Report

Natural Hazard Risk Assessment (Bushfire)

SITE: CATTLE CREEK WIND FARM

LOCATION: CECIL PLAINS-MOONIE ROAD, CATTLE CREEK, QLD 4407

LOCAL GOVERNMENT AREA: TOOWOOMBA REGIONAL COUNCIL AND WESTERN DOWNS REGIONAL COUNCIL

CLIENT: ERM AUSTRALIA PTY LTD



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COPYRIGHT NOTICE: Parts of this document contain material originally prepared by:

Author: Aaron Bulfin
Bushfire Consultant

BEngSc (EnvEng), GCertEngSci (FireSafetyEng), GCertSci (AppClimSc)

Reviewed: Linden Wears

Principal Bushfire Engineer

BSc, PostGradDip (Bushfire Protection), PostGradDip (Fire Safety Eng), BPAD Level 3 Bushfire Practitioner

Version History

Version	Date	Details	Author	Reviewer
Issue A	2025, March	Draft issue of NHRA for review	AB	SC
Issue B	2025, April	Final issue of NHRA for DA	AB	LW
Issue C	2026, July	Alterations to BESS extent / project description	SC	AB
Issue D	2026, July	Minor amendments from client	AB	LW

Executive Summary

Covey Associates Pty Ltd has prepared this Natural Hazard Risk Assessment (NHRA) to support the Development Application for the proposed Cattle Creek Wind Farm, located primarily within the Toowoomba Regional Council area with a smaller portion in the Western Downs Regional Council area. The Project includes wind farm infrastructure and an associated battery energy storage system (BESS) and is subject to Queensland planning requirements relating to natural hazards, specifically bushfire.

The NHRA has been prepared in accordance with:

- the Queensland State Planning Policy (SPP) – Natural Hazards, Risk and Resilience (Bushfire),
- State Code 23: Wind Farm Development, and
- State Code 27: Battery Storage Facility Development.

The assessment also draws on guidance from:

- the Bushfire Resilient Communities Technical Reference Guide and,

Where Queensland-specific renewable energy guidance is limited,

- the CFA Design Guidelines for Renewable Energy Facilities as a technical benchmark.

The Project Area covers approximately 20,000 hectares, however only around five per cent of this area will be disturbed by development. Bushfire hazard and risk have therefore been assessed primarily in relation to the disturbance footprint and the operational corridor, which will remain permanently cleared of bushfire-prone vegetation for the life of the Project. Some infrastructure is located within mapped bushfire prone areas, while the proposed BESS is sited outside mapped bushfire prone areas and therefore complies with the avoidance requirements of State Code 27.

The NHRA includes a desktop-based assessment of bushfire hazard informed by local fire weather, topography, and vegetation. Historical Bureau of Meteorology data was analysed to characterise fire weather conditions, and an FFDI of 75, consistent with State Planning Policy mapping, was adopted for bushfire risk modelling. Vegetation hazard classes were determined using site-verified ecological mapping supplied by ERM, identifying a mixture of woodland, grassland, and low-hazard vegetation types across the Project Area and surrounding land.

Bushfire risk was assessed through detailed radiant heat flux (RHF) modelling undertaken in accordance with Method 2 of AS 3959:2018. Both one-dimensional and two-dimensional RHF modelling was used to determine the separation distances required between proposed infrastructure and retained bushfire-prone vegetation. The modelling demonstrates that, with the proposed development layout and operational corridor clearing, it is feasible to achieve a target radiant heat flux of 29 kW/m² or less at all relevant infrastructure locations.

Based on the RHF assessment, suitably sized Asset Protection Zones (APZs) are achievable around wind turbines, substations, buildings, and ancillary infrastructure within the operational corridor. These setbacks are considered sufficient to manage bushfire impacts to an acceptable level, subject to the implementation of detailed mitigation measures.

This NHRA concludes that, with appropriate bushfire risk mitigation measures in place, the bushfire hazard and risk associated with the proposed Cattle Creek Wind Farm are acceptable and consistent with relevant state and local planning requirements.

A Bushfire Management Plan will be required as a condition of development approval to detail vegetation management, access arrangements, fire water supply, infrastructure resilience measures, and ongoing operational responsibilities. Further detailed studies may also be required at later stages to support implementation and operational management. Per the Performance Outcomes of the relevant State Codes; no further bushfire reporting would be required for the BESS component of the development.

Overall, the Project can be designed and delivered in a manner that appropriately manages bushfire risk and ensures the safety of infrastructure, personnel, and the surrounding community.

Abbreviations Used in Report

Abbreviation	Meaning
AFDRS	Australian Fire Danger Rating System
APZ	Asset Protection Zones
AS	Australian Standard
AWS	Automatic Weather Station
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BESS	Battery energy storage system
BSF	Battery Storage Facility per State code 27 (also referred to as BESS within this NHRA)
BHOC	Bushfire Hazard Overlay Code
BMP	Bushfire Management Plan
BoM	Bureau of Meteorology
BPA	Bushfire prone area
BRC	Bushfire Resilient Communities (2019)
CFA	Victorian Country Fire Authority
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ERM	Environmental Resources Management Pty Ltd
FBI	Fire Behaviour Index
FFDI	Forest Fire Danger Index
FSS	Fire Safety Study
LGA	Local Government Area
MCU	Material Change of Use
NHRA	Natural Hazard Risk Assessment
OC	Operational Corridor – associated with the development
QFD	Queensland Fire Department [Previously QFES, see below]
QFES	Queensland Fire and Emergency Services
RHF	Radiant heat flux
SARA	Queensland State Assessment and Referrals Agency
SC23	State code 23 and associated planning guideline: Wind farm development
SC27	State code 27 and associated planning guideline: Battery storage facility (BSF) development
SEMP	Safety and Emergency Management Plan
SPP	State Planning Policy
TRC	Toowoomba Regional Council
VHC	Vegetation Hazard Class
WDRC	Western Downs Regional Council
WTG	Wind turbine generator
WF	Wind Farm

Supporting Documentation		
Document	**Prepared by**	**Provided by**
Site verified Regional Ecosystem Mapping	*ERM*	ERM on 18/11/2025
Cattle Creek Wind Farm MSES Impact Report (DRAFT)	*ERM*	ERM on 25/11/2025

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1 Introduction

1.1 Scope

Environmental Resources Management Pty Ltd (ERM) has commissioned Covey Associates Pty Ltd (Covey) to complete a desktop Natural Hazard Risk Assessment (NHRA) to support a Development Application (Material Change of Use, MCU) for the proposed Cattle Creek Wind Farm (the 'Project'). The proposed renewable energy facility includes a wind farm (WF) component along with a battery energy storage system (BESS) component and is located on several lots (Table 1-1) along Cecil Plains-Moonie Road, Cattle Creek.

Table 1-1. Subject lots/LGAs included within project area

Local Government Area (LGA)					
Toowoomba Regional Council (TRC)				Western Downs Regional Council (WDRC)	
Lot Number	Plan Number	Lot Number	Plan Number	Lot Number	Plan Number
2	DY452	1	RP174414	8	DY247
27	CP882781	2	RP174414	9	DY247
2	DY831	15	SP201705	21	DY218
3	RP174414	16	SP201705	22	DY800

This NHRA focuses on **Bushfire** risk relative to the disturbance footprint though bushfire risk assessment includes assessment up to 150 metres around the subject lots. Within the disturbance footprint exists the operational corridor (OC) which is a smaller corridor that will remain clear of bushfire prone vegetation for the life of the project. Given that the proposed disturbance footprint and OC cover such a small percentage of the overall project area, the OC will be the primary focus in determining the bushfire hazard and risk to the development.

The bushfire risk assessment will assess and identify the potential bushfire impact to the proposed development (construction and operational phase) as per the State Codes relevant to the development type (namely renewable energy infrastructure such as WF and BESS), and by using the guidance as outlined within the Bushfire Resilient Communities Technical Guide (QFES, 2019), including the following:

- Review historical fire weather, topography and fuels (vegetation) within, and adjacent to the Project
- Apply RHF modelling to assess the bushfire hazard and risk relevant to the proposed development, with the assessment informed by the methodology outlined within BRC.

Future bushfire reporting (Bushfire Management Plan) will appropriately address mitigation measures to deal with requirements for each phase of the development – construction, operational, and decommissioning phases.

1.2 Development Proposal

The proposed development site is located primarily within the Toowoomba Regional Council (TRC) Local Government Area (LGA), though a section of the western portion of the site is within the Western Downs Regional Council (WDRC) LGA. The Project covers approximately 20,000 ha, of which approximately 5 percent of this area will be disturbed by the disturbance footprint[1] .

The proposed WF (Figure 1-1 and Figure 1-2) is located approximately 26 km west of Cecil Plains and 60 km south-west of Dalby. The proposed development consists of the construction, operation, maintenance, and decommissioning of up to 135 wind turbine generators (WTGs), a battery energy storage system (BESS) of up to 450 MW and ancillary infrastructure consisting of:

- WTG foundations, crane hardstands, crane boom laydown, blade laydown and rotor assembly area;
- Access tracks, including:
    - New and upgraded tracks within the project area, generally comprising of a nominal range of 5.5 m – 10 m wide permanent access, and a maximum 50-95 m wide cleared corridor for Oversize Overmass (OSOM) vehicles;
- Low voltage (LV) and medium voltage (MV) underground cabling, as well as MV and high voltage (HV) overhead transmission lines;
- Internal collector substations;
- A switching station adjacent to the existing 330 kV Powerlink transmission line. This has been accounted for within the Disturbance Footprint, thereby allowing the clearing of the site to be assessed as part of the impacts associated with the proposed development (noting, however, that the switching station infrastructure will be constructed, owned and operated by Powerlink);
- Permanent meteorological masts;
- Construction compounds and laydown areas;
- Washdown areas;
- Operational and maintenance facilities; and
- A construction workers accommodation facility.

Further, there is the potential for the inclusion of the below infrastructure:

- Concrete batching plants**;**
- Borrow pits; and
- Communications tower.

[1] Cattle Creek Wind Farm | RWE in Australia

1.3 Site Overview

The project spans more than 20,000 hectares. While most infrastructure is planned for open grassland, some wind turbine generators (WTGs) will be in woodland areas. Vegetation will be cleared around all infrastructure and will remain cleared for the life of the project; this area is referred to as the operational corridor. The project area is bordered by several state forests:

- Kumbarilla State Forest to the west and north,
- Boondandilla State Forest to the south-west, and
- Western Creek State Forest to the south, south-east, and east.

1.3.1 Access

The project area spans either side of Cecil Plains-Moonie Road, with the six primary access points to the development being along Cecil Plains Moonie Road (Figure 1-2). The development will include the construction of up to 168 km of internal vehicle access tracks connecting to each proposed WTG, BESS compound, and ancillary infrastructure.

1.3.2 Water Supply

Given the project is located within a rural setting, there is no known water supply mains or hydrants observed within a desktop assessment using available information from council spatial data[2]. It is anticipated that water sourcing strategy will be developed for the site to facilitate construction works, as well as providing water for firefighting capacity through the life of the development.

From the ecological survey undertaken by ERM in their Cattle Creek project Matters of State Environmental Significance Impact Report (2026), there are 108 waterbodies identified within the Project Area covered by the proposed development (the 'project extent'). These waterbodies may provide a supplementary source of water for firefighting purposes; though this will not negate the need to provide additional SWS (water tanks) that will be required as dedicated water for firefighting purposes as per performance requirements.

[2] Toowoomba Regional Council Bushfire Hazard Overlay mapping

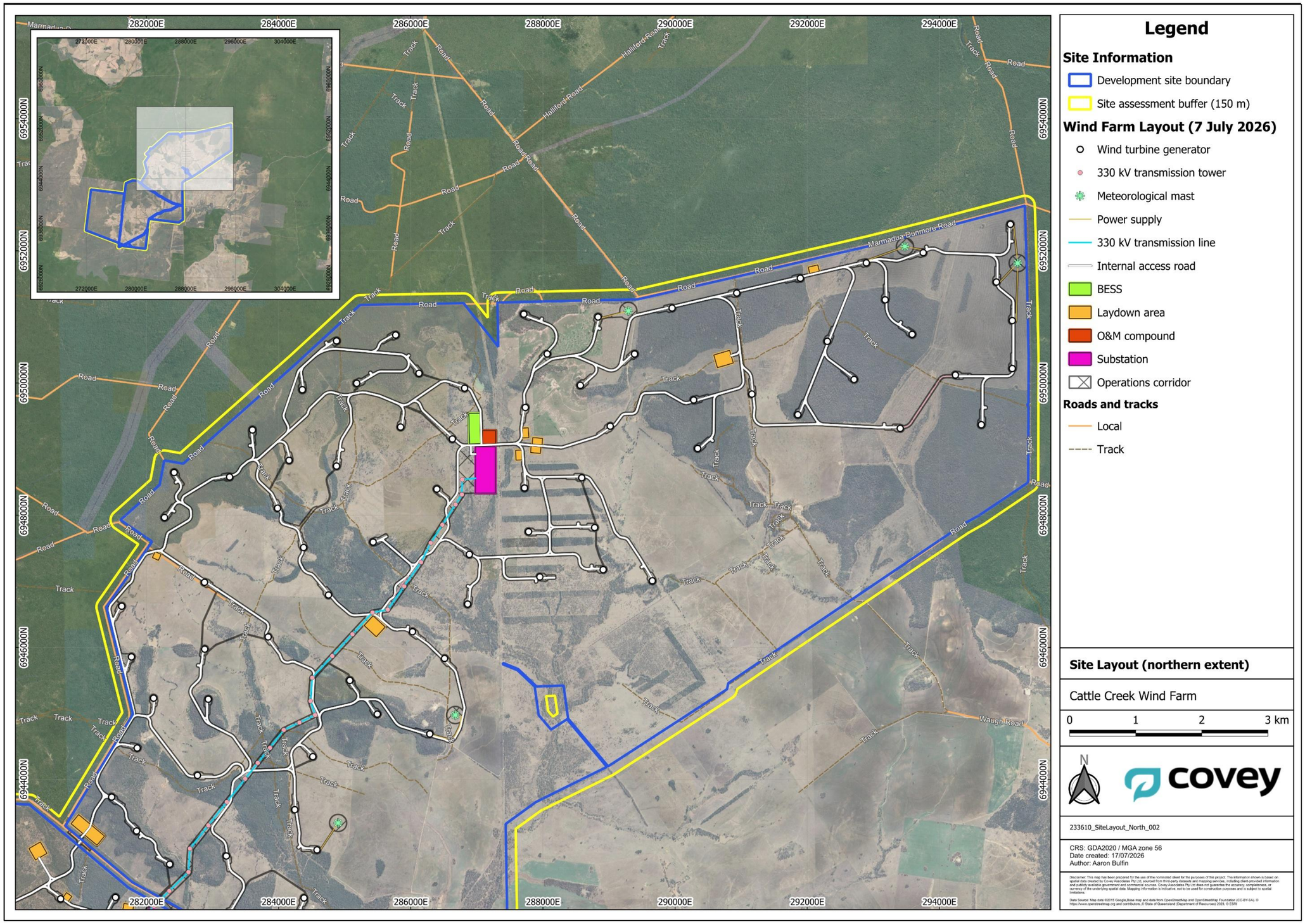


Figure 1-1: Site layout (northern extent)

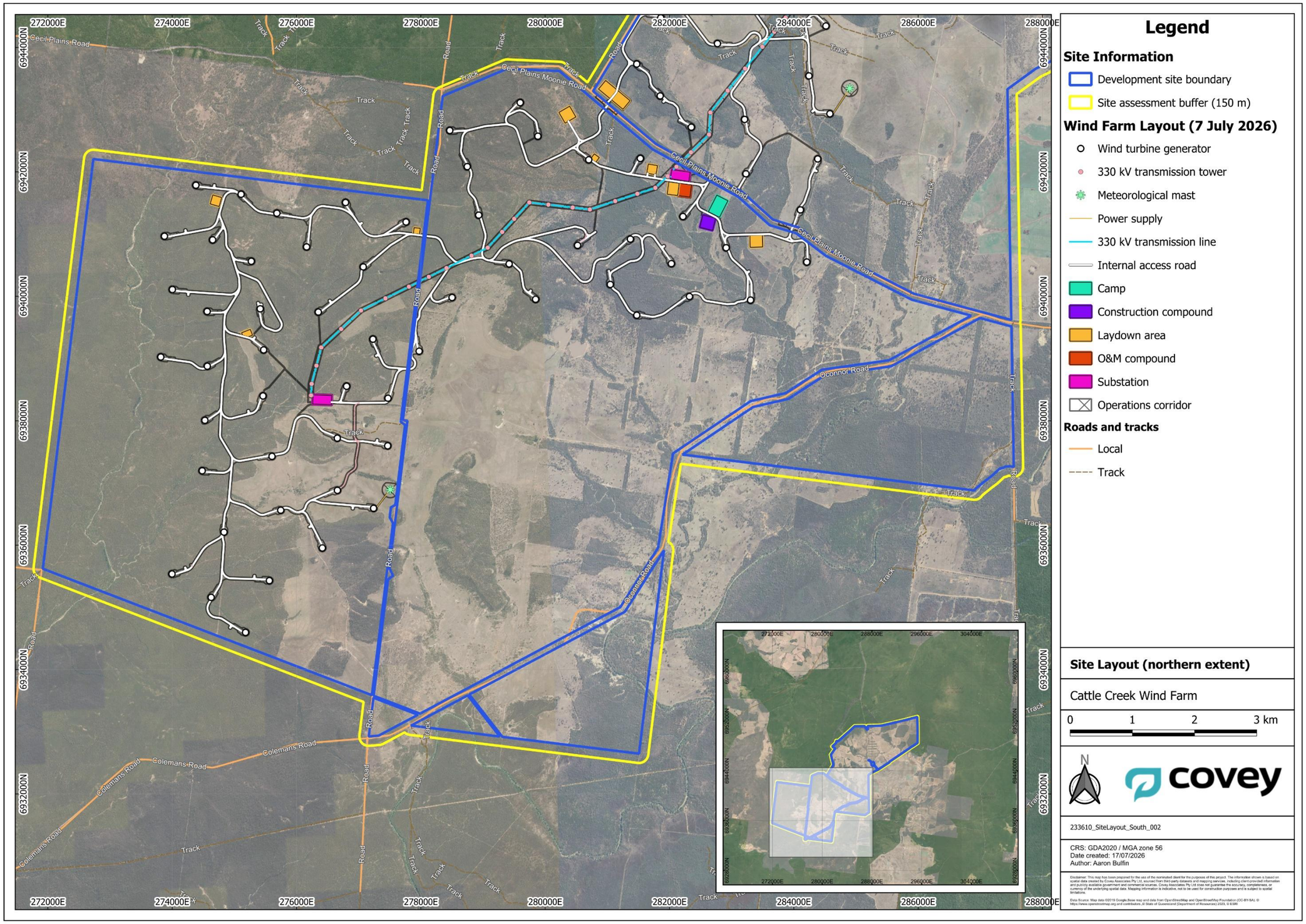


Figure 1-2: Site layout (southern extent)

1.4 Bushfire Planning Context

1.4.1 Technical Documents

This NHRA draws on the following bushfire compliance technical references:

- The State of Queensland. (2017). State Planning Policy.
- Queensland Government. (2019). Natural hazards, risk and resilience – Bushfire. State Planning Policy – state interest guidance material.
- Queensland Government. (2021). Natural hazards, risk and resilience state interest – Bushfire. Example, planning scheme assessment benchmarks.
- Queensland Fire and Emergency Services (QFES). (2019). Bushfire Resilient Communities. Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience-Bushfire'.
- Department of State Development, Infrastructure and Planning (2025). State Code 23 – Wind Farm Development, State Development Assessment Provisions v3.5.
- Department of State Development, Infrastructure and Planning (2025). Planning Guideline: State Code 23 – Wind Farm Development,
- Department of State Development, Infrastructure and Planning (2025). State Code 27: Battery storage facility development. State Development Assessment Provisions v3.5
- Department of State Development, Infrastructure and Planning (2025). Planning Guideline: State Code 27: Battery storage facility development.
- Toowoomba Regional Council (TRC) Planning Scheme (2022)
- The Western Downs Regional Council (WDRC) Planning Scheme (2017) Battery Storage Facility Code from Western Downs Regional Council Planning Scheme (Amendment 2, 2025).
- Country Fire Authority (2023) – *Design Guidelines and Model Requirements: Renewable Energy Fire Safety*,
- Standards Australia (2018) – AS 3959:2018 *Construction of buildings in bushfire-prone areas*,

1.4.2 SPP – Natural hazards, risks and resilience – Bushfire

The State Planning Policy (SPP) is a key component of Queensland's planning system and expresses the state's interests in land use planning and development to secure a liveable, sustainable and prosperous Queensland.

The 'SPP - Natural hazards, risk and resilience state interest – Bushfire', is guidance material prepared primarily to support the implementation of the SPP and the interpretation of the *Natural hazards, risk and resilience* state interest, specifically for bushfire hazard. The guidance material addresses each of the state interest policy subparts and assessment benchmarks individually, in addition to mapping requirements.

Accompanying the 'SPP - Natural hazards, risk and resilience state interest – Bushfire', is the Bushfire Resilient Communities: Technical Reference Guide (BRC), which provides technical guidance and the policy positions of Queensland Fire and Emergency Services (QFES) regarding the consideration of bushfire hazard as part of land use planning and development activities including the following:

- Outlines factors affecting bushfire hazard and potential bushfire risks and impacts
- Outlines the methodology used to prepare the statewide mapping of bushfire prone areas included in the State Planning Policy Interactive Mapping System (SPP IMS)
- Provides technical guidance on procedures for:
    - Reviewing SPP IMS bushfire prone area mapping
    - Undertaking a Bushfire Hazard Assessment (BHA) and Vegetation Hazard Class Assessment

  - Calculating asset protection zone provisions
  - Preparing a Bushfire Management Plan and Landscape Maintenance Plan
- Provides additional information to inform development conditions
- Guides the identification of suitably qualified people for assessments identified in the BRC.

1.4.3 Bushfire Prone Designation

Under the SPP – Natural Hazards, Risk and Resilience (Bushfire), a site is designated as bushfire prone if:

- If the land is identified by a local government in a local planning instrument as a bushfire prone area, based on a localised bushfire study, prepared by a suitably qualified person; and/or
- If the area is shown on the State Planning Policy (SPP) Bushfire Prone Area (BPA) mapping (on the Interactive Mapping System) as a bushfire prone area.

As depicted on Figure 1-3, much the project development lots (see Table 1-1) have been identified as areas of ***Medium Potential, High Potential and Very High Potential Bushfire Intensity*** on the SPP BPA mapping, due to large tracts unmanaged woodland vegetation, typically observed in more rugged terrain. Not all proposed infrastructure is sited within BPA mapped areas (including within the Potential Impact Buffer); this includes the proposed BESS; which is sited outside of mapped BPA – refer to Figure 1-4.

Given the development lots are designated as bushfire prone, this provides the legislative trigger to:

- Undertake a Bushfire Hazard and Risk Assessment, and
- Enforce all Building Classes to be constructed per Australian Standard (AS) 3959:2018 Construction of buildings in bushfire-prone areas (AS 3959).

Per the State Planning Policy (SPP) Interactive Mapping System – *Natural Hazards Risk and Resilience* layers; parts of the operational corridor are within a designated bushfire prone area, associated with bushfire prone vegetation that will remain outside of the operational corridor to the balance of the project area.

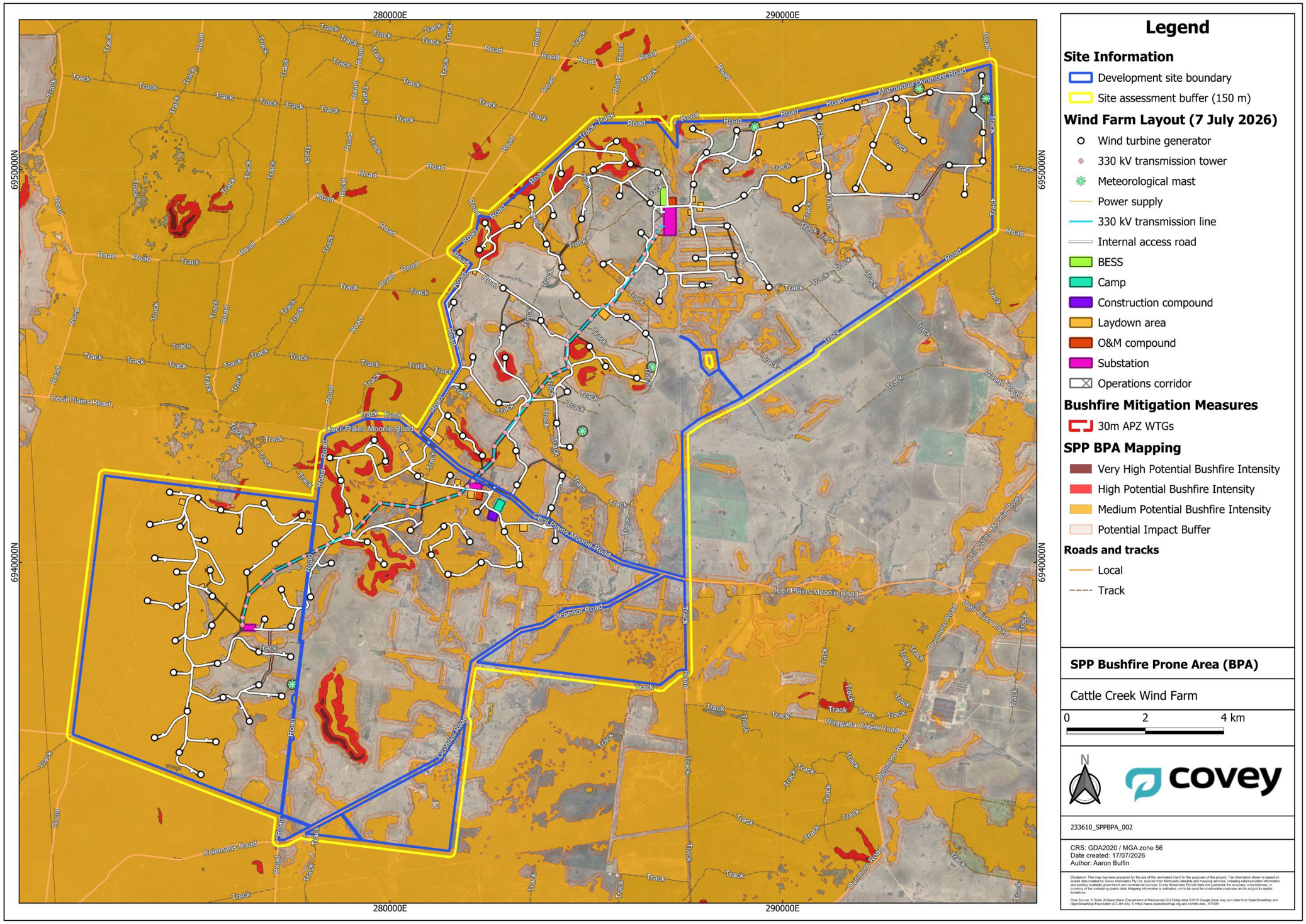


Figure 1-3: SPP bushfire prone area mapping relative to the proposed development layout

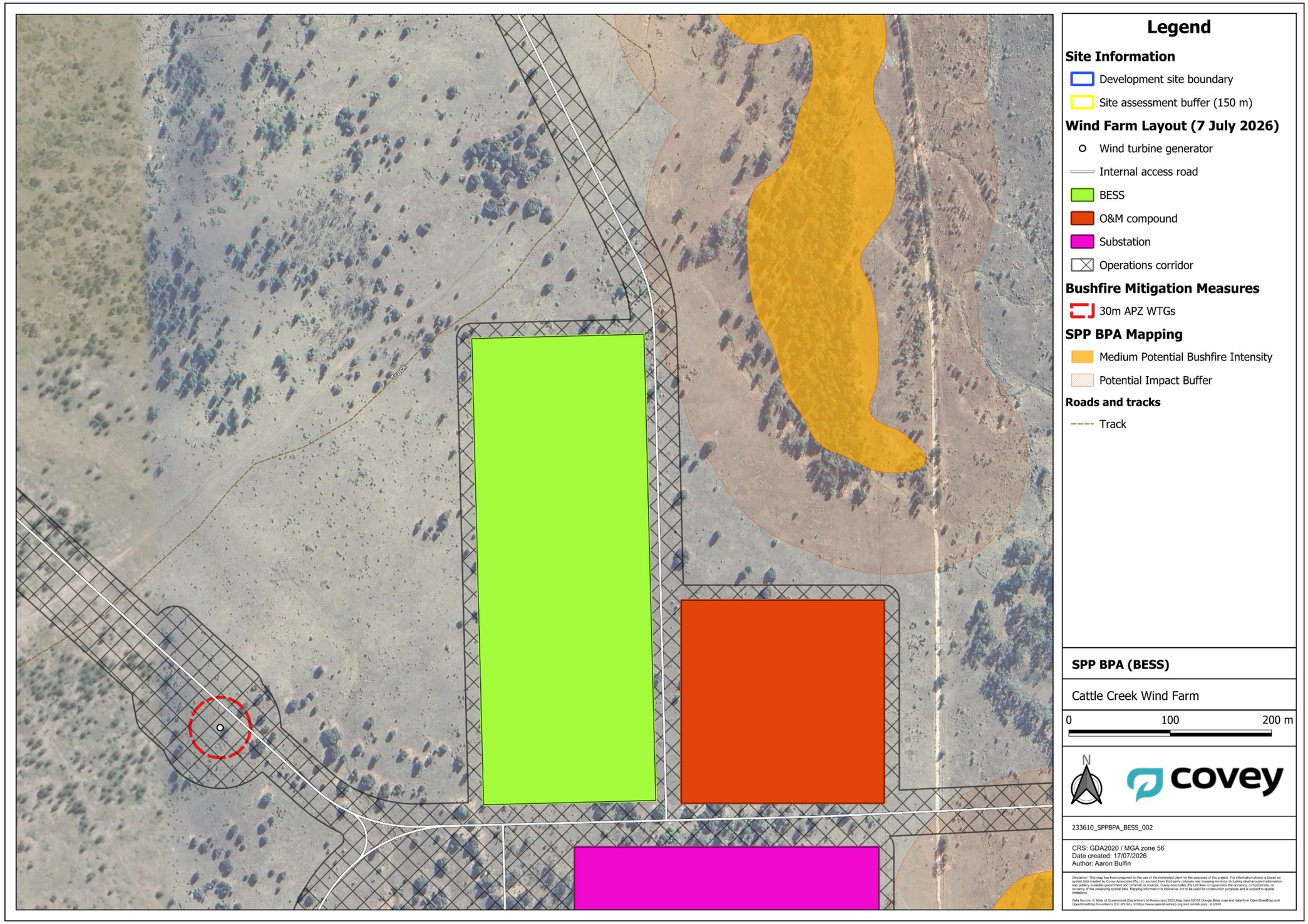


Figure 1-4: SPP bushfire prone area mapping relative to the proposed BESS infrastructure

1.4.4 State Development Assessment Provisions – State Codes 23 and 27

Proposals are required to respond to the following State Development Assessment Provisions, where submitting MCU development applications for facilities proposing renewable energy infrastructure:

- **State Code 23 (SC 23) for wind farm developments**
  - ***PO10*** Development is located, designed, constructed and operated to be responsive to natural hazards and extreme weather events.
  - ***PO11*** Development is constructed and operated to protect the safety of people in the event of natural hazards or extreme weather events occurring.
- **State Code 27 (SC 27) for Battery Storage Facilities developments** (BSF – defined as 'BESS' in this NHRA)
  - ***PO13*** Development is located and sited to avoid natural hazard areas including high erosion risk areas and bushfire prone areas.
  - ***PO14*** Where development cannot be located and sited to avoid natural hazard areas (e.g. Bushfire prone areas, and high erosion risk areas), demonstrate that:
    - there is no suitable alternative location;
    - infrastructure can function effectively during and after a natural hazard event; and
    - mitigation measures are implemented to reduce the risk to people, property and the environment to a tolerable level.
  - ***PO15*** Bushfire hazard is identified and risk is mitigated through strategies for vegetation management, landscape management, water supply, provision of appropriate access, identification of safe assembly or evacuation routes and establishing cleared and maintained asset protection zones around infrastructure that is wholly contained on site.

The aim of both SC 23 and SC 27 is to ensure unacceptable adverse impacts on individuals, communities and the environment do not arise because of the proposed wind farm and BESS development and assesses this through the stated purpose and several Performance Outcomes addressing a variety of matters, including bushfire risk management.

More specifically SC 23 states that:

- WFs are typically located in remote areas that can be exposed to natural hazards such as flooding and bushfires and, in some cases, extreme weather events such as cyclones, heatwaves and droughts.
- Plans and strategies need to be in place to ensure the safety of on-site workers and the surrounding communities in the event of natural hazards or extreme weather events occurring.
- WFs should be designed, constructed and operated to minimise the exposure and vulnerability of the built form of the wind farm to natural hazards and extreme weather events.
- Site layouts should be informed by an assessment of natural hazard risk.
- A Natural Hazard Risk Assessment Report should be prepared and lodged with application to demonstrate compliance with PO10 and PO11.
  - This assessment should demonstrate that all parts of the site layout would be responsive to the risks posed by natural hazards and extreme weather events that could affect the site.
- Further reporting to ensure the WF development appropriately mitigates bushfire risk to tolerable levels, the preparation of a Bushfire Management Plan (BMP) would be conditioned by SARA as part of the approval.

SC 27 states that:

- In addressing PO13, this assessment should demonstrate that all parts of the project layout are located outside of natural hazard areas and responsive to the risks posed by natural hazards that could affect the site.
- In addressing PO14, demonstrate that the development is designed to address impacts from natural hazards where there is no suitable alternative location, such as resilience-focused design and operational strategies.
- PO15 should only be addressed when it is identified that the proposed Battery Storage Facility (BSF) is within bushfire prone area.

As the proposed BESS is sited outside of mapped Bushfire Prone Areas (Figure 1-4), this complies with Performance Outcome (PO13) of the SC27, as such no assessment is required against PO14 and PO15, nor any further bushfire reporting (such as a BMP) is expected to address SC27 as part of the development application process.

1.4.5 Relevant Local Council Planning Scheme Requirements

The majority of the Project Area is zoned as Rural under the TRC Planning Scheme (2022)[3], while the smaller, western section of the project area within WDRC is zoned as Rural (ZM-98). Both TRC and WDRC adopts the previous SPP version Bushfire Hazard Overlay Mapping (2014). Much of the site (pre-development) is subject to Medium or High Bushfire Intensity (Section 1.4.3).

The TRC and WDRC BHOCs applies to all assessable development located within the mapped Bushfire Hazard Area Overlay. The purpose of the BHOC is to manage development outcomes in areas of land identified as land within a bushfire hazard area (i.e. nominated as bushfire prone) so that risk to life, property, community, and the environment during bushfire events is minimised, and to ensure that development does not adversely increase the risks above an acceptable or tolerable level. The proposed development shall achieve the overall outcomes of each LGA Planning Scheme BHOC.

1.4.6 CFA Design Guidelines for Renewable Energy Facilities

The Victorian Country Fire Authority (CFA) has developed design guidance for renewable energy facilities in their publication *Design Guidelines and Model Requirements: Renewable Energy Facilities v4* (CFA 2023). Given the lack of detailed design guidance in Queensland for managing bushfire risk to renewable energy facilities, Covey proposes use of the CFA Design Guidelines to provide an appropriate technical benchmark.

1.5 Other Relevant Documents

There are no known bushfire or flood reports or assessments that have been prepared previously for the Project. An Ecological Assessment and associated digital mapping have been provided by ERM (received 18 November 2025) – refer to Appendix A. This ecological assessment has been used within this NHRA do aid in determining vegetation communities within the project area.

1.6 Document Review

This NHRA provides a point in time assessment subject to the approvals process. If the Project changes it is accepted that a revision to this Report is required.

[3] Toowoomba Regional Planning Scheme v28

2 Bushfire Hazard Assessment

Bushfire severity is predominantly influenced by fuel, weather, and topography; each of which can have a varying effect on bushfires and their potential behaviour, with these main influences explored in the sub-sections below.

Bushfire severity as it relates to vegetation and topography is represented on the Bushfire Prone Area mapping developed by the Local and State government, where increased severity is a result of areas of steeper terrain and vegetation with higher potential fuel loads.

The State Planning Policy (SPP) Bushfire Prone Area (BPA) mapping is based upon the Potential Fireline Intensity, as determined by the fuel, weather, and topography (Newnham, Opie and Leonard, 2017), which classifies the potential risk of a fire front impacting the area with intensity as per Table 2-1.

Table 2-1. Bushfire prone area categories and associated intensities (QFES, 2019a)

Bushfire Prone Area Category	Potential Fire Line Intensity	Colour Code
Low	< 4,000 kW/m^2	Clear
Medium	4,000 – 20,000 kW/m^2	
High	20,000 – 40,000 kW/m^2	
Very High	> 40,000 kW/m^2+	

The State Planning Policy Bushfire Prone Area (BPA) mapping, which has been reproduced on Figure 1-3, identifies the majority of the OC associated with the development works, is wholly within areas mapped BPA.

Given bushfires respect no boundaries, bushfire hazards and risk are considered for full extent of the project area and all lots involved within the development. For this reason, Covey has:

- Analysed the potential radiant heat flux as per BRC guidelines, thus fulfilling the statutory requirements.
- Reviewed the vegetation present within a 150 m radius of the subject lots of the development, and the historical fires and fire weather observed for the local area, to provide a more thorough understanding of the landscape hazards.
- Reviewed the vegetation present within a 150 m surrounding the OC, to inform the RHF modelling for bushfire impact on the proposed infrastructure.

2.1 Weather

Fire weather is often associated with meteorological conditions that can generate increased fire behaviour, making wildfire suppression efforts difficult for emergency personnel. Fire weather can be influenced by many local factors including temperature, wind, relative humidity, and drought factor – all of which are used to calculate Forest Fire Danger Index (FFDI[4]).

The project area is located within the Central Slopes bioregion with Queensland. Fire risk within this region is associated with:

- Higher risk fire weather days; and/or
- Sequential days with an FFDI above 25.

Additionally, these higher fire risk days typically incur:

- Average temperatures of 33°C;
- Relative humidity below 16%; and
- Sustained gentle[5] winds (>18 km/hr).

The southern portion of this bioregion has a climate that is typically cooler than the remainder of the State, which can cause frost to occur between the middle of Autumn to the middle of Spring. This can impact the ability to plan prescribed burns during the more favourable time of the year. Most of the rainfall within this Bioregion occurs in summer as a result of heavy rainfall from thunderstorms, or rainfall associated with tropical rain depressions.

Recent past weather patterns and trends was analysed for the site using data extracted from the Bureau of Meteorology (BoM) recorded from Australia's Automatic Weather Stations (AWS). Dalby Airport AWS (AWS 41522) is located approximately 65 km north-east of the project area, and data from Dalby Airport AWS was analysed for the years 2007-2024.

2.1.1 Selection of FFDI value using SPP

Per the recommendations of BRC for undertaking Method 2 RHF calculation method, the mapped SPP 1:20 year ARI FFDI spatial data (available at BRC MapViewer) has been adopted for the RHF analysis within this report. These values represent the 5% annual exceedance probability fire weather. The value across the site ranges from FFDI 71 to 75 so the maximum **FFDI 75** has been applied to the RHF calculations for the WF. These calculations from BRC of the FFDI ARI are based on an A1F1 climate change scenario.

This value for **FFDI of 75** was used in the RHF analysis outlined in Section 3.1 of this report, which is considered acceptable for bushfire assessment reporting in Queensland.

[4] FFDI was used in this report, instead of the new Australian Fire Danger Rating System (AFDRS) and the associated Fire Behaviour Index (FBI), as the data analysed was historical. Also, FFDI values are used as input for in RHF modelling.
[5] Based on the Beaufort wind scale – refer to The Beaufort Wind Scale | Royal Meteorological Society for more information.

2.1.2 Fire Danger Season

Analysis of monthly FFDI distribution indicates that the fire season typically extends between September and November, peaking in November (which may be seasonally dependant) (Figure 2-1). However, fire occurrences can have a random nature, and a few short sharp fire weather periods can result in conditions where fires may cause, or have the potential to cause, major damage. Damaging fires can occur in any given year, despite some years being drier and hotter than others.

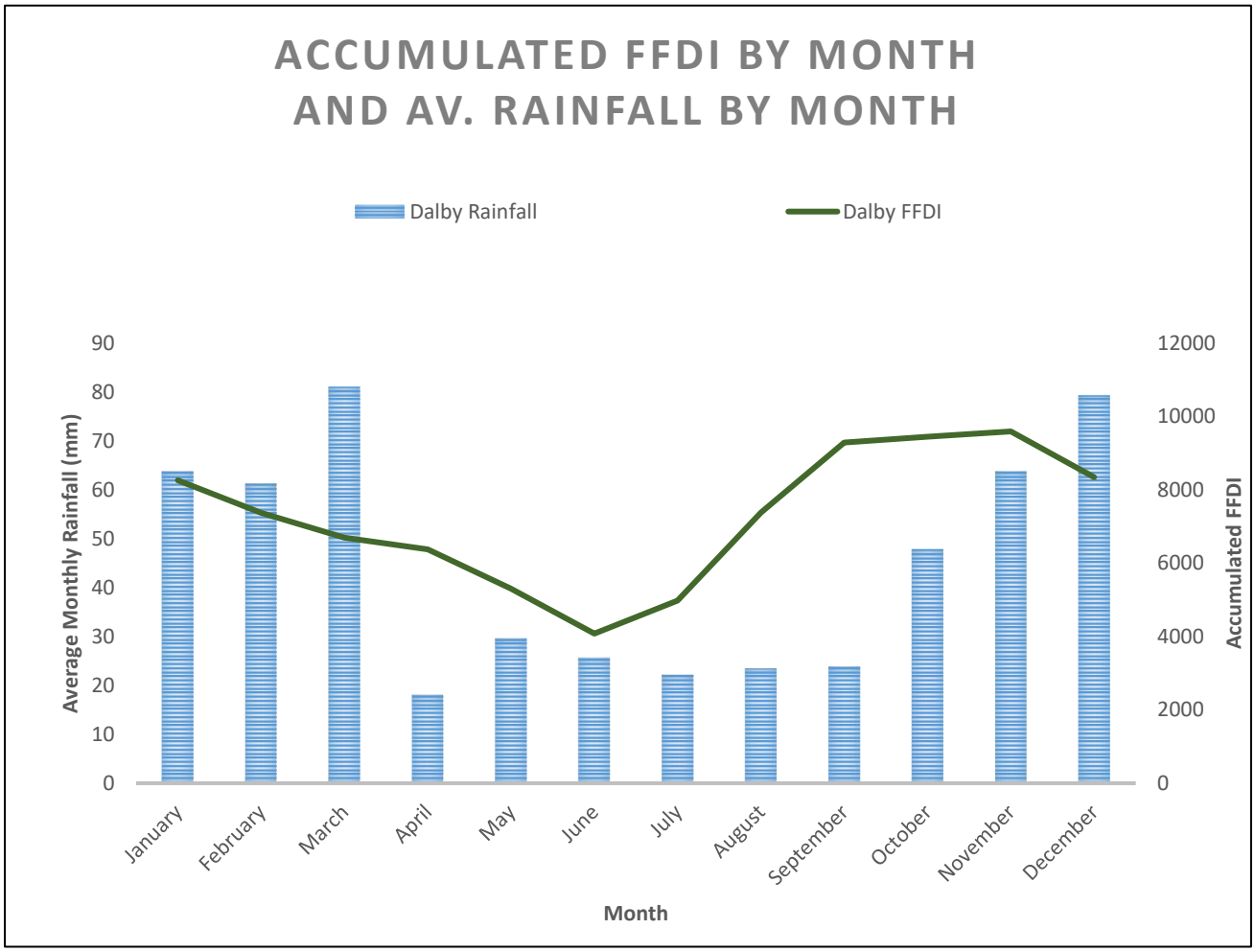


Figure 2-1. Accumulated FFDI and average rainfall by month for Dalby Airport AWS

In Queensland there is no declared fire season, however, it is generally accepted that the season for which fire weather is elevated occurs during spring – given the increasing air temperatures, and low relative humidity (RH). An analysis was undertaken of the highest ranked FFDIs over the recorded period from Dalby Airport AWS. From the FFDI analysis days of elevated fire danger have occurred in Dalby Airport during the summer months. Typically, this analysis shows that the highest ranked fire danger days are typically associated with:

- Air temperatures between 35-40°C, often exceeding this;
- Low RH (≤14%);
- Westerly arc winds; and
- Relatively dry conditions (Drought Factor ≥ 9.5).

2.1.3 Rainfall

The occurrence of days with high fire danger is also influenced by annual rainfall by virtue of the Keetch-Byram Drought Index (KBDI) and Drought Factor. As seen for the analysed AWS, where typically low annual rainfall results in higher accumulated annual FFDIs (Figure 2-2). Accumulated annual FFDI is the summed value of all FFDIs for each year of the analysis. Conversely, years of above-average rainfall can lead to increased vegetation growth. Therefore, although high rainfall levels are less conducive to extensive wildfire impact in the short term, this effect might be reversed in successive years, especially if a period of drought follows. As such, having an above-average year of rainfall cannot be perceived as reducing the ongoing fire risk.

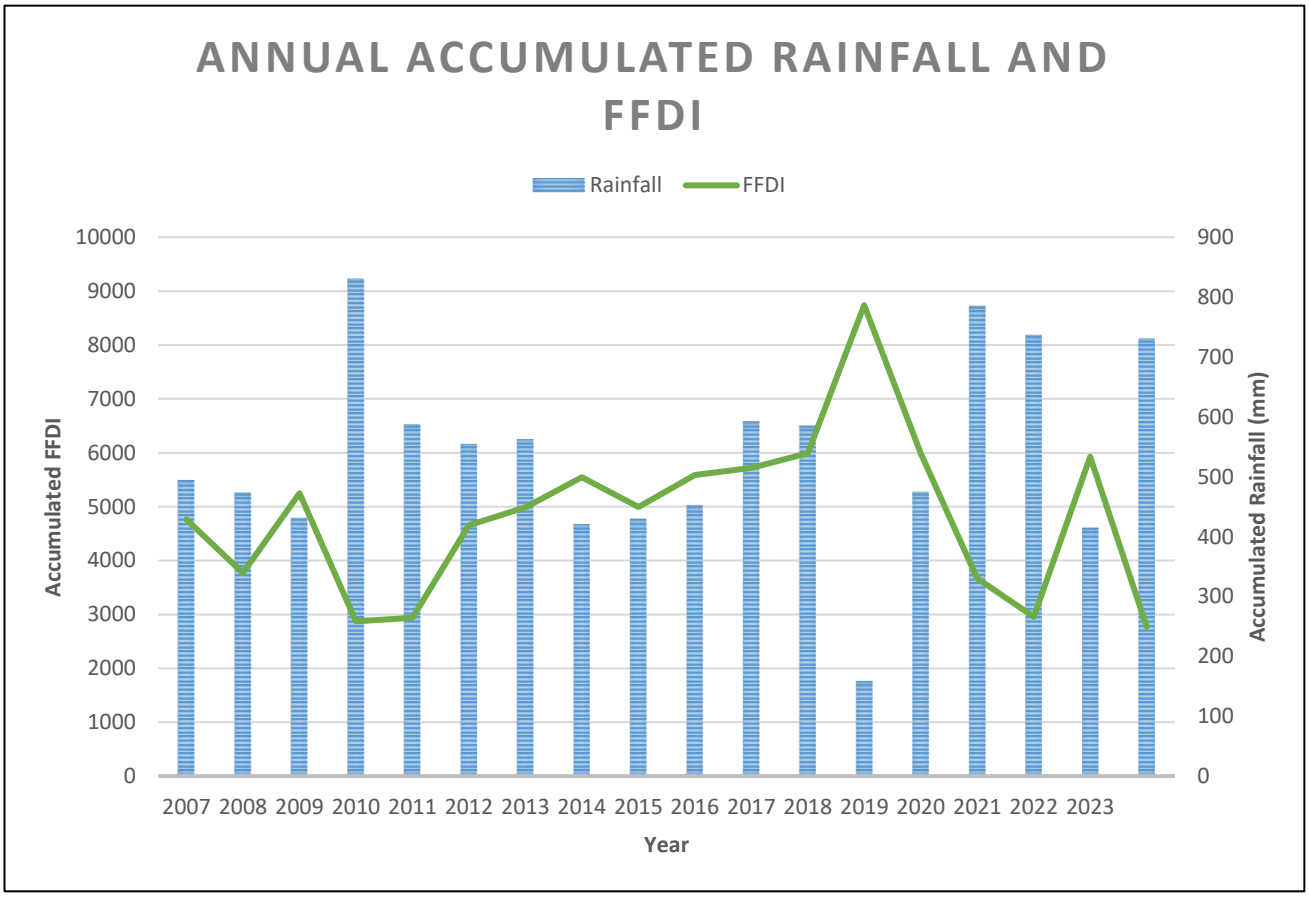


Figure 2-2 - Annual Rainfall vs Accumulated FFDI for Dalby airport AWS

2.1.4 Wind Speed and Direction

Fire weather patterns are closely related to wind directions and synoptic setups. Figure 2-3 shows an analysis of wind directions for FFDI classes 0-11, 12-24, 25-49, 50-74, and 75-99 for Dalby Airport AWS assessed period (2007 to 2024). FFDIs greater than 100 have not occurred over the assessed period. The analysis reveals that FFDI above 25 tend to come from a westerly arc, under inland dry wind influences. Though typically winds associated with lower FFDIs tend to be easterlies and have higher relative humidity due to a maritime influence; there are some occurrences of High and Very High FFDI occurring with easterly winds in this region.

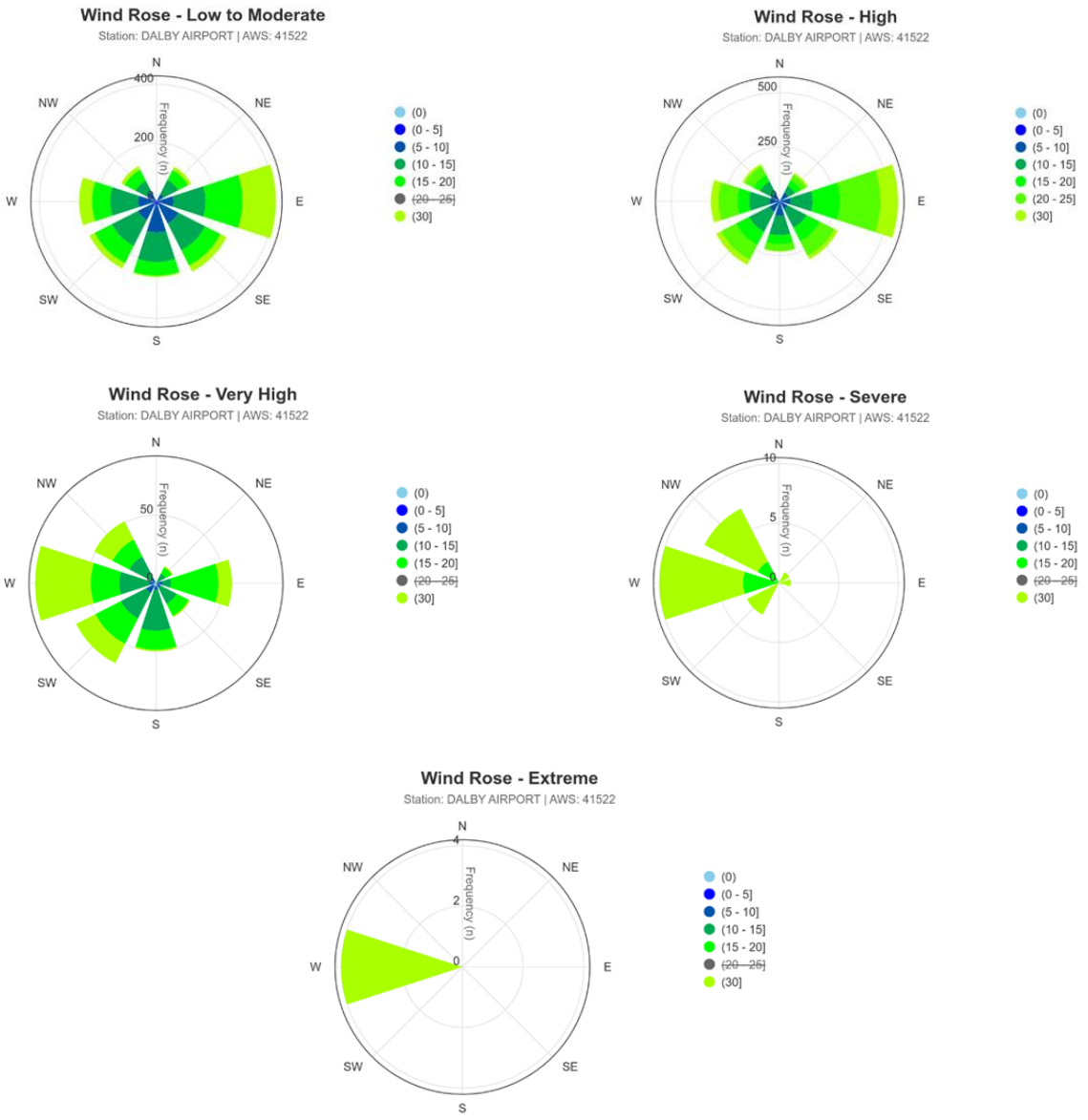


Figure 2-3. Wind rose and accumulated days (count) for 'Low to Moderate', 'High', 'Very High' , 'Severe' , and Extreme Fire Danger Rating days.

2.1.5 Climate Change Impact on FFDI

Climate change relative to the project area can be referenced in the *Climate Change in Australia Report for Central Slopes Cluster* (Ekström, M. et al. 2015,) developed by CSIRO and BoM, key findings for projected climate change within the Central Slopes Cluster is summarised below:

- Very high confidence in:
  - Higher temperatures; and
  - Hot and more frequent hot days with less frost; and
- High confidence in:
  - Increased intensity of heavy rainfall events, though changes to drought less clear,
  - Increase evaporation rates and reduced soil moisture,
  - Little change in solar radiation and reduced humidity throughout the year,
  - Some decrease in Winter wind speed, with fewer East Coast Lows,
  - A harsher Fire Weather climate is expected in the future.

It should be noted that fire weather and fire behaviour are, by nature, difficult to predict with certainty. Therefore, the following limitations exist when predicting bushfires and designing for bushfire mitigation:

- Fire behaviour at elevated FFDIs and under the influence of fire-induced winds driven by strong convection rates can become erratic and thus can be beyond the bounds of predictive models (Cruz *et al.*, 2012); and
- Human-induced climate change may exacerbate fire behaviour and affect vegetation structure and floristics in different ways to those assumed in this project (Dowdy, 2018).

As detailed in Section 2.1.1, the FFDI mapping in the BRC Mapviewer analyses weather data that includes projections for climate change to 2050, and as such, allowance for climate change is already incorporated into the modelling.

2.2 Topography

The slope and topography of land beneath areas of vegetation influence the rate of spread and subsequent severity of bushfire behaviour. Light Detection and Radar (Lidar) information (1 second (30 m)) smoothed, 2010) was downloaded from Elvis – (Elevation and Depth - Foundation Spatial Data, Queensland) to provide an elevation model that covers the full extent of the assessment area to 150 metres around the development boundary) – refer to Figure 2-4 for further information on the slope analysis of the site.

The project area is relatively flat to gentle undulating terrain, with some steeper terrain associated with hills or scattered throughout. Elevation ranges between approximately 310 m to 420 m above sea level and the project infrastructure is positioned at elevations from the lowest to the highest points across the site.

A higher resolution DEM (1-metre resolution) was received from ERM on the 2 of December 2025. However, this higher resolution DEM has not been used for the slope analysis within this NHRA, because there was a small section of elevation data missing to the south-east of the project extent.

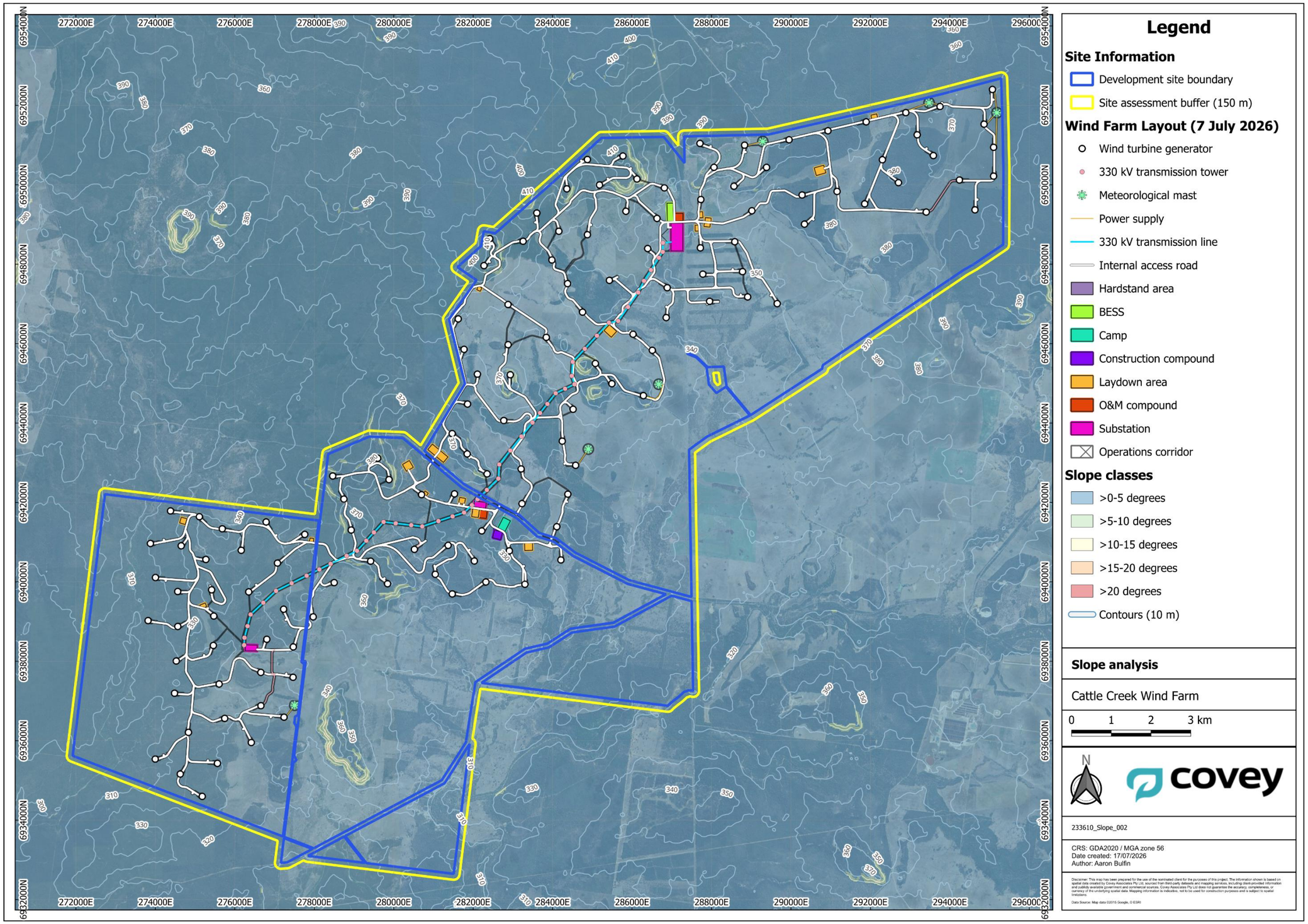


Figure 2-4: Site topography

2.3 Fuel

Fuel load and arrangement significantly impact the bushfire behaviour, potential severity, and scale. Fuel characteristics vary along with changes in type, density, and extent of vegetation communities and land use.

BRC assigns specific fuel loads based on the type of the mapped vegetation community (mapped as Vegetation Hazard Class (VHC)), which is based on Queensland Regional Ecosystems (RE) mapping. BRC defines bushfire prone vegetation as a VHC that can have a potential fireline intensity (RHF) greater than 4,000 kW/m^2, with values lower than this considered as vegetation associated with grass fire prone, or low hazard areas.

BRC specifies that a site reliability assessment shall be performed to confirm the correct assignment of fuel loads, by verifying the vegetation communities on site align with the mapped Regional Ecosystems.

In the absence of a physical site assessment undertaken by Covey, an Ecological Assessment and associated digital mapping has been provided by ERM (received 18 November 2025) – refer to Appendix A.

2.3.1 Site Specific Fuel

The SPP through BRC requires assessment of the 150 m of vegetation adjacent to assets. The vegetation within the project extent was classified into VHC based on information gathered from a combination of:

- State Regional Ecosystem spatial data (https://qldspatial.information.qld.gov.au/catalogue);
- Vegetation Hazard Class (https://qldspatial.information.qld.gov.au/catalogue); and
- Aerial imagery.

Table 2-2. Landscape vegetation within 150 m buffer of the project extent.

VHC	Description
VHC 12.2	Dry eucalypt woodlands on sandstone and shallow soils
VHC 13.2	Dry to moist eucalypt woodlands on undulating metamorphics and granite
VHC 16.2	Eucalyptus dominated woodland on drainage lines and alluvial plains
VHC 17.2	Dry woodlands dominated by poplar box, silver-leaved ironbark or White's ironbark on sand or depositional plains
VHC 18.2	Dry eucalypt woodlands on sand or depositional plains
VHC 20.2	Woodlands dominated by white cypress pine or coast cypress pine
VHC 25.1	Brigalow belah open forests on heavy clay soils
VHC 38.4	Continuous dryland cropping and horticulture
VHC 40.4	Continuous low grass or tree cover
VHC 42.4	Nil to very low vegetation cover.
VHC 43.6	Water bodies.

Within the project area itself, the vegetation has been classified into VHCs based upon the ecological data provided by ERM – for which the vegetation communities have been verified by ecological site assessment (Appendix A). Figure 2-5 and Figure 2-6 shows the extent of VHC mapping from a desktop analysis of the proposed development site and 150 m beyond the project area. Additionally, the client has provided information regarding the proposed operational corridor which will be entirely cleared of bushfire prone vegetation (trees and shrubs) and remain as a cleared vegetation corridor for the life of the project. This has been classified as VHC 42.4; thus, considered as a low hazard vegetation and not bushfire prone.

BRC (p 32) separates all surface landscape areas into three 'prone type' categories – 'Bushfire prone' (1), 'Grass fire' (2), and 'Low hazard' (3). Bushfire prone vegetation (VHC 12.2, 13.2 16.2, 17.2, 18.2, 20.2, 25.1) covers a significant portion of the project extent (49.6%), while grass fire prone (VHC 38.4, 40.4) covers 45.1% and low hazard vegetation (VHC 42.6, 43.6) covers the remaining 5.3% (Table 2-2).

Figure 2-5 and Figure 2-6 depict the constructed spatial VHC layer, the VHCs will be used to inform the fuel loads to be applied to RHF modelling of the identified bushfire prone vegetation areas (Table 2-3).

Table 2-3. VHC observed within 150 m of the project extent and associated fuel load as per BRC.

Vegetation description (VHC)	Vegetation type	Surface Fuel Load (t/ha)	Total Fuel Load (t/ha)	Prone type
VHC 12.2	Woodland	14.6	17.4	Forest/Shrub
VHC 13.2	Woodland	12.8	14.4	Forest/Shrub
VHC 16.2	Woodland	11.1	11.6	Forest/Shrub
VHC 17.2	Woodland	9	9.6	Forest/Shrub
VHC 18.2	Woodland	10.4	11	Forest/Shrub
VHC 20.2	Woodland	8.5	9.3	Forest/Shrub
VHC 25.1	Forest	13.1	15	Forest/Shrub
VHC 38.4	Grassland	3.8	3.8	Grassfire
VHC 40.4	Grassland	4.5	5	Grassfire
VHC 42.6	Low to Nil	2	2	Low Hazard
VHC 43.6	Low to Nil	0	0	Low Hazard

According to BRC, total fuel loads of the identified bushfire prone vegetation within the project area and surrounding 150 m vary between 9.3 t/ha and 17.4 t/ha for the Eucalypt woodlands, which dominate the area. The low hazard vegetation VHC 42.6 is associated with the operational corridor for the proposed development, whilst VHC 43.6 relates to identified water bodies from the ecological assessment.

2.4 Fire Behaviour Discussion

The project extent covers over 20,000 ha and while most of the infrastructure is located within open grassland, some of the WTGs are proposed within forested areas. Vegetation clearing will be undertaken around all proposed infrastructure, with this cleared extent of vegetation to remain throughout the life of the project – this clearing is known as the Operational Corridor of the development layout. Much of the project area is bounded by state forests:

- Kumbarilla State Forest lies to the west and north of the project extent;
- Boondandilla State Forest lies to the south-west of the project extent; and
- Western Creek State Forest lies to the south, south-east, and east of the project extent.

These large extents of forested areas may provide opportunity for large fire runs across the landscape towards the development and as per the weather analysis (Section 2.1.4), elevated fire danger days are associated with westerly wind signatures. Within the development itself, placement of WTGs within forested areas presents bushfire propagation risks in the event of turbine fires and fallen blades.

Seven potential sources of fire ignition have been identified at the project including:

1. Electrical faults/failure from electrical components (including inverter or transformer failures);
2. Vegetation management (i.e., mowing) in dry conditions;
3. Ignition of vegetation from overhead transmission lines;
4. Unauthorised site access and arson;
5. Activities associated with drilling and blasting; and
6. Maintenance activities that may generate heat or cause a spark (hot works) including welding or grinding.

There is limited regulatory policy or guidelines in relation to the placement of WTGs and ancillary infrastructure within bushfire prone vegetation; as such, the CFA guidelines have been heavily relied upon within this NHRA to determine the suitability of the WTGs and ancillary infrastructure proposed for this development.

In addition, external factors which may cause a bushfire within the project include:

1. Lighting strike; and
2. External bushfire spreading via vegetation.

The likelihood of a fire starting within the WF can be significantly reduced through appropriate design standards, maintenance, and active management (refer to CFA (2023) for further information).

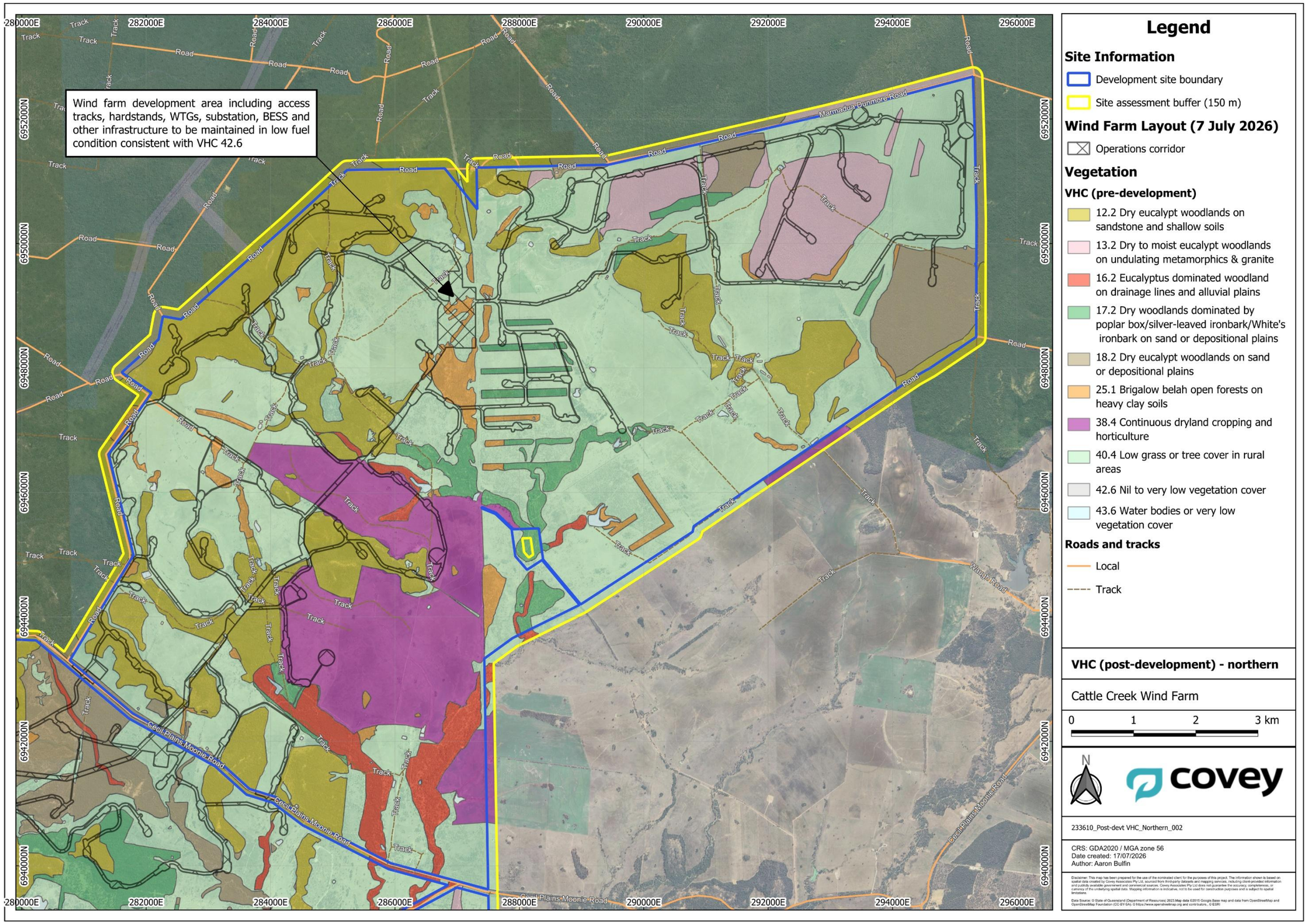


Figure 2-5: Mapped vegetation based on site verified vegetation per data provided by ERM / VHC within assessment area per SPP mapping (northern extent)

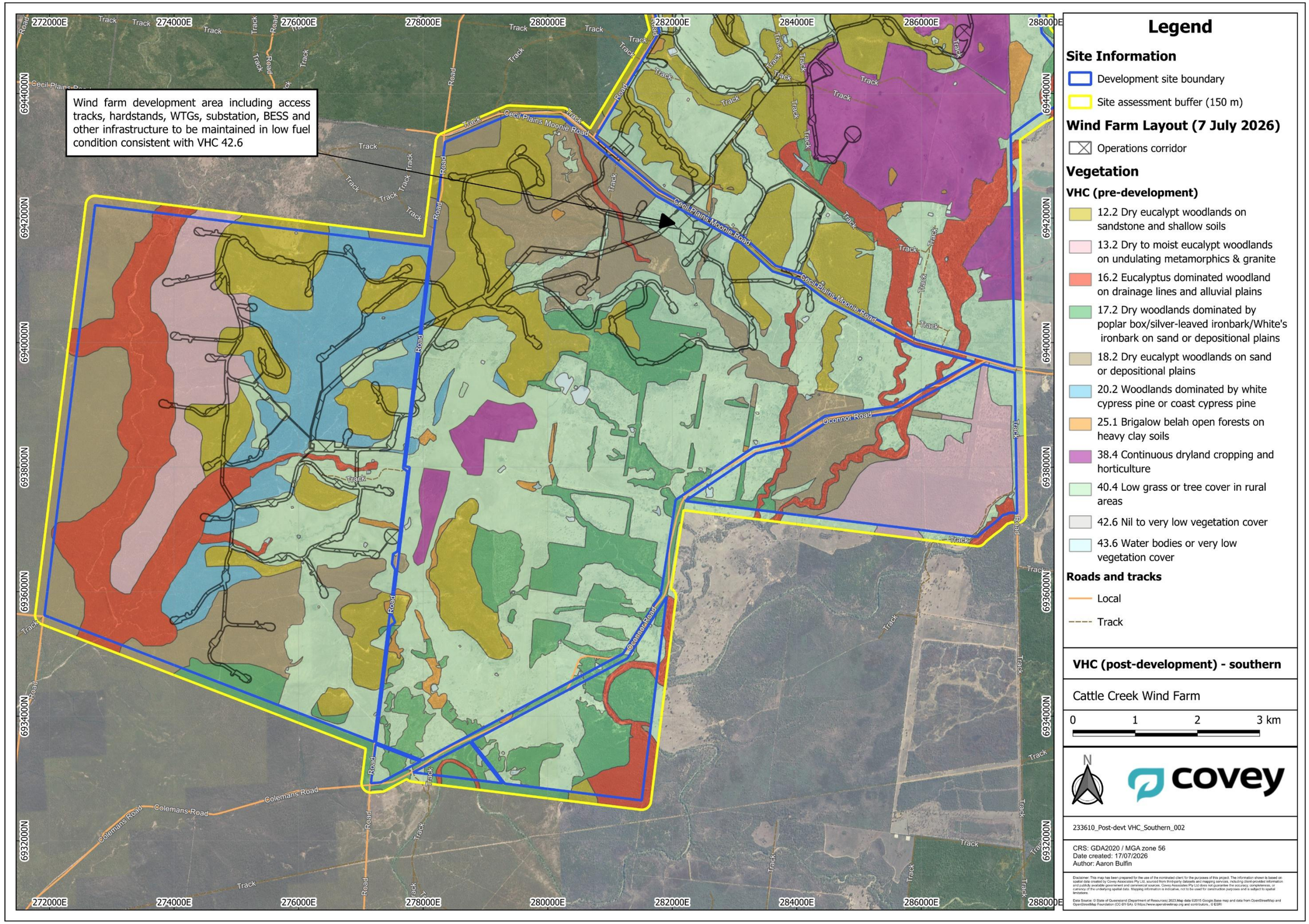


Figure 2-6: Mapped vegetation based on site verified vegetation per data provided by ERM / VHC within assessment area per SPP mapping (southern extent)

3 Bushfire Risk Assessment

The broad process for effective risk management utilised in this NHRA is identified in Figure 3-1 and used under Creative Commons CC BY 4.0 from SPP 'Natural hazards, risk and resilience state interest – Bushfire' (QFES 2019a). While this NHRA seeks to establish the context, identify the bushfire hazard and detail anticipated bushfire risk, it doesn't propose risk treatments nor detail how compliance will be achieved with relevant bushfire risk management requirements, which will be detailed in the future BMP.

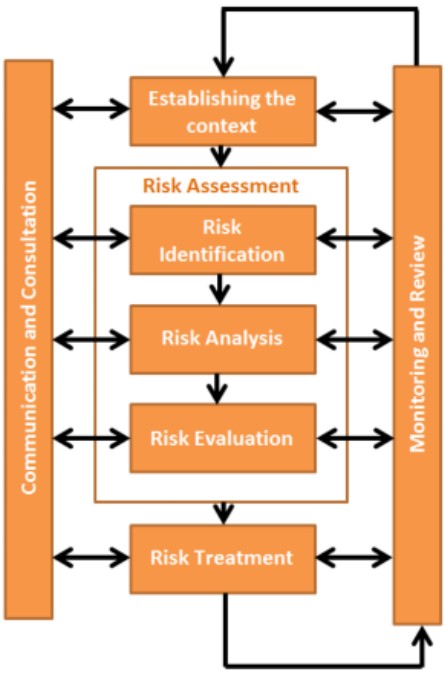


Figure 3-1: Risk management process (*Queensland Government, 2019****, Figure 3).***

3.1 Radiant Heat Flux Analysis

Bushfires present risks through flame contact, ember attack, and Radiant Heat Flux (RHF) exposure. To ensure developments are suitably placed within identified bushfire prone areas, RHF are undertaken to observe and inform sufficient setback distances. RHF calculations identify the rate at which heat transfers to a receiver from a potential fire and how the energy dissipates with increasing distance from the fire.

Subsequently the sizing of Asset Protection Zones (APZs); low fuel zones around buildings/critical infrastructure) should be informed by undertaking Radiant Heat Flux (RHF) calculations to determine the required setback distances, ensuring that the proposed infrastructure is sited as to not be impacted by unacceptable levels of RHF from potential bushfires.

3.1.2 Radiant Heat Flux Calculation Methodology and Inputs

To determine the potential bushfire RHF impact on the proposed BESS infrastructure and wind turbines, 1-D RHF calculations were undertaken in accordance with BRC, which specifies the application of Method 2 of Australian Standard (AS) 3959:2018 'Construction of buildings in bushfire-prone areas' ('AS3959'; Standards Australia 2018).

For this NHRA, the 1-D and 2-D RHF calculations were undertaken using Inferno-BAL modelling software, which was developed in-house by Covey, and which replicates the AS 3959 Method 2 RHF calculations as per inputs detailed in Table 3-1, noting the following:

- Most inputs are default as per Method 2 AS 3959, including flame width
- For flame temperature:
    - AS 3959 specifies a flame temperature input value of 1,090°K to be applied to ancillary infrastructure

Table 3-1. Radiant Heat Flux model assumptions – modified Method 2 of AS 3959

Situation	Calculation Parameters	Flame Properties		Target
	Default Inputs	Flame Temperature	Head Fire width	Radiant Heat Flux
WF infrastructure other than BESS (e.g. WTGs, substation)	Emissivity: 0.95 ε Heat of Combustion: 18600 kJ/kg Relative Humidity: 25% Ambient Temperature: 308°K Transmissivity: 0.775	**1090°K**	100 m	≤29 kW/m^2

In addition to the above, other RHF modelling inputs include the following as summarised on Table 3-2:

- As per Section 2.1.1, the 5% annual exceedance probability fire weather of **FFDI 75** has been adopted
- 1-metre DEM of the existing terrain surface to derive effective slope beneath vegetation but noting that given the DEM data does not include the proposed design surface, and as such, the RHF results are indicative given the site slope may be subject to change post-development.
    - *Effective Slope* is defined as the slope under the classified vegetation which most influences the bushfire attack (per AS3959-2018).
    - *Site Slope* is the slope under the subject area, site or asset (per AS3959-2018).
    - Varied slope values have been used to account for variation in elevation across the wind farm site.
    - Further description of 'effective slope' and 'site slope' is provided in Appendix B.
- Site specific vegetation hazard classes and their associated potential fuel loads for Bushfire Prone vegetation only, determined in accordance with procedure 5.4.2 Step 2 of BRC (2019) as per Table 2-2; and
    - According to section 7.6 of the BRC, RHF and Bushfire Attack Level (BAL) are not required to be calculated for grassfire prone VHCs or low hazard VHCs (QFES, 2019b). As such, VHC 41.4, VHC 42.6 and VHC 43.6 (all low hazard) were excluded from the model and Table 3-2.

- Rate of spread models are taken from those adopted in AS 3959, relevant to the bushfire fuel types as follows:
    - Woodland vegetation
        - R = 0.0012 * FFDI * SFL as per Catchpole et al, 1998

Table 3-2. Fuel input values and rate of spread equations (per BRC and AS3959).

FFDI	Vegetation Criteria				Rate of Spread Equation
	Vegetation Class	Vegetation Type	SFL (t/ha)	TFL (t/ha)	
75	VHC 12.2	Woodland	14.6	17.4	R = 0.0012 * FFDI * SFL (Catchpole et al (1998)
75	VHC 13.2	Woodland	12.8	14.4	
75	VHC 16.2	Woodland	11.1	11.6	
75	VHC 17.2	Woodland	9	9.6	
75	VHC 18.2	Woodland	10.4	11	
75	VHC 20.2	Woodland	8.5	9.3	

Covey notes that there are limitations predicting fire weather, bushfire behaviour and conducting RHF analysis, which have been detailed in Appendix C.

3.1.3 1-D Heat Flux Results

The 1-D RHF extent have been calculated per AS 3959 Method 2 (see Table 3-1), using the input values as detailed in Section 3.1.1 above, using 1090 K flame temperatures. These values provide an indication of the range of potential setback distances that must be observed between the proposed infrastructure and the assessed bushfire prone vegetation.

Four RHF values (40 kW/m^2, 29 kW/m^2, 19 kW/m^2 and 12.5 kW/m^2 @ 1090 K flame temperature) trigger specific Bushfire Attack Level (BAL) construction requirements under the Building Code of Australia, for certain building classifications, namely BAL-40, BAL-29, BAL-19 and BAL-12.5. A fifth classification also exists for buildings in areas with RHF >40 kW/m^2 where impact by direct flame impingement is almost certain, which is called BAL-FZ (flame-zone).

However, WTG are exempt from this given they are not assigned a specific building classification under the BCA. The 2-D calculations of RHF (Figure 3-2 and Figure 3-3) have been determined per Method 2 of AS3959, using the input values as detailed in Section 3.1.1 above.

Table 3-3. 1D RHF calculation to determine required setbacks (APZs) based on varying slopes and vegetation type (FFDI 75 per SPP).

Vegetation	Slope		Distance required to achieve [using flame temp of 1090 K]			
	Site	Effective	40 kW/m²	29 kW/m²	19 kW/m²	12.5 kW/m²
VHC 12.2 [Woodland]	1°	1°	10 m	13 m	19 m	27 m
	5°	5°	12 m	16 m	23 m	32 m
	10°	10°	15 m	20 m	29 m	40 m
	15°	15°	19 m	26 m	36 m	49 m
VHC 13.2 [Woodland]	1°	1°	8 m	11 m	16 m	23 m
	5°	5°	10 m	13 m	19 m	27 m
	10°	10°	12 m	17 m	24 m	34 m
	15°	15°	16 m	21 m	31 m	43 m
VHC 17.2 [Woodland]	1°	1°	6 m	8 m	12 m	18 m
	5°	5°	7 m	10 m	15 m	21 m
	10°	10°	9 m	13 m	19 m	27 m
	15°	15°	12 m	17 m	25 m	35 m
VHC 18.2 [Woodland]	1°	1°	7 m	9 m	14 m	20 m
	5°	5°	8 m	11 m	17 m	24 m
	10°	10°	11 m	15 m	22 m	32 m
	15°	15°	14 m	19 m	28 m	39 m
VHC 20.2 [Woodland]	1°	1°	6 m	8 m	12 m	17 m
	5°	5°	7 m	10 m	14 m	20 m
	10°	10°	9 m	12 m	18 m	26 m
	15°	15°	12 m	16 m	23 m	33 m
VHC 25.1 [Forest]	1°	1°	9 m	12 m	17 m	25 m
	5°	5°	11 m	14 m	21 m	29 m
	10°	10°	13 m	18 m	26 m	37 m
	15°	15°	17 m	23 m	33 m	46 m

3.1.4 Target Radiant Heat Flux

While the proposed infrastructure at this development are exempt from that BCA specified construction (i.e. they are not assessed as BCA building classifications), SPP guidance material (Natural Hazards, Risk and Resilience State Interest – Bushfire) recommends disturbance footprints excluding roads (i.e. WTG, ancillary facilities such as site offices/compounds, on-site accommodation, switchboards, substations and static water supply points) to be separated from the closest assessable vegetation by a distance that achieves a RHF of 29 kW/m^2 or less.

Notwithstanding the above, Covey notes the following:

- ***Wind Turbine Generators:***
  - Are constructed of non-flammable exterior materials that are highly unlikely to be ignited;
  - The likelihood of loss of life is considered very rare given that limited personnel will be present once the Project is operational. It is anticipated that personnel only onsite for periodic maintenance undertaken at a scheduled and as needed basis; and
  - Based on the above, the target RHF for proposed WTG of 29 kW/m^2 or lower (at 1090 K flame temperature) is considered appropriate to comply with SPP guidance material and manage the risk of bushfire impact on the WTG.
- ***Transformers (Substation yard)***
  - The risk to, and from, transformers is primarily related to potential for over-pressurisation of insulating oil tank resulting in rupture and subsequent pool fire; and
  - Given the limited likelihood of failure, and the difficulty in igniting the insulating oil, the target RHF for proposed transformers of 29 kW/m^2 or lower (at 1090 K flame temperature) is considered appropriate.
- ***O&M Buildings***
  - There are two O&M buildings proposed for the project; and
  - The target RHF for these is 29 kW/m^2 or lower (at 1090 K flame temperature), which is consistent with SPP (BRC).

3.1.5 2-D Radiant Heat Flux calculations

To provide more definitive results on the potential impact of RHF on the proposed WF infrastructure, 2-D RHF calculations were undertaken in accordance with the methodology in BRC, which specifies the application of Method 2 of Australian Standard (AS) 3959:2018 'Construction of buildings in bushfire-prone areas' ('AS3959'; Standards Australia 2018). The RHF calculations were undertaken using Inferno-BAL modelling software, which was developed in-house by Covey, which applies Method 2 of AS3959 – refer to Appendix D for further details.

These 2-D RHF results have been analysed to assess the potential impact of bushfires on the proposed infrastructure of the development layout – with the target RHF observed at each asset location of each WTGs, substation, proposed buildings, and other auxiliary infrastructure. The 2-D RHF results additionally provide detailed results relative to the project infrastructure and vegetation clearing, to then determine whether suitably sized APZs can be achieved – note APZs will be specified in subsequent reporting (BMP).

Based upon the extent of vegetation clearing associated with the OC, there is sufficient setback distance achieved between retained vegetation and placement of proposed infrastructure. On this basis, appropriately sized Asset Protection Zones (APZs) will need to be established around the perimeter of all WTGs, and the substation, to achieve the target RHF detailed in Section 3.1.4. Upon assessment of the 2-D RHF results, Covey is not aware of any specific reason why implementation of the APZs should not be achievable for the proposed development.

In addition to the proposed APZs, additional bushfire risk management measures may also be proposed to increase resilience to bushfire impact, but also to limit the opportunity for an onsite fire to escape and ignite a bushfire, and could include:

- Vegetation Modification and Management
- Vehicular Access Requirements (onsite)
- Bushfire Fighting Water Supply
- Infrastructure Design Requirements (to improve bushfire resilience)

All proposed bushfire risk management measures, including proposed APZs, are to be detailed and documented in the future project BMP, which is to include guidance on the responsibilities for implementation of that measure in addition to ongoing management.

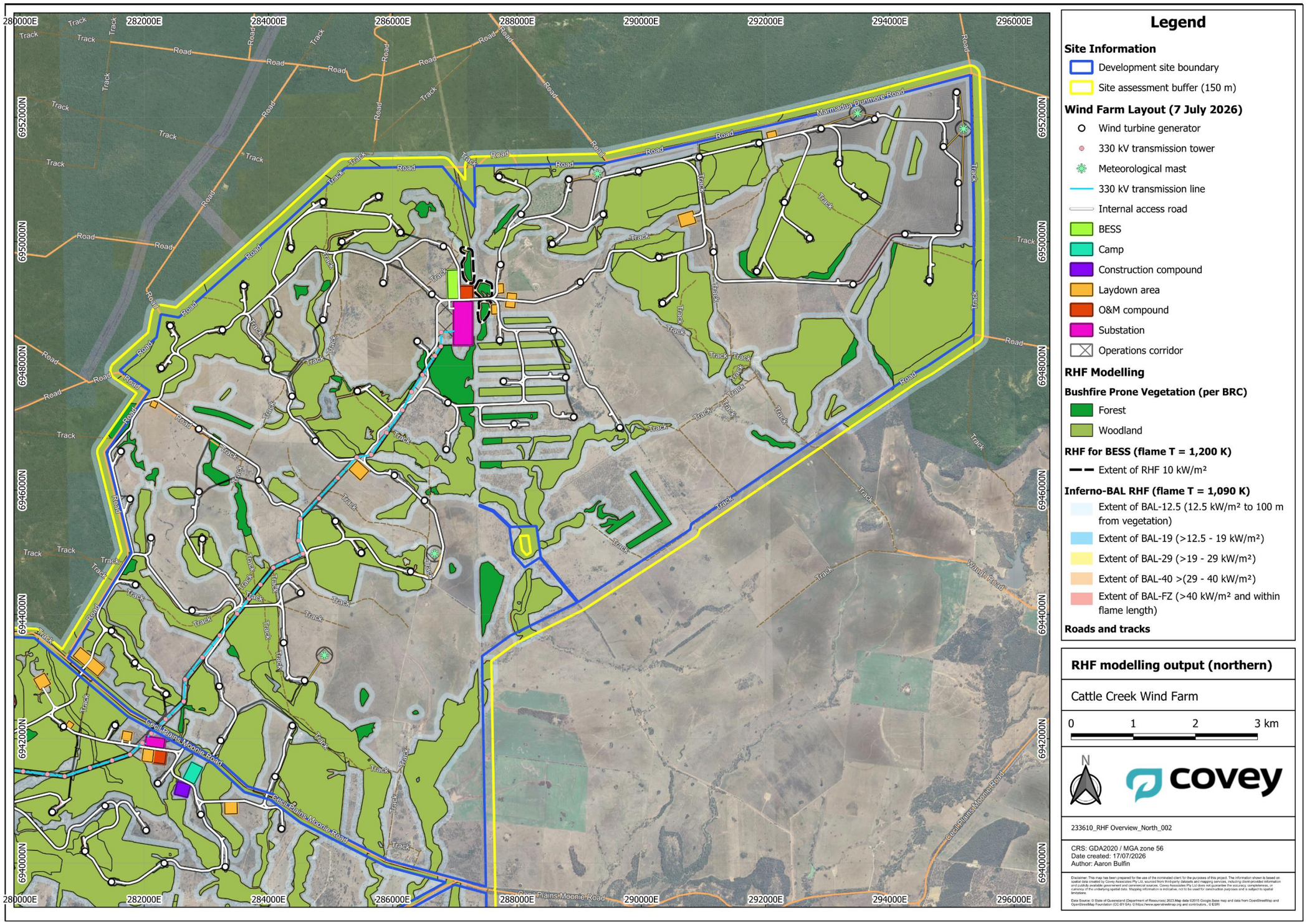


Figure 3-2. RHF modelling results (north) – refer to Appendix E for more detailed maps

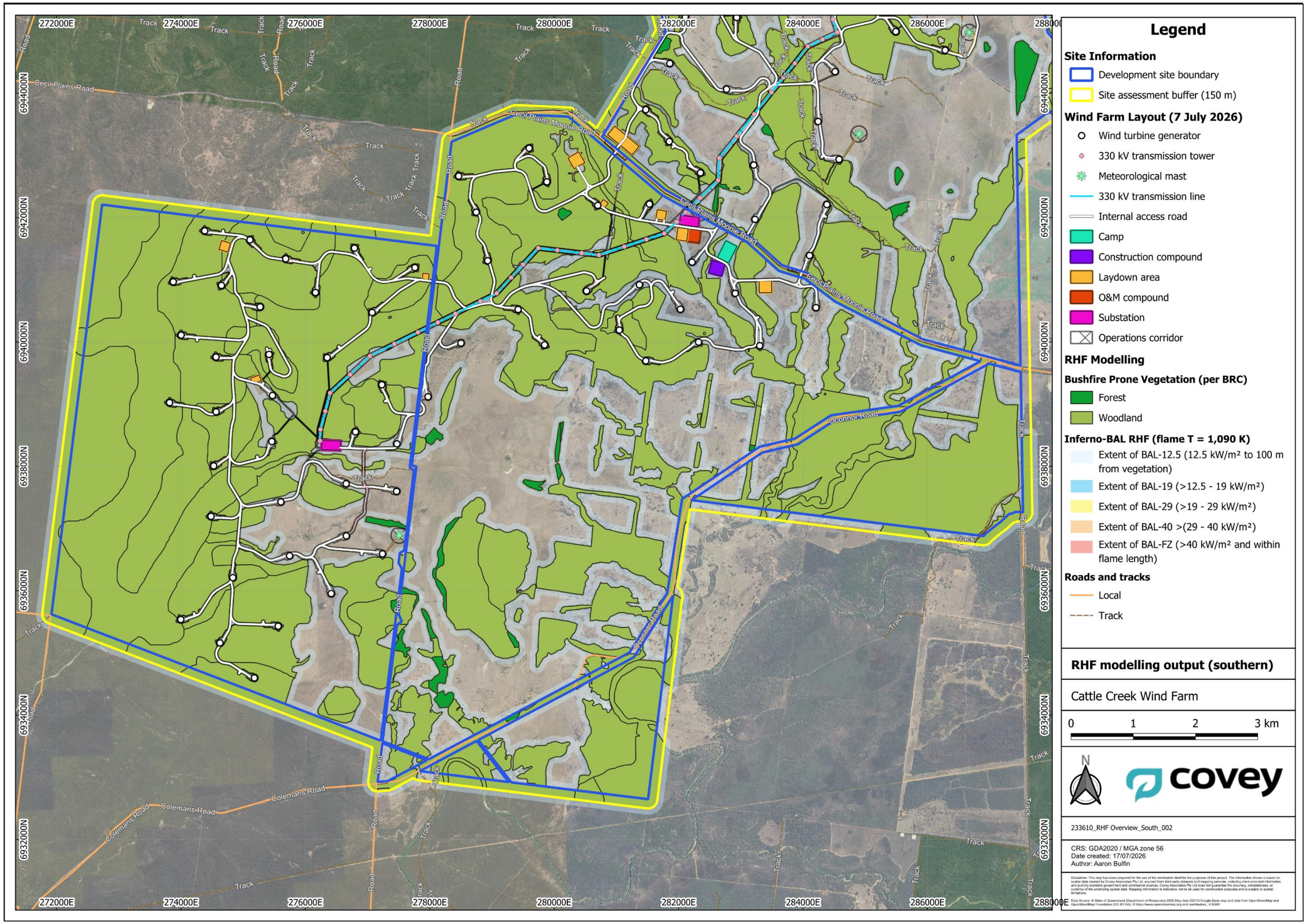


Figure 3-3: RHF modelling results (south) – refer to Appendix E for more detailed maps

4 NHRA Outcomes and Discussion

This NHRA provided a preliminary bushfire hazard assessment and analysed the potential bushfire constraints and impacts to the proposed Cattle Creek Wind Farm Project.

4.1 Bushfire Hazard Assessment Outcomes

The SPP Bushfire Prone Area mapping indicates that the Development Area is subject to Medium and High Potential Bushfire Intensity around areas of woody vegetation with some Very High Potential Bushfire Intensity associated with steep terrain in the southern portion of the development. Some of the proposed infrastructure for the development – including WTGs, ancillary infrastructure, and buildings – are located within mapped BPA. It has been demonstrated that the proposed BESS (BSF) is not located within a mapped BPA.

Elevated fire danger typically occurs within the dryer and warmer months of the year – typically from September to November – though can also occur in other periods of extended dry weather (little to no rainfall). Days of elevated fire danger typically occurred with winds from a westerly arc. Though these observations are made based on weather analysis from nearby stations (within 70 km) it should be noted that elevated fire danger could occur at any time during the year, under the right weather conditions. The fire season for the area is also influenced by rainfall brought by monsoonal systems, with wet years usually leading to an increase in fuel loading (especially in the grass layer), and dry years resulting in reduced grass growth and lower fuel loads which may affect subsequent fire seasons. Per the methodology outlined in BRC, the State mapped FFDI value of 75 had been utilised within this NHRA assessment for determining RHF within the bushfire risk assessment.

Desktop analysis using ground truthed RE mapping indicates the project area is dominated by eucalypt dominated open woodlands (VHC 12.2, 13.2, 16.2, 17.2, 18.2, 20.2, and 25.1), with smaller amounts of grassland (VHC 38.4 and 40.4) and low hazard vegetation (VHC 41.4, 42.6, 43.6). Indicative fuel loads for the bushfire hazardous vegetation within 150 m of the OC vary between 9.3 t/ha and 17.4 t/ha for the Eucalypt woodlands (QFES, 2019a).

The Project is located within undulating terrain, generally at elevations between 310 – 420 m above sea level, at the top of a hilly range that spans in a north-south direction.

Given the size of the project area, the proximity to large, forested areas, and the elevated FFDI, significant bushfire fuels and undulating topography, means that there is possibility for growth and spread of large bushfires to impact the proposed development, and as such, is a risk that requires appropriate management measures to reduce to an acceptable level.

4.2 Bushfire Risk Assessment Outcomes

To determine whether sufficient separation from existing unmanaged Bushfire Prone vegetation exists to proposed infrastructure, 2-D radiant heat flux calculations were undertaken in accordance with AS 3959 Method 2, based on site specific fuel loads and topography, to achieve the target RHFs as follows:

- Proposed WTG, substation, buildings, and ancillary infrastructure to achieve 29 kW/m^2 or lower (at 1090 K flame temperature)

Based upon the extent of vegetation clearing associated with the OC, there is sufficient setback distance achieved between retained vegetation and placement of proposed infrastructure. On this basis, appropriately sized Asset Protection Zones (APZs) will need to be established around the perimeter of all WTGs, buildings,

substation, and ancillary infrastructure, to achieve the target RHF detailed in Section 3.1.4 in order to limit bushfire impact to an acceptable level, and ensure compliance with current planning legislation and guidance material. Covey is not aware of any specific reason why implementation of the APZs should not be achievable for the proposed development.

While this NHRA has focused on bushfire hazard analysis and radiant heat flux impact, suitable mitigation measures will need to be identified in future reporting to ensure that the development suitably addresses the risk of bushfire to a tolerable level.

4.3 Future Reporting Requirements

It is the understanding of Covey per the requirements of the State Code (SC23) that a Bushfire Management Plan (BMP) will need be conditioned as part of the development approval from SARA, and will address the following:

- All proposed bushfire risk management measures, including
    - Vegetation Modification and Management, especially proposed APZ locations and extent
    - Vehicular Access Requirements (onsite)
    - Bushfire Fighting Water Supply
    - Infrastructure Design Requirements (to improve bushfire resilience)
- Implementation and ongoing management responsibilities for the proposed bushfire risk management measures
- Compliance assessment against relevant State and Local Government policies, including relevant aspects of the following:
    - SPP - Natural hazards, risk and resilience – Bushfire.
    - Bushfire Resilient Communities. Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience-Bushfire'.
    - State Code 23 – Wind Farm Development
    - Toowoomba Regional Council (2022); and,
    - Western Downs Regional Council Planning Schemes (2017) (Amendment 2025)

Given the proposed BESS is sited outside of mapped Bushfire Prone Areas and therefore complies with PO13 of SC27, any further bushfire reporting required to support the development application is not expected to address PO14 or PO15 of SC27.

Additionally, the facility will require the development of a Safety and Emergency Management Plan (SEMP) that identifies appropriate emergency management and emergency response procedures for the facility in responding to fire and bushfire risks that the facility may pose.

4.4 Compliance Assessment

Covey has conducted an assessment against the bushfire related requirements of the following in the tables below (as noted):

- SPP - Natural hazards, risk and resilience – Bushfire (see Table 5-1)
- State Code 23 – Wind Farm Development (see Table 5-2)
- State Code 27: Battery storage facility development (see Table 5-3)
- Toowoomba Regional Council Planning Scheme Bushfire Hazard Overlay Code (see Table 5-4)
- Western Downs Regional Council Planning Scheme Bushfire Hazard Overlay Code (see Table 5-5)

As detailed in Section 4.3, the future project BMP will provide more detail on the bushfire risk management strategy and associated mitigation measures, and as such, will include the final bushfire compliance assessment.

5 Compliance Assessment

5.1 SPP - Natural hazards, risk and resilience – Compliance Assessment

Table 5-1. Development compliance SPP - Natural hazards, risk and resilience.

State Interest Policy		Compliance / Recommendations
1	Natural Hazard areas are identified including: (a) Bushfire prone areas (b) Flood hazard areas, (c) Landslide hazard areas, (d) Storm tide inundation areas, (e) Erosion prone areas.	As detailed in this NHRA, the majority of the disturbance footprint, including proposed renewable energy infrastructure, has been identified within areas of ***Medium Potential***, ***High Potential*** and ***Very High Potential Bushfire Intensity*** on the SPP BPA mapping, due to large tracts unmanaged woodland vegetation. The BESS (BSF) is not within a mapped BPA (Figure 1-4), per SC27, only compliance with PO13 is applicable. This NHRA has not considered other natural hazards including: • Flood hazard, • Landslide hazard, • Storm tide inundation, and • Erosion prone areas. Consideration of hazards (b) to (e) are outside the scope of this NHRA.
2	A fit-for-purpose risk assessment is undertaken to identify and achieve an acceptable or tolerable level of risk for personal safety and property in natural hazard areas.	This NHRA has identified the bushfire hazard and undertaken a bushfire risk assessment against the proposed development layout. The main compliance assessment has been in determining the spatial positioning of development infrastructure relative to identified bushfire hazard through RHF analysis. This NHRA does not outline the required mitigation measures that may be applied to the development to lower the residual bushfire risk. Per SC23, a project BMP will be conditioned to be developed after approval, which will detail a comprehensive bushfire risk management strategy and associated mitigation measures, to manage bushfire risk to the facility including people and property, while also managing the escape of onsite infrastructure to ignite a bushfire. This will be based on the guidance of the bushfire and renewable energy infrastructure hazard, bushfire risk analysis, the requirements of SC23 and LGA

State Interest Policy		Compliance / Recommendations
		(Council's) BHOC, and underpinned by relevant Model Requirements of the CFA Design Guidelines relating to renewable energy infrastructure.
3	Land in an erosion prone natural hazard area is not to be used for urban purposes, unless the land is located in: (a) an urban area in a planning scheme; or (b) an urban footprint identified in a regional plan.	**Not Applicable – Outside the scope of this bushfire NHRA**
4	Development in bushfire, flood, landslide, storm tide inundation or erosion prone natural hazard areas: (a) avoids the natural hazard area; or (b) where it is not possible to avoid the natural hazard area, development mitigates the risks to people and property to an acceptable or tolerable level.	The proposed development in within an identified bushfire hazard area, per the SPP BPA mapping. Though the entire development is not able to be sited outside mapped BPA, the proposed infrastructure and associated vegetation clearing (OC) provides suitable setback between constructed infrastructure and bushfire hazards through the RHF analysis undertaken within this NHRA. This NHRA has not considered other natural hazards including: • Flood hazard (mentioned above), • Landslide hazard, • Storm tide inundation, and • Erosion prone areas.
5	Development in natural hazard areas: (a) supports, and does not hinder disaster management capacity and capabilities, (a) directly, indirectly and cumulatively avoids an increase in the exposure or severity of the natural hazard and the potential for damage on the site or to other properties, (b) avoids risks to public safety and the environment from the location of the storage of hazardous materials and the release of these materials as a result of a natural hazard maintains or enhances the protective function of landforms and vegetation that can mitigate risks associated with the natural hazard.	The majority of the disturbance footprint, including proposed renewable energy infrastructure, has been identified within BPA, noting that the BESS (BSF) is sited outside the mapped BPA. This NHRA has undertaken an assessment to identify the bushfire hazard and determine the bushfire risk through assessment of RHF. This NHRA does not detail specific mitigation measures to ensure the residual bushfire risk is appropriately mitigated to a tolerable or acceptable level. This assessment will be undertaken within a BMP that will be conditioned upon the approval of the development application.

State Interest Policy		Compliance / Recommendations
		The BMP will assess and detail management measures for the development, ensuring: • The bushfire risk management strategy will support disaster management capacity and capabilities, by reducing burden on emergency services personnel through minimisation of bushfire impact (or spread) and improvement of onsite vehicular access and firewater supplies (where applicable). • Will avoid an increase in the exposure and severity of bushfire hazard through provision of appropriate separation from unmanaged vegetation to limit bushfire impact on proposed infrastructure, while limiting opportunity for escape of onsite fire events to ignite a bushfire. Additionally, a number of fire protection measures will be proposed to infrastructure to improve bushfire resilience, and to enable early onsite fire detection and suppression.
6	Community infrastructure is located and designed to maintain the required level of functionality during and immediately after a natural hazard event.	**Not Applicable – No community infrastructure is proposed as part of this development**
7	Coastal protection work in an erosion prone area is undertaken only as a last resort where coastal erosion or inundation presents an imminent threat to public safety or existing buildings and structures, and all of the following apply: (a) The building or structure cannot reasonably be relocated or abandoned. (b) Any erosion control structure is located as far landward as practicable and on the lot containing the property to the maximum extent reasonable. Any increase in coastal hazard risk for adjacent areas from the coastal protection work is mitigated.	**Not Applicable – Outside the scope of this bushfire NHRA**
8	Erosion prone areas within a coastal management district: Development does not occur unless the development cannot feasibly be located elsewhere and is: (a) coastal-dependent development; or	**Not Applicable – Outside the scope of this bushfire NHRA**

State Interest Policy		Compliance / Recommendations
	(b) temporary, readily relocatable or able to be abandoned development; or (c) essential community infrastructure; or (d) minor development of an existing permanent building or structure that cannot be relocated or abandoned.	
9	*Erosion prone areas within a coastal management district:* Development permitted in policy 8 above, mitigates the risks to people and property to an acceptable or tolerable level.	**Not Applicable – Outside the scope of this bushfire NHRA**

5.2 State Code 23 (Wind Farms) – Compliance Assessment

Covey have conducted an assessment against the bushfire related Performance Outcomes of SC23 in Table 5-2, omitting the following on the basis that they don't specifically relate to management of either risk and therefore outside the scope of this NHRA, and assumed to be addressed in other relevant reporting (as required):

- PO1 to PO4 (Protected wildlife and associated habitats and areas of high ecological value)
- PO5 (Agricultural Land)
- PO6 (Natural Drainage Patterns)
- PO7 to PO9 (Protecting water quality and erosion control)
- PO12 and PO13 (Acoustic Amenity)
- PO14 (Electromagnetic Interference)
- PO15 (Shadow Flicker)
- PO16 (Social Impacts)
- PO17 (Areas identified by state or local government planning instruments as having high scenic amenity)
- PO18 to PO21 (Transport Networks)
- PO22 and PO23 (Aviation safety, integrity and efficiency)
- PO24 to PO27 (Decommissioning)

Table 5-2. State Code 23 (Wind Farm) Assessment Criteria – Bushfire Only

Performance Outcomes	Response
Natural hazards and extreme weather events	
PO10 Development is located, designed, constructed and operated to be responsive to natural hazards and extreme weather events	The proposed wind farm portion of the development in within an identified bushfire hazard area, per the BPA mapping. Though the development is not able to be sited to avoid mapped BPA, the proposed infrastructure and associated vegetation clearing (OC) provides suitable setback between constructed infrastructure and bushfire hazards through the RHF analysis undertaken within this NHRA. This NHRA has not considered other natural hazards including: • Flood hazard, • Landslide hazard, • Storm tide inundation, and
PO11 Development is constructed and operated to protect the safety of people in the event of natural hazards or extreme weather events occurring.	

Performance Outcomes	Response
	• Erosion prone areas. This NHRA has undertaken an assessment to identify the bushfire hazard and determine the bushfire risk through assessment of RHF. This NHRA does not detail specific mitigation measures to ensure the residual bushfire risk is appropriately mitigated to a tolerable or acceptable level. This assessment will be undertaken within a BMP that will be conditioned upon the approval of the development application.

5.3 State Code 27 (BESS) – Compliance Assessment

Covey have conducted an assessment against the bushfire related Performance Outcomes of SC27 in Table 5-3, omitting the following on the basis that they don't specifically relate to management of either risk and therefore outside the scope of this NHRA, and assumed to be addressed in other relevant reporting (as required):

- PO1 (Areas of high ecological value and associated wildlife habitats)
- PO2 to PO4 (Risk Mitigation)
- PO5 to PO7 (Incident Response)
- PO8 (Social Impacts)
- PO9 and PO12 (Agricultural Land)
- PO16 to PO19 (Protecting Water Quality and Erosion Control)
- PO20 to PO21 (Acoustic Amenity and Vibration)
- PO22 (Visual Impact)
- PO23 (Lighting)
- PO24 to PO28 (Transport Networks)
- PO29 and PO30 (Infrastructure)
- PO31 to PO35 (Decommissioning)

Table 5-3. State Code 27 (BESS Facilities) Assessment Criteria – Bushfire Only

Performance Outcomes	Response
Natural hazards	
PO13 Development is located and sited to avoid **natural hazard** areas including **high erosion risk** areas and **bushfire prone areas.**	The proposed BESS in accordance with the development layout will be sited outside of mapped Bushfire Prone Areas (see Figure 1-4). Therefore, the BESS (BSF) component of the proposed development has been located to avoid mapped Bushfire Prone Areas (per SPP mapping).
PO14 Where development cannot be located and sited to avoid **natural hazard** areas (e.g. **Bushfire prone areas**, and **high erosion risk** areas), demonstrate that: • there is no suitable alternative location; • infrastructure can function effectively during and after a **natural hazard** event; and • mitigation measures are implemented to reduce the risk to people, property and the **environment** to a tolerable level.	**Not applicable** As the proposed BESS in accordance with the development layout will be sited outside of mapped Bushfire Prone Areas, compliance is achieved with PO13 and assessment isn't required against PO14 or PO15.
PO15 Bushfire hazard is identified and risk is mitigated through strategies for vegetation management, landscape management, water supply, provision of appropriate access, identification of safe assembly or evacuation routes and establishing cleared and maintained asset protection zones around infrastructure that is wholly contained on site.	**Not applicable** As the proposed BESS in accordance with the development layout will be sited outside of mapped Bushfire Prone Areas, compliance is achieved with PO13 and assessment isn't required against PO14 or PO15.

5.4 TRC 8.2.2 BHOC Assessment Criteria

Table 5-4. Toowoomba Regional Council Planning Scheme Policy 8.2.2 Bushfire Hazard Overlay Code assessment criteria (Table 8.2.2:2)

Performance outcomes	Acceptable outcomes	Comment
For all development:		
PO1 Community infrastructure is only located in a bushfire medium and high-risk area where the function and role of the infrastructure necessitates its location in the area and there are no suitable alternative sites in a low bushfire hazard area.	No acceptable outcome is nominated.	**Not Applicable – not community infrastructure**
PO2 Community infrastructure is able to function effectively during and immediately after bushfire events.	**AO2.1** The community infrastructure is located on land that is not subject to High or Medium bushfire risk; or *Note for AO2.1: A site-specific bushfire hazard assessment is necessary to demonstrate that although the proposed development site is within bushfire hazard area, the bushfire hazard is low on that site.* **AO2.2** The community infrastructure will not involve any new building work other than a minor extension (<20 m² Gross Floor Area) to an existing building; or **AO2.3** The community infrastructure development is located within a bushfire hazard area (as identified in the Bushfire Hazard Overlay Maps) but is	**Not Applicable – not community infrastructure**

Performance outcomes	Acceptable outcomes	Comment
	designed to function effectively during and immediately after bushfire events. *Note for AO2.3: The development application must include and comply with a comprehensive Bushfire Management Plan.*	
PO3 Development is provided with an adequate water supply for firefighting purposes that is safely located and freely accessible.	**AO3.1** Development within a water supply area involving the creation of a new lot/s or involving proposed and existing buildings with a combined gross floor area greater than 50 m², is connected to Council's reticulated water supply system It will be readily available at all times for firefighting vehicles and a water supply outlet located within the road reserve is within 40 m² of the following: (a) All of the land; or (b) A building envelope designated on each lot; or (c) The centre of each lot, excluding access handles (where no building envelope is designated); and (d) All existing and proposed buildings And Fire hydrants are designed and installed in accordance with Queensland Fire and Emergency Services' Fire Hydrant and Vehicle Access Guidelines, Unless otherwise specified by the relevant water entity **AO3.2** Development outside a water supply area involving proposed or existing buildings with a combined gross floor area greater than 50 m², are provided	**AO3.1** is not relevant to the proposed WF/BESS which is a utility (not residential) and will be located outside a water supply area. The facility shall be designed with sufficient water capacity for firefighting which will be determined within future reporting requirements (BMP) as conditioned within the approval by SARA. **AO3.2** will be satisfied for the proposed WF within future reporting (BMP) as conditioned per approval by SARA. The BESS is not located within a mapped BPA

Performance outcomes	Acceptable outcomes	Comment
	with a dedicated on site water storage system that permanently holds a minimum of 10,000 L (e.g. dam, swimming pool or water tank) for firefighting purposes. **AO3.3** A water tank is provided within 10 m of each building (other than a Class 10 building) which: (a) Is either below ground level or of non-flammable construction; (b) Has a take-off connection at a level that allows the following dedicated, static water supply to be left available for access by fire fighters: (i) 10,000 L for residential buildings; (ii) For industrial, commercial; and other buildings, a volume specified in AS2304-2011 [now superseded by AS 2304:2019]; (c) Includes shielding of tanks and pumps in accordance with AS2304-2011 [now superseded by AS 2304:2019]; (d) Includes a hardstand area allowing medium rigid vehicle (15 tonne fire appliance) access within 6 m of the tank; (e) Is provided with rural fire brigade tank fittings if serviced by a rural fire brigade (i.e. 50 mm ball valve and male camlock coupling and, if underground, an access hole of 200 mm (minimum) to accommodate suction lines); and Is clearly identified by directional signage at the street frontage	(Figure 1-4), therefore will not form part of future bushfire reporting requirements (BMP). **AO3.3** As above, large static water supplies will be in place for the proposed WF and these supplies will also meet the requirements of **AO3.3**, which will be satisfied within future reporting (BMP) as conditioned per approval by SARA.
Hazardous Materials		
PO4	**AO4.1**	**Not Applicable**

Performance outcomes	Acceptable outcomes	Comment
Public safety and the environment are not adversely affected by the detrimental impacts of bushfire on the manufacture or storage of hazardous materials in bulk.	Development complies with a Bushfire Management Plan for the premises.	The BESS is not located within a mapped BPA (Figure 1-4). therefore will not form part of future bushfire reporting requirements (BMP).
Reconfiguring a lot and Material Change of Use		
PO5 Lot design and the siting of buildings provide safe sites for habitable and non-habitable buildings.	**AO5.1** All development enables buildings and structures to achieve setbacks from hazardous vegetation that are: (a) sited within the area of lowest hazard within the lot; and (b) provide for adequate setbacks from hazardous vegetation; and (c) 1.5 times the predominant mature canopy tree height or 10 m, whichever is the greater; and (d) 10 m from any retained vegetation strips or small areas of vegetation; and (e) sited so that elements of the development least susceptible to fire are sited closest to the bushfire hazard.	No lots are being created by the proposed development, and no habitable buildings are proposed. The non-habitable buildings will be surrounded by APZs that meet **AO5.1** (b), (d) and (e) with minimum APZs commensurate with RHF ≤29 kW/m2, however, may not meet elements (a) and (c). **AO5.1** will be satisfied for the proposed WF within future bushfire reporting (BMP) as conditioned per approval by SARA.
PO6 For development that will result in multiple buildings or lots, roads and access are designed to mitigate against bushfire hazard by ensuring adequate access for:	**AO6.1** The road design is capable of providing access for firefighting and other emergency vehicles, in accordance with the standards identified in SC6.2 PSP No. 2 – Engineering Standards – Roads and Drainage Infrastructure. **AO6.2** The lot layout ensures that all roads are through roads.	All-weather access is to be provided to all elements of the proposed WF but there will be some short dead-end roads to the furthermost wind turbines which are unavoidable due to the remote nature of the development and local topography. **AO6.1-6.4** and SC6.2 PSP No. 2 – Engineering Standards – Roads and Drainage Infrastructure relate to residential development and are not necessarily relevant to the proposed utility including the fact that large numbers of residents will not be evacuating the site while firefighting crews are accessing the site to undertake fire suppression during a bushfire. However, consultation with TRC is recommended early

Performance outcomes	Acceptable outcomes	Comment
(a) firefighting and other emergency vehicles; and (b) the evacuation of people in the event of an emergency.	**AO6.3** The lot layout does not include long narrow lots, long access ways or rear lots. **AO6.4** The road has a maximum gradient of 1 in 8 (12.5%).	in the detailed design phase to obtain concurrence on the applicability of this element is recommended as the proposed WF/BESS may not comply with all specifications. **AO5.1** will be satisfied for the proposed WF within future bushfire reporting (BMP) as conditioned per approval by SARA.
PO7 For development that will result in multiple buildings or lots, fire breaks are provided that: (a) adequately and effectively separate the development site from surrounding vegetation to mitigate against bushfire hazard; (b) have sufficient width to enable continuous access for firefighting and other emergency vehicles, residents and equipment; and (c) are in secure tenure and are maintained.	**AO7.1** The development incorporates a fire break provided by a perimeter road that: (a) separates the boundary of the lots and the adjacent bushland; (b) has a minimum cleared width of 20 m; (c) has a formed road width of 6 m; and (d) is constructed to an all-weather standard. **AO7.2** The development includes fire breaks which are located as close as possible to the boundaries of the lot(s) and the adjoining bushfire hazard and the fire breaks have: (a) a minimum cleared width of 6 m; (b) a minimum formed width of 4 m; and (c) a maximum gradient of 1 in 8 (12.5%);	**Not Applicable** **AO7.1** and **AO7.2** are applicable to urban development and are not considered relevant to the proposed development.

5.5 WDRC BHOC 8.2.3 Assessment Criteria

Table 5-5. Western Downs Regional Council (WDRC) Planning Scheme Policy 8.2.3 Bushfire Hazard Overlay Code assessment criteria (Table 8.2.3.1)

Performance outcomes	Acceptable outcomes	Comment
For accepted, accepted subject to requirements and assessable development (code, code (fast tracked) and impact)		
PO1 Development does not increase the number of persons living or working on land subject to high bushfire hazard identified on **Bushfire hazard overlay maps (OM-003)** unless it is demonstrated that: (a) the subject land is a medium bushfire hazard (or lesser); or (b) development is for community Infrastructure and facilities are located and designed to minimise susceptibility to bushfire events; and (c) a Bushfire Emergency Management Plan is prepared by suitably qualified person(s) and appropriately mitigates risks to life and property.	**AO1.1** Development does not increase the number of lots in areas of high bushfire hazard as identified on **Bushfire hazard overlay maps (OM-003)**. **AO1.2** Uses within the following activity groups are located outside of a high bushfire hazard identified on **Bushfire hazard overlay maps (OM-003)**: (a) accommodation activities group; (b) business activities group; (c) community activities group; and (d) entertainment activities group.	Development does not increase the number of people living or working on land subject to 'high' bushfire hazard as there is no 'high' bushfire hazard mapped on WDRC's Bushfire hazard overlay map (OM-003) within the proposed development area. Proposed development satisfies **P01**.
PO2 In medium bushfire hazard areas as identified on Bushfire hazard overlay maps (OM-003), vehicular access is designed to mitigate against bushfire hazard by: (a) ensuring adequate access for firefighting and other emergency vehicles; (b) ensuring adequate access for the evacuation of residents and emergency personnel in an emergency situation,	**AO2.1** The road design is capable of providing access for firefighting and other emergency vehicles, in accordance with SC6.2 – Planning Scheme Policy 1 – Design and Construction Standards. **AO2.2** In areas of medium bushfire hazard as identified on Bushfire hazard overlay maps (OM-003), roads are provided in accordance with the following: (a) roads are designed and constructed with a maximum gradient of 12.5%;	Proposed WF is a utility development, not a residential development for which the Acceptable Outcomes of **PO2** have been developed and only certain elements of the proposed infrastructure will be located on land mapped 'Medium' bushfire hazard. The proposed access to the WF should follow relevant requirements of the Qld standards, or CFA Guidelines to ensure best practice firefighting access

Performance outcomes	Acceptable outcomes	Comment
including alternative safe access routes. (should access in one direction be blocked in the event of a fire); (c) providing for the separation of developed areas and adjacent bushland. Note—where it is not practicable to provide firebreaks in accordance with AO3.1 Fire Maintenance Trails are provided in accordance with the following: (i) located as close as possible to the boundaries of the lot and the adjoining hazardous vegetation; (ii) the minimum cleared width not less than 6 metres; (iii) the formed width is not less than 2.5 metres; (iv) the formed gradient is not greater than 15%; (v) vehicular access is provided at both ends; and (vi) passing bays and turning areas are provided for firefighting appliances either located on public land or in an access easement that is granted in favour of the Local Government and QFRS [QFD].	(b) cul-de-sac are not used except where: (iii) a perimeter road designed in accordance with AO2.3 isolates the development from hazardous vegetation; and (iv) the cul-de-sac are provided with alternative access linking the cul-de-sac to other through roads; and (v) the maximum length of the cul-de-sac is 200 metres. **AO2.3** In areas of medium bushfire hazard as identified on Bushfire hazard overlay maps (OM-003) and development is for the purpose of reconfiguring a lot, the design incorporates a perimeter road firebreak that: (a) is located between the boundary of the lots and stands of native vegetation; (b) has a minimum cleared width of 20 metres; (c) has a constructed road width of six metres; and (d) is constructed to an all-weather standard.	to the WF and satisfy relevant specifications within **AO2.1** and **AO2.2**. **AO2.1 and AO2.2** will be satisfied for the proposed WF within future reporting (BMP) as conditioned per approval by SARA. There will be no residents as part of the proposed development and only a small number of staff onsite intermittently. The development does not involve reconfiguring a lot, so a perimeter road firebreak is not required (**AO2.3** does not apply).

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Appendix A

ECOLOGICAL SURVEY BY ERM (2025)

APPENDIX B

Methodology for determining slope per AS3959

Topography can influence the rate of spread and flame parameters of bushfires, therefore effecting the potential Radiant Heat Flux. Method 2 of AS3959 requires the input of two specific slope values to determine the RHF; these are:

- Effective slope – the slope under the classified vegetation that most influences the bushfire attack; and
- Site slope – the slope of the land between the classified vegetation and the proposed infrastructure.

The site slope can affect the view factor, and therefore the results of the RHF impact on the infrastructure. The effective slope input influences the RHF calculations the most, therefore the determination of this slope becomes more critical. The slopes are categorised as 'upslope' or 'downslope' which is dependent upon the position of the infrastructure in relation to the classified vegetation (Australian Standards 2018):

- Downslope – If the land beneath the classified vegetation slopes downward from the edge closest to the infrastructure, it is regarded as 'downslope'—even if the terrain between the infrastructure and the vegetation edge varies in gradient; and
- Upslope – If the terrain beneath the classified vegetation rises from the edge closest to the infrastructure, it is classified as 'upslope,' regardless of how the ground slopes between the infrastructure and that vegetation edge.

The slope value inputs are reported in units of degrees, the input value of the effective slope is capped at 30 degrees downslope, and site slope is capped at 20 degrees regardless of slope category. The reason for these slope caps is that convective heat release in bushfires is no longer negligible in understanding the heat flux exposure on the infrastructure (Australian Standards 2018).

Plate 1 overleaf aims to provide clarity for determining the category of the effective slopes and whether the slope value used represents is an input value of up to 30 degrees (downslope) or 0-degrees (for all upslope scenarios). The slope input values should be determined by site assessment, and the appropriate slope value can be adopted to determine the required setback distance to be applied between the classified vegetation and the infrastructure. Slope measurements undertaken on site can be applied to determine the nominal required setback distances to implement an APZ, 1-D RHF values from Section 3.1.3 may be applied where suitable.

RHF values have been provided based on the slope within each AS3959 effective slope categories most affecting fire behaviour within 150 m of proposed WF/BESS elements (1° and downslope 5°, 10° and 15°).

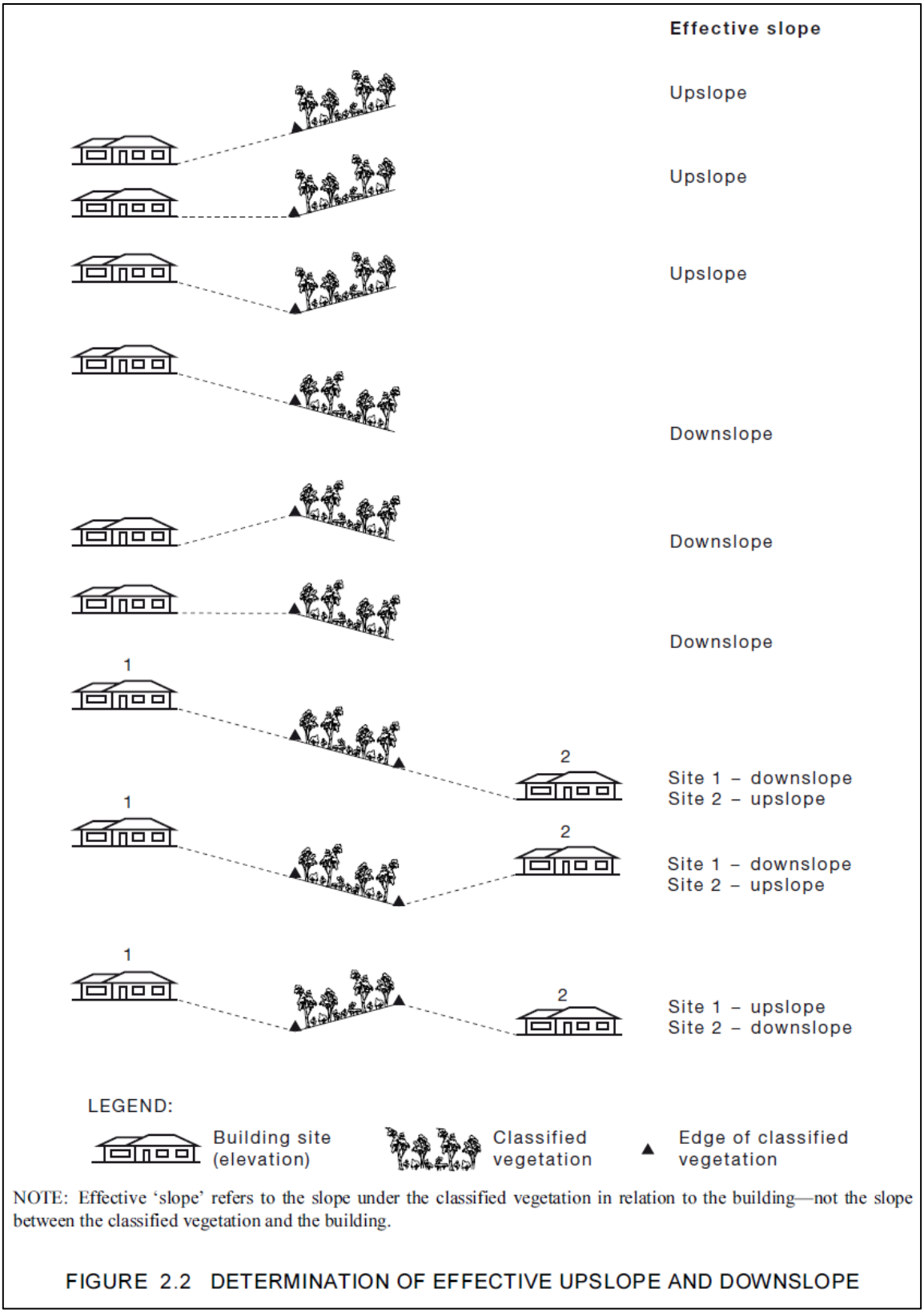


Plate 1 - Visual aid for determining Slope Category *(Source: Australian Standards 2018)*.

Appendix C

LIMITATIONS OF STUDY

Fire weather and behaviour are, by nature, difficult to predict with certainty. Therefore, it follows that those limitations exist when predicting bushfires and designing for bushfire mitigation. The following limitations are noted:

- Fuel loads are based on State dataset and not site-specific fuel measurements;
- Fire behaviour at high fire danger ratings and under the influence of fire-induced winds driven by strong convection rates may become erratic beyond the bounds of prediction models (Cruz *et al.*, 2012);
- Human-induced climate change may exacerbate fire behaviour and affect vegetation structure and floristics in different ways than those assumed in this study (Dowdy, 2018); and
- The assessment is primarily desktop-based and relies on various data inputs, some of which may be outdated.

Also, RHF modelling methodology:

- Assumes an omni-directional head-fire approaching the asset. As detailed in Section 2.1.4, westerly wind signatures are typically associated with hazardous fire weather days. Therefore, large wildfires are likely to be approaching the WF from those directions;
- Adopts older iterations of fire rate of spread models (per statutory standards). Most of these were formulated based on experiments undertaken in Victoria, in areas with fuel loads and structures vastly different from the ones for the WF. It is therefore hard to determine how accurately these models predict local fire behaviour; and
- Disregards interaction between weather parameters with topography and fuels, such as:
    - Rainfall and its interaction with fuels. For example, high rainfalls lead to increased vegetation growth and hence fuel loading. Different vegetation communities also dry out at varying rates, with grasslands curing faster than forests. This leads to fuel availability differentials after wet period; and
    - Wind and its interaction with topography. Winds tend to channel and create eddies in high rugosity areas, such as hills, valleys, and slopes, leading to local conditions that can be significantly different from predicted prevailing wind directions and speeds. This in turn may lead to 'unpredictable' fire behaviour within those areas.

The preliminary calculations completed within this report assume that fuels are contiguous, with standard VHC fuel loading, and without land management treatments (e.g., grazing) being considered. As such, the calculations are likely to be a snapshot in time rather than providing an overview of the potential outcomes of a wildfire impact. Also, RHF analysis does not accurately quantify potential fire intensities, nor can it identify likely fire paths that are likely to be experienced within the WF. If the above parameters are to be investigated, Covey recommends undertaking a dynamic and/or probabilistic bushfire behaviour analysis.

Appendix D

INFERNO-BAL RADIANT HEAT FLUX MODEL METHODOLOGY, INPUT, AND ASSUMPTIONS

INFERNO-BAL METHODOLOGY

Inferno-BAL is a module of the Inferno geospatial system designed by Covey Associates, to calculate radiant heat flux (RHF) and Bushfire Attack Level (BAL) from Method 2 in the AS3959 standard. Rather than calculating radiant heat flux at a single point, Inferno-BAL assesses heat flux at each point within a given area. This allows contours of radiant heat flux to be determined, as well as the maximum potential radiant heat flux and subsequent BAL level over plots and structures. The system is designed to work over very large areas (tens of kilometres) at high spatial resolution (metre scale). All intensive computations utilise graphics processing units (GPUs) where possible allowing the rapid calculation of RHF over these large spatial scales. The system also utilises a server-driven approach where calculations can be queued until resources are available, then data delivered on request.

The RHF at a given point is dependent on the flame length which, in turn, is strongly dependent on the effective slope of the vegetation. The AS3959 standard defines the effective slope as that *which most influences the bushfire attack*. To determine this 'most influential' slope Inferno-BAL calculates the effective slope in all directions around the given point and uses the maximum view factor from all directions to calculate the final RHF for the BAL value.

The heat flux calculations require the following to determine flame length:

- The vegetation characteristics, i.e., fuel type and fuel load;
- The distance to the vegetation patch;
- The site slope between the calculation point and the vegetation patch; and
- The effective slope under the vegetation which most influences the fire behaviour.

To obtain the above information, Inferno-BAL requires the following inputs:

- A digital elevation map, giving the vertical height above a given datum; and
- A geo-located vector data set consisting of flammable vegetation polygons. Each vegetation polygon, or patch, must encode total and surface fuel loads, and fuel type (Forest, Woodlands, Shrublands, Scrub, Mallee, Rainforest, Moorlands or, Grassland – per AS 3959). This can be encoded as a field within the polygon data, or the values can be populated using a code from an auxiliary table.

If required, an additional vector data set representing building envelopes can be included in the model to obtain the aggregate maximum radiant heat flux over spatially specified polygons.

Pre-Processing

The software first undertakes the following pre-processing actions:

1. Verify the input layers; and
2. Rate-of-spread model and fuel load values are populated for each vegetation patch. Any patches with an un-burnable fuel type are removed (for example, water bodies).

View Factor and Effective Slope Calculation

Next the view factor from all possible directions is calculated as illustrated in Figure 1. The red circle is the point at which the BAL is required, the radial black lines are example search paths (only a fraction of which are shown in Figure 1) and the green polygons are patches of fuel. Two example fuels are shown here marked A and B.

The maximum search path length is defined by the user in the *maximum distance* input. The effective slope is calculated from the average gradient of the elevation along a transect from the intersection of the search path and the vegetation. The length of this transect is defined by the user, by default this is 20 m into the vegetation. These transects are shown as the dashed lines in Figure 1. A search path is ignored if it does not intersect any vegetation. The angular increment between the paths ensures every cell at the end of the search path is covered. For a maximum path length of 200 m this results in several thousand search paths per point.

To prevent very short vegetation transects from having an undue influence over the resultant radiant heat flux an optional minimal transect length is applied. By default, this is 1 m. Any paths less than this length are ignored in the calculation.

Many different methods were tested for the effective slope, including the gradient of the slope at the vegetation edge, and the maximum and median slopes along the line. The average gradient method was found to give the smoothest and least sensitive slope measurements within the vegetation out of all the methods tested.

In some cases, vegetation producing higher flame lengths may be behind intervening vegetation. For example, vegetation A in Figure 1 may produce shorter flame lengths and subsequently lower RHF than vegetation B. The calculation assesses up to 4 different vegetation types along each search path and takes the maximum of these as the resulting flame length. Search paths with multiple vegetation types are shown with double lines in Figure 1.

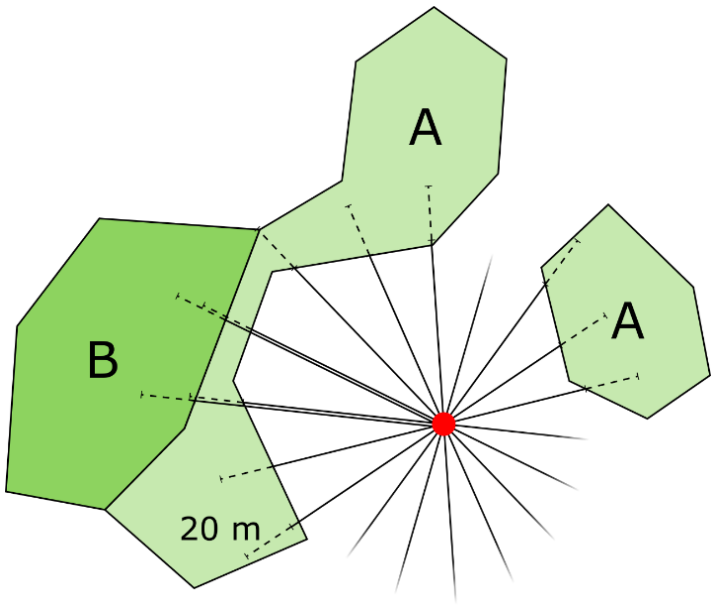


Figure 1 - Radiant heat flux calculation from point (red circle) along various search paths (black lines) to nearby vegetation (green polygons).

Rate of Spread and Distance Calculation

The encoded vegetation characteristics from the vegetation layer are then used to determine which of the eight AS3959 rate-of-spread models to adopt. From each of these a model for flame length is used (which may depend on an intermediate fire intensity empirical model for some fuel types, as in the AS3959 standard Eqns. B3, B4 and B5).

The flame length and distance to the vegetation is then used in the AS3959 view factor calculation. This uses the assumption of a rectangular flame with a fixed width (Eq. B8). The full AS3959 calculation uses an intensive iterative process for the RHF which is too computationally intensive to calculate for each search path. Instead, the view factor is found for a site slope of zero and flame angle of 90 degrees, representing the worst case. The search path resulting in the maximum view factor is found from all possible search paths.

Site Slope Calculation

Once the search path giving the maximum view factor is found, the site slope is calculated using the arctangent of the difference in elevation over this search path divided by the length of the vector. The site slope is clamped from -20 to 20 degrees, as in the AS3959 Method 2 standard.

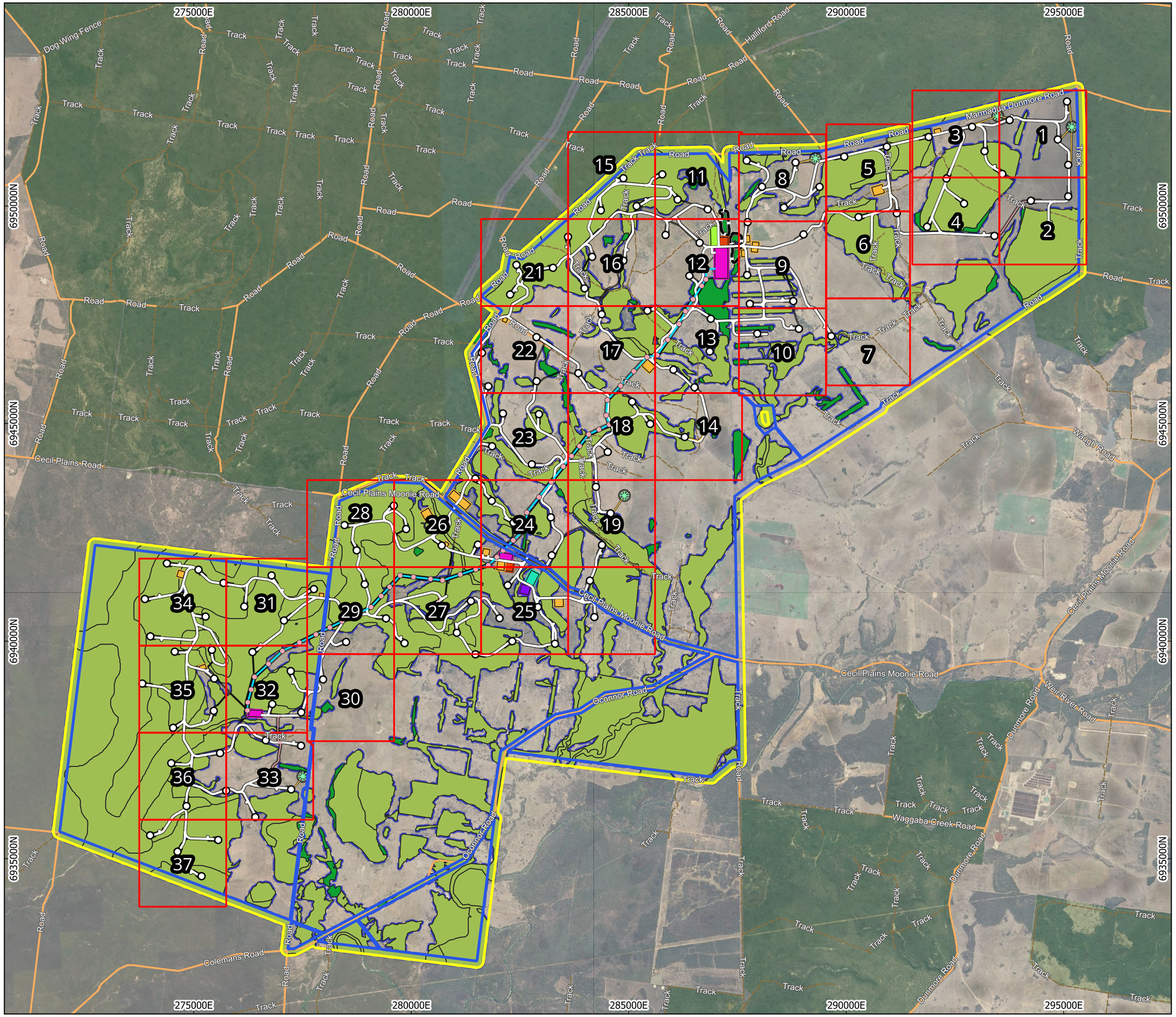
Radiant Heat Flux calculation

The RHF is then calculated using the full AS3959 iterative process at the calculation point for the search path giving the maximum view factor. This step involves some significant assumptions as outlined in the AS3959 standard, including the application of an empirical model for the atmospheric transmissivity (Eq. B9).

This process is repeated for every point within the given area, resulting in a continuous map of RHF. The final steps in the process are to find the maximum radiant heat flux in each polygon plot, if supplied, to categorise these into the BAL levels and to generate the vector isolines of the radiant heat flux.

APPENDIX E

2-D Radiant Heat Flux results – detailed maps of development layout



Legend

Site Information

- Grid_RHF_Atlas_small
- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- Meteorological mast
- 330 kV transmission line
- Internal access road
- BESS
- Camp
- Construction compound
- Laydown area
- O&M compound
- Substation
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for BESS (flame T = 1,200 K)

- Extent of RHF 10 kW/m²

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

Roads and tracks

- Local
- Track

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

2600 m

233610_RHF_Site_Atlas_Key_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
Date created: 17/07/2026
Author: Aaron Bulfin

Disclaimer: This map has been prepared for the use of the nominated client for the purposes of this project. The information shown is based on spatial data created by Covey Associates Pty Ltd, sourced from third-party datasets and mapping services, including client-provided information and publicly available government and commercial sources. Covey Associates Pty Ltd does not guarantee the accuracy, completeness, or currency of the underlying spatial data. Mapping information is indicative, not to be used for construction purposes and is subject to spatial limitations.

Data Source: © State of Queensland (Department of Resources) 2023.Map data ©2015 Google,Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors., © ESRI

294000E
295000E
6952000N
6951000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Meteorological mast
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
Date created: 17/07/2026
Author: Aaron Bulfin

Disclaimer: This map has been prepared for the use of the nominated client for the purposes of this project. The information shown is based on spatial data created by Covey Associates Pty Ltd, sourced from third-party datasets and mapping services, including client-provided information and publicly available government and commercial sources. Covey Associates Pty Ltd does not guarantee the accuracy, completeness, or currency of the underlying spatial data. Mapping information is indicative, not to be used for construction purposes and is subject to spatial limitations.

Data Source: Map data ©2015 Google, © ESRI

294000E

295000E

6950000N

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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

292000E
293000E
6952000N
6951000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Meteorological mast
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

292000E
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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

290000E
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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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Data Source: Map data ©2015 Google, © ESRI

290000E
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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

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RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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Data Source: Map data ©2015 Google, © ESRI

290000E
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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Meteorological mast
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

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RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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Data Source: Map data ©2015 Google, © ESRI

288000E
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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for BESS (flame T = 1,200 K)

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RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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Legend

Site Information

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Wind Farm Layout (7 July 2026)

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RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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286000E

287000E

6951000N

6950000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
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RHF Modelling

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- Extent of RHF 10 kW/m²

RHF for WF elements (flame T = 1,090 K)

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RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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Data Source: Map data ©2015 Google, © ESRI

286000E
287000E
6949000N
6948000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- BESS
- O&M compound
- Substation
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for BESS (flame T = 1,200 K)

- Extent of RHF 10 kW/m²

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Data Source: Map data ©2015 Google, © ESRI

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6947000N
6946000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
Date created: 17/07/2026
Author: Aaron Bulfin

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Data Source: Map data ©2015 Google, © ESRI

286000E

287000E

6945000N

6944000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Meteorological mast
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI



Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Data Source: Map data ©2015 Google, © ESRI

284000E

285000E

6949000N

6948000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

284000E
285000E
6947000N
6946000N
284000E
285000E
6947000N
6946000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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284000E

285000E

6945000N

6944000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Data Source: Map data ©2015 Google, © ESRI

284000E

285000E

6943000N

6942000N

284000E

285000E

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Meteorological mast
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Data Source: Map data ©2015 Google, © ESRI

284000E

285000E

6941000N

6940000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Data Source: Map data ©2015 Google, © ESRI

282000E
283000E
6949000N
6948000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Data Source: Map data ©2015 Google, © ESRI

282000E

283000E

6947000N

6946000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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Data Source: Map data ©2015 Google, © ESRI

282000E
283000E
6945000N
6944000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

282000E
283000E
6943000N
6942000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Laydown area
- O&M compound
- Substation
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

282000E

283000E

6941000N

6941000N

6940000N

6940000N

282000E

283000E

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission line
- Internal access road
- Camp
- Construction compound
- Laydown area
- O&M compound
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

280000E
281000E
6943000N
6942000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

280000E
281000E
6941000N
6940000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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Data Source: Map data ©2015 Google, © ESRI

278000E
279000E
6943000N
6942000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
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278000E
279000E
6941000N
6940000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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278000E
279000E
6939000N
6938000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

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276000E
277000E
6941000N
6940000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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276000E
277000E
6939000N
6938000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- 330 kV transmission tower
- 330 kV transmission line
- Internal access road
- Substation
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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276000E
277000E
6937000N
6936000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Meteorological mast
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Forest
- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

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274000E

275000E

6941000N

6940000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

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274000E
275000E
6939000N
6938000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Laydown area
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

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Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
Date created: 17/07/2026
Author: Aaron Bulfin

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274000E
275000E
6935000N
6934000N

Legend

Site Information

- Development site boundary
- Site assessment buffer (150 m)

Wind Farm Layout (7 July 2026)

- Wind turbine generator
- Internal access road
- Operations corridor

RHF Modelling

Bushfire Prone Vegetation (per BRC)

- Woodland

RHF for WF elements (flame T = 1,090 K)

- Extent of BAL29 zone (19 - 29kW/m2)

RHF impact on infrastructure

Cattle Creek WF and BESS - NHRA

0 200 400 m

N

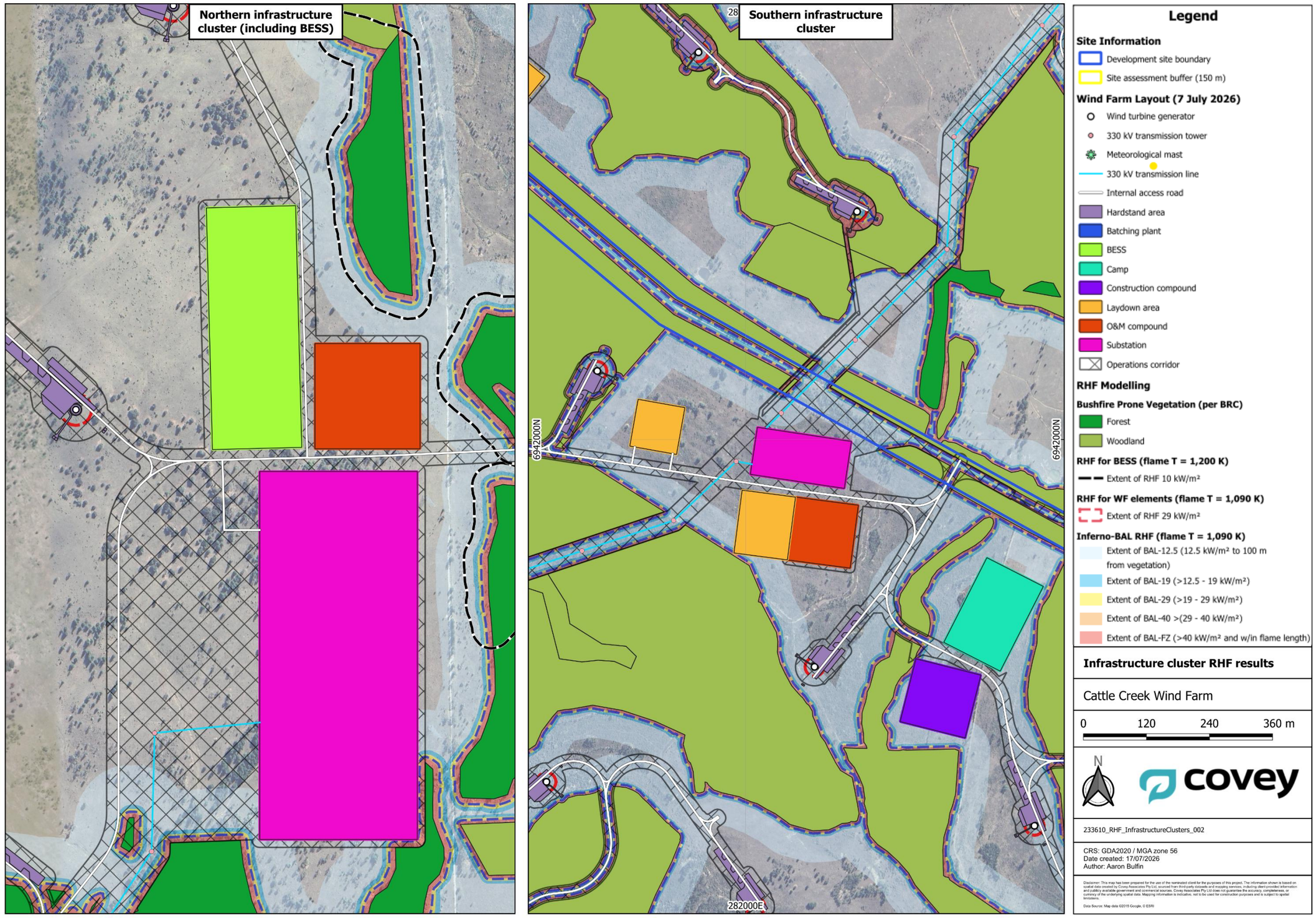
covey

233610_RHF_Site_Atlas_NHRA_0001_0001

CRS: GDA2020 / MGA zone 56
Date created: 17/07/2026
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Northern infrastructure cluster (including BESS)
Southern infrastructure cluster
28
6942000N
6942000N
282000E
Legend
Site Information
Development site boundary
Site assessment buffer (150 m)
Wind Farm Layout (7 July 2026)
Wind turbine generator
330 kV transmission tower
Meteorological mast
330 kV transmission line
Internal access road
Hardstand area
Batching plant
BESS
Camp
Construction compound
Laydown area
O&M compound
Substation
Operations corridor
RHF Modelling
Bushfire Prone Vegetation (per BRC)
Forest
Woodland
RHF for BESS (flame T = 1,200 K)
Extent of RHF 10 kW/m²
RHF for WF elements (flame T = 1,090 K)
Extent of RHF 29 kW/m²
Inferno-BAL RHF (flame T = 1,090 K)
Extent of BAL-12.5 (12.5 kW/m² to 100 m from vegetation)
Extent of BAL-19 (>12.5 - 19 kW/m²)
Extent of BAL-29 (>19 - 29 kW/m²)
Extent of BAL-40 >(29 - 40 kW/m²)
Extent of BAL-FZ (>40 kW/m² and w/in flame length)
Infrastructure cluster RHF results
Cattle Creek Wind Farm
0
120
240
360 m
N
233610_RHF_InfrastructureClusters_002
CRS: GDA2020 / MGA zone 56
Date created: 17/07/2026
Author: Aaron Bulfin
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