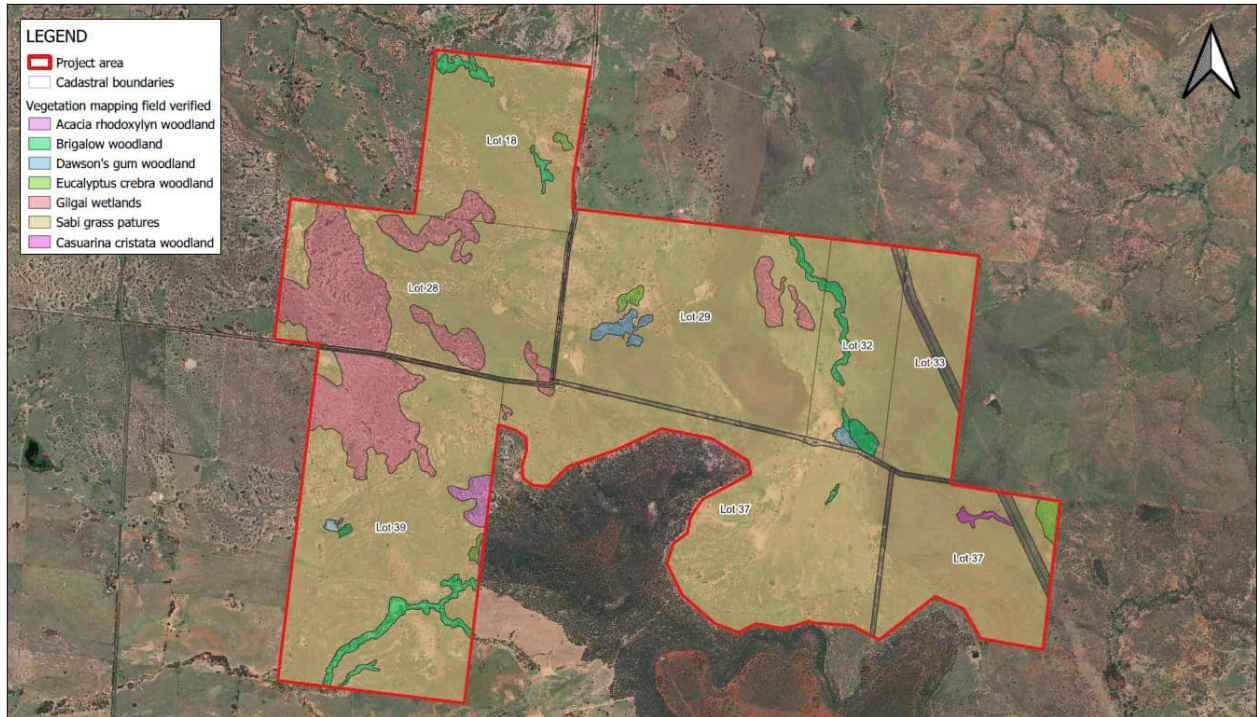


Figure 5 Vegetation mapping (Terra solutions, 2022)

#### 3.4.1 Vegetation exclusions, and downgrades

An analysis of the vegetation in and around the site has determined that no vegetation exclusions or downgrades are included in this assessment.

#### 3.4.2 Vegetation hazard class

For determining bushfire risk, the predominant vegetation formation is considered most likely to influence bushfire intensity. The vegetation hazard classification for Queensland is shown spatially in the Bushfire prone area - Vegetation Hazard Class (VHC) vector file (CSIRO 2014). The vegetation hazard class is mapped at a scale of 1:2M and therefore can incorrectly predict the vegetation hazard at smaller scales.

The VHC was verified via site investigation and observed to be consistent with the current VHC mapping. Mapping refined via site investigation and assessment of aerial imagery is presented in Figure 2. The confirmed VHC's and their potential fuel load are provided in Table 2.

The bushfire mitigation protection measures described in the following sections are recommended based on the typical fuel load accumulated within the vegetation community and factors in the presence of a mid-storey and invasive weeds, which increases the fuel load.

If operational works involving vegetation clearing are undertaken in the future, a slight reduction in fire risk can be expected.



**Table 2 Regional Ecosystem mapping**

Vegetation Community	Regional Ecosystems	Vegetation Hazard Class and description	Potential fuel load (tonnes per hectare)	Fuel continuity
<i>Urochloa mozambiquensis</i> grassland	Non-remnant	31.4 Mixed open forblands to tussock grassland in inland locations	2.8 T/ha	1 T/ha
Gilgai depressions and rises	11.4.8a - Gilgai and small depressions on Tertiary clay plains associated with <i>Acacia harpophylla</i> ecosystems	34.5 - Sedgeland dominated wetlands	13 T/ha	1 T/ha
<i>Acacia harpophylla</i> woodland and fringing woodlands	11.11.16 - <i>Eucalyptus cambageana</i> , <i>Acacia harpophylla</i> woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Lowlands	25.1 - Brigalow belah open forests on heavy clay soils	15 T/ha	1 T/ha
<i>Eucalyptus crebra</i> woodland	10.11.1d - <i>Eucalyptus crebra</i> woodland	12.2 - Dry eucalypt woodlands on sandstone and shallow soils	17.4 T/ha	1 T/ha
<i>Eucalyptus cambageana</i> woodland	11.4.8 - <i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	25.2 - Brigalow belah woodlands on heavy clay soils	6.2 T/ha	1 T/ha
<i>Acacia rhodoxylum</i> woodland	11.9.9 - <i>Eucalyptus crebra</i> grassy woodland. <i>Eucalyptus moluccana</i> sometimes conspicuous on lower slopes. Occurs on Cainozoic to Proterozoic consolidated, fine-grained sediments. (BVG1M: 13c)	13.2 Dry to moist eucalyptus woodlands on undulating metamorphic and granite	14.4 T/ha	1 T/ha
<i>Casuarina cristata</i> woodland	11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest (particularly in southern parts), with or without scattered emergent <i>Eucalyptus</i> spp. such as <i>E. coolabah</i> , <i>E. largiflorens</i> , <i>E. populnea</i> , <i>E. orgadophila</i> , and <i>E. woollsiana</i> .	25.2 Brigalow belah woodlands on heavy clays soils	6.2 T/ha	1 T/ha



### 3.5 Slope Assessment

Effective slope has a direct influence on the potential rate of fire spread and rate of fuel consumption. Site slope is the slope of the ground between the edge of the proposed development or site boundary and the edge of hazardous vegetation and defined in AS3959 as the slope under the classified vegetation which most influences the bushfire attack level.

#### 3.5.1 Effective and Site Slope Assessment

The effective slope is the slope of the ground under the hazard (vegetation). The slope between the vegetation and the proposed building envelope is the site slope. When identifying the effective and site slopes, it may be found that there are a variety of slopes covering different distances. The effective slope is the slope under the vegetation which will most significantly influence the bushfire behaviour for each aspect.

The topography of the site and surrounds has been assessed to identify the maximum slope present under the classified vegetation (hazard). Slope data has been calculated from LiDAR Digital Elevation Model (DEM) (Figure 6).

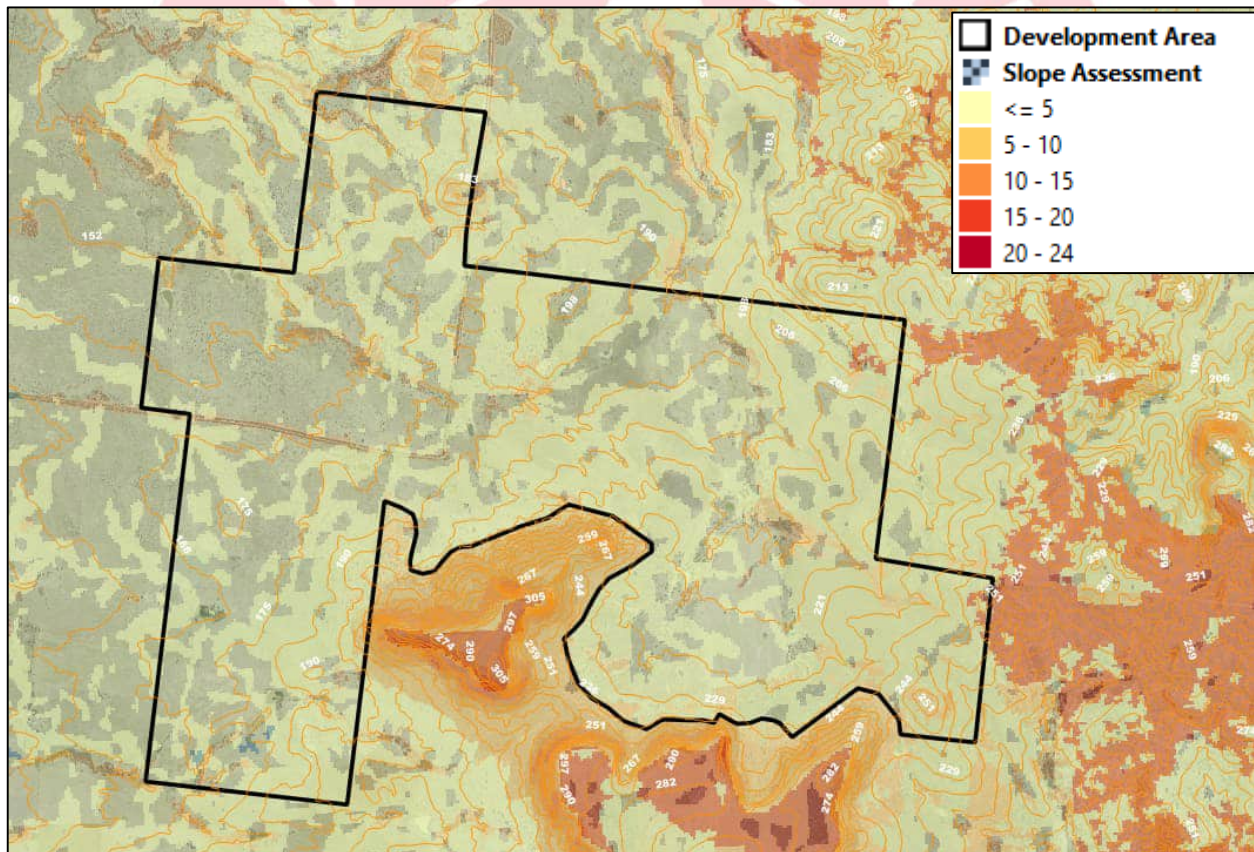


Figure 6 LiDAR DEM slope analysis

## 4 RESULTS AND COMPLIANCE SEPARATION AND RADIANT HEAT EXPOSURE

### 4.1 Separation and radiant heat exposure

Calculation of separation and radiant-heat exposure (radiant heat flux in kW/m<sup>2</sup>) is required for all sites where new development is within bushfire-prone areas or the potential impact buffer, where an applicant proposes an alternative defendable space width to the minimum recommended widths set out in the SPP guidance. Radiant heat exposures are calculated using the preferred bushfire asset protection zone width calculator.

Table 3 provides the SPP bushfire separation output provided in Appendix C and illustrated in Figure 2.

**Table 3 Separations and BAL for each VHC**

VHC	Slope	Separation required	Resulting BAL
31.4 Mixed open forblands to tussock grassland in inland locations	5 deg down	10m	BAL-LOW
34.5 - Sedgeland dominated wetlands	5 deg down	10m	BAL-29
25.1 - Brigalow belah open forests on heavy clay soils	5 deg down	15m	BAL-29
25.1 - Brigalow belah open forests on heavy clay soils	5 deg up	13m	BAL-29
12.2 - Dry eucalypt woodlands on sandstone and shallow soils	5 deg down	15m	BAL-29
12.2 - Dry eucalypt woodlands on sandstone and shallow soils	5 deg up	11m	BAL-29
25.2 - Brigalow belah woodlands on heavy clay soils	5 deg down	11m	BAL-29
25.2 - Brigalow belah woodlands on heavy clay soils	5 deg up	10m	BAL-29
13.2 Dry to moist eucalyptus woodlands on undulating metamorphic and granite	5 deg down	15m	BAL-29
13.2 Dry to moist eucalyptus woodlands on undulating metamorphic and granite	5 deg up	10m	BAL-29
13.2 Dry to moist eucalyptus woodlands on undulating metamorphic and granite	5 deg down	13m	BAL-29

The proposed panel layout and vegetation mapping indicates two types of vegetation that directly impact the proposed development. To standardise the application of the APZ within the proposed development the following APZ will be applied.

- Where the *Urochloa mozambiquensis* grassland (sabi grass patures) and Gilgai wetlands are the dominant fire threat a 10m separation will be applied, irrespective of the effective slop being up or down.
- Where *Acacia harpophylla* woodland and fringing woodlands, *Eucalyptus crebra* woodland, *Eucalyptus cambageana* woodland, *Acacia rhodoxylm* woodland, and *Casuarina christata* woodland are the dominant fire threat a 15m separation will be applied, irrespective of the effective slop being up or down.

The internal compound and a 10m APZ shall be established around the BESS and the work compound.

## 4.2 Shielding

Where an elevation is shielded from direct radiant heat arising from bushfire attack, then the construction requirements for that elevation can be reduced. An elevation is deemed to be not exposed to the source of bushfire attack if all the straight lines between that elevation and the source of bushfire attack are obstructed by another part of the building.

## 4.3 Short Fire Run and Restricted Fire Head Growth

An analysis of the size and shape of the classifiable vegetation in and around the site has determined no Short Fire Run (SFR) or Restricted Head Growth (RHG) considerations within this assessment.

## 4.4 Flame Length

Contemporary research illustrates that flame length ground attachment is not possible at slopes below horizontal and below 15 degrees and has not been considered further within this assessment given that the three transects assessed are all less than 15 degrees.

## 4.5 Compliance with planning scheme provisions

Planning scheme provisions for the Natural hazards, risk and resilience state interest have been with reference to the Banana Shire Planning Scheme overlay provided in Appendix B of this report.



## 5 BUSHFIRE MANAGEMENT

### 5.1 Bushfire Season

In Northern Queensland bushfires predominantly occur in the dry season with a heightened risk during the months (June to December). Fire risk is highest under conditions where vegetation has a high fuel load, low fuel moisture, strong winds, high ambient temperature, and low relative humidity. The main ignition sources are due to out-of-control breach of containment prescribed hazard reduction burning, lightning, arson, accident, and incendiaries.

### 5.2 Updated Australian Fire Danger Rating System

The principal objective of the new Australian Fire Danger Rating System (AFDRS) is to implement a more accurate and nationally consistent system that will enable improved decision-making by response agencies and industry and provoke the desired community response to messaging in order to improve public safety.

The AFDRS uses the latest scientific understanding about weather, fuel and how fire behaves in different types of vegetation to improve the reliability of fire danger forecasts. This strengthens the ability of those working in emergency services to be better prepared, make improved decisions, and provide better advice to the community.

It is aimed at a simplified, action-oriented Fire Danger Rating System (Figure 7).

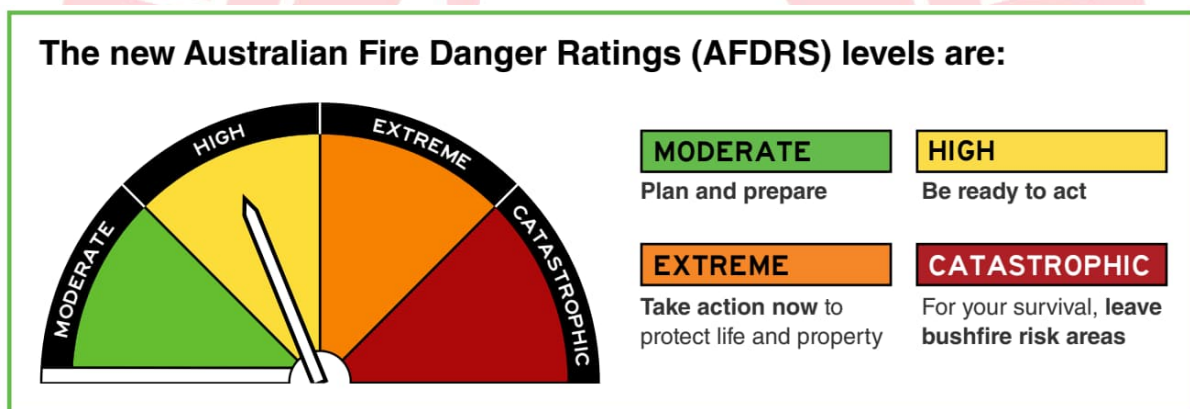


Figure 7 New Australian Fire Danger Rating System

**MODERATE:** *Plan and Prepare* - Have a plan and be ready to act if a fire starts.

**HIGH:** *Be ready to act* - Be alert for fires in your area and be ready to leave or be ready to defend.

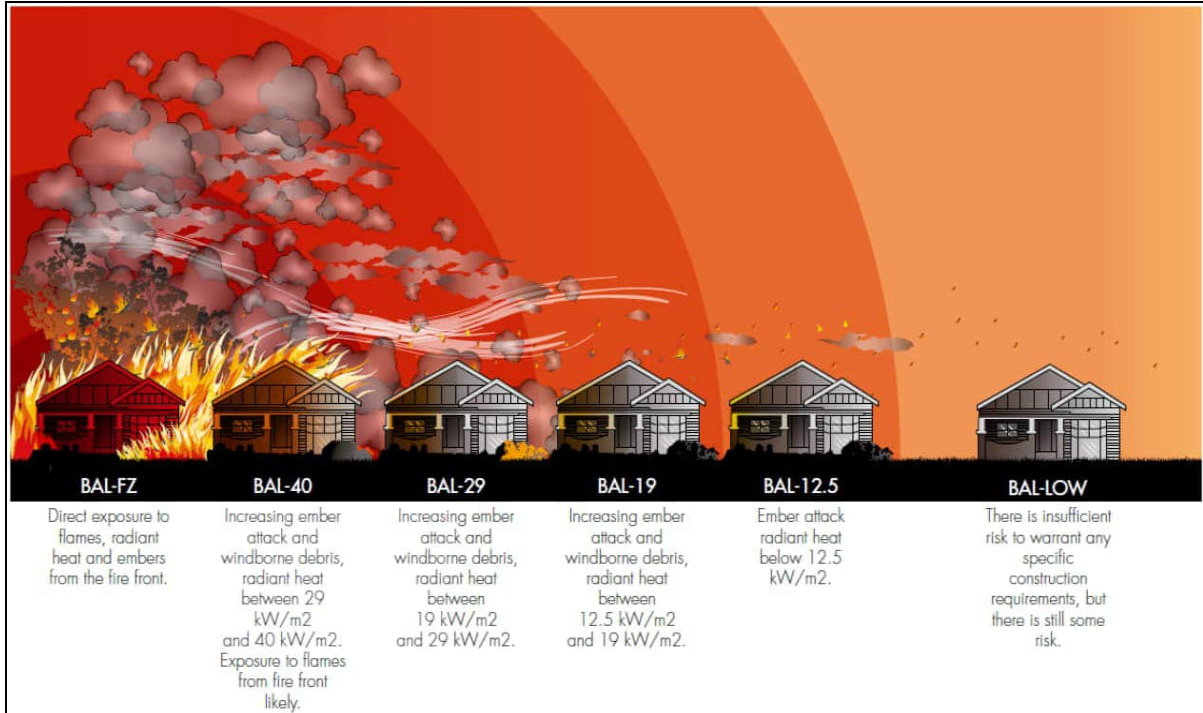
**EXTREME:** *Take action* - Act before a fire starts.

**CATASTROPHIC:** *Leave high risk areas* - Protect your life, leave early.

### 5.3 Bushfire Attack Level (BAL) construction

Bushfire Attack Level (BAL) ratings refer to the fire intensity your house is likely to be subjected to in a bushfire, expressed in terms of radiant heat. The BAL assessment forms the construction component of the bushfire assessment process. The other component is the bushfire planning, which includes Asset Protection Zones (APZ), separation to provide defensible spaces, access, water, electricity, gas, landscaping and emergency management.

Furthermore, the measures contained in the *Australian Standard 3959 Construction of buildings in Bushfire Prone Areas* for each BAL construction level are not for fire resistance. The building will burn. The construction standards are aimed at slowing the ignition and fire spread of the building to provide adequate time to enable occupants to shelter within the building as the bushfire front passes. The degree of vegetation management within the APZ, the unpredictable nature of behaviour of fire, and extreme weather conditions make building adjacent to vegetation very dangerous.



**Figure 8 Relationship between fire behaviour and BAL (WA Guidelines for Planning in Bush fire Prone Areas, 2017)**

## 5.4 Hazard reduction

Bushfire information provided through the regional ecosystem (RE) descriptions indicate the bushfire season is limited to early dry season when there is good soil moisture, with some later fires in the early storm season or after good spring rains. The intensity of these fire can vary and generally have 5 to 15-year intervals.

Hazard reduction burning is recommended early in the winter season, although there is value in occasional late dry season fires, or storm burns, over small areas. Where possible, ignite initial fires from upper ridges to burn down. Multiple dates of ignition within the same forest area will produce a mosaic of burnt landscape.

Avoid ignition such that fires burn from the bottom of hills upwards. Too frequent fires may eliminate fire-killed shrubs and small trees (such as Casuarinas). Once boundaries are secured with early fires, late dry season and storm-burning may provide the intensity required to enhance seed germination of many species but restrict spread and allow the creation and maintenance of a multi-aged mosaic. Ensure moderate densities of mature casuarinas, cypress pine and wattles are maintained; ensure the persistence of large eucalypts.

**Table 4** provides fire guidelines of the fire frequency required for the Regional Ecosystems identified in and around the site.

Table 4 DES Fire guidelines

Regional Ecosystem	Fire guidelines
11.4.8a - Gilgai and small depressions on Tertiary clay plains associated with <i>Acacia harpophylla</i> ecosystems	SEASON: Wet to early dry season when soil is moist. INTENSITY: Low. INTERVAL: Brigalow should be left long unburnt often for >10 years. STRATEGY: Patchy, within the 20-30% range of area burnt. ISSUES: Acacias (e.g., brigalow) germinate infrequently following high rainfall events, mature slowly and are long-lived. Acacias are vulnerable to frequent and high-severity fires. Fire in surrounding fire-adapted communities can be used to mitigate against wildfire. Fuel loads within Acacia communities can sometimes also require infrequent patchy burns, particularly following years of good rain, to protect them from wildfire and promote diversity at the ground layer. Long absence of fire can result in canopy closure by Acacias and lead to self-protection of these communities. Introduced invasive grasses (e.g., buffel <i>Cenchrus ciliaris</i> ) may increase the risk and severity of fires.
11.11.16 - <i>Eucalyptus cambageana</i> , <i>Acacia harpophylla</i> woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Lowlands	STRATEGY: Maintain fire management of surrounding country so that wildfires will be very limited in extent. Frequent fire at the edge of this RE keeps fuel loads low. Protection from fire is necessary. ISSUES: <i>Casuarina cristata</i> is fire sensitive, although germination can be good in bare areas. Brigalow is soft-seeded, so germination is not promoted by fire. Buffel grass invasion will increase risk from fire. High intensity fires will cause damage to overstorey. Grazing may be an option for reducing fuel loads where exotic grass such as buffel have invaded.
10.11.1d - <i>Eucalyptus crebra</i> woodland	SEASON: Summer to winter. INTENSITY: Low to moderate. INTERVAL: 4-25 years. STRATEGY: Aim for 40-60% mosaic burn. Burn with soil moisture and with a spot ignition strategy so that a patchwork of burnt/unburnt country is achieved. ISSUES: The fire regime should maintain a mosaic of grassy and shrubby understoreys. Control of weeds is a major focus of planned burning in most areas. Careful thought should be given to maintaining ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas. Variability in season and fire intensity is important, as well as spot ignition in cooler or moister periods to encourage mosaics.
11.4.8 - <i>Eucalyptus cambageana</i> woodland to open forest with <i>Acacia harpophylla</i> or <i>A. argyrodendron</i> on Cainozoic clay plains	STRATEGY: Maintain fire management of surrounding country so that wildfires will be very limited in extent. Frequent fire at the edge of this RE keeps fuel loads low. Protection from fire is necessary. ISSUES: <i>Casuarina cristata</i> is fire sensitive, although germination can be good in bare areas. Brigalow is soft-seeded, so germination is not promoted by fire. Buffel grass invasion will increase risk from fire. High intensity fires will cause damage to overstorey. Grazing may be an option for reducing fuel loads where exotic grass such as buffel have invaded.
11.9.9 - <i>Eucalyptus crebra</i> grassy woodland. <i>Eucalyptus moluccana</i> sometimes conspicuous on	SEASON: Summer to winter. INTENSITY: Low to moderate. INTERVAL: 4-25 years. STRATEGY: Aim for 40-60% mosaic burn. Burn with soil moisture and



Regional Ecosystem	Fire guidelines
lower slopes. Occurs on Cainozoic to Proterozoic consolidated, fine-grained sediments. (BVG1M: 13c)	with a spot ignition strategy so that a patchwork of burnt/unburnt country is achieved. ISSUES: The fire regime should maintain a mosaic of grassy and shrubby understoreys. Control of weeds is a major focus of planned burning in most areas. Careful thought should be given to maintaining ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas. Variability in season and fire intensity is important, as well as spot ignition in cooler or moister periods to encourage mosaics.
11.3.1 - <i>Acacia harpophylla</i> and/or <i>Casuarina cristata</i> open forest (particularly in southern parts), with or without scattered emergent <i>Eucalyptus</i> spp. such as <i>E. coolabah</i> , <i>E. largiflorens</i> , <i>E. populnea</i> , <i>E. orgadophila</i> , and <i>E. woolliana</i> .	INTERVAL: n/a. b, d: Occasional fires 5 - 10 years. STRATEGY: Maintain fire management of surrounding country so that wildfires will be very limited in extent. Frequent fire at the edge of this RE keeps fuel loads low. Protection from fire is necessary. ISSUES: <i>Casuarina cristata</i> is fire sensitive, although germination can be good in bare areas. <i>Brigalow</i> is soft-seeded, so germination is not promoted by fire. <i>Buffel</i> grass invasion will increase risk from fire. High intensity fires will cause damage to overstorey. Grazing may be an option for reducing fuel loads where exotic grass such as <i>buffel</i> have invaded.

## 5.5 Ignition risk

The most probable time for a bushfire to ignite on the site is during site preparation (i.e., excavation works), building construction and during operations of the solar farm.

A bushfire may potentially arise from the following sources:

- Machinery and associated equipment (e.g., welding, fuel, oil, and flammable chemicals) generate heat and sparks which ignite dry flammable materials and vegetation.
- Careless disposal of rubbish or wastes such as cigarettes, matches and/or paper.
- Flammable matter such as stockpiles of mulched/chipped vegetation dead/dry on-site vegetation.
- Deliberate lighting of fires to burn waste for non-project purposes (e.g., open fires to keep warm or cooking food), and
- Burning of vegetation waste if approved by the local Rural Fire Warden.

## 5.6 Strategies to suppress unplanned fires

The threat of bushfire attack poses an ever-present risk to life, property, and the environment throughout rural and urban areas alike. Bushfires can be caused by a variety of factors, including lightning strikes, sparks from machinery and fallen or clashing powerlines.

Fire suppression actions start from the time the fire is detected until it is extinguished. **Table 5** provides guidance on the activities to be undertaken during fire danger days. The solar farm facility prioritises bush fire protection measures to inhibit bushfires (grassfires) leaving the site, the effective protection of human life, facility, and community assets and reduces ignition potential on site to acceptable levels. Only general maintenance works that do not require mechanical machinery that can create an ignition source will be permitted on fire danger days.

Whilst the likelihood of ignition is relatively low, the risk of ignition can be readily managed with simple management procedures including:

- Removal of ignition sources is an important component of bushfire management. This is particularly important during severe weather conditions.
- Ignition sources external to the project activities include illegal burning off, car dumping, inappropriately discarded cigarette butts or the deliberate lighting of bushland.
- Sources of ignition related to the operation include the hot exhausts of vehicles and spark or flame sources such as grinders or welders.
- Other sources of ignition include lightning, the arcing of power lines and the escape of fire from legal burning off.

## 5.7 Strategies to minimise potential spread of bushfires

A range of permanent, natural and point fire control advantages exist to minimise the potential for the spread of bush fires in and around the site. The following sections define the different advantages, their characteristics, and considerations.

**Table 6** summarises the control advantages in and around the site. The Operator will ensure the facility effectiveness of fire control advantage infrastructure on site is maintained to minimise the potential for the spread of fires from or into and from the property. In general,

- Priorities the maintenance of Asset Protection Zones and vehicle access trails/roads.
- Maintain Assets Protection Zone to standards in accordance with NSW RFS, specifically management of the ground and shrub growth, and lower tree branches under the tree line for a minimum of 2m height, and
- Point advantages such as water availability and access locations are signposted and maintained.

**Table 5 Activities and Fire Danger ratings**

ELEMENT	NONE	MODERATE	HIGH	EXTREME	CATASTROPHIC
Preparedness for ignition	Assessing the required level of day-to-day preparedness by monitoring Fire Danger Indexes and synoptic conditions on a continuous basis throughout the fire season. Identifying pre-emptive incident management and ensure staff are aware of response procedures. Prior to each fire season an annual and biannual inspection of the fire management requirements.				
Response to ignition		Plan and commence preparation for a wildfire. Check fire equipment.	Fire suppression equipment tested, water ready and ready to act.	Fire suppression equipment tested, water ready and ready to act. Monitor for ignition points, if fire growth	Leave bushfire risk areas.
Minimise hot works through appropriate work scheduling	No requirements for specific wildfire preparedness or suppression.	If deemed appropriate. Hot works should be accompanied by a spotter and a fire extinguisher.	If deemed appropriate. Hot works should be accompanied by a spotter and a fire extinguisher.	No hot works	No hot works
Minimise vegetation maintenance activities through appropriate work scheduling		No requirements	If deemed appropriate. Vegetation management should be accompanied by a spotter and a fire extinguisher/ fire vehicle.	If deemed appropriate. Vegetation management should be accompanied by a spotter and a fire extinguisher / fire vehicle.	No vegetation maintenance activities



**Table 6 Ignition risk and actions**

Ignition Risk	Actions
Deliberate / Arson	Promoting cooperative surveillance programs with fire agencies and community. Promoting staff, community education and awareness programs. Limiting public access during severe and catastrophic fire weather conditions. Cooperatively assist NSW Police and the Rural Fire Service to investigate all fires believed to have been deliberately lit.
Campfires	Promoting staff, community education and awareness programs.
Debris Burning	Ensure neighbours obtain appropriate permits to implement Debris burns.
Machinery use	Maintain high level of employee awareness (e.g., toolbox talks). Ensure adequate buffer zone between activities and fuel source. All hot work activities to have a spotter and a fire extinguisher within work zone when required. Hot works to be avoided during total fire bans or on FDR days of Very High or greater. Do not undertake mechanical clearing works on Extreme and Catastrophic fire danger days Removal of some visual rocks before slashing. Avoid driving on/through long grass (vehicle exhaust systems are known to igniting grass fires)
Electrical & lightning	Liaise with electricity providers to ensure maintenance of powerlines. Further information visit <a href="https://www.electricalsafety.com.au/">https://www.electricalsafety.com.au/</a>

## 5.8 Potential impacts

The high electricity generation of a solar farm facility increases the likelihood of accidental fire in the region. Consequences of bushfire include:

- Loss of life
- Damage to infrastructure such as fences, machinery, and buildings
- Increased susceptibility of erosion or invasion by weeds following a fire
- Loss of vegetation and flora species
- Loss of localised fauna habitat and species

## 5.9 Design and siting

The following elements should be incorporated into the design of the solar farm to ensure compliance with bushfire planning requirements:

- Public roads are designed in accordance with the geometry, turning radii and vertical clearing provision in the Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots, Queensland Fire and Emergency Services, 2015, and the Road Planning and Design Manual 2nd edition, Department of Transport and Main Roads, 2013.
- Design elements of the public road do not impede access for fire-fighting and maintenance for fire-fighting purposes.

- Development does not increase the severity or extent of bushfire prone areas or the risk to people or property on the site or to other properties. The purpose of this is to ensure development does not:
  - Create additional bushfire prone areas or exacerbate the impacts of a bushfire through landscape design or areas designated for revegetation or rehabilitation.
  - Increase the risk of bushfire from potential sources of ignition such as electricity distribution and transmission networks.
- Development avoids or mitigates the risk from the manufacture or storage of hazardous materials within bushfire prone areas through:
  - Materials manufactured or stored on-site are not hazardous; or
  - Structures used for the manufacture or storage of hazardous materials are located outside of bushfire prone areas; or
  - Buildings and structures used for the manufacture or storage of hazardous materials are located outside of the bushfire defendable space, as furthest away from the bushfire prone area as practicable and are designed to prevent exposure of the hazardous materials in the event of a bushfire.
- Essential infrastructure (e.g., electricity, gas and telecommunications) is designed and located to minimise the creation of ignition sources, such as underground.

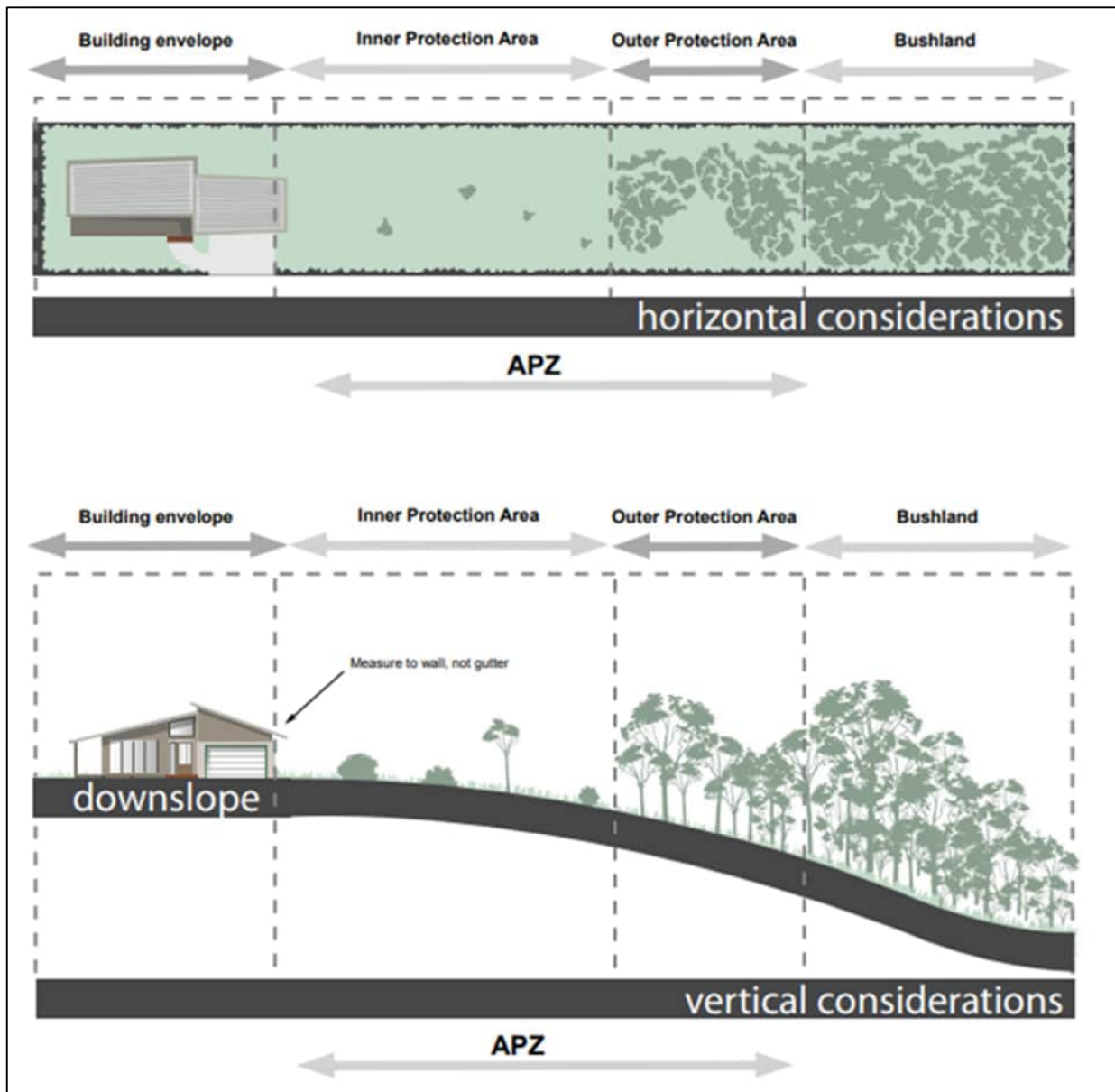
## 5.10 Defendable space

Defendable space separates buildings from areas of bushfire hazard to allow fire authorities to access and suppress bushfires. These spaces are also referred to as Asset Protection Zones (APZ) and extend from the edge of the development to the hazard (surface and near surface fire fuels). The APZ reduces exposure to bushfire attack by establishing a 'low fuel' buffer zone between development and bushfire-prone areas to ensure that fuels which may contribute to the spread of bushfire, are minimised close to the development.

Increasing the APZ width between buildings and hazardous vegetation is critical to reducing exposure to bushfire attack mechanisms such as direct flame contact, radiant heat and ember attack.

APZ's can include the following:

- Fire trail
- Footpaths
- Lawns
- Discontinuous gardens
- Swimming pools
- Driveways
- Unattached non-combustible class 10 structures with suitable separation from the dwelling
- Open space / parkland (consistently managed grasses)
- Car parking



**Figure 9 Components of defensible space (Figure A4.1 – NSW PBP 2018)**

Separation reduces exposure to bushfire attack by establishing a ‘low fuel’ buffer zone between development and bushfire-prone areas that:

- Reduces the viability of wind-borne embers, which is the main attack vector responsible for ignition of homes
- Diminishes the effect of bushfire radiant heat on structures and smoke on occupants
- Enables access for emergency services to suppress fires and protect property during critical event conditions
- Provides opportunities to establish control lines from which to conduct hazard reduction or back-burning operations

The performance of the APZ must be such that:



- There is minimal fine fuel at ground level which could be set alight by a bushfire
- Any vegetation in the firebreak does not provide a path for the transfer of fire to the development – that is, the fuels are discontinuous



**Plate 1** Example defensible space signage

Any areas that are designated Asset Protection Zones, should be delineated by rural fencing, signposted or bollards (whatever is practical in the circumstances) to ensure vegetation creep does not occur and further landowners and ground management are aware that the area is to be maintained for Bush fire protection purposes. Examples are provided **Plate 8**.



**Plate 2** Delineation of APZ and defensible spaces

### 5.11 Defendable space criteria

The intent of a defensible space is to provide fire-fighting service access between the hazard and asset, as well as to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fire fuel. This area also allows airborne embers to fall safely without igniting further outbreaks and provides a safer firefighting position and is operationally important for implementation of clear fire control lines. The performance of the defensible space must be such that:

- There is minimal fine fuel at ground level which could be set alight by a bushfire
- Any vegetation does not provide a path for the transfer of fire to the development – that is, the fuels are discontinuous
- Provide access for emergency services to access between the asset and bush fire threat

The presence of vegetation in the defendable space is acceptable provided that:

- Grasses are generally no higher than 50-75mm.
- As a rule, trees are allowed within a defendable space but only where those trees are at least 5m away from a dwelling and do not touch or overhang any buildings and are located far enough away from any dwelling so that they will not ignite the dwelling by direct flame contact or radiant heat emission.
- Trees are well spread out and do not form a continuous canopy
- Species do not retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period.
- A recommended performance standard for the fuel load of a defendable space is between 0-8 t/ha. Shrubs may occur within a defendable space commensurate with a spatial distribution of 15-20%. For example, an area of 100m<sup>2</sup> (10mx10m) can have up to 20% of this area composed of shrubs.

Woodpiles, wooden sheds, combustible material storage areas, large areas / quantities of garden mulch, stacked flammable building materials etc. are not permitted in the defendable space.

### Legislative basis for maintaining defendable spaces

It should be noted that clearing within the applied defendable spaces may contravene certain provisions of the *Vegetation Management Act 1999* depending on the location of rural residential zone boundaries. The following exemptions apply under *Vegetation Management Act 1999*:

- Exempt firebreak to infrastructure of 1.5 times the canopy height of adjacent vegetation – applies to infrastructure/buildings etc.
- 10 m firebreak on lot boundaries.

Note: These exemptions, whilst applying post approval are assumed by the assessing authority DNRME during the assessment phase.

### Determining appropriate setbacks

Defendable spaces should achieve separation between buildings/structures and hazardous vegetation that results in a known maximum radiant heat flux level at any point on a building or building envelope or lot boundary (BRC, 2019). Furthermore, building-to-building separation distances are important to reduce the likelihood of adjacent buildings igniting if a neighbouring building is already burning.

The proposed panel layout and vegetation mapping indicates two types of vegetation that directly impact the proposed development. To standardise the application of the APZ within the proposed development the following APZ will be applied.

- Where the *Urochloa mozambiquensis* grassland (sabi grass pastures) and Gilgai wetlands are the dominant fire threat a 10m separation will be applied, irrespective of the effective slope being up or down.
- Where *Acacia harpophylla* woodland and fringing woodlands, *Eucalyptus crebra* woodland, *Eucalyptus cambageana* woodland, *Acacia rhodoxylon* woodland, and *Casuarina christata* woodland are the dominant fire threat a 15m separation will be applied, irrespective of the effective slope being up or down.

The internal compound and a 10m APZ shall be established around the BESS and the work compound.

## 5.12 Construction

### Building Construction Requirements

Australian Standard 3959 "Construction of buildings in bushfire-prone areas" provides for six (6) levels of building construction these being BAL - Low, BAL - 12.5, BAL - 19, BAL - 29, BAL - 40 and BAL - FZ. The *Australian Standard 3959:2019 Construction of buildings in bushfire prone areas*.

Any future alterations, extension to structures, even if they are complying, should consider the appropriate bushfire construction standards at that time. time.

### Groundwork and Sub-structure construction phase

During the ground phase potential ignition sources of the subject development may include hot works, incorrect disposal of cigarette butts and hot exhausts from vehicles, electrical failures, and sparks from metal contact.

Groundwork and Sub-structure construction phase fire management plan should be developed. Preparation of the site should include mitigating fire ignition sources. This should include vegetation management such as slashing and mowing long grasses in and around the development site, car parking and access tracks. This is especially important during summer months where Rates of Spread of fire can significantly increase due to the prevailing weather condition.

Handheld fire extinguishers should be carried on each vehicle and on site for quick access and suppression of fires.

Where neither reticulated water nor an existing static water supply is available during the construction phase, a temporary 10,000 litre Static Water Supply within proximity of the development site shall be provided before the commencement of any construction works. This temporary supply will allow for the replenishment of attending fire services which will facilitate the rapid suppression of any potential ignitions. The temporary supply may be removed when the prescribed fire-fighting water supply is installed.

### Ongoing Operations

Routine inspections of bush fire safety systems and equipment should be identified within the Bushfire Emergency Management and Operations Plan and occur annually at a minimum. Ideally these inspections should occur moving out of the colder months in preparation for the bushfire season. The most common types of inspections that are required are surface, near surface (grasses and debris) and elevated (shrub) fire fuel level accumulation in APZs, canopy separation reequipments in APZs, and maintaining building fire hygiene such as cleaning gutters and down pipes.

## 5.13 Access

In the event of a serious bushfire threat to the proposed development, it will be essential to ensure that adequate ingress/egress is provided within the design of the solar farm. Well-designed and located access to and from sites which are at risk of bushfire attack reduces vulnerability by:

- Providing easy and safe movement away from any encroaching fire for both staff and emergency services.
- Providing emergency services with easy access to a safe working area close to assets and water supply to suppress fires and protect property.



- Allowing for alternative safe access and evacuation routes should access in one direction be blocked in the event of a bushfire.
- Providing opportunities to establish control lines from which to conduct hazard reduction or back-burning operations.

Development is to provide safe access and egress routes to the development site, access within the development site through perimeter roads or fire trails, and appropriately designed driveway access.

The site is located with all-weather public roads immediately in and through the site with multiple access points from the public road system. The access to the public road system shall be maintained and operational at all times.

Access to the workshop depot and the BESS shall be provided in accordance with *Fire hydrants are designed and installed in accordance with Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots, Queensland Fire and Emergency Services (2015)* to ensure Category 1 fire appliance can access these locations in the event of a fire.

Acceptable outcome of the Banana Shire Planning Scheme Bushfire overlay requires all other perimeter and internal trails system shall comply with:

- A minimum cleared width of 6m and a minimum formed width of 4m.
- A minimum of 4.8m vertical clearance.
- A cross-fall of no greater than 10 degrees, and
- A maximum gradient of 12.5%, with adequate drainage to prevent soil erosion and minimise ongoing trail maintenance.

## 5.14 Water supply

The intent of water measures is to provide adequate services of water for the protection of structures during and after the passage of a bush fire.

10,000 litre Static Water Supply within proximity of the development, accessible to vehicles and appropriate firefighting fitting shall be provided before the commencement of any construction works.

Acceptable outcome of the Banana Shire Planning Scheme Bushfire overlay requires a 25,000L dedicated static water supply for fire-fighting purposes shall comply with the following criteria:

- Have a minimum pressure and flow of 10 litres a second at 200 kPa;
- Be of concrete construction.
- Have an outlet pipe of 50mm in diameter, fitted with a 50mm male camlock (standard rural fire brigade fitting) and an isolating valve.
- Located > least 9m from any potential fire hazards, such as venting gas bottles and combustible structures and the bushfire threat, and
- Fire trail with ample capacity to support firefighting vehicles within 3m of the static water supply outlet is provided.

Where reticulated water supply is not provided, a static water supply for fire-fighting purposes should be above-ground, accessible, clearly marked and manufactured from concrete or metal. If raised, the tank stand should be made from non-combustible material. These static water supplies (tanks) should be positioned on the non-hazard side of the building and have firefighting fitting/outlet with a ball valve fitted to the outlet within the defensible space. If not appropriate, they should be appropriately shielded to protect the tank and fire

fighters accessing the water. All exposed water pipes, valves, taps and fittings should be metal and the supply line from tank to ball valve have the same bore size.

Where static water supply is provided Figure 10 provides an indication of the type of signage that should be installed at the front gate and at a location that is clearly visible (assume smoke) to approaching emergency services to guide them to the static water supply.



Figure 10 Indication of static water supply signage

## 5.15 Electricity, Gas supplies and Hazardous materials

The intent of electricity, gas and hazardous material measures is to locate these utilities and materials so as not to contribute to the risk of fire to a building.

### Electricity

Location of electricity services should limit the possibility of igniting the surrounding bush land or the fabric of buildings. Where practicable, electrical transmission lines are underground. If overhead, electrical transmission lines are installed with short pole spacing (30m), unless crossing gullies, gorges, or riparian areas, then no part of a tree is closer to a power line than required distances.

### Gas

Any reticulated or bottled gas should be installed and maintained according to the requirements of the relevant authorities and AS/NZS 1596:2014.

All fixed gas cylinders are kept clear of all flammable materials to 10m and shielded on the hazard side. All above-ground pipes and connections to and from gas cylinders are metal, and polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not permitted. Furthermore, if gas cylinders need to be kept close to the building, safety valves are directed away from the building and at least 2m away from any combustible material, so they do not act as a catalyst to combustion.

Gas utilities should be positioned to not impede fire fighters accessing water supplies while undertaking suppression operations.

### Hazardous Materials

Hazardous materials are any materials that can fuel the fire, such as leaf litter, grass, garden mulch and woodpiles. They can also be made up of solid combustibles or flammable liquids and gases such as petrol,

kerosene, alcohol, LPG, natural gas, and acetylene. Vehicle, machinery, and other mechanical equipment that utilise fuels for operations can also be considered hazardous.

The incorrect design and placement of carport and garages in residential developments could propagate fire towards the residential dwelling. Any liquids or fuels that are considered hazardous should be positioned away from the dominant bush fire threat. If located in a building/structure, it should be a minimum of 6m away from any other building. Vegetation surrounding these locations shall be maintained to defensible space standards and the construction standards shall minimise the impact of ember attack to ignite the structure.

## 5.16 Landscaping and Vegetation Management

A combination of hard (materials) and soft (design) landscaping will benefit the survivability of a building during a bushfire event. The type, quantity and condition of fuel has a very important effect on bushfire behaviour in proximity to a building. Poorly located vegetation and landscaping features that burns readily may expose a structure to increased levels of radiant heat and flame contact.

Landscape design and management of potential fuel load is an integral component of the design of new development. Landscape design and management is concerned with avoiding or minimising opportunities for ignition of landscaping features and providing a reduced fuel area which is compatible with the defensible space. Landscaping should be designed and managed to minimise flame contact and radiant heat to buildings and the potential for wind driven embers to cause ignitions.

Therefore, the main criteria for consideration during landscape design is to ensure that landscaping treatments and areas of defensible space do not increase the level of bushfire risk or mechanisms of bushfire attack (direct flame contact, radiant heat, embers attack, and wind) to which people and property are exposed. Defensible spaces need not be 'fuel free' – judicious landscape design ensures a balance between landscape design outcomes and minimising the vulnerability to bushfire attack.

Landscaping treatments are to be supported by management or maintenance arrangements that ensure the fuel load can be practically maintained at or below acceptable levels.

Principles of best practice landscape design and management include:

- Establishing minimal fuel around buildings of a nominal 10 metres.
- Flammable materials should not be touching or be close to vulnerable parts of buildings such as windows, decks and eaves. Such fuels include the following:
  - Flammable shrubs and trees
  - Flammable mulches or fences
  - Trees where the canopy overhangs the building
  - Climbing plants or vines in contact with external timber fascia, pergolas, posts, beams and/or trellis
- Establishing non-flammable features such as fire trails or paths within defensible spaces between the development and bushfire prone areas, constructed of non-combustible materials such as clay, concrete, gravel and pebbles.
- Creating gaps in canopy trees through selective clearing of existing vegetation or planting layout; ensuring tree canopies do not overlap or by creating large gaps between groups or clumps of trees. This measure is designed to reduce the potential spread of crown fires.
- Establishment of lawn substitutes including non-flammable ground covers e.g. decorative stone or gravel.



- Planting or maintaining plant species which minimise leaf litter drop and minimise contribution to the accumulation surface fuel, for example persistent leaf litter.
- Planting or maintaining low-flammability species.
- Planting or maintaining species with attributes which:
  - Reduce the ease of combustion;
  - Minimise contribution to potential fuel load; or
  - Act as a potential barrier, reducing the rate of fire spread.

Landscape management is critical to the long-term success of bushfire protection measures. Landscape management measures which reduce exposure to bushfire attack include:

- Ensuring that street and road verges and nature strips containing hazardous vegetation are regularly pruned, mown, or grazed.
- Removing accumulated leaf litter and woody debris at regular intervals.
- Keeping areas beneath retained or planted trees and shrub cleared of fuel. This may include vegetation management measures such as:
  - Canopy lifting to reduce near surface or ladder fuel loads and reduce flame heights;
  - Clearing of understorey vegetation;
  - Removal of accumulated litter and woody debris removal of loose bark and dead limbs from standing trees
- Regular mowing or slashing of grass to less than 10 centimetres in height.

Where the development involves essential infrastructure, it is designed or located to minimise the likelihood of ignition of hazardous vegetation, so it does not increase the severity or extent of bushfire on people or property on the site or to other properties.

The dimensions and configuration of revegetation or rehabilitation areas should not create an additional bushfire prone area in the future, or alternatively, a landscape maintenance plan should be developed that demonstrates that revegetation and rehabilitation areas are designed and managed to achieve a potential fuel load which is less than eight (8) tonnes/hectare in aggregate and fuel structure which is discontinuous (Patch and corridor filtering rules used to create the state-wide bushfire-prone area mapping should be used to determine if dimensions and configuration of areas designated for revegetation and rehabilitation will not create a bushfire prone area in the future. Guidance on this can be found in Bushfire Resilient Communities, 2019.

A landscaping maintenance schedule within the Bushfire Emergency Management and Operations Plan should be included that includes long term management arrangements that achieve and maintain a potential available fuel load which is less than eight tonnes/hectare in aggregate and has a fuel structure which is discontinuous.

## 5.17 Emergency Management

At risk developments, such as solar farms require a greater degree of planning and coordination to ensure the facility is protected from a wildfire event and does not contribute to wildfire ignition and spread.

The aim of a Bushfire Emergency Management and Operations Plan is to inform and enhance emergency management arrangements prior to and during a bushfire impacting on the site and provide monitoring schedules and treatments of activities that mitigation bushfire risk into perpetuity.

The development of the Bushfire Emergency Management and Operations Plan works should incorporate the information provided through the Bush fire and Natural Hazards Cooperative Research Council (BNHCRC) emergency management research outcomes, Australasian Fire and Emergency Service Authority Council (AFAC) knowledge hub and the Australian Disaster Resilience Handbook Collection.

At a minimum, the Bushfire Emergency Management and Operations Plan should:

- Developed in accordance with AS3745:2010 Planning for emergencies in facilities.
- Development of an Emergency Management Committee with responsibilities for decisions determined.
- Provides decision triggers to inform when to evacuate and all potential evacuation routes.
- An appropriate refuge location should also be considered if bushfire prevents evacuation.
- Consider the amount of travel likely to be generated during an emergency evacuation; the capacity of the broader road network to facilitate safe emergency evacuation; limitations/constraints inherent in the road system; and management of potential traffic conflicts (such as emergency vehicles versus evacuating members of the public).
- Provides guidance on the appropriate management actions during elevation fire danger days.
- Illustrate the Bushfire Protection Measures (location and type of hazard (vegetation), defensible space, access, water, and construction standards) that will be implemented as part of the development to reduce the risk from bushfire to an acceptable level and should be clearly displayed within the property to ensure current occupants are aware of the bush fire risk.
- Compartmentalises the landscape into bushfire management zones with quantifiable bushfire risk treatment identified in each zone.
- Provide landscaping maintenance and monitoring schedules, and triggers to undertake management and maintenance of Bush fire protection measures.

Furthermore, the Bushfire Emergency Management and Operations Plan should provide information that assists in wildfire suppression operations, such as:

- 24/7 emergency contact details including alternative telephone contact.
- Location of site infrastructure and assets.
- Fire-fighting water supply plan.
- Site access and neighbour/ internal road plan.
- Identification of built, natural and cultural assets in and around the site.
- Emergency escape routes, refuges, and location of any nearby Neighbourhood Safer Places.
- Location of hazards (Physical, Chemical and Electrical) that will impact on fire-fighting operations and procedures to manage identified hazards during fire-fighting operations.
- Aviation assets (helipads and aviation water supplies) and risks (powerlines).
- Fire history in and around the site.
- Schedule of on-ground works and review and updating schedule.

## 6 CONCLUSION AND RECOMMENDATIONS

This assessment has been based on the bushfire hazards in and around the site at the time of production (October 2022). It is clear from this investigation and assessment that the site constitutes Bushfire Prone Land.

A BHA accordance with the SPP has been compiled to inform the development of Bushfire Management (Section 5) that is in accordance with the Banana Shire Council Planning Scheme (2021) and SPP guidance.

In summary, the following key recommendations have been generated and applied within the Bush fire Management Plan to enable the proposed development to comply:

### Design and Siting

The development is located and designed to ensure the Workshop buildings and BESS envelopes achieve a radiant heat flux level of less than 12.5 kW/m<sup>2</sup>.

### Separation

The proposed panel layout and vegetation mapping indicates two types of vegetation that directly impact the proposed development. To standardise the application of the APZ within the proposed development the following APZ will be applied.

- Where the *Urochloa mozambiquensis* grassland (sabi grass pastures) and Gilgai wetlands are the dominant fire threat a 10m separation will be applied, irrespective of the effective slope being up or down.
- Where *Acacia harpophylla* woodland and fringing woodlands, *Eucalyptus crebra* woodland, *Eucalyptus cambageana* woodland, *Acacia rhodoxylon* woodland, and *Casuarina christata* woodland are the dominant fire threat a 15m separation will be applied, irrespective of the effective slope being up or down.

The internal compound and a 10m APZ shall be established around the BESS and the work compound.

### Construction

A BAL 12.5 shall be applied to the buildings within the work compound.

### Access

The site is located with all-weather public roads immediately in and through the site with multiple access points from the public road system. These access to the public road system shall be maintained operational at all times

All access trails around the perimeter of the solar panels shall be positioned within the APZ and have a capacity of 16T to service medium rigid fire appliances.

Acceptable outcome of the Banana Shire Planning Scheme Bushfire overlay (Appendix B) requires Perimeter and internal trails system shall comply with:

- A minimum cleared width of 6m and a minimum formed width of 4m.
- A minimum of 4.8m vertical clearance.
- A cross-fall of no greater than 10 degrees, and
- A maximum gradient of 12.5%, with adequate drainage to prevent soil erosion and minimise ongoing trail maintenance.



Access to the workshop depot and the BESS shall be provided in accordance with *Fire hydrants are designed and installed in accordance with Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots, Queensland Fire and Emergency Services (2015)* to ensure Category 1 fire appliance can access these locations in the event of a fire.

## Water

10,000 litre Static Water Supply within proximity of the development, accessible to vehicles and appropriate firefighting fitting shall be provided before the commencement of any construction works.

Acceptable outcome of the Banana Shire Planning Scheme Bushfire overlay (Appendix B) requires a 25,000L dedicated static water supply for fire-fighting purposes shall comply with the following criteria:

- Have a minimum pressure and flow of 10 litres a second at 200 kPa.
- Be of concrete construction.
- Have an outlet pipe of 50mm in diameter, fitted with a 50mm male camlock (standard rural fire brigade fitting) and an isolating valve.
- Located > least 9m from any potential fire hazards, such as venting gas bottles and combustible structures and the bushfire threat.
- Fire trail with ample capacity to support firefighting vehicles within 3m of the static water supply outlet is provided.

## Landscaping and Vegetation Management

The dimensions and configuration of revegetation or rehabilitation areas shall not create an additional bushfire prone area in the future.

A maintenance plan (within the Bushfire Emergency Management and Operations Plan) that stipulates that revegetation and rehabilitation areas are designed and managed to achieve a potential fuel load which is less than 8t/ha in aggregate and discontinuous fuel structure.

## Bushfire Emergency Management and Operations Plan

It is recommended that a Bushfire Emergency Management and Operations Plan (BEMOP) prior to the completion of construction that includes the following elements:

- Developed in accordance with AS3745:2010 Planning for emergencies in facilities.
- Development of an Emergency Management Committee with responsibilities for decisions determined.
- Provides decision triggers to inform when to evacuate and all potential evacuation routes.
- An appropriate refuge location should also be considered if bushfire prevents evacuation.
- Consider the amount of travel likely to be generated during an emergency evacuation; the capacity of the broader road network to facilitate safe emergency evacuation; limitations/constraints inherent in the road system; and management of potential traffic conflicts (such as emergency vehicles versus evacuating staff).
- Provides guidance on the appropriate management actions during elevation fire danger days.
- Compartmentalises the landscape into bushfire management zones with quantifiable bushfire risk treatment identified in each zone.
- Provide monitoring schedules, and triggers to undertake management and maintenance of Bush fire protection measures.

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## Appendix A

### Plates (photographs) and transects

Plates 1 –6 depict the elements in and around the site that are considered within the bush fire hazard assessment (C/o Terra solutions). The classified vegetation, separations, effective and site slope are identified in Section 4, page 13 Bushfire Hazard assessment of this report.



**Plate 3** Remnants of Dawson's gum woodland to open forest



**Plate 4** Derived grasslands from Dawson's gum woodland (exotic grasses)



**Plate 5** Dominant grassland bush fire threat



**Plate 6** Vegetation associated on the rises associated with cleared gilgai lands.





**Plate 7** Example of the *Casuarina christata* woodlands



**Plate 8** Example of the brigalow and belah riparian woodland

## Appendix B

# Acceptable outcomes to banana shire council planning scheme bushfire overlay

**Table 7 Compliance with planning scheme provisions**

Performance Outcome	Acceptable Outcome	Compliance
<b>Benchmarks for accepted and assessable development</b>		
<b>PO1 – PO9 Are concerning subdivision which are not assessed for this project</b>		
<p><b>PO10</b> Site layout achieve an acceptable or tolerable risk to people. Landscape or open space provided as part of the development: (a) acts as a buffer between hazardous vegetation and development; and (b) does not create additional bushfire prone areas. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.</p>	<p><b>AO10.1</b> Site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas. <b>AO10.2</b> This landscaping and open space comprises protective landscape treatments that: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens; or (b) are designed to ensure a potential available fuel load is maintained at less than 8 tonnes/hectare in aggregate and that fuel structure remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.</p>	<p>Assessment process in accordance with BRC has been completed to determine the open spaces between the bushfire hazard and development. The separations (APZ) are illustrated on Figure 2.</p> <p>The proposed panel layout and vegetation mapping indicates two types of vegetation that directly impact the proposed development. To standardise the application of the APZ within the proposed development the following APZ will be applied.</p> <p>Where the <i>Urochloa mozambiquensis</i> grassland (sabi grass pastures) and Gilgai wetlands are the dominant fire threat a 10m separation will be applied, irrespective of the effective slop being up or down.</p> <p>Where Acacia harpophylla woodland and fringing woodlands, <i>Eucalyptus crebra</i> woodland, <i>Eucalyptus cambageana</i> woodland, <i>Acacia rhodoxylun</i> woodland, and <i>Casuarina christata</i> woodland are the dominant fire threat a 15m separation will be applied, irrespective of the effective slop being up or down.</p> <p>The internal compound and a 10m APZ shall be established around the BESS and the work compound.</p>
<p><b>PO11</b> The development establishes evacuation areas, to achieve an acceptable or tolerable risk to people.</p>	<p><b>AO11</b> If in an isolated location, development establishes direct access to a safe assembly/evacuation area.</p>	<p>The development provides 13 access points to the public road system that can be use by responding fire services and evacuating staff.</p>



Performance Outcome	Acceptable Outcome	Compliance
<b>Benchmarks for accepted and assessable development</b>		
	Note – Guidance on identifying safe evacuation areas is contained in the QFES Bushfire resilient communities document.	
<p><b>PO12</b> If on a lot of over 2000m<sup>2</sup>, where involving a new premises or an existing premises with an increase in development footprint, development:</p> <p>(a) locates occupied areas as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and</p> <p>(b) ensures vehicular access is located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions.</p>	<p><b>AO12</b> No acceptable outcome is prescribed.</p>	<p><b>N/A</b> No Class 1-4 building (occupied overnight building) is not proposed.</p>
<p><b>PO13</b> Development is located within a reticulated water supply area or includes a dedicated static water supply that is available solely for fire-fighting purposes and can be accessed by fire-fighting vehicles.</p> <p>Note – Swimming pools, farm ponds and dams are not considered reliable sources of static water supply in Queensland due to regular drought events.</p> <p>[Note for Local Government – Information on how to provide an appropriate static water supply, may form a condition of a development approval. For further information on preferred solutions refer to the QFES Bushfire resilient communities document.]</p>	<p><b>AO13</b> No acceptable outcome is prescribed.</p>	<p>In accordance with the Banana Shire planning scheme a 25,000L dedicated static water supply for fire-fighting purposes shall comply with the following criteria:</p> <ul style="list-style-type: none"> <li>▪ Have a minimum pressure and flow of 10 litres a second at 200 kPa;</li> <li>▪ Be of concrete construction.</li> <li>▪ Have an outlet pipe of 50mm in diameter, fitted with a 50mm male camlock (standard rural fire brigade fitting) and an isolating valve.</li> <li>▪ Located &gt; least 9m from any potential fire hazards, such as venting gas bottles and combustible structures and the bushfire threat, and</li> <li>▪ Fire trail with ample capacity to support firefighting vehicles within 3m of the static water supply outlet is provided.</li> </ul>



Performance Outcome	Acceptable Outcome	Compliance
<b>Benchmarks for accepted and assessable development</b>		
<p><b>PO14</b>            Vulnerable uses listed in Table 7 of SPP Natural hazards, risk and resilience - Bushfire or are not established or intensified within a bushfire prone area unless:            (a) there is an overriding need in the public interest for the new or expanded service the development provides; and            (b) there are no other suitable alternative locations within the required catchment; and            c) site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structures.            Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this performance outcome</p>	<p><b>AO14</b>            No acceptable outcome is prescribed.</p>	<p><b>N/A</b>            The proposal is not a vulnerable identified in Table 7 of SPP Natural hazards, risk and resilience – Bushfire.</p>
<p><b>PO15</b>            Community infrastructure providing essential services listed in Table 7 of SPP Natural hazards, risk and resilience - Bushfire are not established within a bushfire prone area unless:            (a) there is an overriding need in the public interest for the new or expanded service the development provides (for example, there are no other suitable alternative locations that can deliver the required level of service or meet emergency service response times during and immediately after a bushfire event); and            (b) the infrastructure can function effectively during and immediately after a bushfire event.            Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this performance outcome.</p>	<p><b>AO15</b>            No acceptable outcome is prescribed.</p>	<p><b>N/A</b>            The proposal is not a vulnerable identified in Table 7 of SPP Natural hazards, risk and resilience – Bushfire.</p>

Performance Outcome	Acceptable Outcome	Compliance
<b>Benchmarks for accepted and assessable development</b>		
<p><b>PO16</b> Development avoids or mitigates the risks to public safety and the environment from the manufacture or storage of materials listed in Table 7 of SPP Natural hazards, risk and resilience - Bushfire that are hazardous in the context of bushfire to an acceptable or tolerable level.</p> <p>Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this acceptable outcome.</p> <p>Editor's note – In addition to the requirements of this code the Work Health and Safety Act 2011 and associated Regulation and Guidelines, the Environmental Protection Act 1994 and the relevant building assessment provisions under the Building Act 1975 contain requirements for the manufacture and storage of hazardous substances. Information is provided by Business Queensland on the requirements for storing and transporting hazardous chemicals, available at: <a href="http://www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting">www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting</a>.</p>	<p><b>AO16</b> No acceptable outcome is prescribed.</p>	<p><b>N/A</b> The proposal does not propose that hazardous materials that are present in the quantities identified in the Work Health and Safety Regulation, schedule 15.</p>
<p><b>PO17</b> Asset protection zones are designed and managed to ensure they do not increase the potential for bushfire hazard.</p> <p>Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this performance outcome.</p>	<p><b>AO17.1</b> Landscaping treatments within any asset protection zone comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.</p> <p>Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.</p> <p>OR</p>	<p>Refer to PO10.</p>

Performance Outcome	Acceptable Outcome	Compliance
<b>Benchmarks for accepted and assessable development</b>		
	<p><b>AO17.2</b>            Landscaping management within any asset protection zone maintains a:            (a) potential available fuel load which is less than eight tonnes/hectare in aggregate; and            (b) fuel structure which is discontinuous.            Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this acceptable outcome.</p>	
<p><b>PO18</b>            Revegetation or rehabilitation areas are designed and managed to ensure they do not result in an unacceptable level of risk or an increase in bushfire intensity level.            Note – The undertaking of a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this performance outcome.</p>	<p><b>AO18.1</b>            Required revegetation or rehabilitation:            (a) is located outside of any asset protection zone; or            (b) maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate and fuel structure which is discontinuous.            Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with acceptable outcome (b).  <b>AO18.2</b>            Revegetation or rehabilitation of areas located within mapped medium, high or very high potential bushfire intensity areas, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load.            OR            Revegetation or rehabilitation of areas located within the mapped potential impact buffer area, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load.</p>	<p>No rehabilitation areas are being proposed.</p>

Performance Outcome	Acceptable Outcome	Compliance
<b>Benchmarks for accepted and assessable development</b>		
	<p>Note – The preparation of a vegetation management plan undertaken in accordance with the methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this acceptable outcome.</p>	

Performance Outcome	Acceptable Outcome	Compliance
<b>Benchmarks for accepted and assessable development</b>		
<p><b>PO52</b> Development avoids any areas mapped on Overlay Maps OM-0301 - OM-0304 as a Bushfire Prone Area, does not increase the extent or severity of bushfire or exposure to the identified risk, taking into consideration:</p> <ul style="list-style-type: none"> <li>(a) vegetation type;</li> <li>(b) slope;</li> <li>(c) aspect;</li> <li>(d) bushfire history;</li> <li>(e) ecological values of the site;</li> <li>(f) ongoing maintenance; and</li> <li>(g) on-site and off-site fire hazard implications;</li> </ul>	<p><b>AO16.1</b> Development does not occur in areas mapped on Overlay Maps OM-0301 - OM-0304 as a Bushfire Prone Area;</p> <p>or</p> <p><b>AO16.2</b> A written assessment by an experienced or qualified bushfire management consultant confirms that the site is not a Bushfire Prone Area as mapped on Overlay Maps OM-0301 - OM-0304;</p> <p>or</p> <p><b>AO16.3</b> Except for residential dwelling classes, development in areas mapped on Overlay Maps OM-0301- OM-0304 as Medium Potential Bushfire Intensity Areas or Potential Impact Buffer Area complies with an approved Bushfire Management Plan incorporating:</p> <ul style="list-style-type: none"> <li>(a) lot design and the siting of buildings and uses such that:               <ul style="list-style-type: none"> <li>(i) high intensity uses are located on the least bushfire prone area on the site and activities least susceptible to fire are sited closest to the bushfire hazard;</li> <li>(ii) efficient emergency access is optimised;</li> </ul> </li> </ul>	<p><b>AO16.3</b> Bushfire risk and site layout has considered aspect, elevation, slope and vegetation.</p> <p>The proposal will apply perimeter APZ (10 and 15m width) supported by fire trails (forming a fire break and firefighting access within the development) and ongoing maintenance through the establishment of a Bushfire Emergency Management and Operations Plan</p> <p>The work compound and BESS are in low hazardous areas, away from high intensity bushfire areas.</p>



	<ul style="list-style-type: none"> <li>(iii) bushfire risk is effectively minimised having regard to aspect, elevation, slope and vegetation;</li> <li>(b) firebreaks that provide adequate:             <ul style="list-style-type: none"> <li>(i) setbacks between buildings/ structures and hazardous vegetation;</li> <li>(ii) access for fire-fighting or other emergency vehicles;</li> </ul> </li> <li>(c) provision for water supply dedicated to fire-fighting purposes;</li> <li>(d) the required extent of vegetation clearing and landscaping and where required modified development design and/or lot layout to minimise clearing of regulated vegetation and impacts on matters of environmental significance;</li> <li>(e) landscaping species that are less likely to exacerbate a bushfire event;</li> </ul>	
<p><b>PO53</b> Essential community infrastructure in any area mapped on Overlay Maps OM-0301 - OM-0304 as a Bushfire Prone Area is able to function effectively during and immediately after bushfire events.</p>	<p><b>AO16.4</b> No hazardous materials, manufactured or stored in bulk, are on land mapped on Overlay Maps OM-0301 - OM-0304 as a Bushfire Prone Area.</p>	<p>No hazardous materials, manufactured or stored in bulk, are on land mapped on Overlay Maps OM-0301 - OM-0304 as a Bushfire Prone Area</p>
<p><b>PO54</b> Public safety and the environment are not adversely affected by the detrimental impacts of bushfire on hazardous materials manufactured or stored in bulk</p>	<p><b>AO16.5</b> New dwellings on land mapped on Overlay Maps OM-0301 - OM-0304 as a Bushfire Prone Area are:</p> <ul style="list-style-type: none"> <li>(a) located centrally within existing cleared areas on a lot which allows a regular shaped area (with a minimum dimension of 50m) of 5,000m<sup>2</sup> to be identified that:             <ul style="list-style-type: none"> <li>(i) is free of highly combustible vegetated areas; and</li> <li>(ii) is on southerly to easterly facing slopes not exceeding 15% gradient; or</li> <li>(iii) on flat lands at the base of north to western facing slopes not exceeding 15% gradient</li> </ul> </li> <li>(b) provided with a fire protection buffer around the complete perimeter of the dwelling unit for a minimum width of 50m;</li> </ul>	<p>No dwelling proposed.</p>
<p><b>PO55</b> Adequate water storage is provided for firefighting purposes that is safely</p>	<p><b>AO16.6</b></p>	<p>A 25,000L dedicated static water supply for fire-fighting purposes shall comply with the following criteria:</p>

<p>located, accessible at all times and fitted with the standard rural fire brigade fittings.</p>	<p>Where a reticulated water supply is not available, water supply tanks are provided for fire-fighting purposes within the development. The water tanks must:</p> <ul style="list-style-type: none"> <li>(a) have 25,000 litres dedicated for fire-fighting purposes;</li> <li>(b) have a minimum pressure and flow of 10 litres a second at 200 kPa;</li> <li>(c) be of concrete construction;</li> <li>(d) have an outlet pipe of 50mm in diameter, fitted with a 50mm male camlock (standard rural fire brigade fitting) and an isolating valve;</li> </ul> <p><b>AO16.7</b> The water supply outlet is located at least 9m from any potential fire hazards, such as venting gas bottles and combustible structures</p> <p><b>AO16.8</b> A safe and accessible hard stand area capable of accommodating a fire fighting vehicle is provided not more than 3m from the water supply outlet.</p>	<ul style="list-style-type: none"> <li>▪ Have a minimum pressure and flow of 10 litres a second at 200 kPa;</li> <li>▪ Be of concrete construction.</li> <li>▪ Have an outlet pipe of 50mm in diameter, fitted with a 50mm male camlock (standard rural fire brigade fitting) and an isolating valve.</li> <li>▪ Located &gt; least 9m from any potential fire hazards, such as venting gas bottles and combustible structures and the bushfire threat, and</li> <li>▪ Fire trail with ample capacity to support firefighting vehicles within 3m of the static water supply outlet is provided.</li> </ul>
<p><b>PO56</b> Bushfire hazard mitigation avoids impacts on matters of environmental significance such as fragmentation, habitat loss and edge effects.</p>	<p><b>AO16.9</b> Development includes road access for fire-fighting appliances that has:</p> <ul style="list-style-type: none"> <li>(a) a minimum cleared width of 6m and a minimum formed width of 4m;</li> <li>(b) a minimum of 4.8m vertical clearance;</li> <li>(c) a cross-fall of no greater than 10 degrees;</li> <li>(d) a maximum gradient of 12.5%, with adequate drainage to prevent soil erosion and minimise ongoing trail maintenance; and</li> </ul> <p><b>AO16.10</b> Essential community infrastructure is not located on land identified on Overlay Maps OM-0301 -OM-0304 as Very High to Medium Potential Intensity Areas.</p>	<p>The proposal is not considered essential community infrastructure.</p> <p>Perimeter and internal trails system shall comply with:</p> <ul style="list-style-type: none"> <li>▪ A minimum cleared width of 6m and a minimum formed width of 4m.</li> <li>▪ A minimum of 4.8m vertical clearance.</li> <li>▪ A cross-fall of no greater than 10 degrees, and</li> <li>▪ A maximum gradient of 12.5%, with adequate drainage to prevent soil erosion and minimise ongoing trail maintenance.</li> </ul>

## Appendix C

### SPP bush fire modelled separation outputs

**REPORT**

SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	31.4 Mixed open forblands to tussock grasslands in inland locations
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	10.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	0.60
NEAR SURFACE FUEL LOAD	-	t/ha	2.10
BARK FUEL LOAD	-	t/ha	0.10
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	2.80
TOTAL SURFACE FUEL LOAD	w	t/ha	0.00
POTENTIAL FIRE LINE INTENSITY	I	kW/m	0
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	0.00
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL-LOW

DISCLAIMER: Fire-line intensity and radiant heat calculations where effective slope exceeds 20 degrees (downslope) or 15 degrees (upslope) may be unreliable. In these locations, specialist assessment is warranted.

SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	34.5 Sedgeland dominated wetlands
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	10.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	3.00
NEAR SURFACE FUEL LOAD	-	t/ha	5.00
BARK FUEL LOAD	-	t/ha	5.00
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	13.00
TOTAL SURFACE FUEL LOAD	w	t/ha	8.00
POTENTIAL FIRE LINE INTENSITY	I	kW/m	26824
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	27.00
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	12.2 Dry eucalypt woodlands on sandstone and shallow soils
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	15.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	12.00
NEAR SURFACE FUEL LOAD	-	t/ha	2.60
BARK FUEL LOAD	-	t/ha	1.80
ELEVATED FUEL LOAD	-	t/ha	1.00
TOTAL OVERALL FUEL LOAD	W	t/ha	17.40
TOTAL SURFACE FUEL LOAD	w	t/ha	14.60
POTENTIAL FIRE LINE INTENSITY	I	kW/m	14900
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	26.81
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	12.2 Dry eucalypt woodlands on sandstone and shallow soils
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Upslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	11.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	12.00
NEAR SURFACE FUEL LOAD	-	t/ha	2.60
BARK FUEL LOAD	-	t/ha	1.80
ELEVATED FUEL LOAD	-	t/ha	1.00
TOTAL OVERALL FUEL LOAD	W	t/ha	17.40
TOTAL SURFACE FUEL LOAD	w	t/ha	14.60
POTENTIAL FIRE LINE INTENSITY	I	kW/m	10553
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	28.12
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	25.1 Brigalow belah open forests on heavy clay soils
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Upslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	13.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	10.50
NEAR SURFACE FUEL LOAD	-	t/ha	2.60
BARK FUEL LOAD	-	t/ha	1.90
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	15.00
TOTAL SURFACE FUEL LOAD	w	t/ha	13.10
POTENTIAL FIRE LINE INTENSITY	I	kW/m	54838
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	28.47
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	25.1 Brigalow belah open forests on heavy clay soils
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	15.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	10.50
NEAR SURFACE FUEL LOAD	-	t/ha	2.60
BARK FUEL LOAD	-	t/ha	1.90
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	15.00
TOTAL SURFACE FUEL LOAD	w	t/ha	13.10
POTENTIAL FIRE LINE INTENSITY	I	kW/m	77431
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	28.66
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	25.2 Brigalow belah woodlands on heavy clay soils
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Upslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	10.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	3.40
NEAR SURFACE FUEL LOAD	-	t/ha	2.10
BARK FUEL LOAD	-	t/ha	0.70
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	6.20
TOTAL SURFACE FUEL LOAD	w	t/ha	5.50
POTENTIAL FIRE LINE INTENSITY	I	kW/m	22667
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	25.01
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC	-	25.2 Brigalow belah woodlands on heavy clay soils
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	11.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	3.40
NEAR SURFACE FUEL LOAD	-	t/ha	2.10
BARK FUEL LOAD	-	t/ha	0.70
ELEVATED FUEL LOAD	-	t/ha	0.00
TOTAL OVERALL FUEL LOAD	W	t/ha	6.20
TOTAL SURFACE FUEL LOAD	w	t/ha	5.50
POTENTIAL FIRE LINE INTENSITY	I	kW/m	32005
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	26.51
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC		13.2 Dry to moist eucalypt woodlands on undulating metamorphics and granite
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Upslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	10.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	9.40
NEAR SURFACE FUEL LOAD	-	t/ha	3.40
BARK FUEL LOAD	-	t/ha	0.60
ELEVATED FUEL LOAD	-	t/ha	1.00
TOTAL OVERALL FUEL LOAD	W	t/ha	14.40
TOTAL SURFACE FUEL LOAD	w	t/ha	12.80
POTENTIAL FIRE LINE INTENSITY	I	kW/m	7657
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	26.93
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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SPP Bushfire Separation Distance Calculator			
VARIABLE DESCRIPTION	VARIABLE	UNITS	VALUE
<i>Input Values</i>			
FIRE WEATHER SEVERITY	FDI		67.00
VEGETATION HAZARD CLASS	VHC		13.2 Dry to moist eucalypt woodlands on undulating metamorphics and granite
REMNANT STATUS	-	-	Remnant
SLOPE TYPE (UPSLOPE OR DOWNSLOPE)	ST	-	Downslope
EFFECTIVE SLOPE UNDER THE HAZARDOUS VEGETATION	eSlope	degrees	5.00
SLOPE BETWEEN SITE AND HAZARDOUS VEGETATION	$\theta$	degrees	5.00
DISTANCE OF THE SITE FROM HAZARDOUS VEGETATION	d	m	13.00
<i>Output Values</i>			
SURFACE FUEL LOAD	-	t/ha	9.40
NEAR SURFACE FUEL LOAD	-	t/ha	3.40
BARK FUEL LOAD	-	t/ha	0.60
ELEVATED FUEL LOAD	-	t/ha	1.00
TOTAL OVERALL FUEL LOAD	W	t/ha	14.40
TOTAL SURFACE FUEL LOAD	w	t/ha	12.80
POTENTIAL FIRE LINE INTENSITY	I	kW/m	10811
RADIANT HEAT FLUX	q	kW/m <sup>2</sup>	27.13
BUSHFIRE ATTACK LEVEL (AS 3959-2009)	BAL	-	BAL 29

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