Attexo
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Appendix M

Bushfire Hazard Assessment and Management Plan

BUSHFIRE HAZARD ASSESSMENT AND MANAGEMENT PLAN

SGP North Solar Farm Project, Kowguran

PREPARED FOR
ARROW ENERGY PTY LTD

February 2025

Meridian Urban

BUSHFIRE PLANNING



QUALITY STATEMENT

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Member Planning Institute of Australia
Member Fire Protection Association of Australia
Member International Association of Wildland Fire
Member Natural Hazard Mitigation Association (USA)
Member of Association of Fire Ecology

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This report is prepared for the benefit of the named Client only. No third party may rely upon any advice or work completed by Meridian Urban in relation to the services, including this report, except to the extent expressly agreed in writing by Meridian Urban.

It is acknowledged and agreed that the site may be subject to a degree of bushfire hazard. The client acknowledges and agrees that Meridian Urban has not created or contributed to the creation or existence of this hazard and the Client indemnifies Meridian Urban for claims arising out of or resulting from a bushfire event except to the extent attributable to the negligence of Meridian Urban.

The Client agrees that the Consultant shall have no liability in respect of any damage or loss incurred as a result of bushfire.

Arrow Energy Pty Ltd

SGP North Solar Farm Project, Kowguran

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1 Introduction

Meridian Urban has been commissioned by Arrow Energy Pty Ltd C/- Attexo to provide a bushfire hazard assessment and associated management plan for the proposed SGP North Solar Farm at Kowguran.

This report accompanies a Development Application made under the Western Downs Planning Scheme which seeks approval for a Development Permit for a Material Change of Use for a Renewable Energy Facility.

The project area (shown at **Figure 1**) is mapped as subject to potential bushfire hazard in the Western Downs Planning Scheme Bushfire Overlay Map. It is also identified in the State-wide bushfire prone areas mapping in the State Planning Policy.

This bushfire hazard assessment and management plan has been prepared in accordance with the provisions of the Western Downs Planning Scheme and the provisions of the Natural hazards, risk and resilience (bushfire) State interest of the State Planning Policy 2017, including the compendium Bushfire Resilient Communities technical reference guide prepared by the former Queensland Fire and Emergency Services (QFES), now Queensland Fire Department (QFD).

This assessment aims to consider, and where necessary, mitigate the risk to life and property from potential bushfire threat, as well as ignition risk, and the impact of bushfire attack which includes:

- Direct flame contact
- Ember and firebrand attack
- Radiant heat
- Fire-driven wind.

Building and infrastructure damage is typically associated with one or more forms of bushfire attack. Danger to human life is also associated with these forms of bushfire attack in addition to smoke emission which is a relevant consideration for firefighting services attending the site in the event of bushfire.

This assessment does not seek to remove any threat of bushfire risk, but provide detailed siting, layout, building and / or servicing information to assist the ability of the applicant(s) to manage the threat of this risk. This assessment report is prepared in accordance with best practice industry standards as applicable in Queensland and pursuant to both State and local government bushfire hazard policies and guidelines.

1.1 Summary of Site Details

Site Address	Retreat Road, Kowguran
RP Description	Lot 17 on AU199 (shown in red in **Figure 1**)
Lot Area	491.2ha
Development Area	Approx. 62ha
Local Government	Western Downs Regional Council
Tenure	Freehold
Current Land Use	Vacant
Proposed Land Use	Solar Farm (critical infrastructure)
Local Brigade	Miles Fire Station

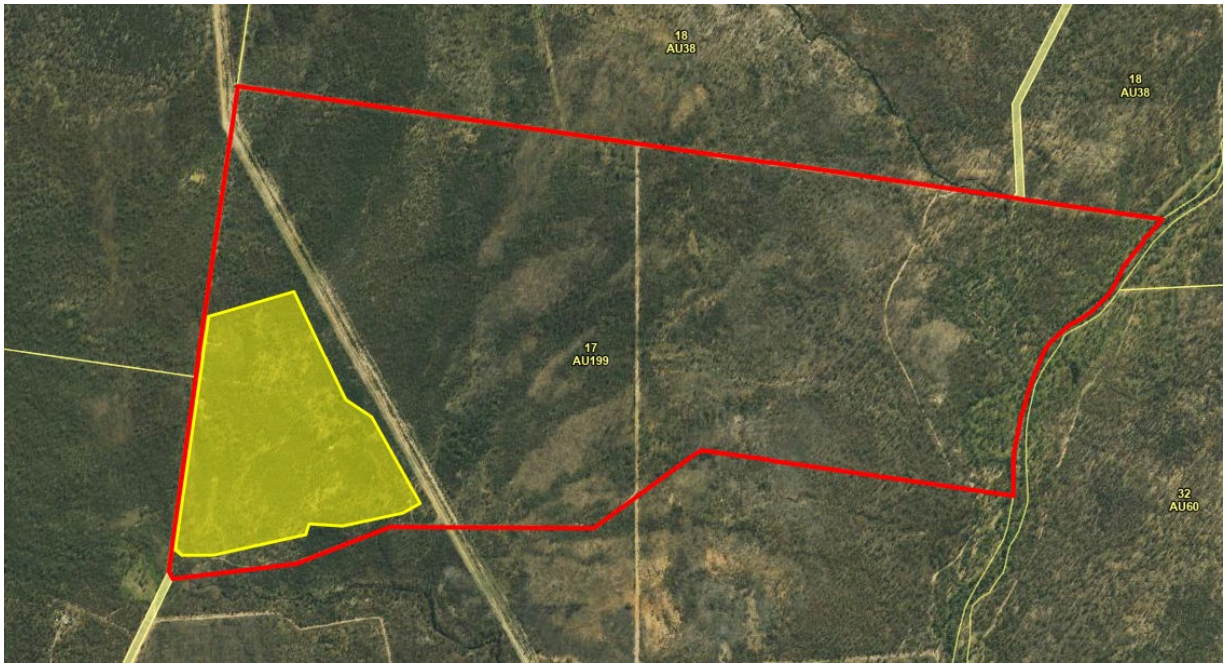


Figure 1 - The Site

*Approximate extent of the development area / project footprint shown as yellow

2 Site and Locality Context

The proposed development site is located within the locality of Kowguran, approximately 18km north of the township of Miles. It is formally described as Lot 17 on AU199. Lot 17 is one of four lots that make up the Girrawheen Station, which was purchased by Arrow Energy in 2012.

Vehicular access to the site is via Retreat Road to the south-west of the site. There is a road reserve to the south-western corner of the site, however this currently does not include a formed road to the site.

The development site forms the south-western corner of Lot 17 on AU199. It is bound to the west and south by the property boundary and the east by two gas pipeline easements, with a combined width of approximately 80m.

The site is currently unoccupied and is largely vegetated both within the site and beyond with a mix of remnant and regrowth vegetation.

The project site is currently zoned Rural in the Western Downs Planning Scheme. The land surrounding the site supports rural and agricultural land uses.

It is predominantly flat, sloping very gently towards Bottle Creek in the east.

Refer to **Figure 2** below for the context of the development site.

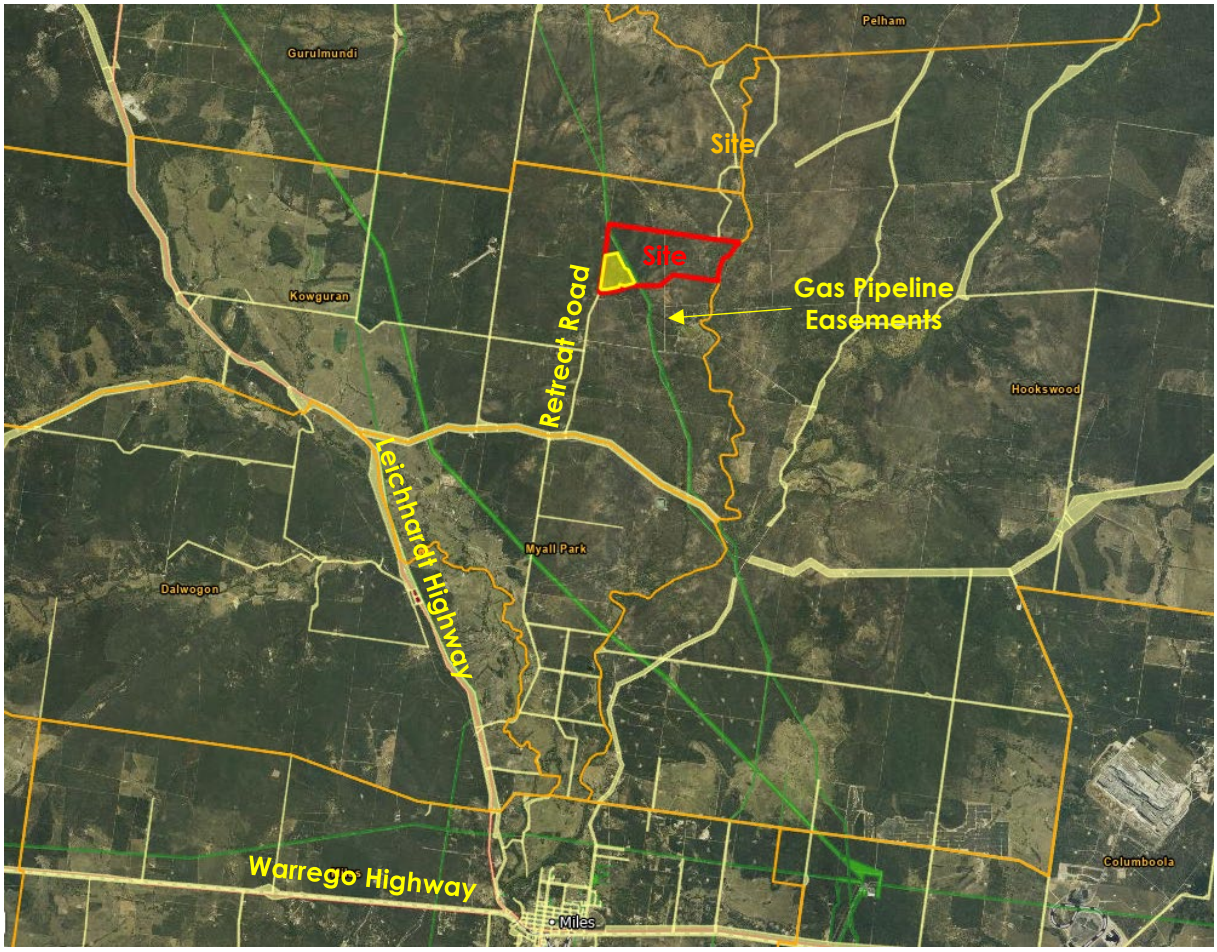


Figure 2 - Landscape-scale context of the locality
(Source: Qld Globe, 2025)

3 Proposed Development

Arrow Energy Pty Ltd (Arrow) is proposing to develop the SGP North Solar Farm (the Project) as part of the broader development of a hybrid power facility (not part of this application). The power facility will supply power to the SGP North Field Compression Station.

The hybrid power facility will comprise:

- Gas reciprocating engines, a battery energy storage system (BESS) and associated infrastructure to be located on adjoining lot being Lot 16 on Plan AU38.
- The solar farm and associated power conversion systems (PCS) located on Lot 17 on Plan AU199 (the subject land). The solar farm will be connected to the main power facility via an 11 kV high voltage transmission line (underground or overhead), which will be incorporated into the gas gathering network. The transmission line will be ancillary to the solar farm.

The solar farm and hybrid power facility form part of the Surat Gas Project North (SGP North) development.

The hybrid power facility and transmission line do not form part of this application and have not been considered in this bushfire assessment.

It is intended that the solar farm will be operated by a third party provider.

The proposal involves the development of a 17 MWp solar farm over approximately 62 ha comprising:

- approximately 30,000 individual solar panels on single axis tracker mounting systems
- three modular power conversion station (PCS) container units enclosing inverters, transformers and switchgear (shown as 'transformers' on development plans)
- an 11 kilovolt (kV) high voltage (HV) transmission line
- underground cabling connecting solar arrays ('strings') to inverter stations
- two meteorological stations for recording meteorological data to track performance and monitor Project Site conditions
- formalisation of site access from Retreat Road, and construction of an access road on the western Site boundary
- two construction laydown areas, a construction carpark, and water storage tank
- internal perimeter road
- bushfire asset protection zone (APZ) (as per the recommendations of this report)
- perimeter fencing.

The proposed site plan is shown in **Figure 3.**

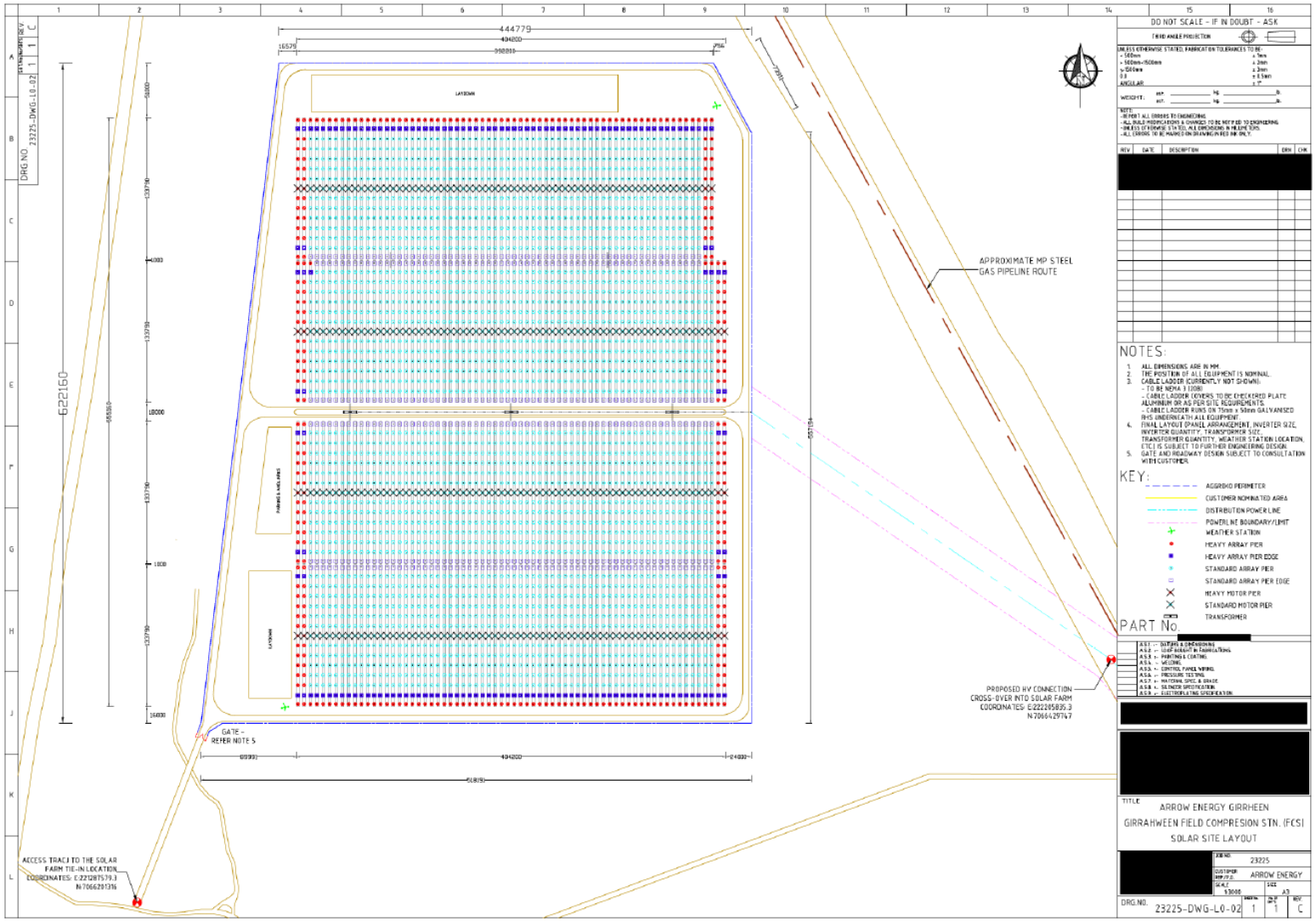


Figure 3 - Proposed Site Plan

4 Understanding Bushfire Hazard

Bushfires have long remained a fundamental characteristic of the Australian bush landscape. There remains a number of common factors which are associated with bushfire events, and these include the incidence of fire weather, availability of fuel along with its type, structure and continuity or fragmentation, and development at urban / bushland interface.

4.1 Bushfire Attack

Bushfire attack refers to the various methods in which bushfire may impact upon life and property and principally encompasses:

- Direct flame contact
- Ember and firebrand attack
- Radiant heat flux
- Fire-driven wind
- Smoke.

During the progression of a bushfire event, these methods either exclusively or in concert interact **(Figure 4)**. It is estimated that approximately 80 to 90 per cent of buildings located within 100m of the bushland interface are lost to bushfire, hence the relevance of statutory provisions and recommendations implemented across Australia which respond to various types of buildings within 100m of adjacent classifiable vegetation.

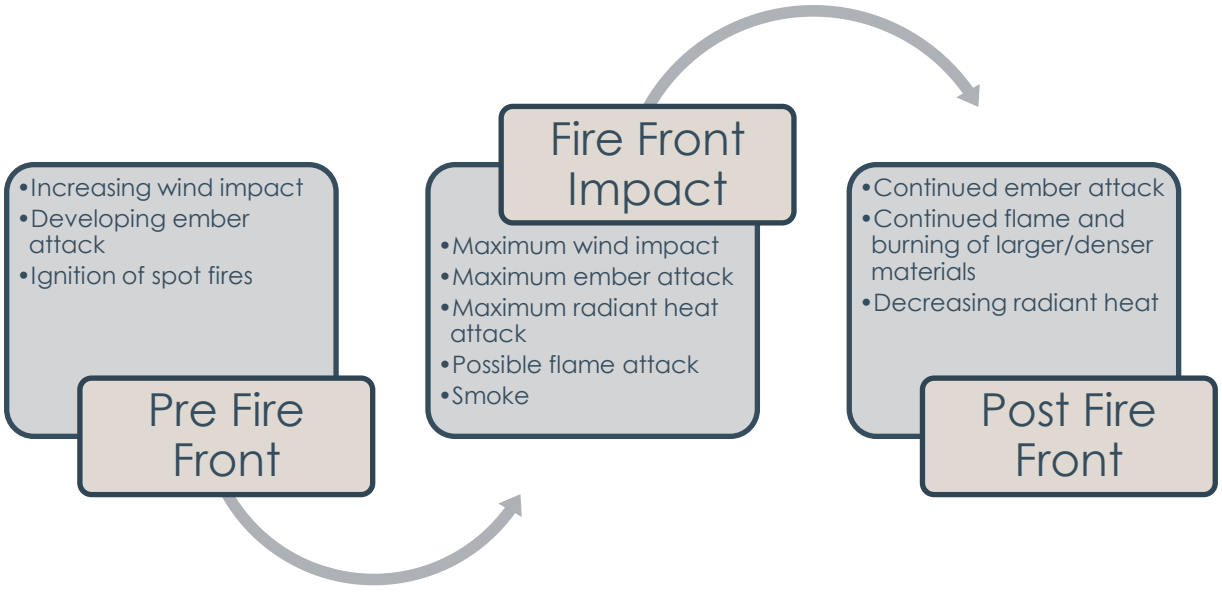


Figure 4 – The Typical Phases of Bushfire Attack

(Derived from Ramsay & Rudolph, 2003)

4.1.1 Direct Flame Contact

Direct flame attack refers to flame contact from the main fire front, where the flame which engulfs burning vegetation is one and the same as that which assumes contact with the building. It is estimated that only 10 to 20 per cent of buildings lost to bushfire occur as a direct result of flame attack.

4.1.2 Ember and Firebrand Attack

The convective forces of bushfire raise burning embers into the atmosphere on prevailing winds and deposit them to the ground ahead of the fire front. Typically, ember attack occurs approximately 30 minutes prior to the arrival of the fire front and continues during the impact of the fire front and for several hours afterwards, thus it is the longest lasting impact of bushfire attack. Firebrands occur in a very similar manner but relate to larger items of debris that may still be carried by the wind when alight, such as candle and ribbon barks.

In essence, building loss via ember attack relates largely to the vulnerabilities and peculiarities of each building, its distance from the classifiable vegetation and whether an occupant (or the like) is present to actively defend it. It is estimated by the CSIRO that approximately 80 to 90 per cent of buildings lost by bushfire are lost as a result of ember attack either in isolation or in combination with radiant heat impact.

Infrastructure is typically less vulnerable to the impact of ember attack than other land uses.

4.1.3 Radiant Heat Flux

Exposure to radiant heat remains one of the leading threats to infrastructure assets associated with bushfire events (**Figure 5)**. Measured in kilowatts per m², radiant heat is the heat energy released from the fire front which radiates to the surrounding environment, deteriorating rapidly over distance. Radiant heat can pre-heat materials making them more susceptible to ignition, or can cause non-piloted ignition of certain materials if the energy transmitted reaches a threshold level. Radiant heat can also damage building materials, reducing the ability for the structure or asset to withstand.

Radiant heat flux (kW/m²)	Potential effects
Greater than 40	• unpiloted ignition of timber walls and fences • direct flame contact likely • extreme levels of radiant heat
29–40	• failure of toughened glass • direct flame contact possible, extreme levels of radiant heat • unpiloted ignition of some timber species after prolonged exposure (e.g. several minutes)[29]
19	• failure of screened float glass
16	• blistering of skin with > 5 seconds exposure
12.5	• failure of plain glass • piloted ignition of dry timber elements after prolonged exposure (e.g. several minutes)[30]
10	• fabrics inside a building could ignite spontaneously with long exposure • critical limit for emergency services – firefighters cannot operate • life threatening with < 1 minute exposure in protective clothing.
7	• fatal to an unprotected person after exposure for several minutes
4.7	• firefighter in protective clothing will feel pain (60 seconds exposure)
3	• firefighters can operate for a short period (10 minutes)
2	• pain is felt on bare skin after 1 minute exposure (non-fatal) • firefighters with protective clothing can withstand this exposure level for a few minutes however, they are likely to experience rise in core body temperature
1	• maximum for indefinite skin exposure
0.5	• direct sunlight at noon on a bright sunny day

Figure 5 – The Effects of Radiant Heat

(Source: Queensland Fire and Emergency Services, 2019)

4.1.4 Fire Driven Wind

The convective forces of bushfire typically result in strong to gale force fire-driven winds, which in itself can lead to damage. The typical effects of fire driven wind include the conveyance of embers, damage from branches and debris hitting the assets, as well as direct damage to vulnerable components.

4.1.5 Smoke

Smoke emission remains a secondary effect of bushfire and is one which is typically not addressed by bushfire hazard assessment. Irrespective, it is important to note the potentially severe impact of smoke emission on the human respiratory system. It can lead to difficulties in breathing, severe coughing, blurred or otherwise compromised vision, and can prove fatal. It is also important to note that toxic smoke can occur during bushfire, particularly where buildings or materials are ignited.

4.2 Vegetation Communities

Fuel load and arrangement represents a considerable component in dictating to a large degree the behaviour of fire in terms of intensity, rate of spread and flame height, and typically relates to dead plant material less than 6mm thick, and live plant material thinner than 3mm. On this basis, it stands to reason that different vegetation groups yield very different fire behaviour and intensity by virtue of their characteristics and fuel load output. The characteristics are not necessarily related to ecological values but remain a function of the propensity for certain groups of vegetation to ignite and sustain fire due to fuel load and arrangement, it can guide estimates on how quickly fire might spread and the likely fire behaviour and intensity which may occur.

Vegetation type, density and arrangement can further influence fire behaviour and intensity. Vertical and horizontal continuity is also a significant element. Thus, vegetation forms a critical element of analysis throughout this report.

4.3 Topography

Topography (effective slope) and to a lesser degree, aspect, are also factors which influence fire behaviour and intensity. Topography can have a drastic affect, with the rate of speed doubling for every 10 degrees of upslope and slowing by half for every 10 degrees of downslope, as a general rule. Aspect can also affect bushfire behaviour where areas with northerly and / or westerly aspects experience a higher level of solar access than those areas with a southern or eastern aspect. Notwithstanding, in times of drought and below average rainfall moisture levels in soil and vegetation in more sheltered areas with southerly and easterly aspects can also decrease substantially giving rise to significantly higher fuel abundance where the preceding fire regime has been less frequent or intense. Thus, aspect can be of less consequence.

4.4 Landscape and Localised Fire Hazard

Two types of risk are relevant in terms of bushfire hazard including:

- landscape risk – where large expanses of bushland over tens to hundreds of hectares are located in immediate proximity to, and may traverse, urban periphery suburbs/townships.
- localised risk – which is most commonly presented by fragmented areas of vegetation larger than 1 hectare in size.

These two types of hazard present different types of fire behaviour, fire intensity and potential rate of spread characteristics.

4.5 Fire Weather

It remains important to understand the influence of fire weather with regard to how it can affect bushfire risk levels on a daily, weekly or seasonal basis.

In Southern Queensland, hot-air fire wind is typically generated by west, north-west and south-westerlies and cool-air fire wind is generated by south-westerlies which are prevalent during Southern Queensland's fire season which extends from August to March, annually. In some situations however, south-easterlies can also drive bushfire behaviour on occasion.

Notwithstanding the above, it is noted bushfires do not always conform to widely-accepted characteristics. Other fire weather conditions must also be contemplated such as preceding weather conditions (such as low rainfall or drought), air temperature and relative humidity. If the area has been subject to drought or low rainfall for a period of time, vegetation health tends to deteriorate with increased leaf drop, curing and drying. This contributes to increased ground fuel loads and general ignition susceptibility. Prolonged dry periods also reduce soil moisture content.

Air temperatures of above 26 degrees Celsius are typically conducive to increased fire weather, as are extended periods of higher than average air temperatures. In conjunction, low relative humidity (i.e. low air moisture content) is also a contributing factor to increased fire weather.

In concert, all of the above factors can impact on the ability for fire to propagate, and alter behaviour and intensity characteristics and as such, fire weather is a significant component of bushfire hazard. Whilst an assessment of vegetation types, fuel loads, effective slope and other factors can be readily undertaken, fire weather can fluctuate across days, weeks and seasons and can have a significant impact on the potential for bushfire threat as well as influence bushfire behaviour and intensity.

The Forest Fire Danger Index (FFDI) is a commonly used method to readily advise the community of the likely ability of fire suppression based on fire weather, which is used to inform the Fire Danger Rating (FDR) System at **Figure 6**. It is important to maintain awareness as to the level of local fire danger during the fire season.

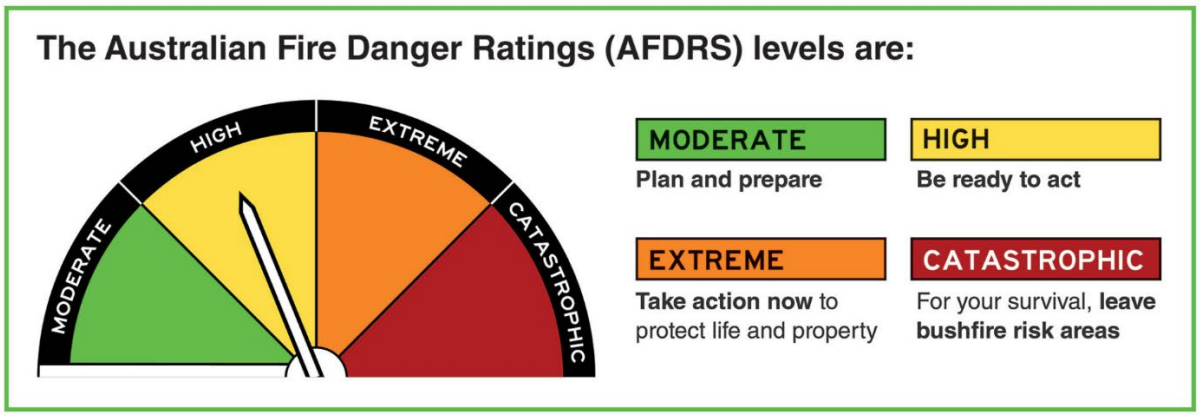


Figure 6 – Australian fire danger rating system

(Source: AFAC, 2022)

5 Regulatory Bushfire Assessment

The following section sets out the regulatory aspects of bushfire hazard relevant to the development site. This process is conducted in accordance with Part 5 of the Bushfire Resilient Communities guidance material supporting the implementation of the State Planning Policy, prepared by Queensland Fire and Emergency Services.

Section 5 of the Bushfire Resilient Communities non-statutory guideline articulates the process for undertaking a bushfire hazard assessment. The process includes the three stages illustrated below **(Figure 7)**. The reliability assessment is provided at Section 5.2 at this report, and the hazard assessment and separation and radiant heat discussions are provided at Section 6 of this report.

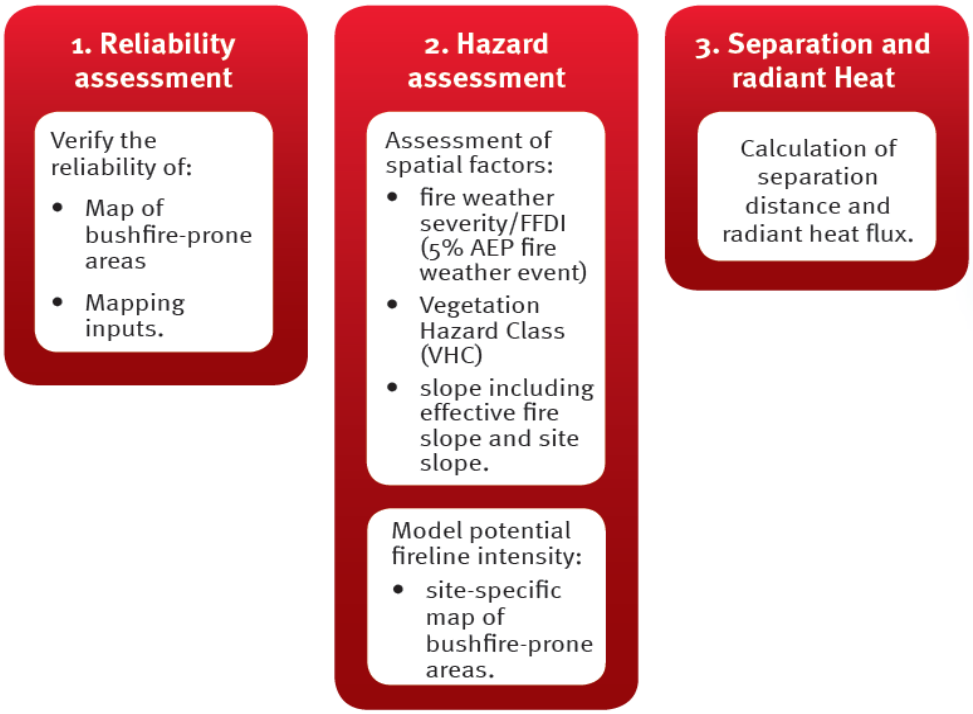


Figure 7 – Overview of the Bushfire Hazard Assessment process as per Bushfire Resilient Communities

(Source: Queensland Fire and Emergency Services, 2019)

5.1 Designated Bushfire Prone Area for Building Purposes

A bushfire hazard overlay map, which forms part of a planning scheme, may designate bushfire prone areas for the purposes of the Building Code of Australia (BCA). The BCA provisions relevant to bushfire apply to Class 1, 2, 3, 9 and associated Class 10a structures.

The Western Downs Planning Scheme 2017 does not state that it designates land as bushfire prone areas for the purposes of the BCA. Furthermore, the proposal is not a Class 1, 2, 3, 9 or associated Class 10a structure pursuant to the Building Code of Australia and as such, assessment against building provisions is not required for this development.

5.2 Reliability Assessment

5.2.1 Western Downs Planning Scheme Bushfire Hazard Overlay Map

Section 8.1 of the Western Downs Planning Scheme identifies the Bushfire Hazard Overlay as an overlay map for the planning scheme.

Figure 8 below is an excerpt of Council's Bushfire hazard overlay map as it pertains to the subject site and proposed development area, including the area surrounding the site out to 150m shown indicatively (blue dashed line).

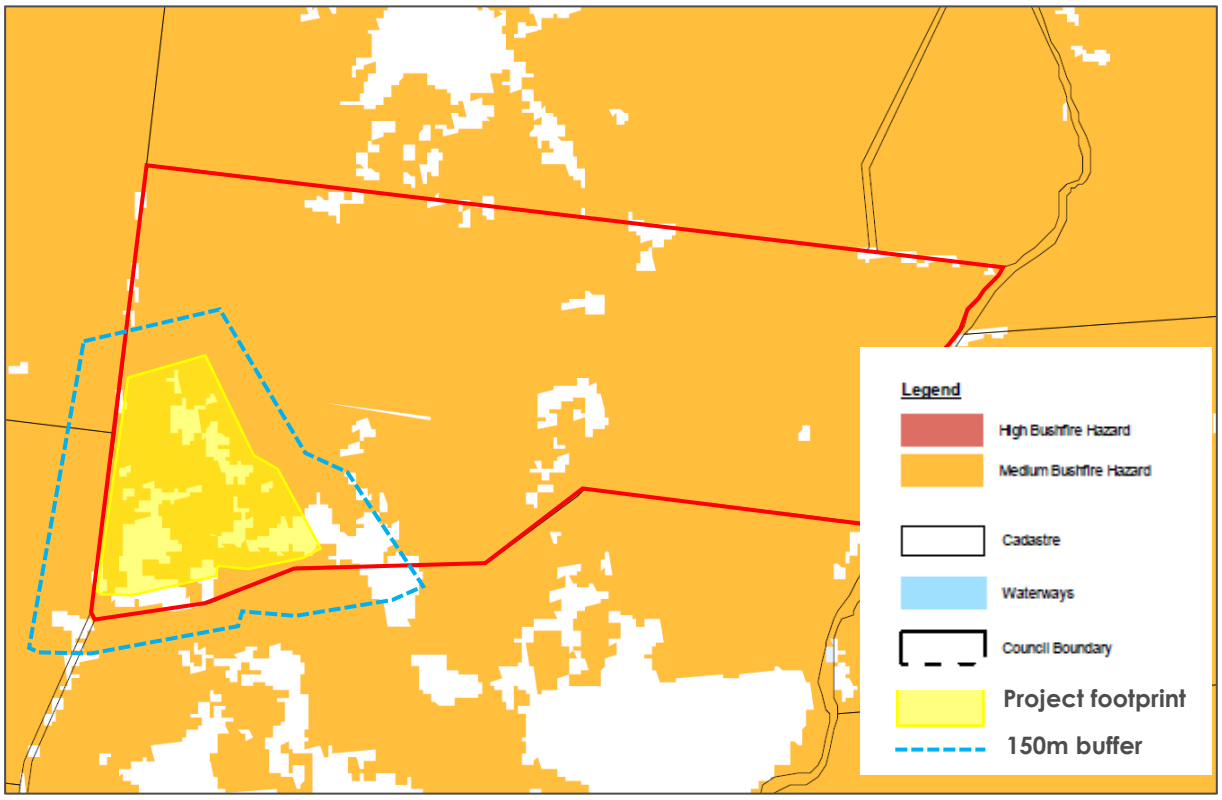


Figure 8 – Excerpt of Western Downs Planning Scheme Bushfire Hazard Overlay Map

(Source: Western Downs Planning Scheme)

Based on this mapping, it is noted that the subject site is predominately surrounded by large expanses of 'medium bushfire hazard'. Bushfire hazard is also present across the wider locality, only fragmented in areas by agricultural and cleared areas further to the south-west and south.

This mapping appears to reflect the 2014 State-wide Bushfire Prone Areas mapping prepared by the Queensland Government (discussed in the following section), but has been amended to reduce the number of hazard intensity categories and does not incorporate the 100m potential impact buffer that forms part of the State's bushfire prone areas mapping. The buffer extent incorporates an area that remains subject to potential bushfire attack, immediately adjoining the bushfire prone area.

5.2.2 State-wide Bushfire Prone Areas Map

The State Planning Policy (SPP) is underpinned by the State-wide bushfire prone areas mapping **(Figure 9).** It is noted that the Western Downs Regional Council appears to have adopted the 2014 version of the State-wide bushfire prone area mapping, with some level of local

refinement as described above. It is of note that the 2014 SPP mapping is the latest mapping applicable to this region.

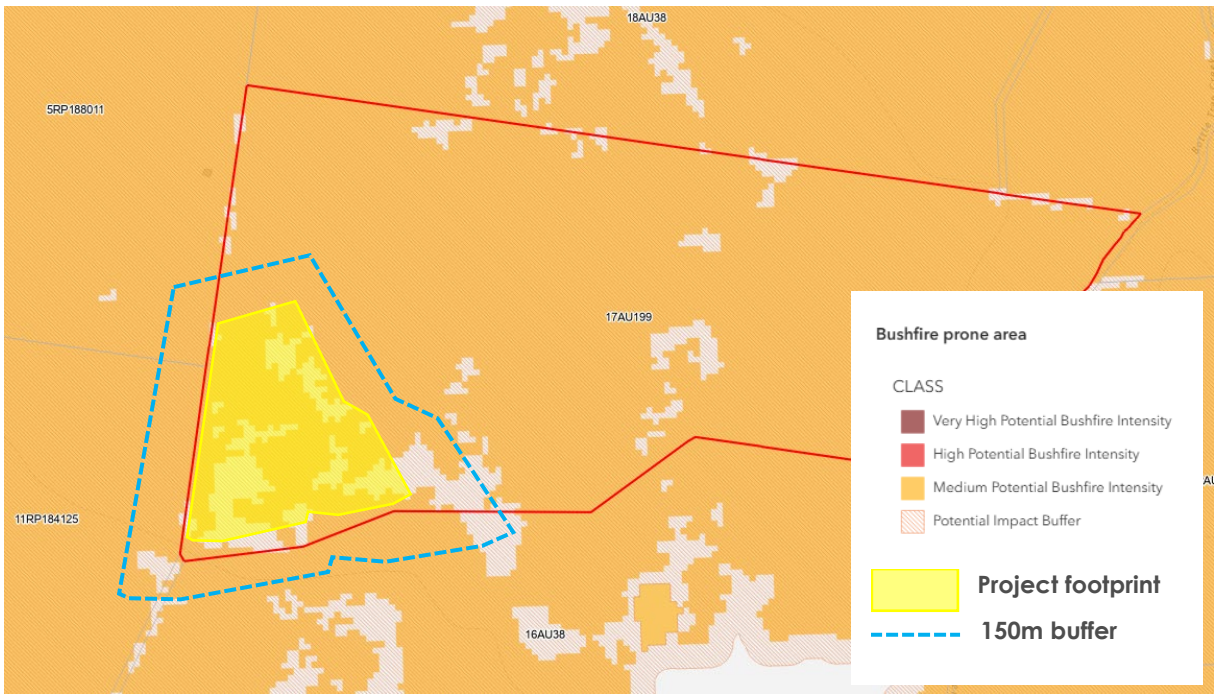


Figure 9 – Excerpt of the State-wide Bushfire Prone Area mapping

(Source: Queensland Government, 2025)

5.2.3 State Planning Policy Assessment

Section 2.1 of the Western Downs Planning Scheme identifies that the State Planning Policy has been appropriately integrated for the Natural hazards, risk and resilience. However, it is not evident which version of the SPP is integrated.

Notwithstanding, for the purposes of this report, an assessment of the current version of the SPP assessment benchmarks for the Natural hazards, risk and resilience State interest is provided below.

Policy statements (4), (5) and (6) of the State interest for Natural hazards, risk and resilience include that development:

- Avoids natural hazard areas or mitigates the risks of natural hazard to an acceptable or tolerable level;
- Where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level;
- Does not unduly burden disaster management response or recovery capacity and capabilities;
- Directly, indirectly or cumulatively avoids an increase in the exposure or severity of the natural hazard and the potential for damage on the site or to other properties; and
- Community infrastructure is located and designed to maintain the required level of functionality during and immediately after a natural hazard event.

Pursuant to the above policy objectives, an assessment against the relevant assessment benchmarks contained within the SPP is included in **Table 1**.

Table 1 - Assessment against the SPP Assessment Benchmarks

SPP Natural Hazards Assessment Benchmark	Compliance Statement
Assessment benchmark 3 *Development avoids natural hazard areas, or where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level.*	**Complies** – This assessment considers the proposed solar farm to be 'critical infrastructure' which is necessary to locate in proximity to other existing infrastructure, in this case being the planned hybrid power facility and ultimately the coal seam gas gathering network. On this basis, it is not possible for the development to avoid the bushfire hazard area. Therefore, comprehensive and conservative mitigation measures are proposed which appropriately reduce potential risk exposure to a tolerable level. The suite of mitigation measures include: - The provision of 10kW/m^2 radiant heat flux exposure asset protection zone (which equates to a 28m separation from the hazardous vegetation along all boundaries of the development footprint) – limiting radiant heat exposure to the asset. - Maintenance of grass within the facility to reduce the chance of grass fires. - Access to the local road network of an adequate standard to provide site access for fire appliances. - Perimeter road/trail around the facility, enabling vehicle turnaround for fire appliances via a loop road. - APZ treatments to provide a low fuel condition that is maintained in perpetuity.
Assessment benchmark 4 Development supports and does not hinder disaster management response or recovery capacity and capabilities.	**Complies** - Disaster management response and recovery capacity and capabilities will be supported by the development through the provision of: - A perimeter road / trail around the facility, or ability for fire appliances to otherwise drive across the APZ. - On-site dedicated water storage for fire-fighting purposes. - Emergency management procedures during construction and operational phases of the development.
Assessment benchmark 5 Development directly, indirectly and cumulatively avoids an increase in the severity of the natural hazard and the potential for damage on the site or to other properties.	**Complies** - The proposed development does not include significant changes to the vegetation hazard class through rehabilitation / revegetation and therefore will not increase the severity of the natural hazard on the stie or other properties. If significant rehabilitation / re-vegetation measures are proposed in proximity to the facility, these must be located outside the asset protection zone and a further hazard assessment may be required to demonstrate the works do not modify the vegetation hazard classes relied on in this report.
Assessment benchmark 6 Risks to public safety and the environment from the location of hazardous materials and the release of these materials as a result of a natural hazard are avoided.	**Complies** - The proposed development does not constitute a hazardous facility. Hazardous materials will be stored in accordance with any relevant Australian Standards and/or industry best practice. The potential for fire relating to the facility is contemplated as part of mitigation measures to limit spread of fire. Additional fire

SPP Natural Hazards Assessment Benchmark	Compliance Statement
	safety and workplace health and safety reporting for evacuation (to include bushfire evacuation) will be prepared under separate cover by the Applicant.
Assessment benchmark 7 The natural processes and the protective function of landforms and the vegetation that can mitigate risks associated with the natural hazard are maintained or enhanced.	**Not applicable** - The surrounding landforms and vegetation will not be affected by the proposal in a way that would increase risk associated with bushfire hazard.

5.2.4 Bushfire Resilient Communities Policies

The Bushfire Resilient Communities Guideline, which is a compendium document to the SPP guidance material, is a non-statutory document intended to guide the implementation of bushfire-related land use planning assessments in Queensland.

In addition to providing technical guidance, the document is informed by ten policy positions (section 2) which guide QFES' (now QFD) approach to land use planning in bushfire prone areas. Those which relate to critical infrastructure or development assessment (as opposed to the formulation of planning policy and instruments by local government) and are not otherwise addressed by the SPP assessment benchmarks above include:

- *Policy 10 - Community infrastructure for essential services are not located in bushfire prone areas unless there is an overwhelming community need for the development of a new or expanded service and there is no suitable alternative location, and further, the infrastructure can be demonstrated to function effectively during and immediately after a bushfire event.*

5.2.4.1 Statement of compliance

With respect to community need or community benefit, the project is part of a planned hybrid power station designed to power the SGP North Field Compression station. The hybrid power station is a key initiative in Arrow's plants to reduce greenhouse gas emissions and meet net zero targets. The potential for the Project to generate up to 17 MWp of solar power significantly reduces Arrow's reliance on fossil fuels for electricity by changing the primary energy source to solar energy.

It is understood by Meridian Urban that an analysis of multiple site locations was conducted with the subject site identified as the most feasible in terms of access to existing transmission infrastructure.

In siting and designing the project, further considerations included:

- minimising community impacts through:
  - removing the risk of disruption to landholders from construction activities through the Applicant owning the property
  - reducing potential community concerns with the development of new transmission lines by limiting the distance between the project site and field compression station.
- siting to ensure that all remnant vegetation areas and associated habitats are avoided, with the infrastructure to be located entirely within regrowth and cleared areas.

The various mitigation measures discussed further in Sections 9 and 10 of this report will facilitate the functioning of the infrastructure effectively during and immediately after a bushfire event.

5.2.5 Western Downs Planning Scheme Bushfire Hazard Overlay Code

As noted in section 5.2.1 of this report, the site is in the Bushfire Hazard Overlay of the Western Downs Planning Scheme. A material change of use in the Bushfire hazard overlay (medium and high hazard areas) is code assessable development (table 5.10.1) and requires assessment against the Bushfire hazard overlay code.

The purpose (section 8.2.3.2) of the Bushfire hazard overlay code is to *manage* ***development that is in bushfire hazard areas so as to ensure that the risk to life, property, community and the environment during bushfire events is minimised and to ensure that development does not increase the potential for bushfire damage***.

The purpose will be achieved through the following overall outcomes:

(a) development in areas at risk from bushfire hazard is compatible with the nature of the hazard;

(b) the risk to people, property and the natural environment from bushfire hazard is minimised;

(c) development does not result in a material increase in the extent, duration or severity of bushfire hazard.

An assessment of the acceptable outcomes and performance outcomes of the code is provided at **Appendix A**.

As demonstrated, the proposal complies with, or can be conditioned to comply with, the majority of the acceptable outcomes of the code. Of note:

- the proposal does not increase the number of lots in the bushfire hazard area.
- the road design can be conditioned to be capable of providing access for firefighting and other emergency vehicles, does not have a gradient of greater than 12.5% and does not include cul-de-sacs.
- The proposal is for a use (Renewable Energy Facility) that is within the Community Activities Group, however the whole site is within the Medium hazard area.

The proposal therefore complies with the overall outcomes and purpose of the code as the development is in the lowest hazard area of the site, the risk to people, property and the environment is minimised through mitigation measures and the potential for bushfire damage is not increased as the development is of a nature, scale and location that is compatible with the hazard.

6 Hazard Assessment

6.1 Methodology

The following assessment was carried out in accordance with the provisions of the Bushfire Resilient Communities Guideline published by QFES (now QFD), as well as the provisions of the Western Downs Planning Scheme.

A range of instruments have been utilised to perform a desktop analysis to complement available site data. These instruments include:

- State-wide bushfire prone area mapping
- Concept plans and supporting information
- Aerial imagery (Queensland Globe)
- QFES Catalyst Fire Management System
- State Planning Policy July 2017
- Bushfire Resilient Communities Guideline
- Western Downs Planning Scheme:
    - Bushfire hazard overlay map
    - Bushfire hazard overlay code.

A field inspection was conducted on 6 October 2023.

6.2 Fire Weather

The QFES Catalyst Fire Management System includes Forest Fire Danger Index (FFDI) mapping which is climate-adjusted for a 5 per cent annual exceedance probability (AEP) fire weather event. Catalyst identifies this area of Southern Queensland as subject to an **FFDI of 68**.

6.3 Vegetation Communities

Vegetation classification is important for a number of reasons, namely it indicates the level of fire intensity and fire behaviour associated with specific stands of vegetation and it also indicates the fuel loads which may exist in certain locations. The vegetation communities within 150m of the project footprint form the basis of this assessment, as per that required by the Bushfire Resilient Communities Guideline process for undertaking a bushfire hazard assessment.

It is noted the majority of vegetation currently located within the project footprint will be cleared to accommodate the proposed development. To this end, the following assessment relates to the vegetation within 150 metres of the project footprint.

The regional ecosystems (**Figure 10**) within 150m of the project footprint include:

- 11.7.4/11.7.7/11.7.5/11.7.2 to the north-east, north-west and south-east
- 11.3.14 to the south.

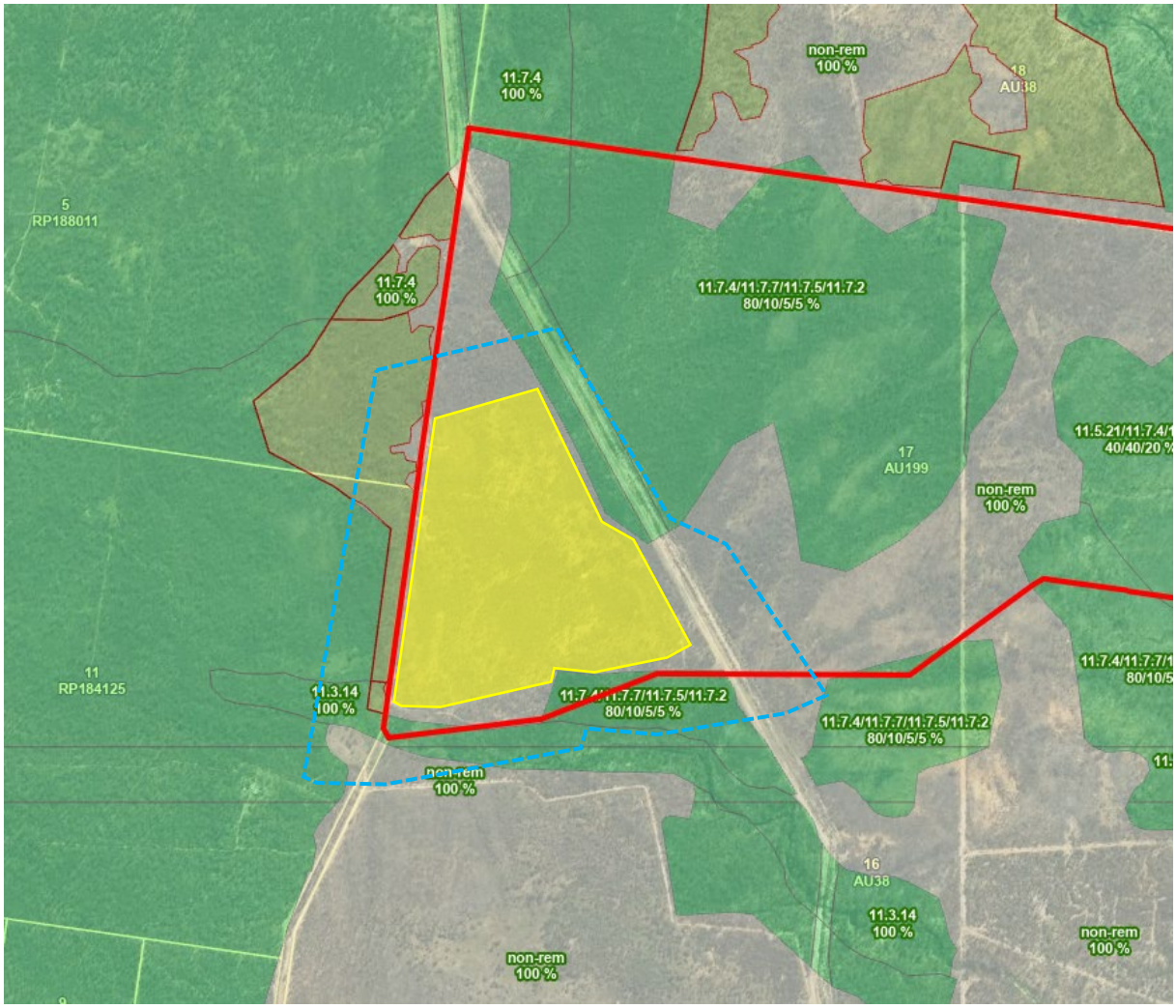


Figure 10 – Regional Ecosystems within 150m of the project footprint

(Source: Qld Globe 2025)

Figure 11 below identifies the current extent of relevant vegetation communities, illustrated via VHC tiles mapping pursuant to the QFD Bushfire Resilient Communities MapViewer. The project footprint and immediate surrounds (up to 150m) contain:

- BVG 9-15 Eastern eucalypt woodlands to open forests (vegetation hazard class 12.2 Dry eucalypt woodlands on sandstone and shallow soils)
- BVG 17-19 Eucalypt dry woodlands on inland depositional plains (vegetation hazard class 18.2 Dry eucalypt woodlands on sand or depositional plains).

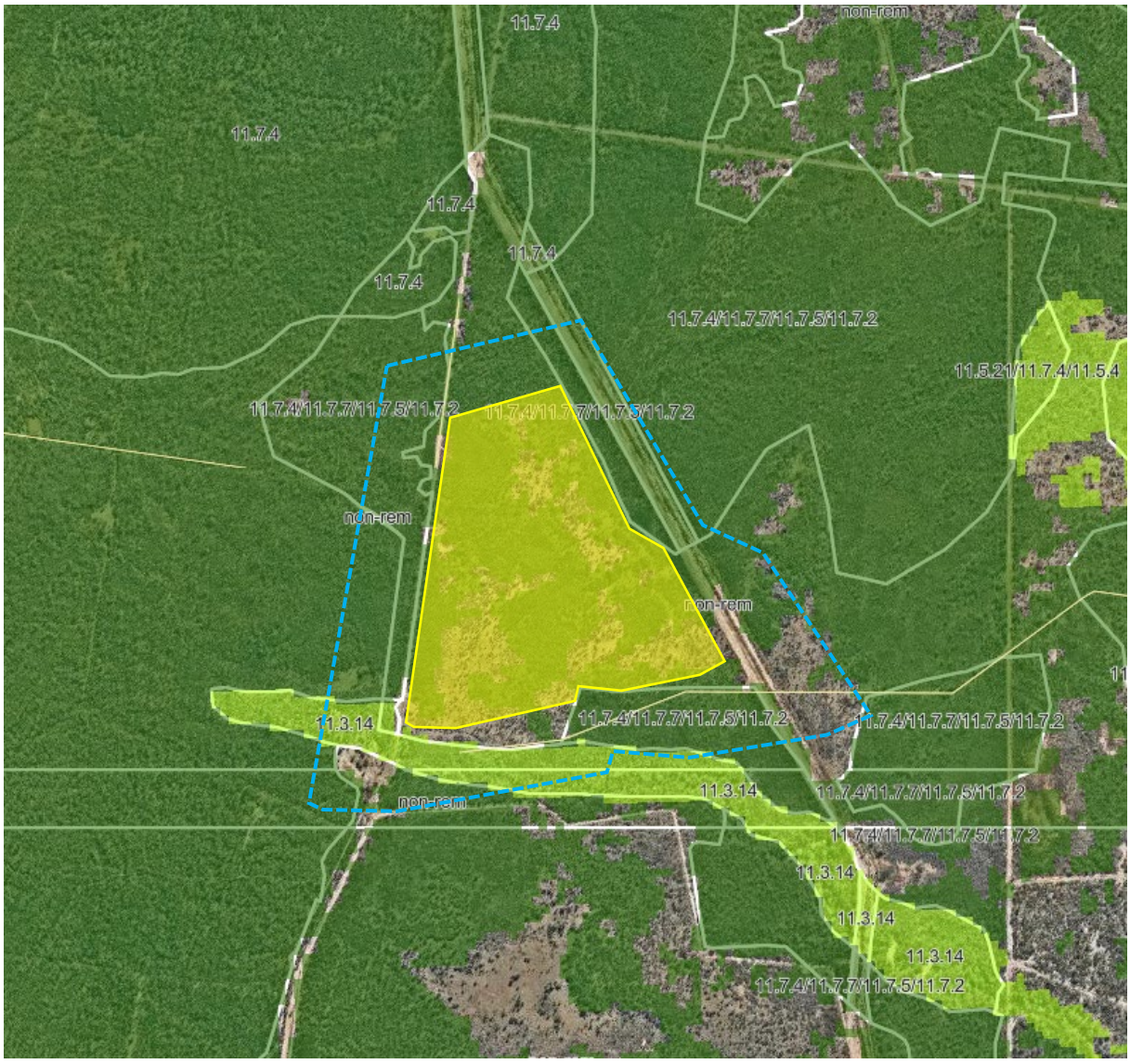


Figure 11 - Catalyst Fire Management System Vegetation hazard class (VHC) tiles

(Source: QFD 2025)

A Vegetation hazard class (VHC) conversion and associated potential fuel loads are set out in the table below (**Table 2**), pursuant to Part 6 of the Bushfire Resilient Communities Technical Reference Guide published by QFES (now QFD).

Areas of non-remnant vegetation which have not yet reached maturity are assessed as mature communities, accounting for the future hazard profile of lands within 150m of the area of development within the site.

Verified Regional Ecosystem data for the site provided by the project ecology teams are also outlined in **Table 2** below.

Table 2 – Vegetation communities within 150m of the proposed facility (remnant and non-remnant)

RE	RE Description	VHC	VHC Description	Potential Fuel Load (t/ha)
11.3.14	Eucalyptus spp., Angophora spp., Callitris spp. woodland on alluvial plains	18.2	Dry eucalyptus woodlands on sand or depositional plains	11.0
11.5.1	Eucalyptus crebra and/or E. populnea, Callitris glaucophylla, Angophora leiocarpa, Allocasuarina luehmannii woodland on Cainozoic sand plains and/or remnant surfaces	18.2	Dry eucalyptus woodlands on sand or depositional plains	11.0
11.7.2	Acacia spp. woodland on Cainozoic lateritic duricrust. Scarp retreat zone	24.2	Acacia woodlands on residuals	8.2
11.7.4	Eucalyptus decorticans and/or Eucalyptus spp., Corymbia spp., Acacia spp., Lysicarpus angustifolius woodland on Cainozoic lateritic duricrust	12.2	Dry eucalypt woodlands on sandstone and shallow soils	17.4
11.7.5	Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks	29.3	Heathlands and associated scrubs and shrublands	20.1
11.7.7	Eucalyptus fibrosa subsp. nubilis +/- Corymbia spp. +/- Eucalyptus spp. woodland on Cainozoic lateritic duricrus	12.2	Dry eucalypt woodlands on sandstone and shallow soils	17.4

The vegetation which potentially constitutes a hazard within 150m of the proposed development area is confirmed to be dominated by a mix of remnant and non-remnant vegetation. Recent fire activity across the area has affects the ground and near surface fuel layers, with only selected mature tree specimens present (predominantly Eucalypts. The average canopy height is approximately 10-15mn which is consistent with its **woodland** classification.

Overall fuel load assessments could not be reasonably undertaken for the site during the field inspection because of recent fire activity. Therefore, verified mature Regional Ecosystem data fuel loads relied upon for the purposes of this assessment.

The highest fuel load observed within 150 metres of the development area of the site is 20.1t/ha according to the verified Regional Ecosystem data and this fuel load is adopted for the purposes of all mitigation calculations to inform the bushfire management plan.

Images have been captured across the site. **Figure 12** below corresponds with **Appendix B** and provides an index of image location and direction taken.

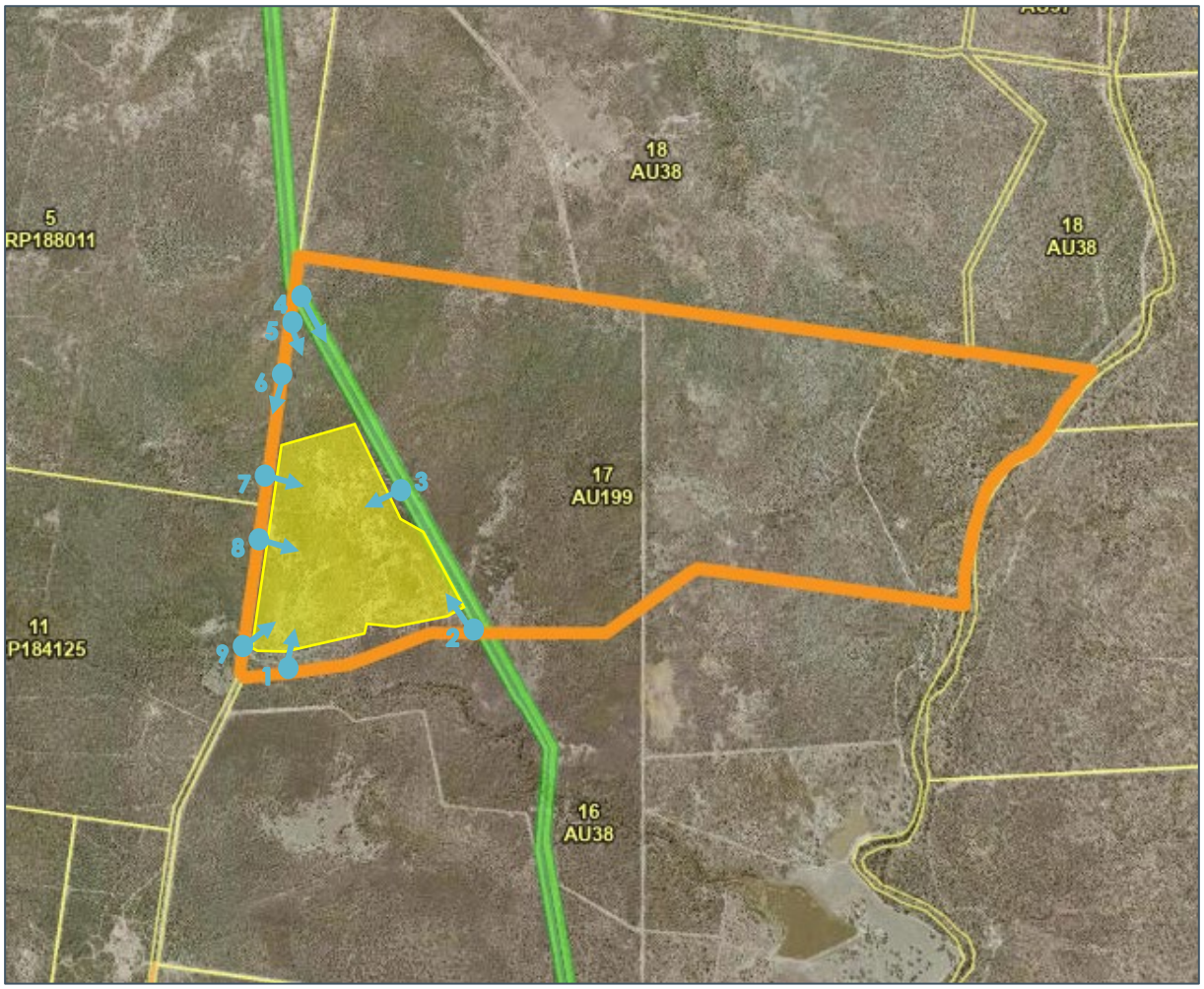


Figure 12 - Site image index map

Pursuant to the vegetation structural classes assessment of Part 6 of the Bushfire Resilient Communities Guideline, the vegetation within 150m of the development areas of the subject land is characterised broadly as Woodland, as per **Table 3**.

Table 3 – Assessment of vegetation structure in accordance with Part 6 of the QFES Bushfire Resilient Communities Guideline

RE	Vegetation structure class	Dominant life form	Density
11.3.14	Trees sparse – very sparse	Trees	Sparse to very sparse
11.5.1	Trees sparse – very sparse	Trees	Sparse to very sparse
11.7.2	Trees closed to mid-dense	Trees	Closed to mid-dense
11.7.4	Trees sparse – very sparse	Trees	Sparse to very sparse
11.7.5	Shrubland	Shrubs	Closed to very sparse
11.7.7	Trees sparse – very sparse	Trees	Sparse to very sparse

6.4 Effective Slope and Site Slope

Effective slope relates to the topography of vegetation beneath classified vegetation, as this influences fire speed and rate of spread – namely, that the speed of fire doubles for every 10 degrees incline. An on-site effective slope assessment has been conducted via Queensland Globe contour data, for a distance of 150m.

Contour information is utilised to illustrate the topography of the area, supplemented via field inspection. There is a slight variation of slope across the area of the proposed solar farm. There is a slight upslope to the north-west, flat to the east, and a slight downslope to the south east.

Based on the current location of the proposed solar farm, a **2 degree downslope** fall to the south-east is identified, representing the steepest extent of the fall as required by effective slope assessment procedure.

Figure 13 includes the slope analysis relative to the proposed facility location.

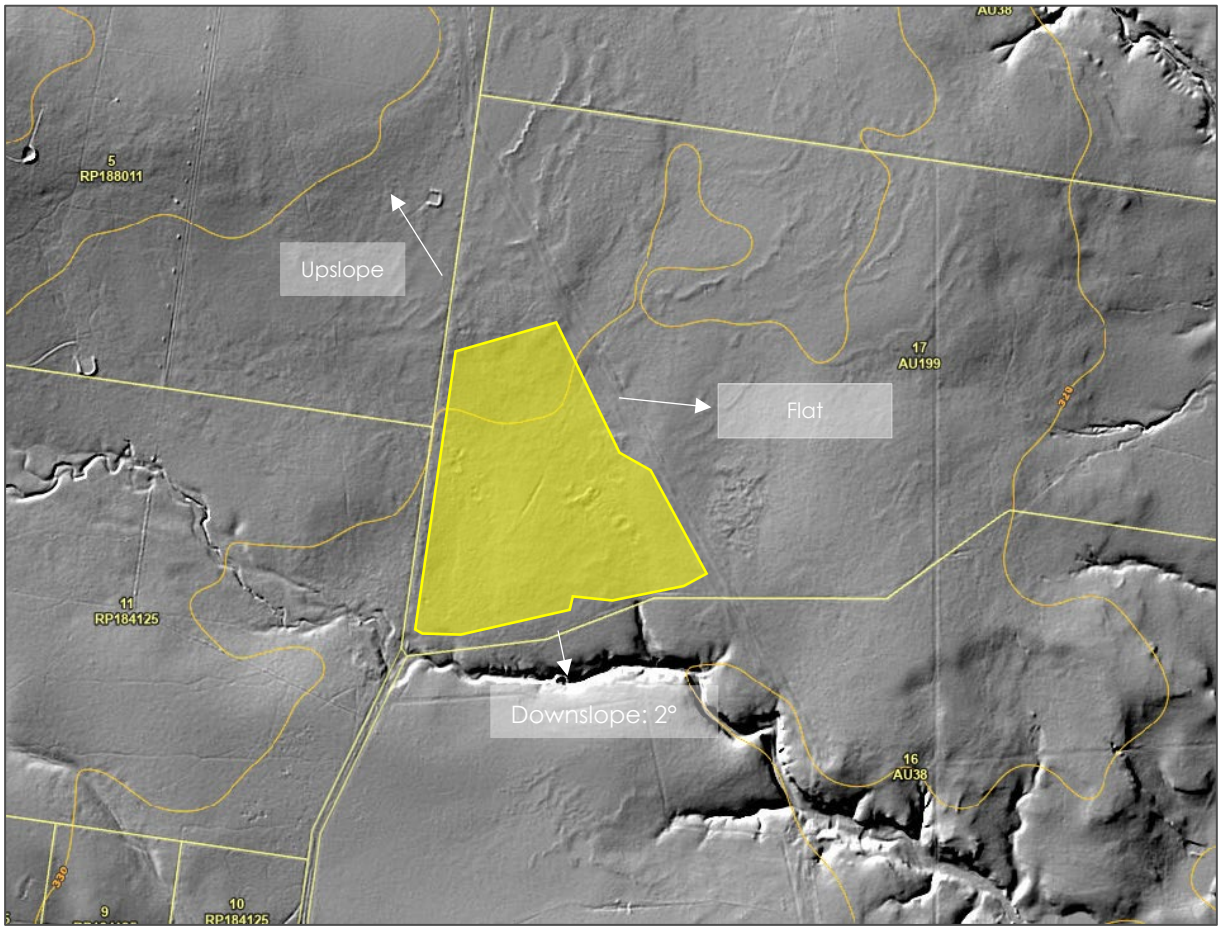


Figure 13 - Effective slopes

6.5 Aspect

Aspect can affect bushfire behaviour where slopes with northerly and/or westerly aspects experience a higher level of solar access than those areas with a southern or eastern aspect. This generally translates to drier fuels with lower moisture content and increased dead/drying/curing material.

Notwithstanding, in times of drought and below average rainfall, moisture levels in soil and vegetation in more sheltered areas with southerly and easterly aspects can also decrease substantially giving rise to significantly higher fuel abundance where the preceding fire regime has been less frequent or intense. Thus, aspect is of only partial consequence in this respect

and this is reflected by the current SPP mapping methodology and information made publicly available by QFES. Given the flat topography of the area, aspect is of limited effect in this instance.

6.6 Fire History

In relation to historical fire activity in the area, ignitions do occur in the general region.

A review of fire scar mapping using Qld Globe identifies wildfire or hazard reduction burns on the site and in the immediate area in February 2023 **(Figure 14)**. This is consistent with observations during the field visit of recent burning on the site, understood to have occurred in recent bushfires.

The Miles Fire Brigade is highly active in the area.

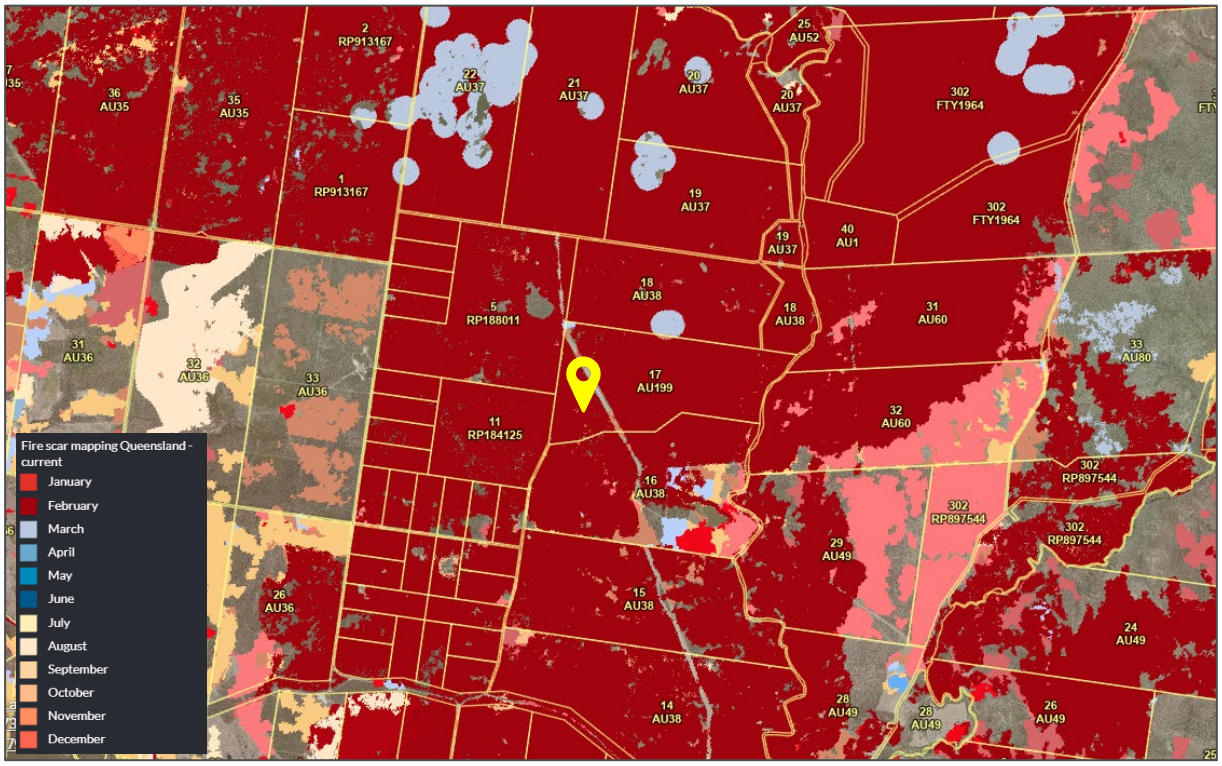


Figure 14 - Historical fire scar mapping within the subject locality

(Source: Queensland Globe, 2023)

6.6.1 Ignition Sources

The CFA Design Guidelines and Model Requirements for Renewable Energy Facilities that applies in Victoria (noting an equivalent is not currently in place in Queensland), provides that fire hazards associated with solar farm facilities includes:

- Electrical hazards, such as panel/inverter electrical faults; power surges; lightning strikes; water ingress; retained DC electricity in solar panels after shut-down/isolation.
- Potential fire spread and limited emergency response due to proximity of panel banks to each other, on-site infrastructure and vegetation (including screening vegetation).
- Landscape hazards, such as bushfire/grassfire ignition from fire within the facility, or external ignition of site infrastructure from embers or radiant heat.

Likely ignition sources in the area include accidental ignition from agricultural and other machinery and equipment, sparking, roadside ignition (potentially caused by cigarette butts thrown from vehicles), arcing powerlines and other rural activities.

Having regard to the proposed use, accidental ignition from mowing and power tools is a risk.

In terms of fires in solar farm operations, the causes of solar panel fires can be various, including issues on installation, isolators, and inverters, among other issues. Sometimes wild animals that are in the area can pose a threat and start a fire due to the panel's high temperature. Solar facilities' large scale can increase the possibility of fire spreading quickly through hot panels.

A recent grass fire in the Brigalow solar farm near Pittsworth started in the laydown area, also requiring appropriate measures and safety provisions are in place from a bushfire perspective as well as a from a broader site emergency management and workplace health and safety perspective for construction as well as operations.

7 Bushfire Intensity and Behaviour Assessment and Extent of Hazard

Stage 3 of the Bushfire Resilient Communities Technical Reference Guide for undertaking a bushfire hazard assessment requires an assessment of radiant heat exposure and required separation, or asset protection, to mitigate the use from potential bushfire hazard threat.

To this end, it is appropriate to consider the potential fireline intensity of vegetation within 150m of the development area, adopting the highest of the fuel load within the immediate assessment area. This provides the require asset protection zone (APZ) distances required in order to comply with the State's provisions for bushfire protection for critical infrastructure assets.

These calculations, as per the FLAMESOL calculator, are set out below (**Figure 15** and **Figure 16**). The inputs are adjusted to those required by QFD, rather than the default standard inputs.

The first provides the APZ extent required to the south. The second provides the APZ extent required to the west to the east.

The below distances are measured from the outside boundary of the facility. This is the extent of low fuel APZ required around the outer edge of the facility, noting the inner area must also be maintained in a low fuel conditions, beneath the solar panels.

Girrawheen Southern Downslope

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	68	Rate of spread	1.08 km/h
Vegetation classification	Woodland	Flame length	9.4700000000000001 m
Understorey fuel load	11.6 t/ha	Flame angle	54 °, 65 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	20.1 t/ha	Elevation of receiver	3.69 m, 4.1 m, 4.25 m, 4.23 m, 4.18 m & 3.44 m
Vegetation height	n/a	Fire intensity	11,284 kW/m
Effective slope	2 °	Transmissivity	0.882, 0.868, 0.848, 0.825, 0.81200000000000001 & 0.742
Site slope	1 °	Viewfactor	0.59430000000000001, 0.4386, 0.2935, 0.1991, 0.1614 & 0.0442
Flame width	100 m	Minimum distance to < 40 kW/m²	7.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	10.6 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	15.8 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	23 m
		Minimum distance to < 10 kW/m²	27.8 m

Figure 15 - APZ distance required to the south of the proposed facility

Girrawheen Western Upslope

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	68	Rate of spread	0.9399999999999999 km/h
Vegetation classification	Woodland	Flame length	8.56 m
Understorey fuel load	11.6 t/ha	Flame angle	54 °, 65 °, 73 °, 79 °, 80 ° & 85 °
Total fuel load	20.1 t/ha	Elevation of receiver	3.33 m, 3.71 m, 3.84 m, 3.83 m, 3.77 m & 3.06 m
Vegetation height	n/a	Fire intensity	9,830 kW/m
Effective slope	0 °	Transmissivity	0.884, 0.871, 0.852, 0.83, 0.8169999999999999 & 0.746
Site slope	1 °	Viewfactor	0.5895, 0.4332, 0.2916, 0.1974, 0.1607 & 0.0439
Flame width	100 m	Minimum distance to < 40 kW/m²	7.1 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	9.699999999999999 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	14.4 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	21.1 m
		Minimum distance to < 10 kW/m²	25.5 m

Figure 16 - APZ distance required to the west and east of the proposed facility

Pursuant to the above, the potential hazard severity relevant to the proposed facility is identified as 'Medium', being over 4,000kW/m but below 20,000kW/m. This is largely consistent with the current bushfire mapping, both local and the State-wide Bushfire Prone Areas mapping in proximity to the subject site. The highest fuel load Regional Ecosystem occurring within 150m of the site along each boundary underpins this analysis, as a conservative approach.

The hazard source in this case is relatively intact and well connected in the area of the site and as such, the threat of potential bushfire remains significant.

In terms of key fire runs, fire may advance toward the site from almost any direction. It is assumed by this assessment that the gas pipeline easement to the east will be maintained in a low fuel state, to align with the conditions of the easement/ Environmental Authority for the gas pipeline. Notwithstanding, given the proposed solar farm facility is offset some distance from this easement, a recommended **28m asset protection zone** is provided around the entirety of the facility.

8 Bushfire risk analysis

Beyond examining the potential behaviour, the consideration of bushfire risk is important. In line with the Queensland Emergency Risk Management Framework (QERMF) prepared by QFES (now QFD), this involves the consideration of:

- Likelihood
- Consequence
- Vulnerability.

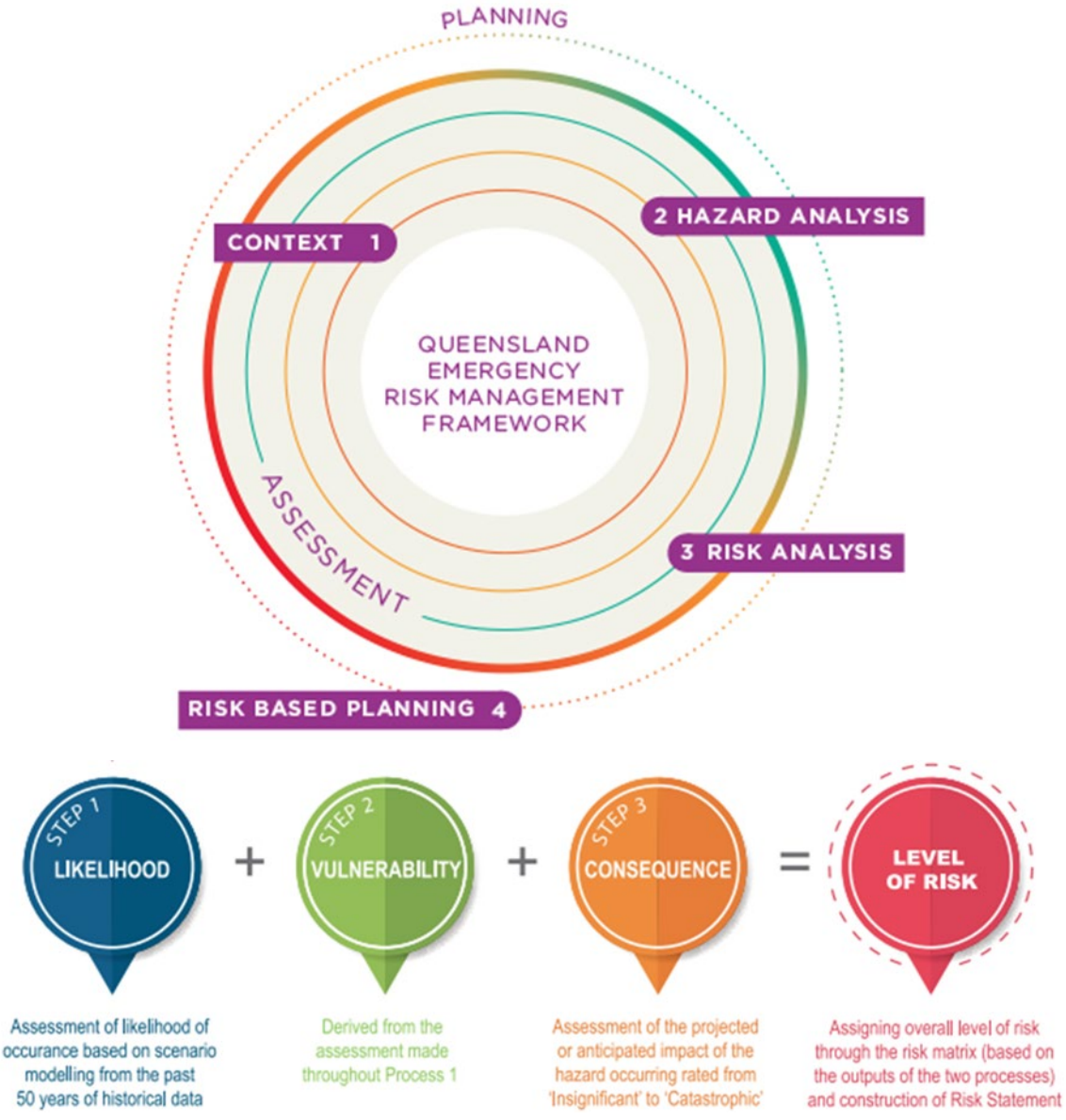


Figure 17 - Queensland Emergency Risk Management Framework overview

From a risk vulnerability perspective, the proposed solar farm facility is susceptible to radiant heat and flame contact. In addition, it also maintains a level of ignition probability.

The table below outlines the assessment of the untreated bushfire risk associated with the proposed facility.

Table 4 - Assessment of likelihood, vulnerability and consequence in accordance with the QERMF

LIKELIHOOD:	Likely
VULNERABILITY:	Moderate
CONSEQUENCE:	
People	Minor
Financial and economic	Minor
Community and social	Insignificant
Public administration	Minor
Environment	Minor

The QERMF provides a fit-for-purpose risk matrix which incorporates the assessment of vulnerability, in addition to likelihood and consequence factors.

The QERMF risk matrix is as follows:

Table 5 - Risk matrix as per Appendix 4 of the QERMF

Likelihood (X)		Rare (1)					Unlikely (2)					Possible (3)					Likely (4)					Almost Certain (5)				
Vulnerability (Y)		V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)	V.Low (1)	Low (2)	Mod (3)	High (4)	Extr (5)
Consequence (Z)	INSIGNIFICANT (1)	VL1	VL2	VL3	L4	L5	VL2	VL3	L4	L5	L6	VL3	L4	L5	L6	M7	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9
	MINOR (2)	VL2	VL3	L4	L5	L6	VL3	L4	L5	L6	M7	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10
	MODERATE (3)	VL3	L4	L5	L6	M7	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10	M7	M8	H9	H10	H11
	MAJOR (4)	L4	L5	L6	M7	M8	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10	M7	M8	H9	H10	H11	M8	H9	H10	H11	E12
	CATASTROPHIC (5)	L5	L6	M7	M8	H9	L6	M7	M8	H9	H10	M7	M8	H9	H10	H11	M8	H9	H10	H11	E12	H9	H10	H11	E12	E13

Key: V.L= Very low; L = Low; M = Medium; H = High; E = Extreme

Scale: 1 (lowest) to 13 (highest)

Table 3 - Risk Matrix

Having regard to the assessment of likelihood (of impact), vulnerability and consequence for the proposed solar (without treatment), the overall risk level is as follows.

OVERALL RISK:	**Moderate (M7)**

The bushfire management provisions contained in the following sections for construction and post-construction, both of which should be used to inform broader operational, workplace and workforce plans, provide a risk management approach to achieve a tolerable level of bushfire risk for the proposed use.

9 Bushfire Management During Construction

Separate bushfire measures apply for the construction period of the project. The next section of this report (Section 10) outlines the ongoing operational management and mitigation specifications that apply in perpetuity. Adoption of the measures provided below are expected to reduce, to a tolerable level, both the risk of bushfire ignition by construction and the threat that bushfires in the wider area pose to the site and people during the construction phase.

The main bushfire protection measures that are relevant to construction of the project include:

- Areas of vegetation surrounding the development site is to continue to be managed by the land holder pursuant to its obligations under the Fire and Emergency Services Act 1990. Arrow is the landholder for part of this land, other landholders also exist in the immediate area.
- The identified APZ (covered in Sections 7 and 10 of this report) is to be cleared at the outset of the construction phase (along with the vegetation to be removed to site the solar farm facility). The APZ will provide a buffer between the surrounding bushfire hazard and the facility under construction. This APZ complies with QFD APZ requirements for a 10kW/m2 radiant heat upper limit of exposure.
- Operational management measures must be put in place during construction to mitigate risk of ignition and risk of fire impact on and from the laydown areas. It is recommended that any construction laydown area is benefited by asset protection zones and separated from nearby hazardous vegetation by a minimum of 28m. Where this cannot be achieved, it is recommended that these areas are not used for activities that are likely to cause ignition (such as use of machinery and power tools that could throw sparks or generate heat and smoking) and these areas do not house any temporary buildings (unless in immediate proximity to the access point). Construction laydown areas should be managed as an inner asset protection zone, in a low fuel condition and grass maintained (no exceeding 100mm in height).
- Fire suppression equipment is provided (as per the CFA Design Guidelines and Model Requirements for Renewable Energy Facilities):
    - For buildings, fire suppression equipment must comply with the National Construction Code
    - For electrical installations, a minimum of two (2) suitable fire extinguishers must be provided within 3m-20m of any power conversion unit.
- Vegetation removal is to occur across the identified APZ and within the proposed facility footprint to reduce opportunities for a fire entering the site and for a fire being ignited by machinery and equipment or from infrastructure and assets within and escaping from the site.
- Temporary buildings for construction should be located as close as possible to the access point, limiting exposure of potential radiant heat from surrounding bushland and aiding efficient evacuation. Any temporary buildings must also be outside the APZ and separated from hazardous vegetation by a minimum of 28m within the facility boundary.
- Construction of any access road within the site must be to a standard capability of facilitating efficient site egress and access, including for emergency services personnel and appliances for the entire construction phase and the operational phase, in perpetuity. This includes enabling vehicles to traverse the 28m APZ, or via a separate track or road provided to service the perimeter of the facility.

- Access to water for fire suppression and / or protection of structures or equipment located on the site must be provided.
    - The CFA Design Guidelines and Model Requirements for Renewable Energy Facilities that applies in Victoria requires a minimum 45,000L static supply tank to be provided at the primary vehicle access point to each part of the facility (protected by the APZ, and an additional 45,000L tank for every 100ha of site area. As provisions of this nature are not currently present in Queensland, the CFA Guideline is adopted for this assessment. This is to be established during construction and maintained in perpetuity. A program must be put in place through operational strategies to ensure the tanks are checked and filled on a regular basis.
- A worksite policy is required to address the safety of workers and the potential for bushfire ignition on 'Extreme' and 'Catastrophic' fire danger days and on total fire ban days during the construction period. The use of power tools and other equipment during these periods is high risk and regulated under the Fire and Emergency Services Act.

The above provisions and emergency responses to bushfire must be addressed and included with other hazards as part of the operator's construction emergency management planning activities.

Evacuation of the site during construction should include an assembly point at a nominated location outside of the mapped bushfire prone area. This may require personnel to travel back to Miles, and any site evacuation procedures should enable sufficient time for evacuation to occur.

10 Operational Bushfire Management and Mitigation

There are a number of options available to address and mitigate the risk to and from the proposed facility and these are closely aligned with opportunities to:

- reduce the likelihood of potential for bushfire on the subject site
- provide compensatory measures that target the vulnerability and ignition potential of the proposed use.

This section articulates the combined range of bushfire protection and management measures relevant to the site and proposed facility for consideration to address risk.

10.1 Site design and layout

Site design and layout approaches to bushfire protection provide the strongest opportunities to achieve bushfire resilient communities. These approaches allow the highest risk locations to be avoided by development and enable the full suite of mitigation measures to be implemented. This starts with separation distance, provided as asset protection zones (APZs) or defensible space, a resilient road network which also supports separation from hazard but also seeks to directly facilitate emergency access and egress (evacuation). These elements are discussed as follows in relation to proposed solar farm.

10.1.1 Separation of solar arrays

The CFA Design Guidelines and Model Requirements for Renewable Energy Facilities in place in Victoria requires that a minimum 6m separation between solar arrays (strings). This is recommended.

Long runs of solar panel arrays without breaks due to natural site features or access roads can pose hazards to firefighters, prolong incidents and increase the potential for asset damage.

10.1.2 Asset Protection Zone

The purpose of an asset protection zone (APZ) is to provide sufficient separation between bushfire hazard and built form / infrastructure. It:

- limits radiant heat exposure, the transmissivity of which diminishes over distance
- avoids flame contact
- in some cases, can provide working areas for firefighting and defence around facilities by reducing impact of radiant heat
- provides access around facilities
- can mitigate risk of ignition from the proposed facility.

All ongoing activities and infrastructure forming part of the proposed solar farm are not to occur within the APZ, including fuel, water, and materials storage. Vehicle parking and access are permitted. It is acknowledged that the transmission line (overhead or underground) will connect to the facility and likely pass through the APZ. If overhead, it is recommended that the transmission line is also provided with a 28m wide asset protection zone either side of the line (total 56m wide corridor).

The Bushfire Resilient Communities technical reference guide establishes a 10kW/m^2 radiant heat threshold / APZ provision for vulnerable uses and critical infrastructure assets. Whilst solar farms may not be particularly vulnerable to radiant heat, or be a likely potential source of

ignition, they are a significant infrastructure asset. Therefore, a 10kW/m^2 radiant heat threshold has been recommended.

The FLAMESOL calculations outlined above require **a 28m APZ** around the entire footprint of the proposed facility.

These APZ distances are a function of:

- fire weather
- fuel loads
- topography.

A conservative 2 degree downslope to the south is the principal slope that is informing the APZ assessment.

In terms of treatments within the APZ:

- the understorey is to be completely removed and managed as mown grass, rock cover or bare earth. Tree specimens can be retained, provided canopies are separated at maturity. Landscaping can be accommodated provided the species selected comply with the specifications outlined in this report.
- no new tree specimens are planted within the APZ.
- vehicle access across the APZ is acceptable where required.

The Bushfire Management Plan is included at **Appendix C**, and the FLAMESOL calculation for the APZ is included at Section 7.

10.1.3 Building construction

At the time of building approvals, any office buildings / control buildings where persons may work should ideally be constructed to a minimum BAL-12.5 standard, in accordance with AS3959 however this is not a mandate of this report, noting building construction standards cannot be assessed or conditioned by Council at development application stage.

10.1.4 Fire safety

Fire safety more broadly, beyond bushfire, is to be addressed by several additional reports. This report is limited to bushfire hazard, other forms of fire associated with the facility must be addressed separately.

10.1.5 Access and Egress

Access and egress is significant in terms of a range of aspects of bushfire prevention and ability for firefighting. Road design must cater for emergency access and egress in times of potential bushfire emergency events.

It is understood that access to the facility is to be provided via a newly constructed access track to connect with Retreat Road to the south of the site. The road design should be conditioned to be capable of providing access for firefighting and other emergency vehicles.

Evacuation of the facility post-construction is likely to be limited to a small number of persons. Ideally, fire weather conditions and reference to QFD fire events is considered prior to any staff attending the facility during the fire season. Operational plans will be required to identify evacuation requirements, which should consider evacuation to the township of Miles, noting the route between the site and Miles is heavily vegetated. Ideally, workers are not permitted on site on 'Extreme' and 'Catastrophic' fire danger days, and any other day where a fire event is occurring within approximately 40 kilometres of the site.

10.2 Landscaping

The following rationale for landscaping within the boundaries of the subject site is identified to ensure fire risk is not inadvertently introduced, including:

- limiting potential for fuel accumulation on the site
- breaking opportunities for propagation of fire
- ensuring separation distance / defendable space is implemented and maintained in perpetuity
- landscape design which does not inadvertently increase bushfire attack risk to the subject site or adjoining land uses.

The landscaping approach should adopt principles and species selection in accordance with the provisions set out at Section 8 of the Bushfire Resilient Communities technical reference guide prepared by QFES (now QFD), as a minimum. These principles include the following elements:

- low threat (flammability) species are adopted (**Table 6)**
- tree specimens are smooth-barked species only and are not within the APZ of the proposed facility
- the use of organic mulches in garden beds should be avoided
- landscaping design and plant selection accords with Section 8 of the Bushfire Resilient Communities technical reference guide.

Table 6 - Characteristics of low flammability landscaping species and effect on performance in bushfire situations

Plant attribute	Effect	Design measure
Foliage moisture content	Leaves with higher moisture content retard ignition and slow the rate of combustion	Select species with high leaf moisture content (e.g. rainforest species, succulents and semi-succulents)
Foliage volatile oil content	Foliage with higher volatile oil content ignite more readily and enhance ignition of surrounding vegetation, even though volatile oils themselves do not contribute significantly to total radiant heat	Select species with lower volatile oil content
Foliage mineral content	Foliage with higher mineral content tend to be less flammable (e.g. Amyema spp mistletoes)	Species selection should favour species with higher leaf mineral content
Leaf fineness	The ratio of area-to-volume of leaves is one of the main factors affecting ease of ignition and intensity of burning. Finer leaves (greater area to volume ratio) tend to ignite and burn more easily than broader leaves	Species selection should favour broad-leafed species
Density of foliage and continuity of plant form	Species with continuous, denser foliage can act as a barrier to wind-borne embers and radiant heat; however, increased density can increase flammability. Species with open branching and low foliage density are less effective as a barrier, though can be less flammable	Select species on a case-by-case basis

Height of lowest foliage	Shrub and tree species with persistent low height foliage are more likely to be ignited by surface fires, allowing the spread of fires into the canopy above	Species selection should favour species which can be maintained or pruned to reduce persistent, near-ground foliage
Size of plant (volume and spread)	The effect of plant size varies according to volume or spread. Species with a greater spread tend to be more effective as a barrier to the diffusion of radiant heat than narrower trees with the same volume. Species with a greater volume can result in increased ember attack, radiation and flame if ignited. For example, narrow columnar trees are less effective as a barrier than wider trees with the same overall volume	Species selection should ensure plant size (volume and spread) does not increase ignition likelihood
Dead foliage on plant	Persistent dead leaves and woody twigs increase flammability	Species selection should favour species which have a low volume of persistent dead leaves and woody material or can be maintained or pruned to reduce persistent, dead leaves and woody material
Bark texture	Loose, flaky, stringy, papery or ribbon-like bark contribute to ladder fuels which: • can contribute to destructive crown fires • act as a potential source of flame, radiant heat and ember attack	Avoid species with persistent loose, flaky, stringy, papery or ribbon-like bark. Species selection should favour smooth-barked and tightly-held bark species
Potential available surface fuel	The availability of surface fuel is a function of volume (quantity) and fineness. The fireline intensity increases in proportion to available fine fuel quantity. Fine fuel includes dead fallen material such as leaves, bark, twigs and branches up to 6mm in diameter (forest) and grass greater than 5cm in height (grasslands). Coarse fuel ignites less readily but may burn for longer	Species selection should favour species which do not contribute significantly to persistent, fine ground fuel

(Source: QFES, 2019 and Ramsay and Rudolph, 2003)

10.2.1 Fencing

Fencing materials can have a considerable impact on the propagation of fire. Likewise, some fencing materials can alleviate exposure to radiant heat.

Any fencing or barriers must not be constructed from timber. Instead, fencing and barrier materials must be fire resistant. Steel mesh fencing can be used.

In addition, any retaining walls required should be constructed of fire resistant or fire retardant material such as concrete, stone, masonry or the like and not constructed from timber.

10.3 Land and fuel load management

Fuel load management across the broader site may be considered beyond the APZ which must be managed in a strict, low fuel condition in perpetuity. Occasional hazard reduction burns conducted in a mosaic fashion may be an opportunity, having regard to the existing infrastructure assets present, the ecological values of the site and ensuring appropriate fire regimes are adopted.

However, this may present a risk to the infrastructure located on the site, in which case, manual, chemical and mechanical fuel load reduction techniques could be considered.

Weed management is an effective approach.

These are labour intensive approaches but could be undertaken in mosaic-style approaches also, across the broader land holding on a rotative schedule.

10.3.1 Fire Trails and Firebreaks

The provision of fire trails or firebreaks may be contemplated across the wider parcel but particularly, vehicle access across the APZ around the proposed facility is required.

10.4 Water Supply and Firefighting Infrastructure

Firefighting tanks are likely to be provided to service the proposed facility in accordance with industrial firefighting requirements. These should be located as far away from potential hazard as reasonably practicable whilst allowing emergency access.

As per the CFA Design Guidelines and Model Requirements for Renewable Energy Facilities that applies in Victoria, a minimum 45,000L static supply tank to be provided at the primary vehicle access point to each part of the facility (protected by the APZ, and an additional 45,000L tank for every 100ha of site area. As provisions of this nature are not currently present in Queensland, the CFA Guideline is adopted for this assessment. This is to be established during construction and maintained in perpetuity. A program must be put in place through operational strategies to ensure the tanks are checked and filled on a regular basis.

Camlock fittings and pump housing should be provided for the tanks to support rural fire brigades who may tend to the site. Ideally, such facilities are not to be constructed of any material which may fail when exposed to excessive heat however, will need to also satisfy industrial fire safety requirements first and foremost. A 50mm male camlock fitting for emergency fire service use (or as otherwise instructed by QFD) is required.

Access around the entire perimeter of each structure within the facility should be maintained and any hoses and equipment should likewise be capable of reaching all external areas of the facility.

10.5 Operational management

A fire management plan, operational plan and work place health and safety plans are to be prepared for the site, to aid its operation post-construction. Bushfire is an aspect which must be integrated into and embedded within these operational plans. The relevant provisions of this report should be integrated into such plans, and this aspect is able to be readily conditioned. Additional provisions relevant to site operations may include:

- Where an advice, watch and act or emergency warning is issued for a location within 10kms of the site, advice is sought from emergency services and/ or the site operations are immediately ceased and the facility is evacuated:
    - Staff, contractors and visitors are directed to a safe location off-site (i.e. Miles township for example) to be accounted for. Direction to return to site or leave the area can then be provided.

- Under no circumstance should sheltering in place on site occur.

- For warnings (advice, watch and act or emergency) issued for locations within 20kms of the site or in the surrounding area more broadly, contact is made with the fire brigade's fire warden for status and advice, and prepare to cease operations and prepare to evacuate the site. Further information is available directly from:
  - Queensland Fire Department website and social media
  - Queensland Police social media
  - Western Downs Regional Council's Disaster Dashboard
  - ABC radio.
- For a fire that is ignited on the site or in immediate proximity (i.e. smoke is visible from the site):
  - Cease operation and evacuate the site immediately, if safe to do so
  - Call 000.
- On 'Extreme' and 'Catastrophic' fire danger days, or under 'total fire bans':
  - Activities that may generate an ignition threat are not conducted
  - Monitoring of emergency services media regularly throughout operation hours to check for local warnings
  - Follow emergency services advice.

  Forecasted fire weather and fire danger days are available three (3) days in advance from both the Bureau of Meteorology and Queensland Fire Department.

11 Conclusion

This report considers the bushfire hazard profile and mitigation measures required for the proposed SGP North Solar Farm at Kowguran. Based upon this detailed analysis, it is considered that the proposed site offers the ability to achieve a tolerable level of risk.

Based on this assessment, a range of mitigation measures have been derived, having regard to those established at a higher level by the State Planning Policy.

Despite the above, bushfire remains endemic to the Australian bush and it remains the responsibility of the land holder and site operators to implement all relevant emergency protocols, and manage and maintain the site to limit the threat of potential bushfire attack.

APPENDICES



Meridian Urban

Appendix A - Assessment against Western Downs Planning Scheme Bushfire Hazard Overlay Code

Table 7 - Assessment against the Bushfire Hazard Overlay Code

Performance Outcomes	Acceptable Outcomes	Response
For accepted, accepted subject to requirements and assessable development (code, code (fast tracked) and impact)		
PO1 Development does not increase the number of persons living or working on land subject to High Bushfire Hazard identified on Bushfire hazard overlay maps (OM-003) unless it is demonstrated that: (a) the subject land is a Medium Bushfire Hazard (or lesser); or (b) development is for community Infrastructure and facilities are located and designed to minimise susceptibility to bushfire events; and (c) a Bushfire Emergency Management Plan is prepared by suitably qualified person(s) and appropriately mitigates risks to life and property.	**AO1.1** Development does not increase the number of lots in areas of High Bushfire Hazard as identified on Bushfire hazard overlay maps (OM-003).	**Not applicable -** The proposed development is not for subdivision of land.
	AO1.2 Uses within the following Activity groups are located outside of a High Bushfire Hazard identified on Bushfire hazard overlay maps (OM 003): (a) Accommodation activities group; (b) Business activities group; (c) Community activities group; and (d) Entertainment activities group.	**Complies with AO1.2 -** Whilst a Renewable Energy Facility is within the Community Activities Group, the development area is within the medium bushfire hazard area and not within the High Bushfire Hazard Area.
PO2 In Medium Bushfire Hazard Areas as identified on Bushfire hazard overlay maps (OM 003), vehicular access is designed to mitigate against bushfire hazard by: (a) ensuring adequate access for firefighting and other emergency vehicles;	**AO2.1** The road design is capable of providing access for firefighting and other emergency vehicles, in accordance with SC6.2 Planning Scheme Policy 1 – Design and Construction Standards.	**Can be conditioned to comply -** The proposal will be access via a vehicle track, connecting with Retreat Road to the south of the site. Construction of the track should be of an adequate standard to accommodate firefighting and other emergency vehicles and can be conditioned accordingly.
(b) ensuring adequate access for the evacuation of residents and emergency personnel in an emergency situation, including alternative safe access routes (should access in one direction be blocked in the event of a fire); (c) providing for the separation of developed areas and adjacent bushland. Note - Where it is not practicable to provide firebreaks in accordance with A03.1 Fire Maintenance Trails are provided in accordance with the following: i. located as close as possible to the boundaries of the lot and the adjoining hazardous vegetation; ii. the minimum cleared width not less than 6 metres; iii. the formed width is not less than 2.5 metres;	**AO2.2** In areas of Medium Bushfire Hazard as identified on Bushfire hazard overlay maps (OM-003), roads are provided in accordance with the following: (a) Roads are designed and constructed with a maximum gradient of 12.5%; (b) Cul-de-sacs are not used except where: i. a perimeter road designed in accordance with AO3.3 isolates the development from hazardous vegetation; and ii. the cul-de-sac are provided with alternative access linking the cul-de-sac to other through roads; and iii. the maximum length of the cul-de- sac is 200 metres.	**Complies with AO2.2 -** The proposal will rely on the existing road network for access (connections), which does not include gradients of greater than 12.5%. Access to the site from Retreat Road is expected to be generally flat and unencumbered. Cul-de-sacs are not proposed.
	AO3.3	**Not applicable -** The proposal is not for reconfiguring a lot.

Performance Outcomes	Acceptable Outcomes	Response
iv. the formed gradient is not greater than 15%; v. vehicular access is provided at both ends; vi. passing bays and turning areas are provided for fire fighting appliances either located on public land or in an access easement that is granted in favour of the Local Government and QFRS.	In areas of Medium Bushfire Hazard as identified on Bushfire hazard overlay maps (OM-003) and development is for the purpose of Reconfiguring a Lot, the design incorporates a perimeter road firebreak that: (a) is located between the boundary of the lots and stands of native vegetation; (b) has a minimum cleared width of 20 metres; (c) has a constructed road width of six metres; and (d) is constructed to an all weather standard.	

Appendix B - Fuel Hazard Assessment Site Images



FIGURE 1



FIGURE 2



FIGURE 3



FIGURE 4



FIGURE 5



FIGURE 6



FIGURE 7

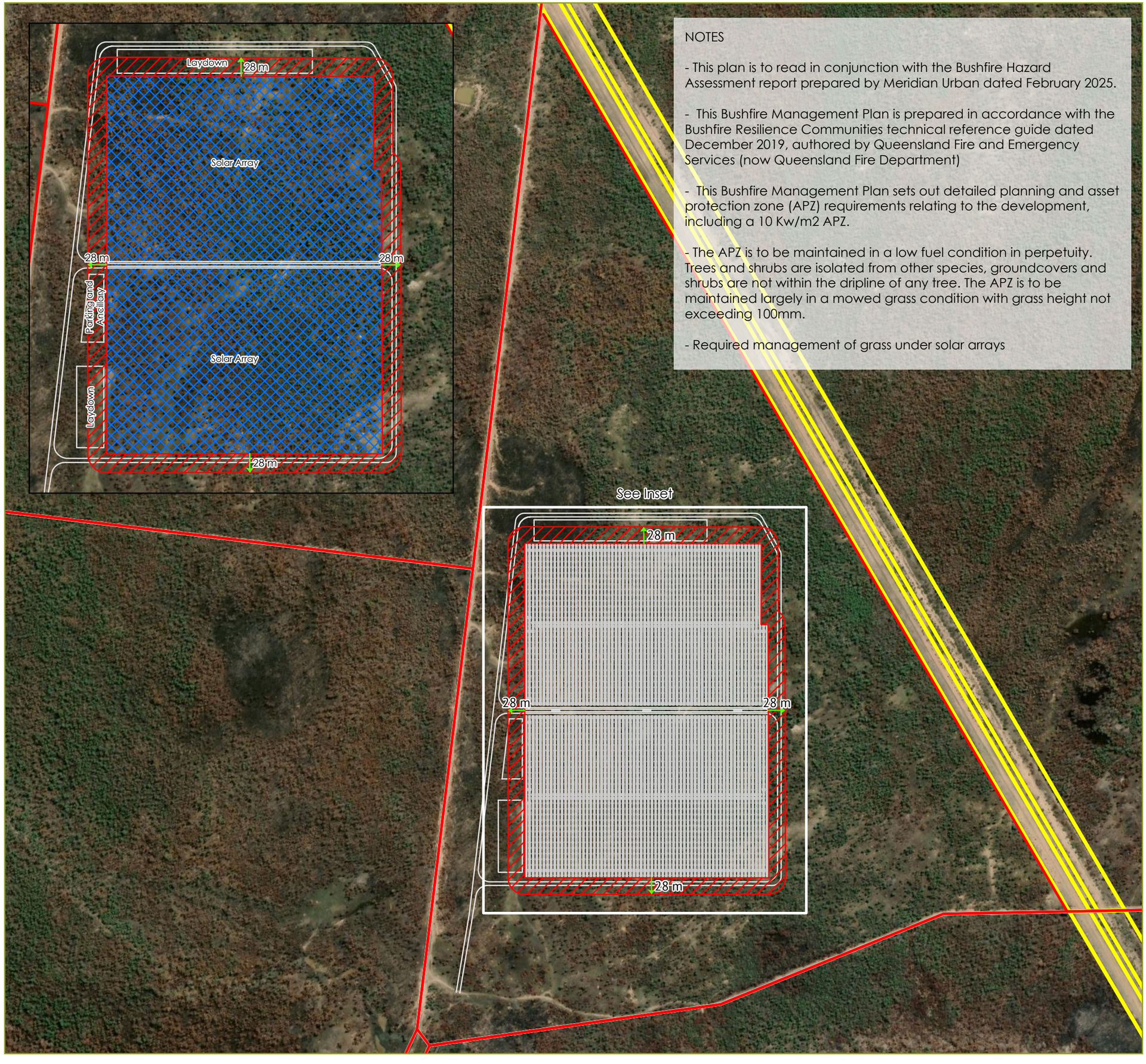


FIGURE 8



FIGURE 9

Appendix C - Bushfire Management Plan



NOTES

- This plan is to read in conjunction with the Bushfire Hazard Assessment report prepared by Meridian Urban dated February 2025.

- This Bushfire Management Plan is prepared in accordance with the Bushfire Resilience Communities technical reference guide dated December 2019, authored by Queensland Fire and Emergency Services (now Queensland Fire Department)

- This Bushfire Management Plan sets out detailed planning and asset protection zone (APZ) requirements relating to the development, including a 10 Kw/m2 APZ.

- The APZ is to be maintained in a low fuel condition in perpetuity. Trees and shrubs are isolated from other species, groundcovers and shrubs are not within the dripline of any tree. The APZ is to be maintained largely in a mowed grass condition with grass height not exceeding 100mm.

- Required management of grass under solar arrays

SGP North Solar Farm Bushfire Management Plan

LEGEND

- Asset Protection Zone (10kw/m2)
- Inner Asset protection Zone
- Lot Boundary
- Easement

N

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0 0.1 0.2 km

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Data Provided by Attexo 22nd January 2025

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