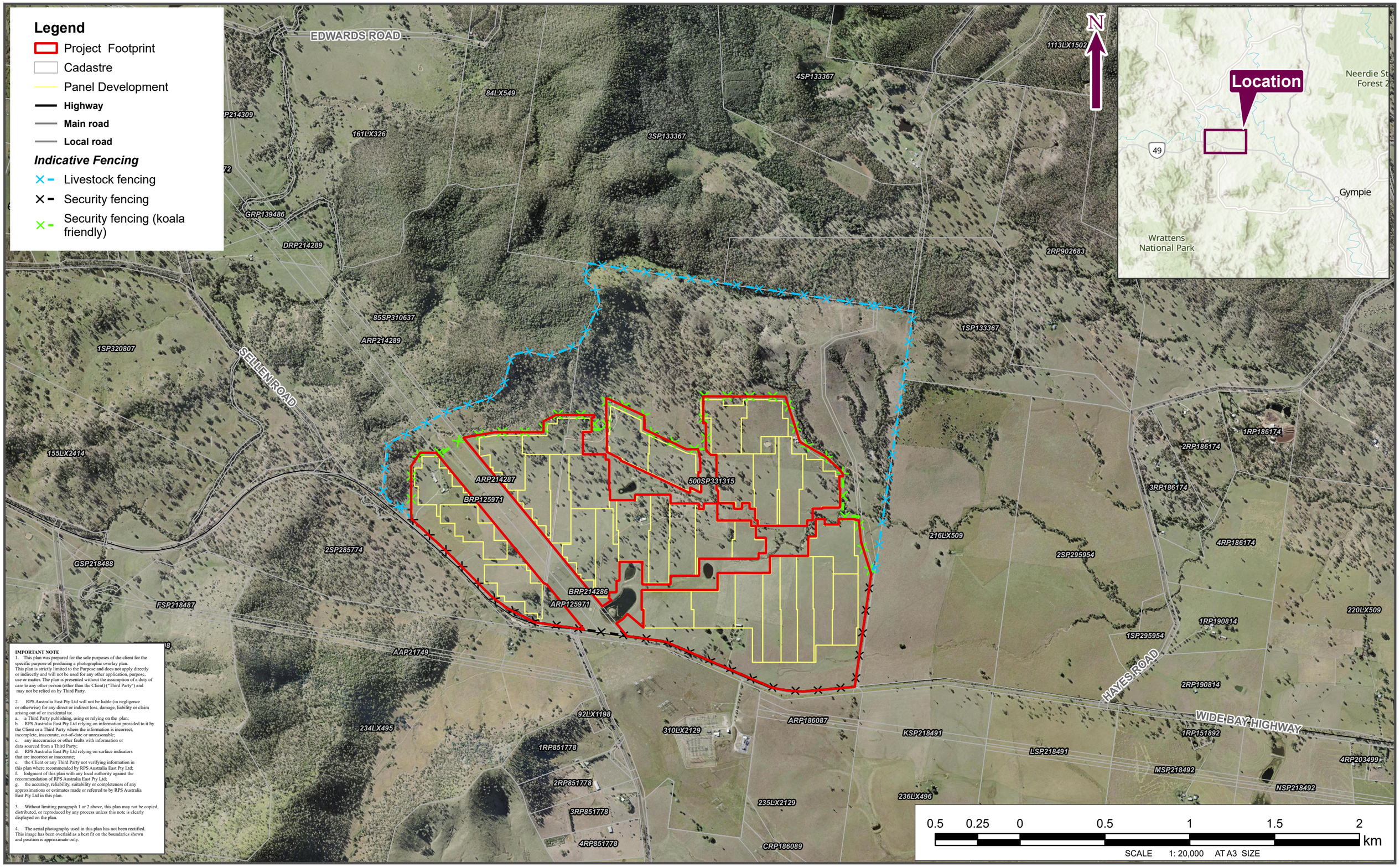

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FIGURE 1: LOCATION MAP - STAGE 1

LOCATION : 1706 WIDE BAY HWY WOOLOOGA

Co-ord System: GDA 1994 MGA Zone 56
Data Sources: RPS, Land and Property 2017

DATE : **21/12/2022**

PURPOSE: **BTA**

VERSION (PLAN BY): B A3 (Robert.Suansri)

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CLIENT: **LIGHTSOURCE DEVELOPMENT SERVICES AUSTRALIA PTY LTD**
JOB REF: **AU213004684.001 / PR142693.1**

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1.3 Objective of Report

This assessment has been undertaken in accordance with, the BRC which provides for the protection of human life and minimises impacts of bushfire on the site. In accordance with the BRC, the objectives of this hazard assessment are as follows:

- To support the planning system and to increase complementarity between bushfire planning and building;
- Inclusion of natural hazards, risk and resilience as a state interest in land use planning;
- Determine the development assessment pathway and mapping extent of the bushfire hazard;
- Determine factors affecting bushfire hazard;
- Potential bushfire risk and impacts;
- Informing bushfire mitigation measures; and
- Calculating bushfire defendable space.

The Natural hazards, risk and resilience – Bushfire – SPP state interest guidance material, 2019 defines specific development outcomes that are compatible with the level of risk. These outcomes include:

- The provision of developments that avoid bushfire prone areas;
- Where it is not possible to avoid bushfire-prone areas, development mitigates the risks to people and property to an acceptable or tolerable level;
- The provision of community infrastructure that functions effectively during and immediately after a bushfire event;
- Maintaining or enhancing the protective function of landforms and vegetation;
- The provision of developments that do not directly, indirectly or cumulatively increase the exposure or severity of the bushfire event;
- The provision of development that supports, and does not hinder, disaster management capacity and capabilities; and
- Ensure that risks to public safety and the environment from the release of hazardous materials stored and manufactured in bushfire prone areas are avoided.

Gympie Regional Council Planning Scheme 2013, Rural Zone Code Bush fire is provided in Appendix A. This provides for:

- Development maintains the safety of people and property, including the function of community infrastructure, during and immediately after bushfire events, and
- Public safety and the environment are not adversely affected by the detrimental impacts of bushfire on hazardous materials manufactured or stored in bulk.

2 BUSHFIRE HAZARD ASSESSMENT

2.1 Methodology

To determine the appropriate setbacks and Bush fire Protection Measures (BPM) the assessment procedures outlined in BRC 2019 have been implemented to accurately define the extent and type of bush fire hazard that guide the recommended BPM.

A variety of data sources were accessed to complete the following assessment:

- Bushfire-prone area (BPA) mapping is referenced out to the SPP IMS;
- Esri® shapefile (.shp) format data from the Queensland Government data portal;
- Available Aerial photography;
- Field observations from site visit;

Three step process was undertaken to complete the hazard assessment:

1. Undertake a site visit to confirm that the extent of mapped bushfire-prone areas correlates with the extent of hazardous vegetation;
2. Undertake a site visit and cross reference with the Queensland Government data portal to Confirm that the classification of hazardous vegetation is consistent with the mapped Vegetation Hazard Class (VHC); and
3. Undertake a site visit and cross reference with the Queensland Government data portal to confirm that site and effective slopes.

2.2 Reliability Assessment

Although state-wide bushfire-prone area mapping is regularly updated, land use and vegetation cover that contribute to bushfire hazard are subject to change, particularly regarding the extent of hazardous vegetation.

The reliability assessment was undertaken for the site and all land within 150 metres of the proposed development. The reliability assessment determined whether the site's observed characteristics are consistent with the inputs used to create the mapping and the mapping outputs.

Where existing mapping of bushfire-prone area input data are assessed as satisfactory, applicants can simply apply the map input data to determine radiant heat flux and defendable space width.

Where the precision and/or accuracy of the bushfire-prone area map or map input datasets are insufficient, the reliability assessment provides a mechanism for applicants to undertake a more detailed assessment to confirm the extent of bushfire-prone areas.

In this case, variabilities in the SPP IMS Data were observed and a hazard assessment will be undertaken to inform the calculations of the radiant heat exposure, separation and other Bushfire Protection Measures.

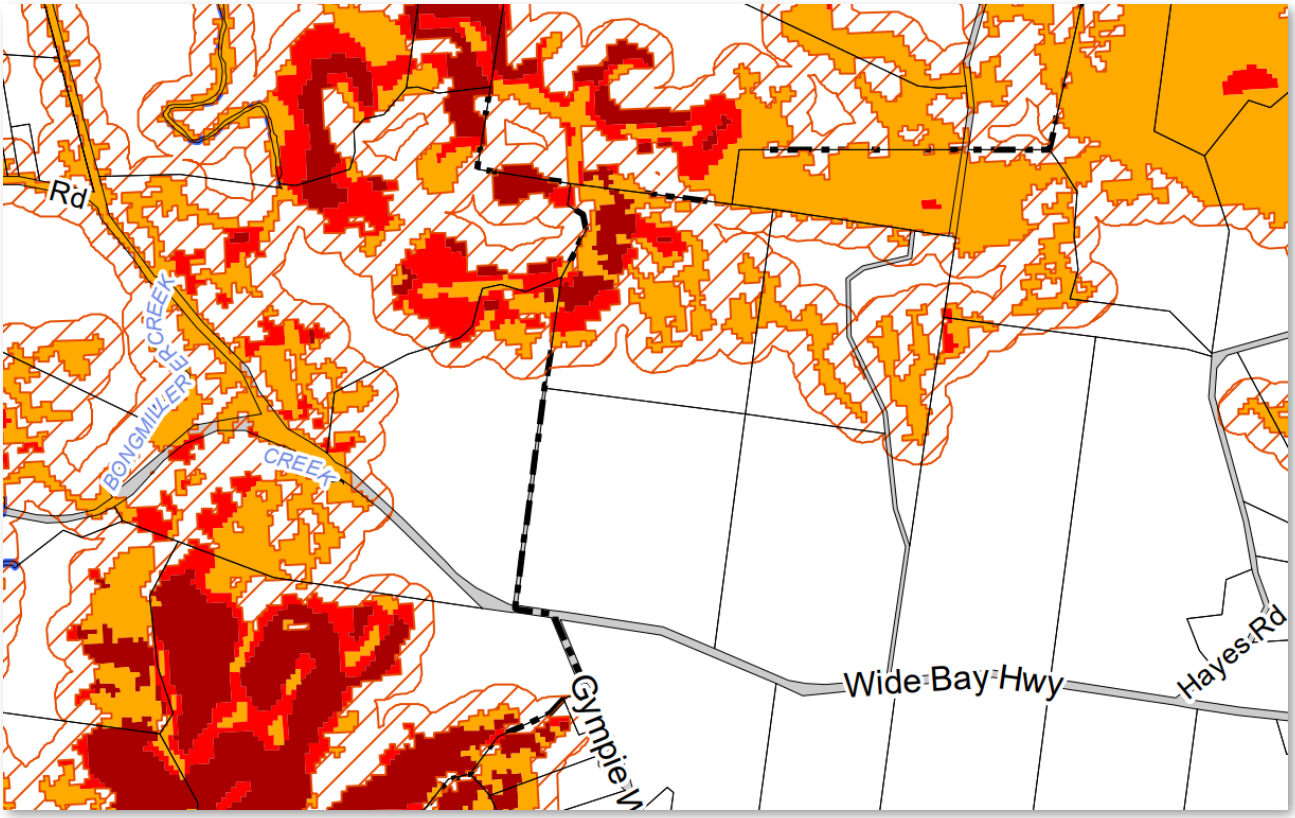

Figure 2 Gympie Bushfire Prone Areas Map (map sheet 10)

The field observations undertaken during the site visit found the verified the slope and vegetation is generally consistent within the SPP IMS Data, and variations to the extent and boundaries of the vegetation is provided in Figure 2 will inform the following hazard assessment.

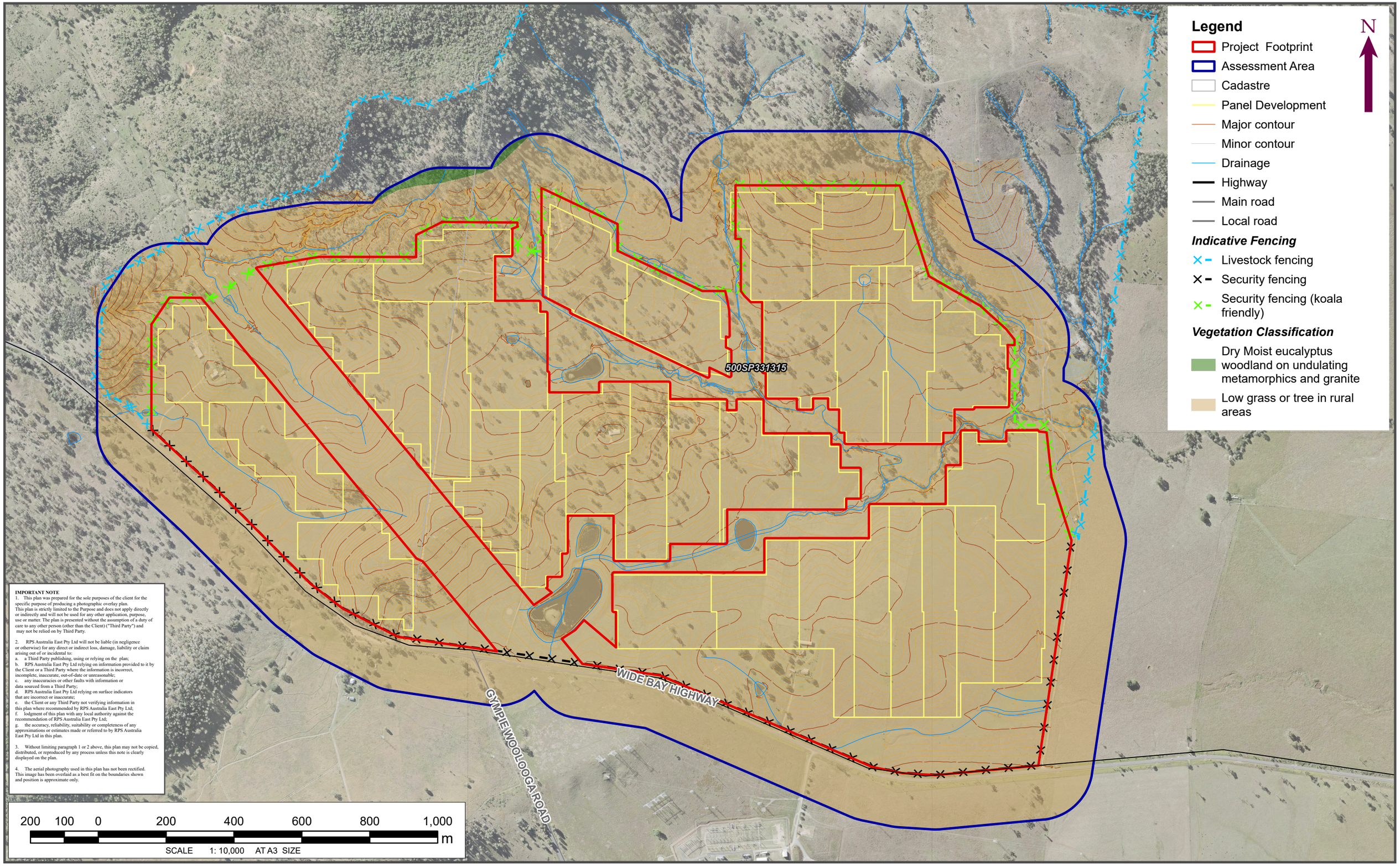

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FIGURE 3: CONFIRMED VHC, SLOPE TO INFORM HAZARD ASSESSMENT - STAGE 1

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2.3 Hazard Assessment

2.3.1 Fire Weather Severity

The Esri® shapefile (.shp) format data was accessed from the Queensland Government data portal to identify all FFDI (1 in 20 year) values within the assessment area.

The FDI for the site is 45.

2.3.2 Vegetation Hazard Class (VHC)

The Esri® shapefile (.shp) format data was accessed from the Queensland Government data portal to obtain the VHC of the site. Vegetation in and around the site is illustrated in **Plate 1-4**.

Bush fire assessments may propose an alternative VHC where the results of a reliability assessment or site-specific botanical survey demonstrate differences between the observed classification or extent of VHCs and those indicated by the mapping inputs for vegetation hazard class.

A site inspection was undertaken in March 2020 verified the mapped Regional Ecosystems and Broad Vegetation Group. Vegetation communities discernible in the field were surveyed using the outline for recording quaternary type information as defined by the 'Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland' (Nelder *et al*. 2012).

The field observations from the site confirmed the VHC indicated on the Queensland Government data portal although the extent and boundary of the VHC has updated. The accurate reflection of the of the VHC is provided in **Figure 2**.

Table 2 Vegetation Hazard Classes

Direction	VHC Code	Description	Distance (m)
North	13.2	Dry Moist eucalyptus woodland on undulating metamorphics and granite	On site
Site and surrounds	40.4	Low grass or tree in rural areas	On site

2.3.2.1 Modify Intensity mapping

Intensity mapping can be modified by refining the vegetation that is considered a bushfire threat, such as patches and corridors of vegetation.

The vegetation within the 150m assessment area has been assessed to identify if any of the four downgrades can be applied.

1. Sub-hectare areas of areas of continuous fuels surrounded by non-continuous fuels that are greater than 100m from any other continues fuel;
2. Downgrade of effective fuel loads of continuous fuels <3ha when surrounded by non-continuous fuels that are greater than 100m from any other continues fuel;
3. Narrow corridors and areas of continues fuel >50m in width; and
4. Isolated patches of hazardous vegetation <0.5ha.

There are no refinements made to the vegetation classifications surrounding this site.

2.3.2.2 Remnant Status

Remnant status is a binary indicator of whether the VHC is remnant vegetation as defined in Vegetation Management Act 1999. Remnant vegetation includes relatively undisturbed woody or non-woody vegetation.

Woody remnant vegetation (dominated by trees and shrubs) has an undisturbed canopy coverage >50%, and >70% has an undisturbed height structure, and consists of species that characterise the undisturbed canopy.

Non-woody remnant vegetation has not been cultivated for 15 years, contains native species normally found in the RE and is not dominated by non-native perennials.

Non-remnant vegetation includes hazardous wood and non-woody vegetation that has the potential to support a significant bush fire with the design life and does not meet structural and floristic characteristics for remnant vegetation.

2.3.2.3 Slope Assessment

Two slope input parameters are required for the estimation of fire behaviour and separation:

1. Effective slope – the more important of the two, refers to the slope of the land under hazardous vegetation measured in degrees. Effective slope has a direct influence on the potential rate of fire spread and rate of fuel consumption.
2. Site slope – is the slope of the ground between the edge of the proposed development or site boundary and the edge of hazardous vegetation.

The slope throughout the 150m assessment area is illustrated in **Table 3**.

Table 3 Slope Analysis

Direction	VHC	Separation	Site slope	Effective slope
North	13.2	118m	12º	13º
South	40.4	0m	0-9º	0-9º

Plate 1 Grasslands within the site

Plate 2 Scattered and isolated tree do not form a continuous forested bushfire threat

Plate 3 Ground tanks (dam) maybe unreliable during prolonged period of drought

Plate 4 Dry Moist eucalyptus woodland on undulating metamorphics and granite

2.4 Separation and Radiant Heat

Calculation of separation and radiant-heat exposure (radiant heat flux in kW/m^2) 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.

Defendable space width should be measured in accordance with clause 2.2.4 of AS 3959:2018 for each VHC and slope combination to which a development is exposed. This assessment defines the edge of hazardous vegetation as the surface, near surfaces fire fuel loads, as it is this fire fuel that drives fire behaviour.

Defendable space width is the horizontal distance between the edge of hazardous vegetation and:

- For subdivisions (RAL): the closest point on a lot boundary or a building envelope (where applicable)
- For material change of use:
  - The closest point of a building envelope; or
  - The external wall of a building; or
  - For parts of the building that do not have external walls (e.g. carports, decks, landings etc.), the supporting posts or columns.

The SPP bushfire defendable space width calculator has been used to calculate. **Table 4** provides the setbacks required around the perimeter of the built development to reach BAL FZ, BAL 40, BAL29, BAL19, BAL 12.5 construction levels. BAL-LOW construction standards result when the risk of bushfire attack is low and bushfire construction standards are not warranted.

Table 4 Bush Fire Attack Levels and Separations

Direction	VHC	Provided Separation	BRC required separation	BAL and distance
North	13.2	118m	10m separation required form BAL29 on the slope in the north of the site	BAL FZ <8m
				BAL 40: 8-10m
				BAL 29: 10-16m
				BAL19: 16-23m
				BAL12.5: 23-100m
				BAL-LOW: >100m
All	40.4	0m	No separation requirements for construction standards	BAL-LOW: > 100m

3 BUSH FIRE PROTECTION MEASURES

This section assesses the Bushfire Protection Measures (BPMs) for the proposed development in consideration of the acceptable outcomes required for Assessment Benchmarks within the State Planning Policy Natural hazards, risks and resilience – Bushfire and Gympie Regional Council Planning Scheme 2013.

3.1 Development Construction

3.1.1 Ground works and sub-structure construction phase

During the construction phase potential ignition sources of the subject development may include hot works, incorrect disposal of cigarette butts and hot exhausts from vehicles over long grass.

The provision of BPMs and suppression assets should be considered during this stage of construction. Consideration should of a temporary 10,000 litre Static Water Supply or a pump on reliable ground tank within close proximity of the development site 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 once the BPMs within a BFAR are implemented.

Vegetation control around access roads, parking areas and temporary assets such as building site office, should also be considered at temporary BPMs during this stage of construction.

3.1.2 Ongoing Operations

It is proposed that the grounds below the individual photovoltaic modules be fuel reduced to both prevent direct flame contact from grassfires and reduce the likelihood of sparking from the modules causing ignition.

The potential bushfire/ grassfire related risks associated with the operational phase of the development include ignition caused by arcing from transmission lines and electrical shorts, hazards that could accelerate and intensify bushfires/ grassfires (e.g. transformer oil) and health risk associated with burning infrastructure.

The implementation of the recommendations of a BFAR will reduce the risk of bushfire to an acceptable level to allow the development to proceed.

Bushfire Protection Measures (BPMs) and suppression assets should be considered during the ground works and sub-structure construction phase of the project, a 20m Asset Protection Zone (APZ) within grassland hazards will significantly reduce fire spreading to and from the site during construction.

Design and Siting

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

- Hazardous vegetation along access roads and trails is cleared 10m on either side within grasslands to allow emergency egress when required.
- Main access roads within the facility are designed in accordance with 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 access roads and trails do not impede access for fire-fighting and maintenance for fire-fighting purposes.

- Configure buildings to a minimum of 6 metres separation to minimize the potential of building-to-building fire spread.
- Establishment of buildings not to be located upslope from hazardous vegetation, or where this cannot be avoided.
- Development should not occur on ridgelines, saddles and crests where the slope exceeds 14 degrees, and should occur where the effective slope is less than 20 degrees downslope.
- 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.

3.2 Separation – Defendable Space

Defendable space is an area between the bush fire hazard and the asset that allows firefighters adequate access around the asset and access to water for firefighting purposes.

A defendable space can be considered an Asset Protection Zone (APZ) which is an area surrounding a development that is managed to reduce the bushfire hazard to an acceptable level to mitigate the risk to life and property. The required width of the APZ varies with slope and the type of hazard. An APZ can consist of both an Inner Protection Area (IPA) and an Outer Protection Area (OPA). An APZ can include the following:

- footpaths;
- lawns;
- discontinuous gardens;
- swimming pools;
- driveways;
- unattached non-combustible garages with suitable separation from the dwelling;
- open space / parkland; and
- car parking.

Isolated areas of shrub and timbered vegetation are generally not a bushfire hazard as they are not large enough to produce fire of an intensity that will threaten built assets. These areas include narrow strips of vegetation along road corridors.

Any areas that are designated Asset Protection Zones, should be signposted to ensure area is to be maintained in perpetuity for bushfire protection purposes, as indicated in **Plate 5** below.

Evidence demonstrates that increasing the defendable space 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. 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.

Plate 5 Indication of APZ signage

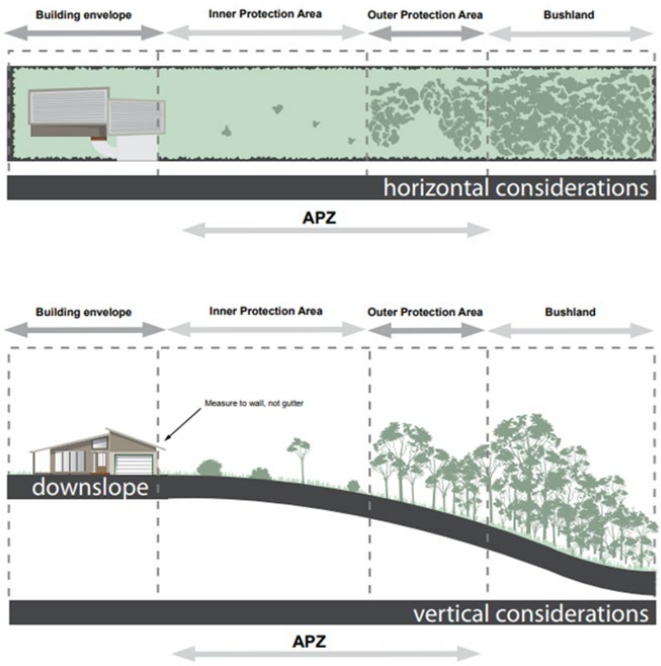

Plate 6 Components of an APZ (Figure A4.1 – NSW PBP 2019)

3.2.1 Inner Protection Area (IPA)

The IPA extends from the edge of the OPA to the development. The intent of an IPA is 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 IPA must be such that:

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

The presence of vegetation in the IPA is acceptable provided that:

- Grasses are generally no higher than 50-75mm.
- As a general rule, trees are allowed within an IPA 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; and
- A recommended performance standard for the fuel load of an IPA is between 0-4 t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example, an area of 100m^2 (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 be permitted in the IPA.

3.2.2 Outer Protection Area

BRC does not provide any guidance on the ability to establish OPA within the defendable spaces. An OPA is located between the IPA and the unmanaged vegetation. Vegetation within the OPA can be managed less intensively. The reduction of fuel in this area substantially decreases the intensity of an approaching fire and restricts the pathways to crown fuels; reducing the level of direct flame, radiant heat and ember attack on the IPA.

Because of the nature of an OPA, they are only applicable in forest vegetation and not relevant in this situation.

3.2.3 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; and
- 10 m firebreak on lot boundaries;

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

3.2.4 Determining the Appropriate Setbacks

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

The development is located and designed to ensure built infrastructure achieve a radiant heat flux level of less than 29 kW/m^2. Achieving this level of separation:

- Reduces potential exposure to bushfire attack, particularly direct flame contact
- Reduces the likelihood of piloted ignition due to radiant heat exposure
- Provides opportunities for emergency access and operational space for firefighters before the arrival of a bushfire
- Improves consistency between planning and building outcomes
- Reduces potential for conflicts between planning and building approvals

The extent of the bushfire defendable space is to be established in accordance with – Detailed Bushfire hazard assessment in the BRC document and AS3959-2018. The required set-backs are dependent on the type of vegetation and the slope under and between the vegetation and built infrastructure.

There are no proposed parks or green spaces with this proposal.

Proposed setbacks from the bush fire hazard have created a defendable space and achieve BAL 29 construction standards.

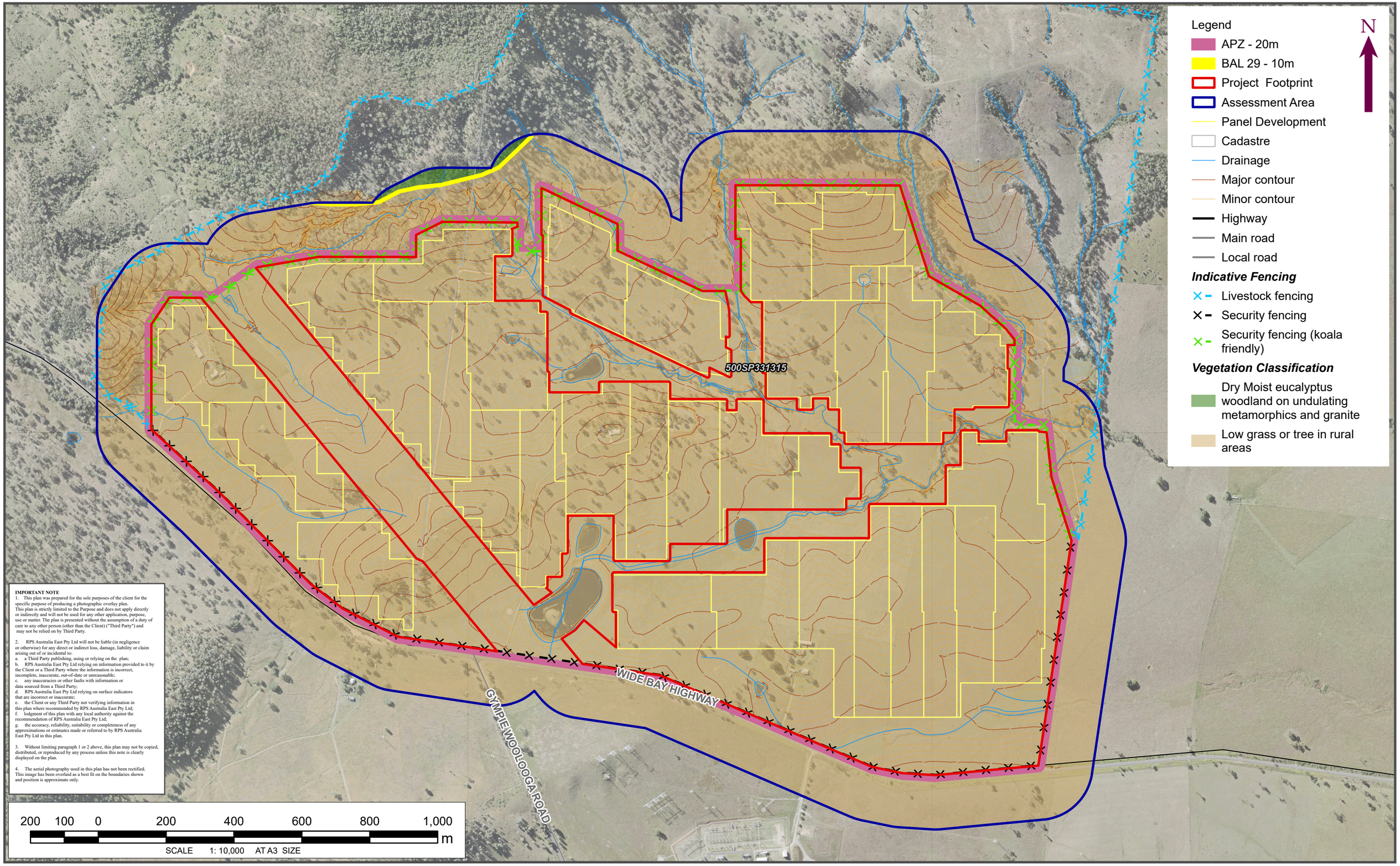

FIGURE 4: BAL AND MITIGATION MEASURES - STAGE 1

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3.3 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 facility. 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 occupants and emergency services.
- Providing emergency services with easy access to a safe working area close to dwellings 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 and appropriately designed driveway access.

The fire-fighting supply must be dedicated, ensuring that it is always available for the intended use. Due to regular drought events, swimming pools, farm dams and ponds are not considered reliable sources of static water supply in Queensland.

All roads, internal and external, to the development are designed to have sufficient capacity for evacuating population and minimize traffic congestion in the event of a bushfire. Wide Bay Highway is sealed and two-way. Internal access track shall be provided to enable two-way traffic and passing. Vegetation Management Plan to exclude ground and shrub plantings adjacent to the internal access track.

Gympie Regional council has only designated on Neighbourhood safer place. This is located at Curra Country Club at 4 David Drive, Curra QLD, is accessible by sealed roads approximately 16km by road to the east of the site.

In line with the Queensland Fire and Emergency Services Fire Hydrant and Vehicle Access Guidelines, there are various fire truck access requirements, including a minimum roadway clearance of 3.5m wide by 4.8 high. This allows fire trucks to gain access to a safe working area close to dwellings and water supplies, constructed roads must be as specified in the ‘Road Planning and Design Manual’ provided by Department of Transport and Main Roads. Roads must be constructed to facilitate safe passage of a laden fire truck in all weather conditions, must be capable of accommodating a vehicle of 15 tonnes. Road’s grade must be able to accommodate these trucks, with dips, slopes and exit angles addressed. Turning bays must be made available for trucks to turn around at dead end roads if more than 60m in length from the nearest intersection. The turning circle must have a radius of minimum 8m.

Establish direct access to a safe assembly/evacuation area in the event of an approaching bushfire and ensure access routes do not expose occupants to bushfire hazard – if routes are exposed to bushfire hazard, alternative direct and safe routes to public road system must be provided.

Due to the size of the development and available cleared country to the east a refuge area centralized in the development area is not required. The cleared country associated with Wide Bay Highway to the east provides short-term refuge where Neighbourhood safer place at Curra provides appropriate off-street parking and have facilities to accommodate the population as short notice.

The internal access trail shall be no longer than 500m and comply with Queensland Fire and Emergency Services - Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots and Department of Transport and Main Roads - Road Planning Design Manual 2nd edition.

3.4 Water Supply

Reticulated water supply is not provided to the site, although it is noted that the site offers several ground tanks (dams) that hold water. Although these assets could be used to facilitate suppression operations, they are not reliable during drought conditions and are commonly not suitable for drafting of water. Static water supply will need to be provided to provide water services for the protection of on-site buildings.

In combination with a 20m APZ around any building and solar panel infrastructure, the provision of 10,000Lt dedicated water tank should be located on site. The installed with pumps minimum 5hp or 3kW petrol or diesel-powered pump and are shielded against bush fire attack. Any hose and reel for firefighting connected to the pump shall be 19mm (internal diameter), and fire hose reels are constructed in accordance with AS/NZS 1221:1997 Fire hose reels and installed in accordance with AS 2441:2005 Installation of fire hose reels. Adequate and reliable access to the tank should be provided at all times.

The water tank requires RFS (Rural Fire Services) Storz connections specifications to ensure efficient access and use of the water source in the event of a fire emergency. It is required that the RFS Storz connection is 50mm in size and is low to the ground as possible without compromising access, this maximises head pressure. Fire hoses typically have Storz connection types of the end of their hoses, but RFS will have various adapters that may be used. There is no required distance between the water tank and hose reel or pump as fire trucks are able to access the tank directly with both hose and pump.

3.5 Electricity, Gas and Hazardous Materials

The output of the proposed transformers will be linked to a substation at which point transmission lines will connect the proposed facility. Transmission lines will travel over several kilometres of predominately grazed pastures or agricultural land and as such should arcing occur (in the right conditions) ignition of the surrounding vegetation and grassland below may be possible.

Maintenance of the vegetation around the transmission lines should be in accordance with the Energy Queensland – Vegetation Management Strategy - ENA Guidelines for Safe Vegetation Management - Overhead Lines.

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

3.6 Hazardous Industry

A preliminary hazard assessment has been completed in accordance to identify bushfire hazards, analyses the effects on people and the environment and their probability of occurrence.

The development may have staff office, amenities block, solar panel infrastructure and associated cabling, workshop, perimeter fencing CCTV and inverters on site. The hazard of these built assets is the potential to create fire (ignition sources) and for fire to travel off site onto neighbouring lands.

Fire hazards from the solar panels is limited because only a small portion of materials within the solar panels are flammable, and those components cannot self-support a significant fire. Flammable components of PV panels include the thin layers of polymer encapsulates surrounding the PV cells, polymer back sheets (framed panels only), plastic junction boxes on rear of panel, and insulation on wiring. The rest of the panel is composed of non-flammable components. Furthermore, the establishment of solar panels provides

shadowing over the surface and near surface fire fuels which results in suppressing grass growth and reduces the amount of fire fuels available for consumption. This reduction in fire fuels will result in a suppression in the 'rate of spread' of a fire head within and under the solar panels.

The ignition sources of this development could be:

1. Above ground powerlines and power sources;
2. Arc flash from power sources;
3. Build-up of dry fire fuels in areas (on solar panels) that generate heat;
4. Location of inverters in relation to BPMs within the development;

The implementation of appropriate design and BPMs will result in risk levels that do not preclude development approval from a bushfire management perspective. Appropriate design and regular maintenance of infrastructure, Fire Management Zones (APZs) and fuel loads (Landscaping) shall be undertaken to verify the safety systems established to mitigate bushfire risk.

The NC Clean Energy Technology Centre indicated in the United States The International Association of Fire Fighters (IAFF) and International Renewable Energy Council (IREC) partnered to create an online training that should be provided to the local NSW RFS brigades and staff www.iaff.org/pvsafetytraining.

3.7 Landscaping and Vegetation Management

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 defendable 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 defendable 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.

We note that defendable 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 are set out below.

Landscape design measures, which reduce vulnerability to bushfire attack, include:

- Establishing minimal fuel around buildings of a minimal of 10 metres, optimal 20m.
- 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, and
  - Climbing plants or vines in contact with external timber fascia, pergolas, posts, beams and/or trellis.
- Establishing non-flammable features such as ground tanks, driveways or paths within defendable spaces between the development and bushfire-prone areas. Paths and driveways should use non-combustible materials such as clay, concrete, gravel and pebbles.
- Ensuring potential hazardous features and out-buildings such as sheds, coops and machinery storages are sited well away from the development and, preferably, sufficiently separated from bushfire-prone areas or shielded from bushfire attack by other buildings such that they are not consumed and contribute to hazard.
- Ensuring the layout of garden beds, lawns and driveways or paths are configured to break-up the continuity of fuel loads within defendable spaces. Continuous vegetation within defendable spaces

assists the spread of fire—separating garden beds and clumps of trees or shrubs with areas of low fuel in between breaks up fuel continuity; reducing potential rate of spread and fire intensity. Examples include placing maintained lawns, pathways or ponds between clumps of trees or shrubs and garden beds.

- 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 (10-20m) between groups, lines, and 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 verges of vehicle access 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 5 centimetres in height;
- Provided that reliable and sufficient water is available, installation of irrigation and sprinkler systems to create a well-watered landscape.

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 8 t/ha in aggregate and fuel structure which is discontinuous. 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.

Parks, open space, landscaping and fuel sources in the bushfire prone area located between hazardous vegetation and building envelopes do not increase the potential for bushfire hazard. This can be demonstrated by providing a landscape maintenance plan which includes long term management arrangements that achieve and maintain a potential available fuel load which is less than 8t/ha aggregate and has a fuel structure which is discontinuous.

Landscaping within the areas identified as defendable spaces and adjacent to access trails shall be managed to ensure a build-up of fire fuels does not occur.

4 CONCLUSION AND RECOMMENDATONS

It is clear from this investigation and assessment that the site constitutes Bushfire Prone Land. In accordance with the provisions of BRC, AS3959-2018 and the Gympie Regional Council Planning Scheme 2013, Rural Zone Code Bush fire, the recommendations outlined within this assessment will substitute as appropriate actions to reduce the risk of damage and/or harm in the event of a bushfire event.

In summary, the following key recommendations have been generated to enable the proposed development to comply with the Gympie Regional Council Planning Scheme 2013, Rural Zone Code Bush fire.

Design and Siting

- Design elements as described in section 3.2 of this report should be incorporated to ensure compliance to bushfire requirements; and

Separation

- A bushfire defendable space is provided between the solar panel infrastructure and hazardous vegetation of 20m.
- A bushfire defendable space is provided between any building and hazardous vegetation of 20m is required.
- This defendable space between the hazard and buildings shall be managed as a Defendable Space (Asset Protection Zone).

Access

- Access requirements as described in section 3.4 of this report should be incorporated to ensure compliance to bushfire requirements, Namely:
  - Roads and trails are designed in accordance with the geometry, turning radii and vertical clearance provisions in the Queensland Fire and Emergency Services - Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots and Department of Transport and Main Roads - Road Planning Design Manual 2nd edition.

Water

- A 10,000Lt water tank is located within the APZ on site with appropriate pump and fire-fight hose connections.

Landscaping and Vegetation Management

- A landscape maintenance 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.
- The dimensions and configuration of revegetation or rehabilitation areas, fire trails, open space, landscaping and fuel sources in the bushfire prone area that are located between hazardous vegetation and solar infrastructure shall not increase the potential for bushfire hazard.

This assessment has been based on the bushfire hazards in and around the site at the time of inspection and production (March 2020).

Finally, the implementation of the adopted measures and recommendations forwarded within this report are based on a thorough assessment under the Bushfire Resilient Communities 2019 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.

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Appendix A

Acceptable outcomes to Gympie Regional Council Planning Scheme Rural Zone Code Bushfire

Acceptable outcomes to Gympie Regional Council Planning Scheme Rural Zone Code Bushfire

Performance Outcome	Acceptable Outcome	Compliance
PO34 Development maintains the safety of people and property, including the function of community infrastructure, during and immediately after bushfire events.	**AO34.1** Development is not located in areas identified as a High or Medium bushfire hazard area. or **AO34.2** Road access for firefighting appliances and firebreaks are provided through a perimeter road that separates the use from areas of bushfire hazard and that road has a minimum cleared width of 20 metres; *and* **AO34.3** For a development requiring MCU involving new or existing buildings with a gross floor area greater than 50m2 where a reticulated water supply is not available and a water tank is provided for the purpose of household water supply, one tank within 100m of each class 1, 2, 3 or 4 building has: (a) fire brigade tank fittings; and (b) if the buildings are in a high or medium risk area identified in the bushfire hazard overlay, the building's take off connection from the tank is at a level that allows 5,000 litres to be dedicated for fire-fighting purposes.	YES – Appropriate Bush fire mitigation measures recommended
PO35 Public safety and the environment are not adversely affected by the detrimental impacts of bushfire on hazardous materials manufactured or stored in bulk.	**AO35.1** No Acceptable Outcome identified.	YES – Does not contribute to bush fire impacts on community