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# Environmental Impact Statement Glenellen Solar Farm

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## Appendix E: Bushfire Risk Assessment

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October 2020

## DOCUMENT TRACKING

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<b>Project Manager</b>	Daniel Magdi
<b>Prepared by</b>	Eliza Biggs, Robert Cawley
<b>Reviewed by</b>	John Norris
<b>Approved by</b>	Dan Magdi
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Template 2.8.1

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## Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
BFMC	Bush Fire Management Committee
BoM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
DMP	Decommissioning Management Plan
ERP	Emergency Response Plan
FDI	Fire Danger Index
FDR	Fire Danger Rating
FRNSW	Fire and Rescue New South Wales
GFDI	Grassland Fire Danger Index
LGA	Local Government Area
MW	Megawatts
NSW RFS	NSW Rural Fire Service
OEMP	Operations Environmental Management Plan
PBP	Planning for Bushfire Protection
PV	Photovoltaic
SDS	Safety Data Sheet
SEARs	Secretary's Environmental Assessment Requirements

## Glossary

Term	Description
Assets	Anything valued by people which includes houses, crops, forests and, in many cases, the environment.
Asset Protection Zone (APZ)	A fuel-reduced area surrounding a built asset or structure which provides a buffer zone between a bushfire hazard and an asset. The APZ includes a defensible space within which fire fighting operations can be carried out. The size of the required asset protection zone varies with slope, vegetation and Fire Danger Index (NSW RFS, 2019).
Bushfire	Unplanned vegetation fire. A generic term which includes grassfires, forest fires and scrub fires both with and without a suppression objective.
Fire Danger Index (FDI)	A relative number denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed.
Fire Danger Rating (FDR)	A relative class denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed. Expressed as LOW, MODERATE, HIGH, VERY HIGH, SEVERE, EXTREME or CATASTROPHIC.
Fuel hazard	Fine fuels in bushland that burn in the continuous flaming zone at the fire's edge. These fuels contribute the most to the fire's rate of spread, flame height and intensity. Typically, they are dead plant material, such as leaves, grass, bark and twigs thinner than 6 mm thick, and live plant material thinner than 3 mm thick.
Grassland Curing	The proportion of dead material in grasslands – usually increases over summer as tillers die off and dry out, increasing the risk of grassland fire.  Note: Grassland curing is measure of grass greenness and expressed as a percentage of the dead grass material based a visual estimate using a guide such as CFA (2014).
Intensity	The rate of energy release per unit length of fire front usually expressed in kilowatts per metre (kW/m).
Residence time	The time required for the flaming zone of a fire to pass a stationary point; the width of the flaming zone divided by the rate of spread of the fire.
Spotting	Behaviour of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

**Note:** Definitions sourced from the AFAC Bushfire Glossary (AFAC, 2012) unless referenced otherwise.

# 1. Introduction

## 1.1 Background

This Bushfire Risk Analysis has been prepared for Trina Solar (Australia) Pty Ltd on behalf of Glenellen Solar Farm Pty Ltd (the ‘Proponent’) to support a Development Application to construct and operate a utility-scale photovoltaic (PV) solar farm near Jindera, New South Wales (NSW), expected to have an electricity generation capacity of up to 200 megawatts (MW<sub>AC</sub>) at the point of connection, producing enough energy (400 GWh) to power the equivalent of 94,899 average NSW households each year (based on a representative household consumption of 4,215 kilowatt hour (kWh) per annum: Australian Energy Market Commission, 2019).

The land associated with Glenellen Solar Farm (GSF, the Proposed Development) is located within the Greater Hume Shire Local Government Area (LGA), approximately 20 km north of Albury in the south western slopes part of the NSW Murray Region (see **Figure 1**). Direct access to the Site is via Ortlipp Road and Lindner Road and an emergency egress route for the Site is proposed from Drumwood Road. There will also be internal access tracks created for GSF. These roads can provide emergency evacuation routes and emergency vehicle entry.

The Proposed Development would comprise approximately 334.2 hectares (ha) of land (referred to as ‘the Development Footprint’) within a subdivided area of the wider landholdings of Jindera Substation (Lot 1 DP 588720), 66 Blight Road West, Glenellen, NSW 2642 (Lot 3 DP 411022 and Lot 3 DP 1190444), and 535 Drumwood Road, Jindera, NSW 2642 (Lot 27 DP 753342, Lot 101 DP 791421 and Lot 1004 DP 1033823) (the “Site”). The Site is bound by Drumwood Road to the south-east, Dead Horse Creek to the north, and Ortlipp Road and an area of woodland to the north-west. The Site and Development Footprint are shown in **Figure 2**.

The Proposed Development will generate electricity through the conversion of solar radiation to electricity using PV panels, laid out across the array area in a series of modules, mounted on a single axis tracking system with piled steel supports. Other infrastructure on site would include electrical invertors, underground electrical cabling, internal access tracks, water tanks, operational buildings, vehicular access, parking areas, security fencing along with landscape screening where required.

## 1.2 Purpose of this Report

This Bushfire Risk Analysis has been prepared to provide an assessment of potential hazards associated with bushfire and electrical fire. It first considers relevant guidance within NSW, then presents an overview of the existing environment. Next it considers potential fire hazards associated with the Site throughout the lifecycle of the Proposed Development. Finally, in line with the appropriate standards, it provides a coordinated response to fire risks.

Section 100B of the *Rural Fires Act 1997* requires that the Commissioner of the RFS issue a Bush Fire Safety Authority (BFSa) for residential, rural residential or rural subdivision and special fire protection purpose developments on bushfire prone land. Special Fire Protection Purpose Developments include:

- a school
- a childcare centre

- a hospital (including a hospital for the mentally ill or mentally disordered)
- a hotel, motel or other tourist accommodation
- a building wholly or principally used as a home or other establishment for mentally incapacitated persons
- housing for older people or people with disabilities within the meaning of *State Environmental Planning Policy No 5 - Housing for Older People or People with a Disability* (now *State Environmental Planning Policy (Seniors Living)*)
- a group home within the meaning of *State Environmental Planning Policy No 9—Group Homes*
- a retirement village
- any other purpose prescribed by the regulations.

The Proposed Development is classified as State Significant Development and is not a subdivision for residential or rural residential purposes, nor is it a development for a special fire protection purpose, hence the issue of a *Bush Fire Safety Authority* from the Commissioner of the NSW Rural Fire Service (NSW RFS) under section 100B of the *Rural Fires Act 1997* is not formally required. Nonetheless, the *Rural Fires Act 1997* places a duty of care on landowners/managers to prevent fire spreading on and from their land, which is a principle that will be adhered to through all phases of the Proposed Development.

As the Proposed Development could be exposed to bushfire risk from grasslands or nearby areas of vegetation, and carries the risk of a potential fire starting from within its boundary, this bushfire assessment has been conducted in accordance with *Planning for Bush Fire Protection 2019* (PBP 2019), (NSW RFS, 2019), which was legislatively adopted on 1 March 2020.

In accordance with relevant guidelines, consideration is given to human health and safety as well as potential interruption of existing services during the construction, operational and decommissioning phases of the Proposed Development. Fire could damage structures and impact the safety of employees and contractors at the Site. Fire leaving, or occurring externally to, the Site poses a threat to human life, safety, and infrastructure and imperils native flora, fauna and ecosystems. Fire risk can be considered in terms of environmental hazards that increase the likelihood or severity of fire (vegetation, topography and weather patterns), as well as activities and infrastructure that increase combustion or ignition risks.

This Bushfire Risk Analysis represents the first step towards the development of a comprehensive Bushfire Emergency Management and Operations Plan which will be prepared post-consent, once full detailed design specifications of the Proposed Development have been determined. Through consultation with the relevant fire authorities, during post-consent preparation of the Bushfire Emergency Management and Operations Plan, agreement will be reached on the specific details of mitigation and emergency response requirements that will take into consideration the final layout.

### 1.3 Consultation

Consultation regarding the Bushfire Risk Analysis was sought from the NSW RFS Southern Border Hume Zone Office in Albury, and the NSW RFS Planning & Environmental Services Manager, Batemans Bay.



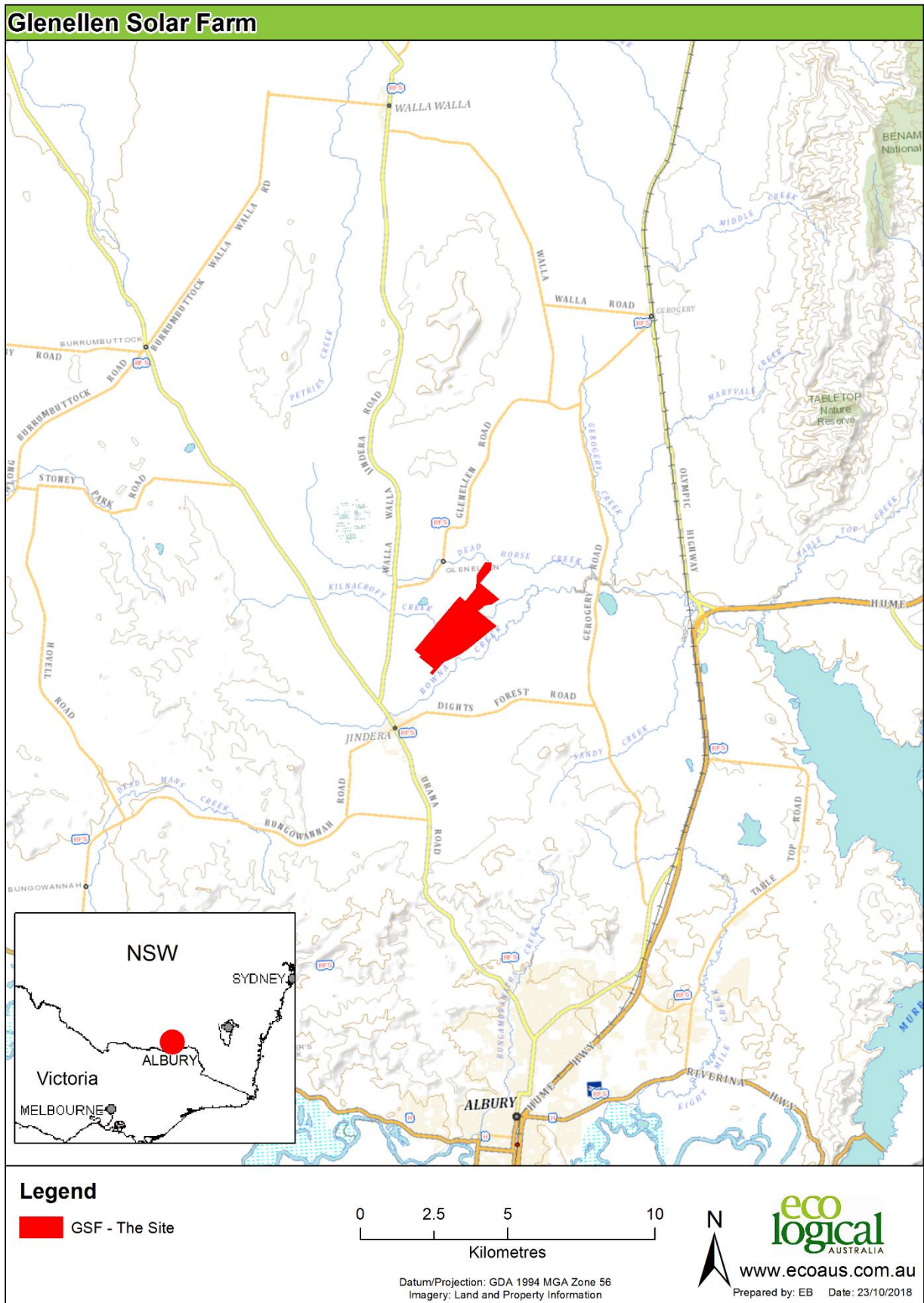


Figure 1: Location Map



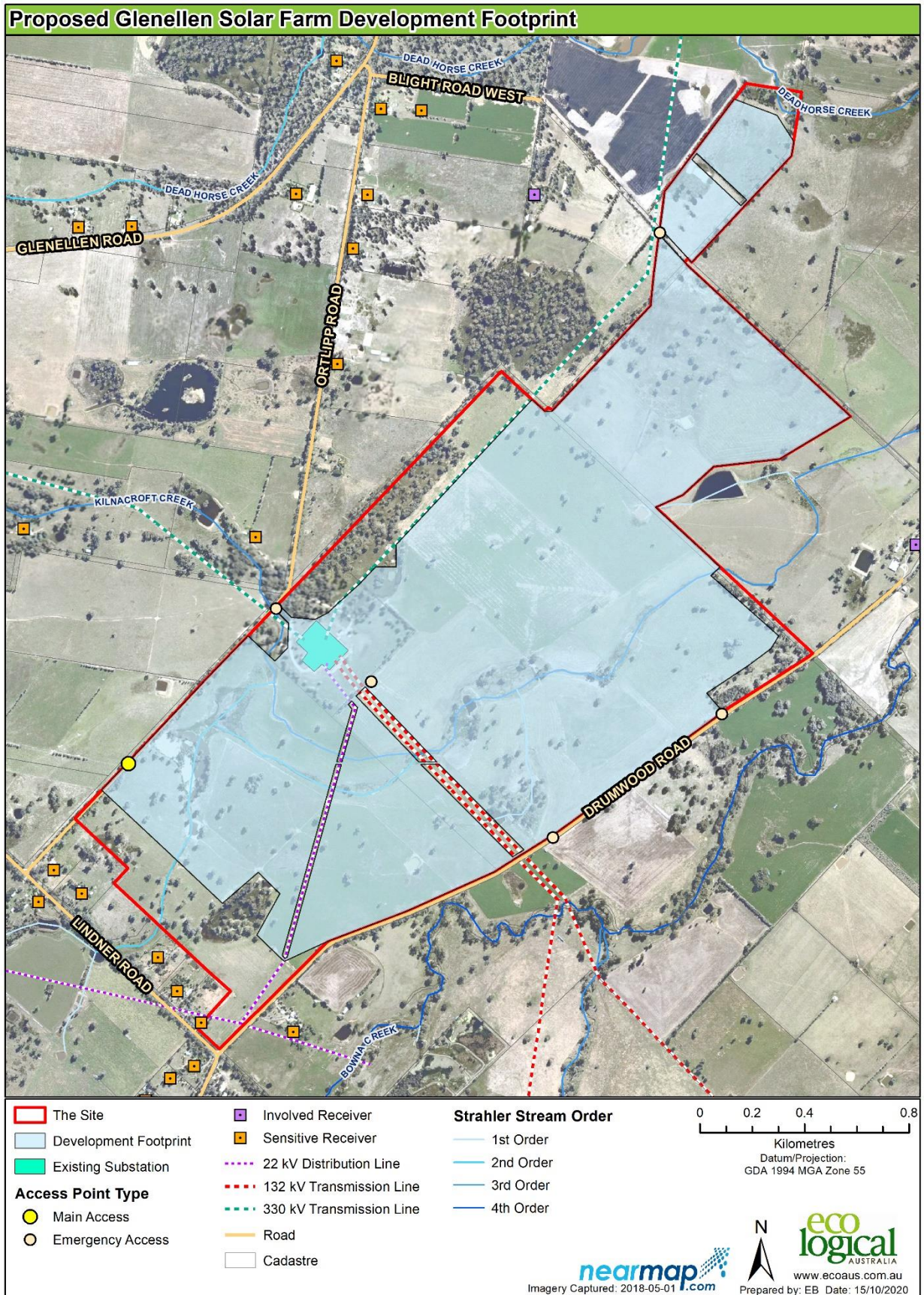


Figure 2: The Site and Development Footprint

## 2. Existing Bushfire Risk Profile

### 2.1 Climate

Climate factors are a major influence on the character and potential hazards of any development site, including erosion and plant growth potential (DLWC, 2000).

The Site is located within the South Western Slopes bioregion. This bioregion is dominated by a sub-humid climate characterised by hot summers and no dry season (NPWS, 2003). Warm summers occur at higher elevation along the eastern boundary, however mean annual temperature (11 - 17°C) increases across the bioregion from low temperatures in the south to higher temperatures in the north and west (NPWS, 2003).

The closest Bureau of Meteorology (BoM) weather station is at Albury Airport (Station 072146), located approximately 15 km south east of the Site. The mean annual maximum temperature is 22.1°C and the mean annual minimum temperature is 8.7°C (BoM, 2018). Mean annual rainfall is 710 mm and records indicate monthly mean rainfall received at the Site is highest in the months of June – August, however winter rainfall is not strongly dominant (BoM, 2018). The mean number of rainfall days >1 mm are higher in winter and range between 4 days (March) to 11.5 days (July) (BoM, 2018). However, mean rainfall days >25 mm are less frequent, ranging from 0.2 days in June to 0.6 in October, and are generally higher in the summer months (0.5 days) (BoM, 2018). This indicates that while mean rainfall at the Site is mildly winter dominant, rainfall intensity is generally higher in August to February.

Wind speeds are generally higher in the afternoon (3 pm conditions) and are generally stronger and more frequent in spring and summer. Winds are predominantly westerlies ranging between 7.8 and 11 km/h (BoM, 2018).

Prevailing weather conditions associated with the bushfire season in the Hume Zone Bush Fire Management Committee (BFMC) area are north-westerly winds accompanied by high daytime temperatures and low relative humidity (Hume BFMC, 2016). There are also dry lightning storms occurring during summer in areas across the district, many being recorded around the softwood plantations and National Park in the east of the zone. The bush fire season generally runs from November to March (Hume BFMC, 2016).

The statutory Bush Fire Danger Period occurs from 1 October to 31 March annually, reflecting seasonal fire hazards, although this will vary from year to year depending on the prevailing climatic conditions in the region. The bushfire season can also be brought forward when a drier than average winter results in the landscape being more susceptible to fires starting and spreading in late spring and early summer.

The harvest period is between November and mid-December and is considered a high-risk period due to the use of machinery in crops, providing both an ignition source and fuel. The harvest period also creates additional activities such as vehicles transporting grain, grain dryers and grain augers. Higher temperatures are experienced in January and February, coupled with low humidity and dry crop stubble over extensive areas thus extending the period of a high fuel load.



## 2.2 Fuel Hazard

### 2.2.1 Fire spread potential within the Site

The Site is located in a predominantly flat landscape, with elevation ranging from approximately 210 to 220 m (Australian Height Datum (AHD)), with a small rise in the centre of the Site. Shallow flat depressions meander through the Site, draining water to several farm dams. The topography of the site falls generally northwards at very flat grades. The landform of the Site would be described as level plain to undulating rises (National Committee on Soil and Terrain, 2009).

The Development Footprint covers approximately 334.2 ha of rural land which has historically been substantially cleared and cultivated to improve pastures for grazing livestock, and for infrequent cropping. There are patches of retained and regenerated native woodland scattered throughout, as well as scattered remnant paddock trees. Approximately 96.71% of the Development Footprint is considered cleared agricultural land, with only 3.29% of the Development Footprint occupied by poor condition native vegetation.

Existing land uses of the Site include agricultural activities and the existing TransGrid substation (Jindera substation on Ortlipp Road) and electricity transmission/distribution lines. Existing fire hazards on site include small areas of native vegetation and although managed, grazed pastures are also susceptible to grass fires in hot, dry and windy conditions.

Higher flammability risk areas are the treed areas of the Site. Woodland fragments are sparse across the Site and will be retained in areas not developed for the Proposed Development as detailed in Section 8.2.4 of the EIS. Due to the construction and operational activities occurring outside the more densely treed areas, it is considered unlikely the Proposed Development will pose a significant bushfire risk. Although cleared areas of the Site are not currently mapped as bushfire prone land, grassland fires burn at a higher intensity and spread more rapidly with a shorter residence time than that of fires in other vegetation classifications (RFS, 2018).

Up to 11.4 ha of native vegetation and 81 paddock trees occurring within the Development Footprint will be removed prior to construction. All trees within the Array Area will be removed; however, in line with the design principal which prioritises the avoidance of vegetation removal where possible, small stands of trees will remain within the Site but outside the Array Area as shown on **Figure 2**. Due to their size and distance from other areas of vegetation, these trees are classified low threat vegetation under section A1.10 of PBP 2019.

The Proposed Development will alter the land management practices within the Development Footprint, potentially resulting in an increase in pasture fuel load as a consequence of reduced grazing pressures from livestock. As a result, grassfires within the Site are considered a potential risk; however, this risk can be effectively managed through mitigation measures to reduce the fuel load within the Site.

Under the PV panel infrastructure, it is intended that pasture fuels are maintained in a low fuel state (<100 mm) by land management activities such as mechanical methods (e.g. slashing and mowing) and potential sheep grazing. While a fire could still spread in these fuels under adverse fire weather conditions, there is less potential for damage to infrastructure than if heavier pasture fuels are present. Heavier pasture fuels are more difficult to extinguish, have a longer flame length, travel slower with a longer residence time than lighter pasture fuels (Cruz *et al*, 2017), and therefore have a higher potential

to damage elevated infrastructure. In addition, asset protection zones would also be designed and maintained around buildings and infrastructure to reduce the risk of fuel loads building up around sensitive assets. These management actions will be included in the relevant environmental management plans.

The flammability of solar farms is very low as they are predominantly constructed of glass, silicon, steel and aluminium. The flammable components of solar PV panels include the thin layers of polymer encapsulates surrounding PV cells, polymer back sheets, plastic junction boxes and wiring insulation, however the components which make up a small portion of PV panels cannot self-support a significant fire.

In the case that panels were able to be initially ignited, the likelihood of a fire spreading within the solar farm, by propagating from panel to panel, is difficult to assess at this stage. This is because of a lack of previous fire records from fire agencies and solar farm sites, or available research results for similar environments, climates, and solar farm components relevant to Australia. Although no relevant information is available from within Australia, the risk of a fire spreading widely from panel to panel is considered likely to be very low because of the panel construction materials (panels are predominantly constructed of glass, silicon, steel and aluminium) and fire resistance rating, as well as the time of flame exposure which is required to initially ignite these materials.

Portions of the Site and its surrounds are mapped as bushfire prone land (Vegetation Category 2) on the Greater Hume Shire Bushfire Prone Land Map (Greater Hume Shire Council, 2011). The maintenance of an Asset Protection Zone incorporating a Category 1 fire trail construction around the perimeter of the Development Footprint will reduce fuel load and provide improved access to emergency vehicles. **Figure 3** shows the Site relative to mapped Bushfire Prone Land.

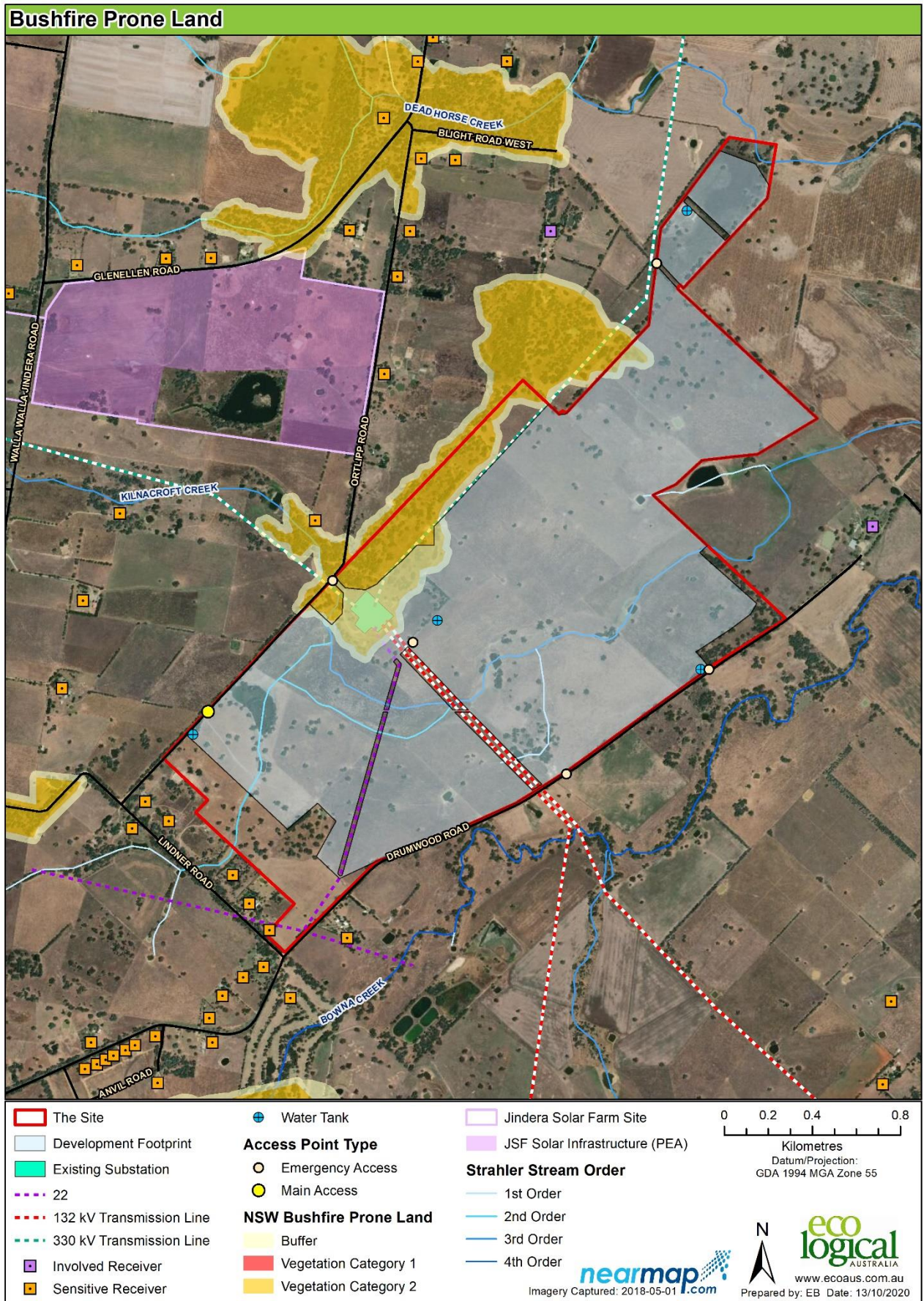


Figure 3: Bushfire Prone Land, and potential emergency exit and water tank locations



### 2.2.2 Fire spread potential within the surrounding landscape

Small portions of the Site to the north-west of the Development Footprint, including land within the Jindera Substation allotment, and its surrounds are classed and mapped as bushfire prone land (Vegetation Category 2, **Figure 3**; NSW Department of Planning Industry and Environment, 2020). Category 2, symbolised as light orange on the Bushfire Prone Land Map and given a 30 m buffer, is considered to be a lower bush fire risk than Category 1 and Category 3 but higher than the excluded areas. This vegetation category has lower combustibility and/or limited potential fire size due to the vegetation area shape and size, land geography and management practices.

The land surrounding the Site is primarily used for agricultural activities including cropping and grazing, with associated rural dwellings, in addition to rural residential subdivision along Lindner Road.

In the wider area, due to historic clearing for agriculture, broad-scale vegetation cover is generally low except within road reserves, in isolated patches in paddocks, low-lying areas and gullies, and in gardens, parks and surrounding residences across the landscape. In cleared areas, groundcover generally consists of grazed improved pastures and cropping.

Groundcover adjacent to the Site is dominated by grazed pastures and while managed, it could be susceptible to grassfires in hot, dry and windy conditions. These areas are not classified as bushfire prone, may still carry a grassfire if:

- Grasses are cured (generally more than 50% for continuous fire spread (Cheney & Sullivan, 2008), although discontinuous spread can be propagated in instances as low as 25-30% curing (Cruz *et al*, 2017))
- Grass loads are heavier, which provides a greater chance of ignition and fire spread (although grassfires may still start and burn through grazed, eaten out areas and stubble)
- Pasture grass fuels are continuously linked across the landscape.

At the Site it is unlikely that adjoining pastures will be carrying heavy pasture loads which are also fully cured, as neighbouring properties are agricultural grazing enterprises. A more likely scenario is that by mid to late summer (when pastures are either partially to fully cured), the pasture condition is likely to be either slashed or well grazed. Grassfires burning in lighter pasture fuels will burn at a *quicker* rate of spread, *lower* flame height and *shorter residence time* than heavier pastures (Cruz *et al*, 2017).

Grassfire spread can be held up or stopped where continuous cured grass cover is broken up by local roads, green creek lines, arterial public roads, firebreaks, fully grazed down areas and farm breaks/tracks. Such features occur in the landscape surrounding the Site, and include:

- Drainage lines and rivers
- Screening, ornamental or wind break plantings of low-spotting native and non-native tree species
- Residential houses, shed and other infrastructure required for agricultural activity
- Powerline easements
- Public roads which run along the boundaries of the site
- Farm access tracks in all adjoining properties.

These features make it very unlikely that large areas of the surrounding landscape can easily support a continuous (fully linked) cured grass cover, which will then allow development of a large-scale grassfire.

## 2.3 Fire History and Ignition Sources

There is no fire history documented within 10 km the Site, however the broader Hume Zone BFMC area (inclusive of Greater Hume LGA) experiences on average 50 bushfires per annum, of which very few can be considered to be major fires (Hume BFMC, 2016). Across Hume Zone BFMC area the main sources of fire ignition are identified by Hume BFMC (2016) as:

- Escapes from legal burning off
- Lightning (mainly associated with late spring and summer thunderstorm activity, which is normally (but not always) accompanied by rainfall)
- Farm machinery (activity early in the summer when cereal crops are being harvested often produce outbreaks of fire across the Zone. Many haystack fires have also been experienced in recent years that appear associated with the unusual rainfall pattern)
- Travelling public (Hume, Riverina and Olympic Highways pass through the Zone with a number of recorded ignitions occurring each year)
- Trains (main Melbourne to Sydney railway line has been a known ignition source in the past decade)
- Incendiarism (Arson/fire setting is most common in the grassland and forested areas adjacent to townships, particularly the suburbs of Albury. Areas of high incidence have been identified by the BFMC).

Any of these potential ignition sources, besides trains, are possible in the vicinity of the Site.

### 2.3.1 Ignition sources during Construction and Decommissioning

During the construction and decommissioning phases of the Proposed Development, the following are potential ignition sources:

- Machinery movement in long grass, including vehicles, earth moving equipment, mowers and slashers
- Hot work activities, including welders and grinders
- The storage of waste and combustible materials onsite
- Storage of flammable liquids
- Electrical faults
- Lightning strikes
- Cigarette butts disposed of carelessly on-site or from cars travelling nearby.

The existing overhead electricity transmission lines also pose a potential hazard, however, TransGrid and Essential Energy are required to maintain line infrastructure to minimise fire risk.

Considering the sparse vegetation cover over the Development Footprint and other factors discussed above, it is considered unlikely that the Proposed Development would pose a significant bush fire risk. The bush fire hazard associated with the activities listed above is considered highly manageable through staff and contractor consultation and awareness programs, electrical equipment selection, appropriate



access arrangements, fuel load reduction programs, safety protocols during periods of high fire risk and the implementation of an emergency response plan as detailed below in Section 3.

Potential fire risk during decommissioning activities would be similar to those for construction. The Site will be fully decommissioned and returned to a state suitable for agricultural use at the end of its life. The commitment to decommission the project is explicit throughout the EIS. The Proponent has specifically requested in their development application for a planning approval of only 30 years. Prior to the expiry of that 30 years, all infrastructure associated is required to be removed, with possible exception to underground cables deeper than 500 mm, and the Site returned to agricultural use as part of a decommissioning process.

It is expected that a requirement to decommission and restore the Site to its original state would be included as a condition of consent. Trina Solar would be responsible for decommissioning the Proposed Development and whoever owns it would be bound to this obligation under the EP&A Act. At the lease expiry, the management of the land would return to the landholder.

### 2.3.2 Ignition sources during Operation

In addition to the potential ignition sources identified above, the operational phase would include fire risks associated with damaged or faulty electrical equipment.

The solar panels are non-reflective and present no risk of ignitions from concentrated solar energy. Ignitions from other PV equipment is theoretically possible from electrical faults such as arc faults, short circuits, ground faults and reverse currents (Allianz Risk Consulting, 2012).

It is conceivable that arcs or melted components resulting from a fault could, if conditions were suitable, ignite grass fuels under or surrounding installations and potentially start a fire. The level of fire risk from faults cannot be assessed at this stage because there is no case history available (see also **Section 2.2**), however, the risk of faults is considered to be low.

## 2.4 Life and Asset Risk

### 2.4.1 Fire-fighter and public safety

The usage of the general area surrounding the Site would mostly be limited to residents and employees who are involved in agricultural enterprises, persons living in rural residential premises within proximity of the proposed solar farm, people using local roads and the operators of the solar farm site.

All Fire and Rescue NSW (FRNSW) stations are equipped with the resources, including breathing apparatus, and trained personnel required to deal with fire and hazmat incidents. The fire-fighters likely to respond to a fire in this area would be FRNSW fire fighters (located in Albury Civic Fire Station, 15 km south from the Site) and/or volunteers from the NSW RFS. The nearest RFS Brigades are at Glenellen and Jindera, approximately 1.8 km north and 2.5 km south of the Site respectively. A multi-agency Pre-Incident Plan for the Site would be developed as part of the preparation of a Bushfire Emergency Management and Operations Plan for the Proposed Development under PBP 2019.

The commercial helicopter business, Forest Air, situated approximately 1 km from the Site has eight helicopters equipped for fire-fighting.

Potential risks to fire-fighter safety associated with a fire burning the solar panels and associated equipment include:

- Electrocution – as solar panels would be energised under any natural or artificial light conditions; therefore, isolation of DC current can only occur at an inverter (Backstrom & Dinni, 2011)
- Safe use of water spray or foam application is only possible from the perimeter of the solar panelled portion of the farm and could not reach the 250 to 500 m required to reach the furthest internal distance (without an aerial ladder platform appliance)
- Inhalation of potentially toxic fumes and smoke from any plastic components such as cables (although the main structure of the panels will be glass and aluminium) or other decomposed products of the panels (Allianz Risk Consulting, 2012).

The materials for individual components within the solar farm infrastructure have not yet been finalised, therefore, the flammability and toxicity of burning components cannot be determined in detail at this time. The burning of materials such as backing sheets and ethylene vinyl acetate (EVA) will produce hazardous gasses and therefore may require breathing apparatus if those materials are adopted. Thus, the level of risk from burning solar panel components is difficult to quantify. Any fire-fighters attending a fire at the solar farm should be equipped with breathing apparatus and trained in structural and electrical fire-fighting – specific safety requirements for firefighters will be determined prior to construction, following the agreement of final design specifications and materials, as discussed in **Section 3.8**.

#### 2.4.2 Assets

Assets are potentially at risk from a bushfire that may propagate within the solar farm and spread from the Site, or from an external fire threat. The following assets are proposed on site or located within two kilometres of the Proposed Development:

##### ASSETS LOCATED ON-SITE

Existing assets at risk from fire include the TransGrid substation located within the Site.

The proposed solar farm will consist of:

- approximately 300 ha of solar PV modules on piled supports
- inverters
- underground cabling
- connection to Jindera Substation
- temporary construction/ operations compound
- security fencing
- maintenance and access tracks
- landscaping including screen plantings.

##### ASSETS LOCATED OFF-SITE

Existing receivers and assets located within 2 km of the Site include:

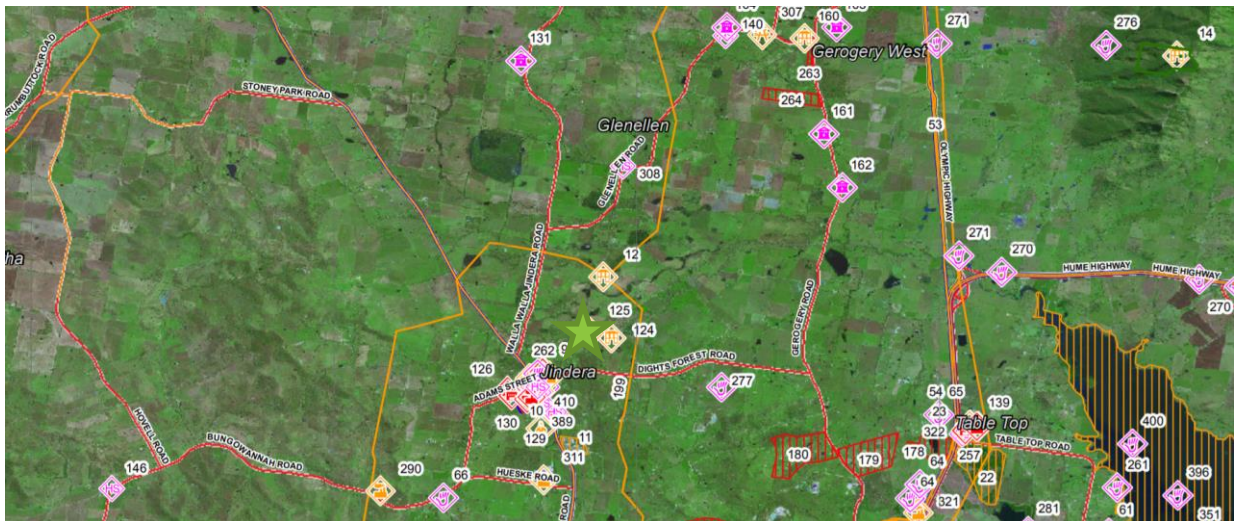
- Two involved dwellings and 108 non-involved dwellings
- Rural inhabited landholdings

- Agricultural enterprises including livestock (and associated infrastructure)
- Local roads
- Forest Air Helicopter Base (approximately 1 km north from the Site)
- 132 kV high voltage TransGrid powerlines, and several local 11 kV Essential Energy lines
- Fences.

The closest assets described by the Hume BPMC (2016) are listed in **Table 1** below and illustrated in **Figure 4**.

**Table 1: Near assets described by the Hume BPMC (2016)**

Map Ref	Asset name	Type	Subtype	Risk level	Priority	Distance from Site
12	Lindner Road Electrical Sub-station	Economic	Infrastructure	Very High	2A (T24)	~ 0km NW
125	Jindera Sewerage Works	Economic	Infrastructure	High	2A	~ 1km S
9	Jindera Aged Care Facility	Human	Special Fire	Very High	2A (T15;29;32;53)	~ 2km SW



**Figure 4: Snapshot of the Hume Zone West bushfire planning map (Hume BPMC, 2016); green star indicates Site location.**

## 2.5 Cumulative impacts

The proximity of multiple construction and/or operational projects provides opportunity for potential cumulative impacts. Key mitigation strategies for cumulative impacts are the spatial and temporal separation of impacts

A search of the NSW Major Projects Register, VicPlan, and LGA websites (NSW and Victoria) was undertaken on 3 September 2020 to identify major projects and renewable energy projects which may contribute to cumulative impacts. The location and status of projects identified within 30 km of the Proposed Development during the search are provided in **Table 2** and projects within 50 km are shown in **Figure 5**.

**Table 2: Nearby major and/or renewable energy projects**

Project	Approximate Distance and Direction from Site	Development Phase
Jindera Solar Farm (130 MW)	310 m NE	NSW DIPE decision pending
Walla Walla Solar Farm (300 MW)	21 km N	NSW DIPE decision pending
Hume Battery Energy Storage System (20 MW/40 MWh capacity)	22 km SE	NSW DIPE decision pending
Howlong Sand and Quarry Expansion	25 km W	Response to Submissions
Wodonga Solar Farm, Victoria (54 MW)	26 km SW	Approved
Culcairn Solar Farm (400 MW)	27 km NNE	NSW DIPE decision pending

The construction and/or operation of these proposed developments may coincide with construction and/or operation of the Proposed Development; however, it is not possible to know which proposed developments will progress to completion at this point in the development process. The cumulative impacts related to bushfire mitigation and other developments in the area are as follows:

- *Volunteer fire-fighter workload* – Response call outs should not increase because the ignition risk is very low and possibly lower than the risk from surrounding agricultural activities. There will, however, be an ongoing requirement for briefing on the ERP
- *Construction stage transport and road use* – The bushfire mitigation infrastructure (i.e. fire breaks, and water storage) will add a small percentage to the total construction traffic and road use
- *Ongoing operations* – there would be a low potential for cumulative operational impacts should fire move through the landscape impacting more than one receiver.

The proximity of multiple projects actively managing fire risk could assist in management responses and may create a positive cumulative impact, in comparison with existing conditions. The Jindera Solar Farm will incorporate fire-sensitive design features and has committed to preparing a Bush Fire Management Plan (NGH Environmental, 2019).

In consultation with Council and RFS, the preparation of the Bushfire Emergency Management and Operations Plan will consider, on an ongoing basis, the most current information available regarding fire risk from and to surrounding land uses.



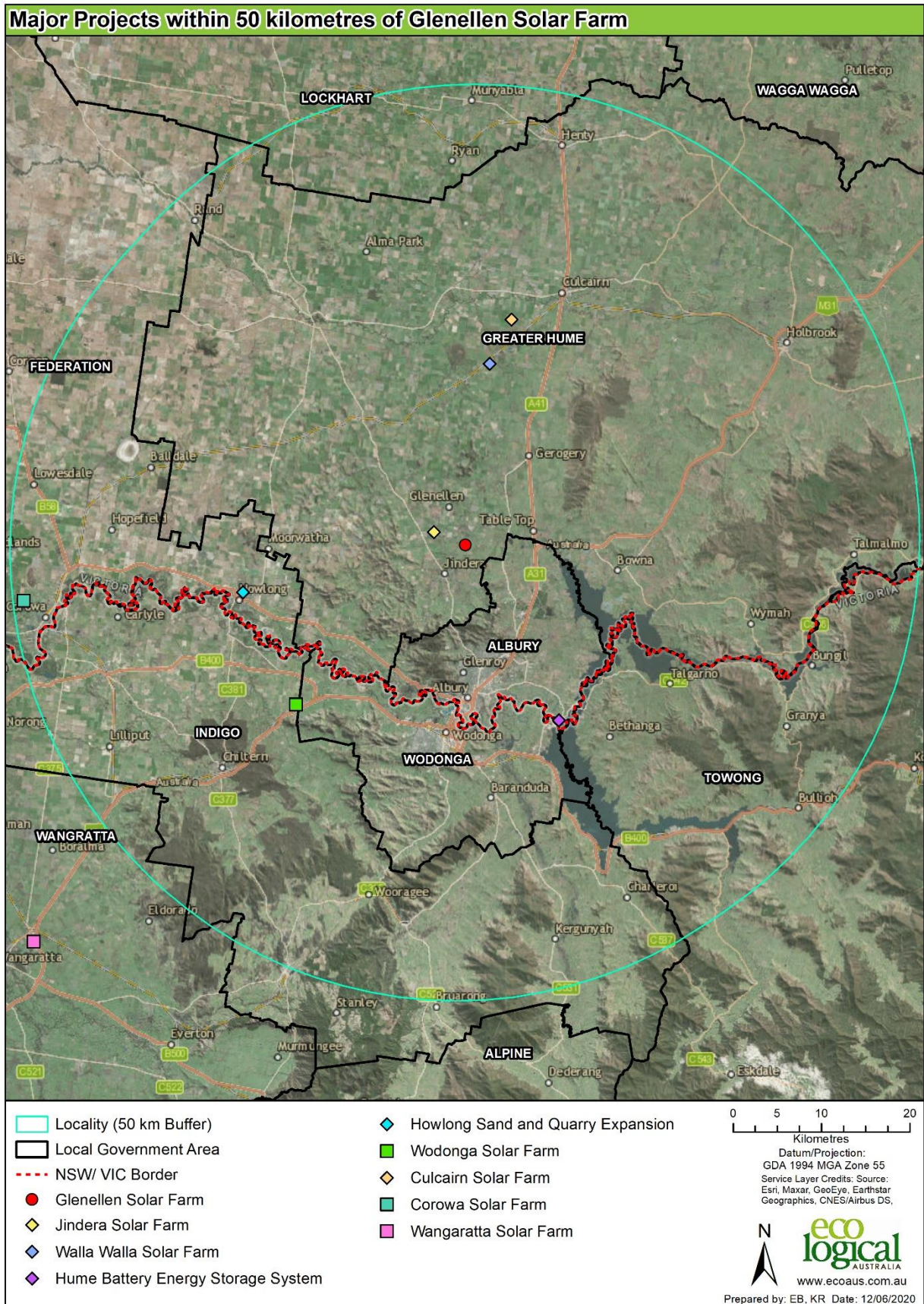


Figure 5: Renewable energy / major projects within 50 km of the Proposed Development

## 3. Mitigation strategies

### 3.1 Overview

Mitigation strategies presented are guided by Section 8.3.5 of *PBP 2019* (NSW RFS, 2019) in the context of the bushfire risk factors present at the Site. They include requirements for asset protection zones (APZ), site landscaping, access, water and utilities, and fire preparedness and response. These management actions will be included in the Construction Environmental Management Plan (CEMP), Operational Environmental Management Plan (OEMP) and Decommissioning Management Plan (DMP) prepared, in consultation with fire authorities and Council, prior to each respective phase of the Proposed Development.

### 3.2 Asset Protection Zones

#### 3.2.1 Description

An APZ is defined (NSW RFS, 2019) as:

*A fuel reduced area surrounding a build asset or structure which provides a buffer zone between the bushfire hazard and an asset. The APZ includes a defendable space within which fire fighting operations can be carried out. The size of the required APZ varies with slope, vegetation and fire danger index.*

An APZ can be maintained as a lower fuel hazard area through mowing/slashing or grazing grass, creating a defendable space of ploughed/ fallow ground or mineral earth break (such as fire trail). APZs do not eliminate the fire risk, under adverse conditions fire may spot over, or embers may travel through APZs, however, they may lower fire risk it to an extent where fire control is more feasible under most conditions, or damage to the asset is reduced or eliminated. As such, they can assist in reducing the potential for a fire to impact the Site, as well as spread from the Site.

#### 3.2.2 Specifications

APZs would also be designed in accordance with NSW RFS guidance including *Standards for Asset Protection Zones*, and maintained to reduce the risk of fuel loads building up. An APZ will significantly reduce the likelihood of a bushfire spreading into the solar farm or from the solar farm into surrounding farmland. The specifications recommended for the APZs are shown in **Table 3**. These specifications will ensure the risk of a fire propagating across the APZ is minimised and that burning embers will not spot across the APZ, except under very high winds.

**Table 3: APZ requirements**

APZ/fire break	Width	Specification
Development Footprint APZ	20 m width from woodland areas and 10 m width in grassland areas	<p>The Proposed Development shall include a suitable setback (managed as an APZ) around the perimeter between the security fence and the panel array which allows for a trafficable, defendable firefighting space that permits unobstructed vehicle access, with adequate room for emergency vehicles to access the Site and manoeuvre around.</p> <p>The APZ will be maintained from the commencement of construction in perpetuity as an Inner Protection Area (PBP 2019 – Appendix 4) as follows:</p>



APZ/fire break	Width	Specification
		<p><b>Trees</b></p> <p>Canopy is less than 15% at maturity</p> <p>Canopy at maturity must not touch or overhang any buildings on site including infrastructure</p> <p>Lower limbs are removed to 2 m above ground</p> <p>Canopies should be separated by 2 m – 5 m</p> <p>Preference should be given to smooth barked or evergreen trees</p> <p><b>Shrubs</b></p> <p>Should not form a continuous canopy and not more than 20% of groundcover</p> <p><b>Grass</b></p> <p>where present should be kept as mown &lt;100 mm in height</p> <p><b>Leaf litter and debris</b></p> <p>leaf and other debris including woodchip should be removed.</p> <p>The perimeter APZ also incorporates a mineral earth perimeter Category 1 fire trail (trafficable 4 m width with passing bays every 250 m) within the 10 m APZ, maintained in accordance with NSW RFS fire trail standards (NSW RFS, 2019a).</p> <p>Portions of this APZ may be established as a gravel surface. This will have the added benefit of reducing future ongoing vegetation management requirements.</p>

Minimum APZ requirements may be further determined in consultation with NSW RFS following the final design and layout of the Proposed Development. This will account for the varying slope across the Site, the fire danger index (FDI) and vegetation formations across the Site.

### 3.3 Site Landscaping

#### 3.3.1 Screen plantings

Vegetation screens are proposed to reduce the visibility of the solar array from nearby residences. Trees and shrubs abutting the APZ on the side of an approaching fire may increase the risk of embers carrying across a fire break and creating the potential for a spot fire to spread on the other side (Cheney & Sullivan, 2008). The planting of trees and shrubs for visual screening on the external side of the APZ may increase the risk of embers from an external fire entering the solar farm, and therefore the following mitigation measures are recommended for screen plantings:

- Use species suitable for the environment that have low fire spotting characteristics (such as smooth bark or evergreen species) and avoid high flammability species in consultation with the RFS and local nurseries
- Plant as a continuous form with no breaks of sufficient size to allow winds to funnel through;
- Plantings are placed on the outer side of the APZ (away from the asset)
- Routine maintenance occurs prior each fire season to remove dead materials, dead plant growth and leaf litter from within the vegetation screen.

#### 3.3.2 Fuel management within the Site

There is potential for a grassfire to start and spread within the footprint of the solar farm (see **Sections 2.2 and 2.3**); ignitions could include lightning fires, human error or electrical faults.

For this reason, the fuel load across the Proposed Development will be monitored and vegetation fuels internal to the APZ and throughout the solar farm will be actively managed through mechanical slashing, mowing and/or grazing as required to reduce the risk of grassfires starting within the Site and ensuring that fires originating from outside the Site do not intensify as a consequence of entering the Site. This will also minimise the radiant heat exposure to solar farm components and reduce the risk of a fire spreading beyond the solar farm.

In addition, asset protection zones would also be designed and maintained around buildings and infrastructure to reduce the risk of fuel loads building up around sensitive assets. These management actions will be included in the relevant environmental management plans.

During the bushfire season, pastures within the Site (including under panels) are to be maintained with minimal fuel load (<100 mm grass height). Fuel management requirements would be achieved through mechanical methods such as slashing and mowing, herbicide, and/or potential grazing. If grazing is utilised, overgrazing will be avoided to maintain the groundcover and reduce the potential for erosion.

Cropping may also be undertaken in the six metre wide spaces between PV panel rows (**Figure 6**). Cropped areas will pose a higher fire risk due to increased fuel loads when crops reach maturity and cure. Bushfire mitigation measures employed to reduce impacts of this higher fire risk should include:

- A mosaic of crop plantings of varying age classes is used to reduce the availability of higher uniform fuel loads across the Site at any one given time
- The creation of adjoining alternate cropped, and uncropped areas is maintained to breakup continuous potential fire runs within the Site
- Avoidance of harvesting machinery on very high fire danger days or above to reduce likelihood of ignition.



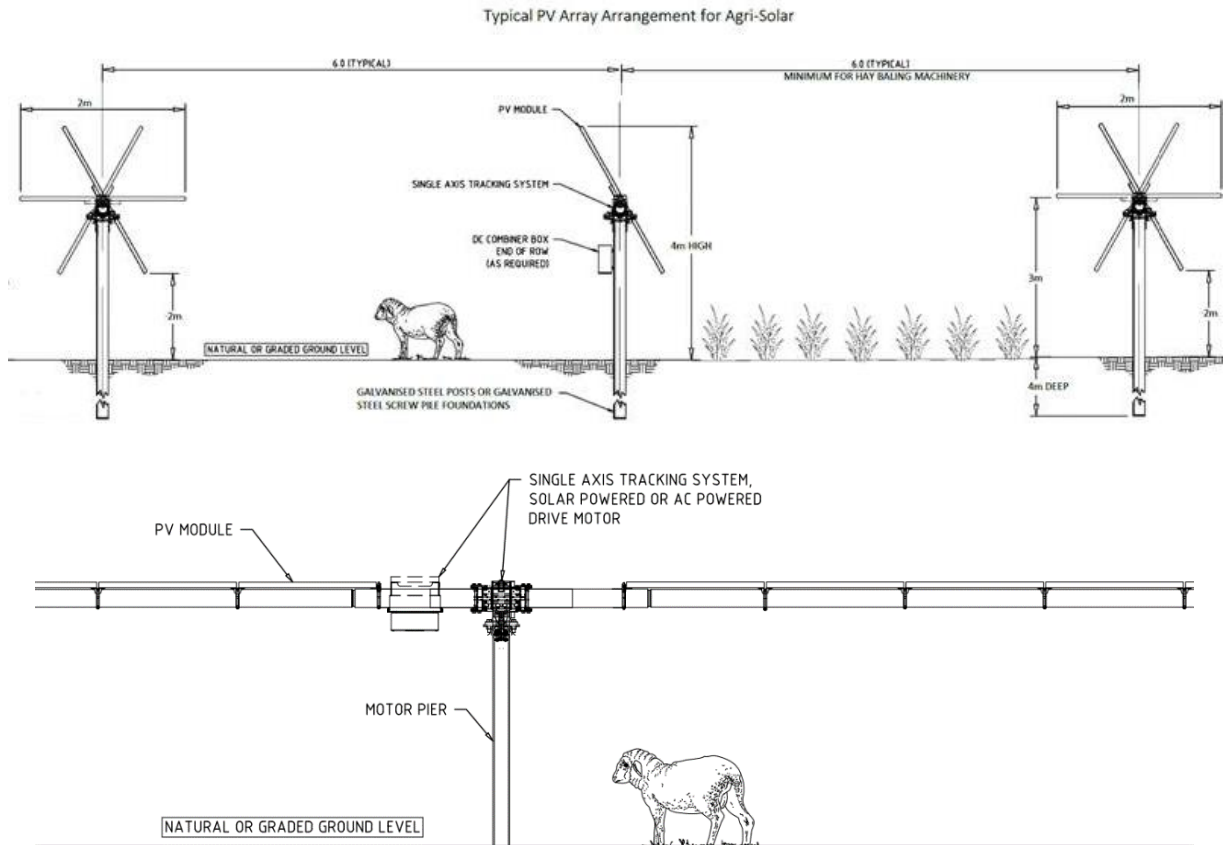


Figure 6: Generic Tracking System SAT elevation view showing approximate dimensions (Images courtesy of Zenviron)

### 3.4 Construction and Design

Electrical equipment selected for the 30 year life span of the Proposed Development would be designed to minimise the potential for ignition and certified to comply with relevant Australian Standards. The Proposed Development will ensure that all equipment at the Site is installed correctly and maintained in good order to prevent sources of ignition from faulty equipment. All installed equipment would be earthed appropriately following comprehensive testing of soil conductivity to ensure lightning effects are not harmful to the operation of the Proposed Development.

Chemical storage will be in accordance with Safety Data Sheet (SDS) requirements and *Australian Standard AS1940-2004: The storage and handling of flammable and combustible liquids*, or its latest version and would consider potential fire hazards (e.g. the use of fire cupboards for the storage of chemicals). An inventory of the quantities, storage location and copies of SDSs will be held at both access points to the solar farm and will be made available to the emergency services on arrival to the Site.

Solar panels and other components (such as cables) may be exposed to flame contact if a fire were to spread within the solar farm footprint. Therefore, it is recommended that components that are vulnerable to damage from temperatures associated with flame contact are shielded as far as possible. Design should consider the following features:

- Burial of cables underground

- Shielding of above ground cables and circuitry.

All electrical equipment must comply with relevant construction standards and design; installation of electrical equipment such as junction boxes, inverters, transformer and electrical cabling is to be in accordance with AS 3000:2007 Wiring Rules.

### 3.5 Construction and Operations protocols during bushfire season and on days of Very High or worse fire danger

A hot works permitting system is in place and, to minimise the risk of grassfire ignitions, all operations involving earth moving equipment, vehicles, slashers and hot works (e.g. grinders, welders) must cease during Total Fire Bans, while the Grassland Fire Danger Index (GFDI) is or is forecast to be 35 or greater, or high winds are forecast. This will require establishing an operational procedure for onsite monitoring and recording of temperature, relative humidity and wind speed, as well as associated training.

On days when Very High Fire Danger Rating or higher is forecast for Jindera, the “fires near me” app is to be checked hourly for the occurrence of any fires likely to threaten the site; and all plant, vehicles and earth moving machinery are cleaned of any accumulated flammable material (e.g. soil and vegetation).

Should construction of the solar farm take place between 1 October and 31 March (see **Section 2.1** for data on seasonal occurrence of fire weather), the following measures are recommended to control the risk of grassfire ignitions:

- The APZ is constructed as one of the first stages of development
- A suitable fire appliance is present on site with at least two personnel trained in bushfire fighting.

### 3.6 Access

The Site is well serviced by council roads which afford direct access to the Site. The main access to the Site is proposed via a new entry from Ortlipp Road (**Figure 3**). In an emergency, secondary access to the Site may be obtained from any of the access points, including along Drumwood Road and Blight Road.

Appropriate emergency vehicle access will be provided across the entire Site. There will be five (5) gated emergency entrance and exit points (including the main entrance) along the perimeter security fence of the Development Footprint ensuring that the Proposed Development can be accessed or evacuated at a number of locations (see **Figure 3**).

A perimeter Category 1 fire trail is to be constructed around the solar farm footprint (Array areas) within the APZ, from the commencement of construction and maintained for the life of the Proposed Development, in accordance with NSW RFS standards for fire trails (NSW RFS, 2019a).

Appropriate emergency vehicle access will be provided and maintained across the entire Site via internal access tracks. Internal access tracks will be 4 m - 16 m wide with intermittent wider stretches for passing, parking and at corners, and will be constructed in accordance with RFS requirements.

A number of internal management tracks will provide an internal access network within the Site. The safety hazards for fire-fighters from PV panels (**Section 2.4.1**) and local fire-fighting capability are such that fire suppression within the Array areas of the solar farm cannot be expected or relied upon.

Therefore, fire suppression is most likely to be staged from the APZ or beyond, and not the internal access tracks. As such internal trails dedicated specifically for fire-fighting are not proposed (although the internal management tracks may be utilised if approved by the fire agency incident controller). An exception to this would be aerial water bombing that is compliant with air operations safety procedures; however, these resources may not be available at short notice for a fire that could spread several kilometres within an hour.

### 3.7 Water and Utilities

#### FIREFIGHTING WATER:

Although it is a lower risk site, the availability of water supplies to assist with initial fire attack and fire suppression operations will further reduce the risk of a fire spreading into or from the Site by reducing the time fire crews will spend away from an active fire to refill water supplies. Therefore, a dedicated fire emergency water supply of 40,000 litres fitted with NSW RFS compatible Storz couplings (also FRNSW compatible) is recommended to be provided as a filling point for fire tankers. Four 10,000 litre dedicated fire emergency water tanks are proposed at the Site for the sole use of fire protection in line with, and exceeding, the RFS standards (NSW RFS, 2019); two located along Ortlipp Road and two located along Drumwood Road (see **Figure 3**).

#### GENERAL WATER:

Non-potable water required for the Proposed Development would be sourced offsite under agreement with existing water access licences. Accordingly, a water access licence from DPI Water would not be required for construction activities. Potable water required for the construction, maintenance and decommissioning phases of the Proposed Development will be sourced from local water cartage services in the surrounding area, along with ensuring appropriate licences are held.

#### ELECTRICITY:

No new transmission lines will be installed as part of the development. The development will not impact the existing transmission easement of management in accordance with National electrical transmission line standards including the specification in *ISSC3 Guideline for Managing Vegetation Near Power Lines* (Resources and Energy NSW, 2016).

### 3.8 Fire Preparedness and Response

Whilst the likelihood of a damaging fire impacting the solar farm is considered low, the consequence could be significant (such as the potential loss of panels and/or related electrical systems are damaged). The risk of a fire starting from the solar farm and spreading to surrounding areas is also considered low.

The CEMP, OEMP and DMP will provide safety protocols to ensure all staff and contractors are aware of the bushfire risk on site and the mitigation measures required to reduce this risk. It is recommended that a **Bushfire Emergency Management and Operations Plan** is prepared for the Site as a Condition of Consent in further consultation with relevant fire authorities post-consent and prior to commencing construction activities, acknowledging specific risks associated with the Site, Proposal and surrounding influences. The Plan will identify:

- Potential ignition reduction strategies, including management procedures for hot works permitting, smoking, vehicle use off formal access tracks, and Total Fire Ban requirements

- Preparedness procedures in response to increasing fire danger such standard equipment required during the fire season and the suspension of activities as the FDI rises
- Daily monitoring of the Fire Danger Rating, and communication of any further mitigation measures required to all staff and contractors
- Protocols for basic training of all staff on the appropriate response to a fire emergency and in the use of firefighting equipment on site
- Fire suppression equipment and locations during construction and operation. Firefighting equipment lists will also be detailed in the Work Method Statements
- Finalised water tank locations and details
- Finalised and agreed details of the APZ
- Management procedures for the use, storage and maintenance of flammable materials.

Due to the unique electrical hazards associated with solar farms it is recommended that procedures for responding to and reporting a bushfire are documented in a discrete **Emergency Response Plan (ERP)** (as a sub-plan of the Bushfire Emergency Management and Operations Plan). The ERP should include consideration of personnel working on site during construction and operations, as well as responding fire authorities. The ERP will:

- Address foreseeable on-site and off-site fire events
- Clearly state work health safety risks and procedures to be followed by fire-fighters, including:
  - Identify personal protective clothing and minimum level of respiratory protection
  - Provide details/procedures for ensuring access to the Site
  - Specify a procedure to determine minimum evacuation zone distances
  - Identify evacuation triggers and protocols
  - Document a safe method of shutting down and/or isolating the PV system and other necessary components of the solar farm
  - Any other risk control measures required to be followed by fire-fighters
  - Identify suppression response strategies and tactics, including aerial suppression options/management:
    - Given the possible toxicity of smoke from burning solar farm components, fire-fighters, farm workers and neighbours should avoid working down wind of any fire burning within the solar farm
    - Aerial water bombing that is compliant with air operations safety procedures should also be addressed noting the high voltage transmission lines nearby which may pose a risk to aerial operations.

Two copies of the ERP should be permanently stored in a prominent 'Emergency Information Cabinet' to be located at the main entrance point to the solar farm (Ortlipp Road, see **Figure 3**), external to any security fence or locked gate, and a copy provided to local emergency responders. The NSW RFS Hume Zone Office and Fire and Rescue NSW will also be supplied with details including the Site Manager name and 24hr contact number, along with an alternate contact; proposed construction start date and duration; and Site access details should the emergency services need to gain quick entry to the site in the event of an emergency.

It is recommended the Plan is prepared for the duration of the life of the Proposed Development and updated at least every five years detailing:

- Responses to an emergency alert being issued by fire authorities
- Incident management and control arrangements.

As part of the preparation of a Bushfire Emergency Management and Operations Plan for the Proposed Development under PBP 2019, contact will be made by the site operator with the Local Emergency Management Committee to develop a multi-agency Pre-Incident Plan for the Site which would establish emergency management procedures with relevant authorities for the safety hazards presented by the Site. The operator of the solar farm should brief the local volunteer fire brigades and neighbouring farmers at appropriate intervals, for example, at annual pre-season fire meetings, on safety issues and procedures.

### 3.9 Summary of Mitigation Actions

A summary of the bushfire mitigation strategies and recommendations made in this document are provided in **Table 4** below.

**Table 4: Summary of mitigation strategies and actions**

Mitigation Strategy	Section of Report	Action
Create and maintain an Asset Protection Zone (APZ) around the Development Footprint	3.2	<p>A 20 m APZ is to be established around the Development Footprint from woodland areas and 10 m width in grassland areas.</p> <p>The APZ is to be maintained from the commencement of construction in perpetuity in accordance with the NSW RFS (2019) APZ requirements for an Inner Protection Area.</p> <p>The Development Footprint APZ is to incorporate a 4 m Category 1 perimeter fire trail (see Access below).</p>
Implement appropriate site landscaping	3.3	<p>Where screen plantings are proposed they are to be:</p> <ul style="list-style-type: none"> <li>• Located on the external side of the APZ</li> <li>• Consist of low flammability and spotting species</li> <li>• Be planted as a continuous break</li> <li>• Maintained to remove any dead leaf litter, branches and dead vegetation.</li> </ul> <p>Within the solar farm layout, maintain minimal fuel load by grazing, slashing, mowing or herbicides.</p> <p>Alternate cropped and uncropped areas to breakup continuous potential fire runs within the Site.</p> <p>Use a mosaic of crop plantings of varying age classes to reduce the availability of higher uniform fuel loads across the Site at any one given time.</p> <p>Avoid harvesting machinery on very high fire danger days or above to reduce likelihood of ignition.</p>
Construction and design	3.4	All electrical equipment must comply with relevant construction standards and design and is to be in accordance with AS 3000:2007 Wiring Rules.
Construction and Operations protocols during bushfire season and on days	3.5	All operations involving earth moving equipment, vehicles, slashers and hot works (e.g. grinders, welders) must cease during Total Fire Bans, while the Grassland Fire Danger Index (GFDI) is or is forecast to be 35 or greater, or high winds are forecast.

Mitigation Strategy	Section of Report	Action
of Very High or worse fire danger		<p>During Very High or worse fire danger days, the “fires near me” app is to be checked hourly for the occurrence of any fires likely to threaten the Site; and all plant, vehicles and earth moving machinery are cleaned of any accumulated flammable material (e.g. soil and vegetation).</p> <p>Should construction take place during a declared Bushfire Danger Period, the following measures are recommended to control the risk of grassfire ignitions:</p> <ul style="list-style-type: none"> <li>• The APZ is constructed as one of the first stages of development</li> <li>• A suitable fire appliance is present on site with at least two personnel trained in bushfire fighting.</li> </ul>
Maintain emergency access/egress for fire fighters and site personnel	3.2 & 3.6	<p>The APZ is to incorporate a 4 m Category 1 perimeter fire trail, established and maintained in accordance with NSW RFS requirements (NSW RFS, 2019) including provisions for passing bays and turn around points.</p> <p>Proposed main access point is from a new entry from Ortip Road. In an emergency, secondary access to the Site may be obtained from any of the access points, including along Drumwood Road and Blight Road.</p>
Water and utilities	3.7	A dedicated water supply of four 10,000 litre tanks fitted with Storz couplings as filling points for fire tankers: one at the operations compound, one at the main entrance and two along Drumwood Road.
Fire preparedness and response	3.5 & 3.8	<p>A Bushfire Emergency Management and Operations Plan (incorporating a discrete ERP) including:</p> <ul style="list-style-type: none"> <li>• Ignition reduction strategies</li> <li>• Fire suppression equipment details</li> <li>• Flammable materials storage requirements</li> <li>• Fire preparedness procedures</li> <li>• Fire reporting and response to formal emergency alerts</li> <li>• A standalone ERP: detailing firefighting restrictions, potential hazards, specialised Personal Protective Equipment (PPE) requirements, shut-down/isolation procedures, evacuation zone distances, aerial suppression considerations and availability of the ERP.</li> </ul>

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