Appendices

Item 12.2.2B

UNDER SEPARATE ELECTRONIC COVER

ORDINARY COUNCIL MEETING

To Be Held

Wednesday, 24th April 2024

Commencing at 5.00pm

At

ADMINISTRATION CENTRE EATON
1 Council Drive - EATON

This document is available in alternative formats such as:
~ Large Print
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Upon request.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Development Application

Lot 504 (5) Hardisty Court, Picton East

Prepared for Tesla Corporation Management Pty Ltd

Prepared by Taylor Burrell Barnett

February 2024

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Document Information

Development Application

Tesla Corporation Management Pty Ltd

23/103

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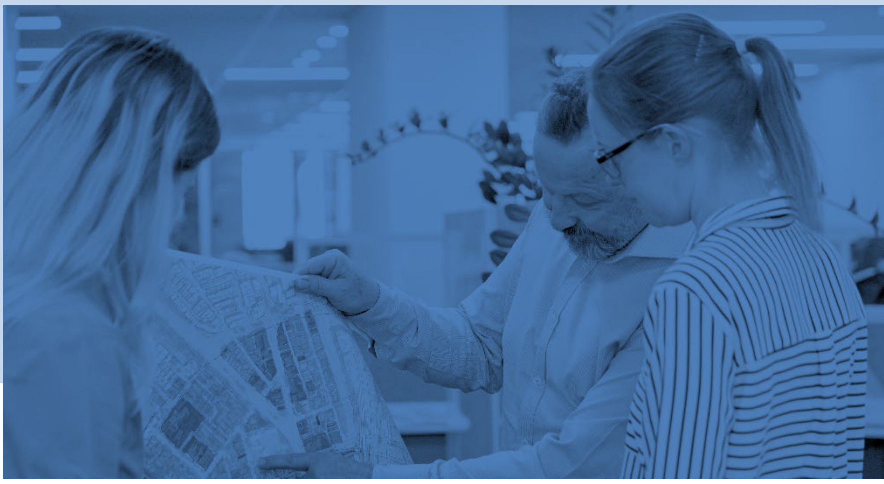

Revision	Status	Author	Approved by	Date Issue
1.0	Draft	F Jas	M Willcock	15/02/2024
A	Final	F Jas	M Willcock	19/02/2024

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

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Technical Appendices

Appendix A - DA Forms, Checklists, and Certificate of Title;
Appendix B - Development Plans and Elevations;
Appendix C - Bushfire Management Plan;
Appendix D - Bushfire Risk Report; and
Appendix E - Acoustic Assessment.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

1.0 Introduction

Taylor Burrell Barnett (TBB), acting on behalf of our Client, Tesla Corporation Management Pty Ltd, has prepared this development application report in support of proposed works for the conversion of a peaking station (comprising diesel generator sets) to a battery energy storage system. The proposal has been prepared in accordance with provisions of the state and local planning framework.

Our Client is in the process of converting peaking stations to battery energy storage systems (BESS). For this site, the BESS will absorb energy from the grid and discharge that energy at a later time to provide electricity as needed. The BESS will provide a complementary and supporting role to provide capacity and stability to the South West Interconnected System (SWIS) which will facilitate the build out of additional renewable generation. As industry and government move towards net zero greenhouse gas emissions, this particular proposal is preferred as a clean energy alternative, and is a superior solution to meet the demands of peaking power.

This report describes the proposal and provides justification in respect of the statutory planning framework. The following appendices are to be read in conjunction with this report:

- **Appendix A** – DA Forms, Checklists, and Certificate of Title;
- **Appendix B** – Development Plans and Elevations;
- **Appendix C** – Bushfire Management Plan;
- **Appendix D** – Bushfire Risk Report; and
- **Appendix E** – Acoustic Assessment.

Details on the specifics of the application are provided below in **Table 1**. Further information regarding the development proposal are provided further in this report, together with justifications against the planning framework.

Table 1 Summary of Proposed Development Application

Proposal	Details
Shire of Dardanup Town Planning Scheme No.3 Land Use Definition	'General Industry' zone Approved 'Use Not Listed – Power Station'
Land Details Tenure Registered Proprietor	Lot 504 (No. 5) Hardisty Court, Picton East 6229 Freehold, no subdivision proposed Tesla Corporation Management Pty Ltd
Proposed Capacity (Battery Storage)	40MWh
Development Area	5,740m^2
Vehicle Access	Existing crossover from Hardisty Court
Period of Construction	Up to 12 months
Expected Lifespan of Facility	25 years

1.1 Other / Relevant Approvals

In 2010, the Shire granted development approval for 'Use Not Listed' and classified as a 'Power Station'. The proposed works aim to replace diesel generators with a BESS to continue to operate in accordance with the approved use. It is considered that the proposed works would comfortably fit within this unlisted use as a 'Power Station'.

In 2012, development approval was granted for two acoustic walls running along the eastern and western sides of the lot. It is understood that the walls were constructed to provide acoustic mitigation.

On 24 September 2015, the Department of Water and Environment Regulation (DWER) issued a licence under the *Environmental Protection Act 1986* for 'Electric Power Generation' for the subject site.

1.2 Pre-lodgement Consultation

On 24 November 2023, TBB staff liaised via telephone with Suzanne Occhipinti from the Shire of Dardanup (the Shire) regarding the proposed works at the subject site. TBB and the Shire discussed the details of the original approval for the power station, how this application will be assessed based on the proposed works, and what additional information is to be provided as part of a development application.

The Shire requested that information be provided regarding how the BESS facility would function as a ‘power station’ to assist the Shire staff in determining if the proposal is consistent with the approved use.

A memorandum was provided to the Shire on 5 December 2023, providing details of the proposal and additional information provided by the Client supporting the development application being for works only and not comprising a change of use. A response was received on 22 December 2023 from Gabriella Hayward from the Shire indicating that considering the level of change it would be considered a change of use for a ‘Use Not Listed’ and would therefore require Council approval. In addition, it would be considered a ‘complex’ application and would need to be advertised to all properties within a 200m radius of the subject site.

2.0 Site Context

2.1 Legal Description

The development area is wholly contained within Lot 504 (HN 5) Hardisty Court, Picton East. The property details and tenure of the land are described in **Table 2**. A copy of the Certificate of Title for Lot 504 is enclosed in **Appendix A**.

Table 2 Legal Description

Lot No	Deposited Plan	Volume	Folio	Registered Proprietor	Lot Area
504	59719	2731	685	Tesla Corporation Management Pty Ltd	5,740m^2

2.2 Site Characteristics

The site is located approximately 8km east of the Bunbury city centre and approximately 157km south of the Perth CBD. The topography of the subject site is predominantly flat, with the majority of the site covered in an asphalt driveway, gravel and the existing diesel power storage facility and supporting infrastructure (refer **Figure 1**). A chain wire fence is along the lot boundaries and is approximately 1.8m in height. Two existing concrete walls approximately 3m in height on the east and west side screening the existing facility and are understood to be approved by the Shire in 2012.

Figure 1 Site Map

2.3 Surrounding Land Use and Development

To the north, Lot 200 has a land area of 29.5133 ha and is zoned 'General Farming'. The areas of the lot closest to this site contains remnant vegetation, with areas further west used for laydown and storage. Lot 100 (225 Harris Road) has a land area of 10.1662 ha and is observed to be a warehouse for a fertiliser depot.

The adjacent properties along Hardisty Court and Delmarco Drive are zoned 'General Industry'. Lot 503 to the west has been developed for a 'transport depot' land use and Lot 508 to the south has recently been developed and comprises a warehouse. All other industrial lots are vacant.

The zoning and use details for all adjacent properties are summarised in **Table 3**. In context to the adjacent properties, an acoustic assessment was completed (refer **Appendix E** and **section 3.5**). The acoustic assessment confirms that the noise levels for the worst-case options scenario complies.

Table 3 Summary of Zoning and Uses for Adjacent Properties

Property Detail	Compass Direction	Zone / Reserve	Observed use and development
Lot 200 P034987	North	General Farming	Vacant Land
Lot 514 P059719	East	General Industry	Vacant Land
Lot 508 P059719	South	General Industry	Warehouse
Lot 503 P059719	West	General Industry	Transport Depot

3.0 Development Proposal

3.1 Development Overview

The application seeks approval for a battery energy storage system (BESS) as works, pursuant to the current approved use as a 'power station'. Similar to the existing diesel generation already approved, the BESS will provide peak loading capacity into the South West Interconnected System (SWIS) in a less emission intensive fashion, as required by the network. The subject site has an existing connection to the SWIS. The subject site contains an existing transformer, auxiliary transformer, operations centre (comprising a switch room and control room), acoustic walls and circulation driveways, which will continue to be utilised and are not included as part of the proposed works.

The proposed infrastructure and development characteristics for the BESS is outlined as follows:

- Battery Enclosures (x12);
- Inverter Stations (x4); and
- Main Transformer (x1).

The 12 battery enclosures, 4 inverter stations, and 2 new transformers will be placed generally in the location of the existing diesel generators, which will be removed. The battery enclosures will be arranged in a 4x3 grid with the supporting inverter stations and transformers placed between these rows (refer plans in **Appendix B**). The dimensions of each battery enclosure are proposed to be 6.06m in length, 2.44m in width and 2.99m in height. The inverter stations and new transformers are proposed to be 3m in length, 2m in width and 2.4m in height.

The proposed works coincide with the available site area located within the two existing acoustic walls and the existing circulating driveway. The battery enclosures will be smaller than the existing diesel generators within the subject site.

3.2 Site Works

Phase 1 will involve the decommissioning and removal of the existing diesel generator sets that are currently installed on-site. The generators will be removed and transported off-site to be reconfigured and built at another location outside of the Shire. This will mean that demolition of structures on-site is not required, and that removal of equipment and generator sets will not cause excessive noise, dust, vibration or any other nuisance.

Phase 2 will involve the installation of the BESS. The BESS and supporting infrastructure are modular and will be transported to site. On-site construction activities are minor and associated with minimal earthworks/trenching to facilitate underground cabling to install the BESS. The existing concrete bases currently supporting the diesel generators will be reutilised for the BESS infrastructure. There will be a small portion of the site that will be used temporarily for the storage and laydown of the construction equipment and the required materials. The delivery of materials and equipment to the subject site will be managed by the proponent and be completed with minimal impact on the local traffic network.

3.3 Traffic and Access

The existing access is provided from Hardisty Court and is proposed to be retained and used for this application. The proponent will coordinate and manage the delivery of materials and equipment to site, to minimise construction traffic where possible.

Due to the operations of the facility, traffic generation is negligible. The BESS is capable of being controlled and monitored remotely from Perth. Once the construction phase is completed, it is expected that operational staff will visit the site on an as-required basis to conduct on-site operational and maintenance tasks. On average, the site will be accessed by 3-5 light vehicles per week, in weeks where maintenance works are undertaken. These activities are envisaged to occur monthly. There is ample space on-site for parking and considering the sporadic attendance of on-site personnel, office, toilet and waste provisions are not considered necessary. The proposed traffic volumes would be well within the capacity of the existing road network.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

3.4 Services

Leveraging the use of the BESS system, and advanced monitoring systems, this site capitalises on a low maintenance operational schedule. The integration of remote operation not only underscores the site's commitment to sustainability but also sets a benchmark for the future of efficient and eco-friendly energy storage solutions.

3.5 Noise

An environmental noise assessment was prepared by Lloyd George Acoustics to assess predicted noise levels from the proposed facility including fans and transformers, against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

The Acoustic Assessment is provided in **Appendix E** and confirms that the conversion to a BESS will result in an overall reduction in terms of noise. The existing acoustic walls provide noise mitigation and act as a visual screen to the proposed works. The predicted noise levels show that the neighbouring industrial boundaries and nearby residences are compliant including with the assigned levels at worst-case operations, as described in the assessment report. The acoustic assessment notes that a 20% reduction in fan speed between 7.00am and 9.00am on a Sunday, or a delay to the start of operations until 9.00am on a Sunday, would achieve compliance at all residences during normal operations. As the facility can be controlled remotely, operational adjustments would be possible.

The acoustic assessment recommends that measurements be undertaken on the facility is operation to confirm if any further mitigation (i.e. additional noise walls) is required.

3.6 Bushfire Management

A portion of the subject site and surrounding area is identified as 'Bush Fire Prone' on the DFES *Map of Bush Fire Prone Areas*. A bushfire management plan has been prepared by Bushfire Prone Planning in support of the development application, provided in **Appendix C**. The BMP notes that the proposal is fully compliant with the acceptable solutions.

The proposal is considered to be a 'High Risk' land use with regard to the on-site storage of combustible materials and/or flammable hazardous materials, as defined by SPP3.7 and its associated *Guidelines*. For the 'high risk land use' the BMP requires a 'Bushfire Risk Assessment and Management Report' to be produced, which will be implemented prior to commencement of the use.

3.7 Operations and Management

The ongoing operation of the subject site upon completion of the proposed works will be consistent with the current operational arrangement. There will be no personnel on-site on a full-time basis with only maintenance personnel accessing the site.

4.0 Planning Framework

4.1 State Planning Framework

4.1.1 Greater Bunbury Region Scheme

The Greater Bunbury Region Scheme (GBRS) outlines the land use designation for the greater Bunbury region, including the Shire of Dardanup. The subject site is zoned 'Industrial' under the GBRS (refer **Figure 2**). The purpose of this zone is to:

"provide for manufacturing industry, the storage and distribution of goods and associated uses"

The nature of the proposal aligns with the purpose of the 'Industrial' zone in that peaking stations are critical infrastructure to provide electricity during peak load times, benefitting and supporting a range of industries. The proposed works comfortably fit within this zone.

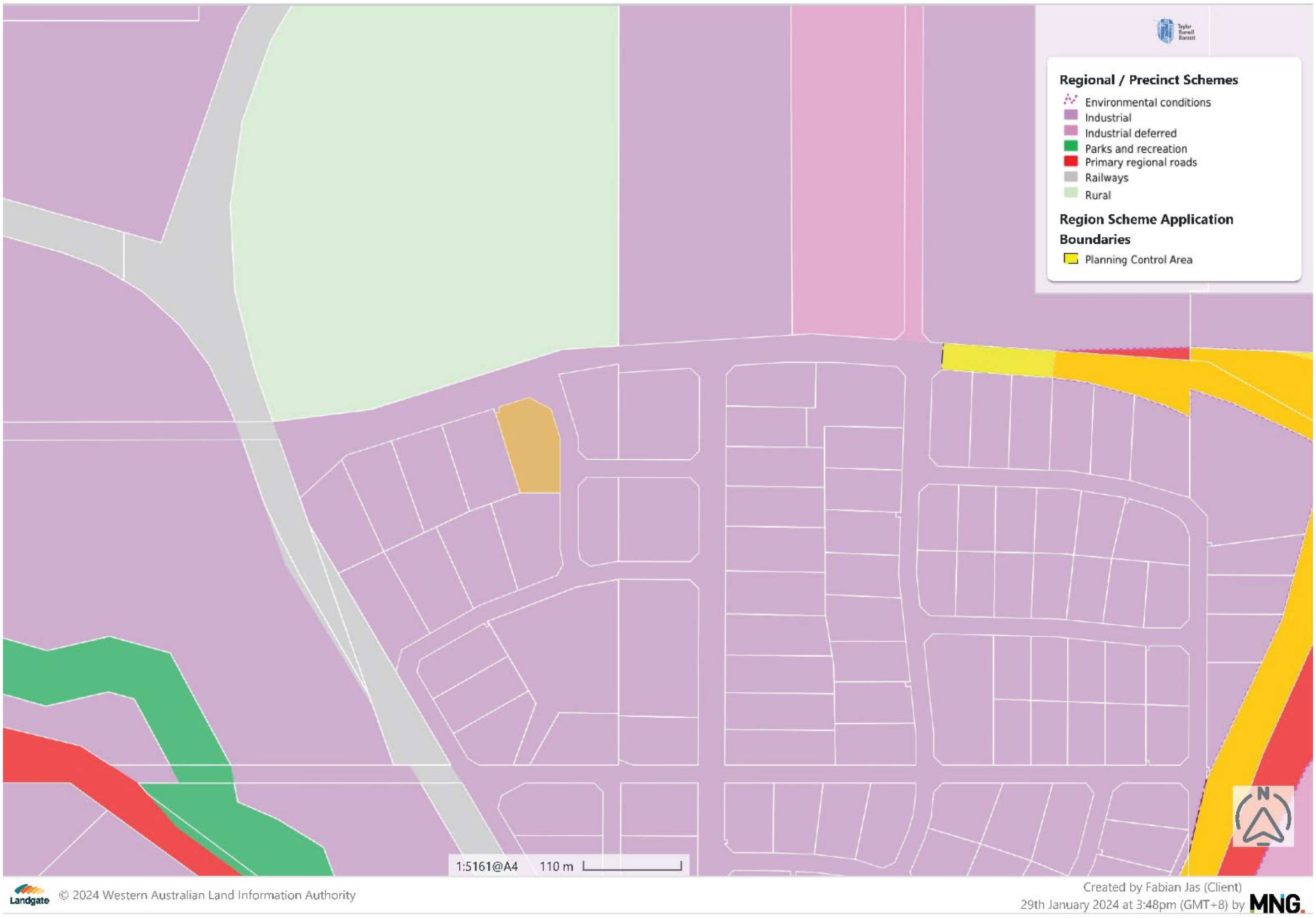


Figure 2 Greater Bunbury Region Scheme Location Map

4.1.2 State Planning Policies (SPP)

The SPPs relevant to the proposal and how the proposed development responds to the objectives and criteria for each are outlined in **Table 4**.

Table 4 State Planning Policies

State Planning Policy	Compliance
State Planning Policy 2.0 – Environment and Natural Resources Policy SPP 2.0 outlines the principles and objectives for responsible planning in the context of environmental and natural resource considerations. In relation to this proposal, SPP 2.0 refers to reducing greenhouse gas emissions by decreasing reliance on non-renewable fuels, stating that: *'planning strategies, schemes and decision making should support the use of alternative energy generation, including renewable energy, where appropriate.'*	**Consistent with the policy intent.** A Battery Energy Storage System is a superior proposal to provide a backup power source, particularly for peak loading on the SWIS. The biggest benefit is the immediate discharge of energy as required to stabilise and strengthen power supply, having regard to the requirements of the network operator. A BESS does not create emissions on-site, and contributes towards the State's net zero emission targets.
State Planning Policy 3.7 – Planning in Bushfire Prone Areas SPP 3.7 applies to all land which has been designated as bushfire prone and all development applications on those lands. Proposed developments in Bushfire Prone Areas must have a Bushfire Risk Assessment undertaken by an accredited professional which includes a Bushfire Attack Level (BAL) assessment, identification of any bushfire hazard issues, and compliance with criteria outlined in policy guidelines.	The portion of the subject site where the BESS facility will be located has been identified as a 'Bush Fire Prone Area' on the Map of Bush Fire Prone Areas (See **Figure 3**). The proposal is considered a high-risk land use and has been designated a BAL rating of BAL-12.5. A Bushfire Management Plan (BMP) is therefore required and has been prepared by Bushfire Prone Planning (refer **Appendix C**). The proposal was assessed against all requirements bushfire protection measures and is therefore compliant with SPP 3.7. The BMP evaluates the ability of the proposed development to enforce and sustain the necessary 'acceptable' solutions and any additional suggested bushfire protection measures. It also assesses its capability to meet the policy intent by reasonably applying supplementary bushfire protection measures as justifiable 'alternative' solutions. For the 'high risk land use' there is an outstanding obligation, created by Guidelines and consequently the Bushfire Management Plan, for a 'Bushfire Risk Assessment and Management Report' to be produced.
State Planning Policy 4.1 – Industrial Interface Draft SPP 4.1 is a guiding policy for planning decisions that consider the long-term future operation of industry and infrastructure facilities, with the aim of avoiding encroachment from sensitive land uses and potential land use conflicts.	The properties that abut the subject site are zoned 'General Industry'. Under the GBRS, the locality is zoned 'Industrial' and 'Industrial Deferred'. The proposed works ensure the ongoing use of the land for a peaking plant, which will be complementary to existing and future industrial uses. The works to convert the facility from diesel generators to a BESS will reduce localised emissions, provide stability to the SWIS, and be compliant with noise and bushfire requirements. Going forwards, it would be anticipated that sensitive land uses within the area will be discontinued or relocated, in accordance with the aim of avoiding encroachment from sensitive land uses into industrial areas, and potential land use conflicts.

4.1.3 Other State Strategies and Policies

In addition to the GBRS and relevant SPPs detailed above, other relevant state planning strategies and position/guidance statements that support the proposal are detailed in **Table 5** below:

Table 5 State Strategies and Position/Guidance Statements

Strategy/Policy	Compliance
State Planning Strategy 2050	The importance of providing improvements to the electric power network and supporting infrastructure to support renewable energy sources is a detailed in this strategy. The proposal aligns

Strategy/Policy	Compliance
This strategy provides a unified planning direction for the state and aims to solidify key strategic objectives by outlining capacity and capability criteria required to achieve them. In regard to environmental objectives, a key aspect is the advancement of renewable energy technology to support strategic objectives to conserve the environment and promote sustainability.	with the strategy's key strategic objectives in that it is providing upgrades to an existing peak load power station by converting non-renewable power to a renewable, BESS Battery Storage facility.
Renewable Energy Facilities Position Statement This position statement is in response to the State's Energy Transformation Strategy that was released in 2019. The objectives centre around developing planning instruments that encourage the development and advancement of renewable energy infrastructure.	The State's position statement supports the transition to renewable energy and promotes planning instruments that facilitate development for renewable energy infrastructure. The proposal aligns with the objectives of the position statement in that it is removing reliance on fuels for peaking power, and instead utilising the storage of excess power from the South West Interconnected System.
Future Battery Industry Strategy (Department of Jobs, Tourism, Science and Innovation) This strategy has been included because of its level of relevance to the proposal. The key vision is to ensure the State's position as a world-leader in sustainability with regard to the battery industry and use of batteries for the storage of power.	Since the proposal aims to further the vision of the Future Battery Industry Strategy, contributing to the roll-out of battery energy storage systems to complement and strengthen the South West Interconnected System. This is consistent with the efforts to decarbonise the electricity generation within the SWIS and further improve the resilience of the network to include additional renewable energy facilities.

4.2 Local Planning Strategy

The Shire of Dardanup's *Local Planning Strategy* (LPS) was endorsed by the Western Australian Planning Commission (WAPC) on 4 May 2015 and details the Shire's long-term vision and direction for land use development.

The proposal is considered to be within a strategically important location, given it is centrally located within an extensive area identified for industrial purposes (refer **Figure 2**). The localities of Picton East, Picton, Davenport and Paradise are contemplated in the *Local Planning Strategy* for future industrial purposes, and are zoned 'Industrial' and 'Industrial Deferred' under the GBRS.

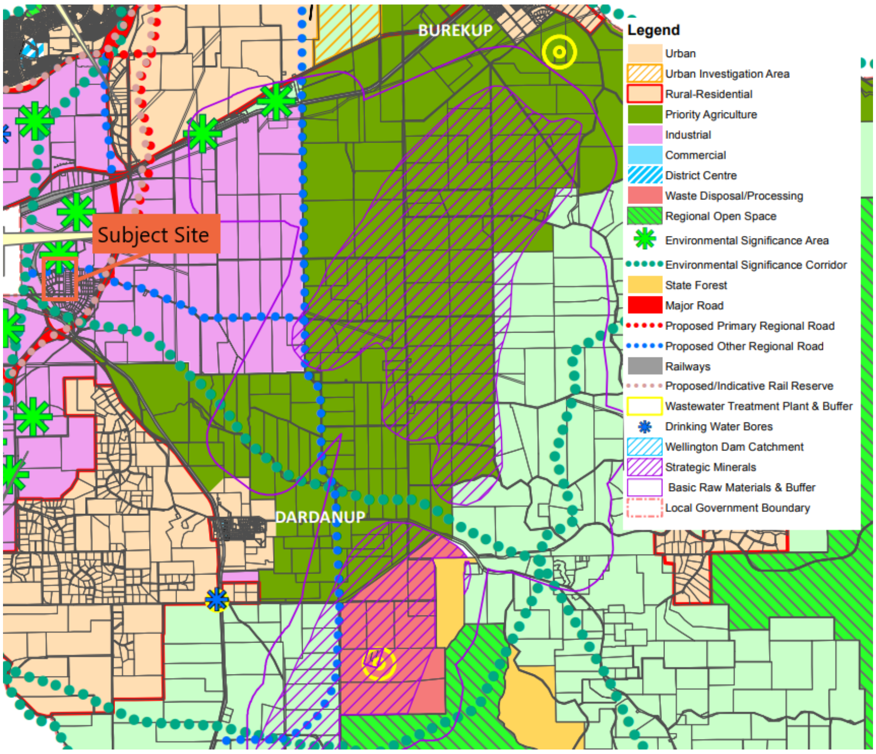


Figure 3 Excerpt from the Local Planning Strategy

With regard to the considerations for industrial development within the Shire, the LPS recognises the value of industrial zoned land and encouraging appropriate use and development. There are no specific objectives in regard to the operation and functionality for land zoned for industrial uses within the LPS. The provisions related to industrial areas are primarily focused on assessing areas currently zoned as industrial and strategic sites that may be zoned industrial in the future to support the expansion of industry in the area. As the subject site is already zoned as 'General Industry', it is considered to be consistent with the intent of the LPS.

It is noted that the *Local Planning Strategy* identifies land for industrial purposes that are also zoned in the GBRS as 'Industrial' or 'Industrial Deferred'. Over time, it is anticipated that 'Industrial Deferred' land would be rezoned under the GBRS to 'Industrial', and local scheme amendments would be undertaken to ensure consistency between the region scheme and the local planning scheme.

4.3 Local Planning Scheme

The land is subject to the provisions of the Shire of Dardanup's Town Planning Scheme No.3 (TPS3). Under the scheme, the land is zoned 'General Industry'.

Since the proposal is for an 'unlisted use', the objectives of the 'General Industry' zone need to be met. The proposal aims to utilise a more efficient and environmentally conscious means of energy storage for the purpose of supporting the electric grid during peak load times. In addition to meeting the needs of the wider community in regard to industrial facilities, the impact of the operation of the proposal on the surrounding properties and greater area will be minimal and still adhere to the objective of the 'General Industry' zone. It is anticipated that the upgrades to a BESS facility will reduce the potential impacts on surrounding properties and any environmentally sensitive characteristics of the site.

Figure 4 Extract of Local Planning Scheme

4.3.1 Zone / Reserve Objectives

The objective of the 'General Industry' zone is to "*provide for a wide range of industrial and associated activities, which can be undertaken without undue constraints on operational performance, so as to meet the needs of the wider community for industrial services and facilities.*" The proposal will continue to provide a critical service for the industrial area and the South

West Interconnected System more generally. Due to the power requirements of industries, this proposal is considered to be essential to the operational ability of the locality and comfortably addresses the zone objective.

4.3.2 Land Use Definition

The Shire has previously granted development approval for a 'Use not listed Power Station' in 2010. The proposed works are considered to be consistent with the approved land use.

4.3.3 Development Requirements

Table 6 outlines the relevant development control provisions detailed in Appendices 2 and 2A of the TPS3, and justification is provided detailing how compliance with each requirement is achieved.

Table 6 Development Table Part B – Non Residential Land Uses

Development Control	Compliance
<u>**Street and Lot Boundary Setbacks**</u> **Front Setback – 10m** **Rear Setback – 10m** **Side Setback – 5m**	**Compliant.** The scope of the proposed development will not change the footprint of the current operation and will continue to comply with the street and lot boundary setback requirements.
<u>**Landscaping**</u> **1. 3m wide abutting all streets, except for approved crossovers.** **2. Council approved canopy shade trees at the rate of 1 tree for every 4 open air parking bays.**	**Noted.** There is an existing 3.5m landscaped verge strip along the frontage abutting Hardisty Court and a 5m landscaped verge strip along the eastern lot boundary abutting Hardisty Court. There are three existing trees on-site. The proposal will not alter the use or scope of the existing power station. Since the existing facility has no allocated open air parking bays, there is no requirement for canopy shade trees to be provided. As part of pre-lodgement consultation with the local government, additional landscaping was not confirmed as an additional requirement. There is opportunity to review the low-threat vegetation and landscaping along the eastern lot boundary, if required, and subject to the ongoing requirements of the Bushfire Management Plan.
<u>**Carparking**</u> **1 space for every 100m² open space used for such purposes, plus** **1 space for every 100m² gross floor area** **Minimum 4 spaces per tenancy or unit**	**Noted.** The existing power station does not have any allocated parking bays on site. The existing operation does not require any full-time employees on-site and the subject site is not open to visitors. There will be maintenance personnel on-site at a rate of approximately 3-5 light vehicles per week in weeks where maintenance works are undertaken. These activities are envisaged to occur monthly. The proposal will not alter the current schedule of personnel on site. There is available land within the subject site for the parking of maintenance vehicles.

4.3.4 Local Planning Policies (LPP)

Table 7 outlines the relevant LPPs that apply to the development proposal. Justification is also provided in **Table 7** to detail how compliance with each LPP is achieved.

Table 7 Local Planning Policies

Local Planning Policy	Requirement	Compliance
CP093 - Sustainability	The objective of this local planning policy is to clarify the Environmental, Social and Economic objectives at all levels of development and identify measures for	The development proposal seeks to convert a diesel generated power station to a BESS powered facility. This upgrade will reduce the usage of non-renewable energy.

	how they can be implemented. Section 3.1.3 details considerations in regards to Energy. These objectives aim to reduce the usage of energy, particularly from fossil carbon sources.	The provisions of this LPP have been successfully met.

5.0 Assessment of Potential Impacts

5.1 Summary Table

Table 8 provides a summary of the potential impacts of the proposed development and the mitigation incorporated to ensure compliance against the relevant policies and regulations is maintained.

Table 8 Assessment of Potential Impacts

Other Considerations / Matters	Potential Impact	Proposed Response/Management
Environmental Management	The nature of the use and proposed upgrades to a BESS facility will result in an improvement in the overall impact of the development on the environment.	N/A
Bushfire	The portion of the subject site where the BESS facility will be located has been identified as a 'Bush Fire Prone Area' on the Map of Bush Fire Prone Areas.	The proposal is considered a high-risk land use and has been designated a BAL rating of BAL-12.5. A BMP is therefore required and has been prepared by Bushfire Prone Planning (refer **Appendix C**). The bushfire assessment also required the inclusion of a Bushfire Risk Assessment and Management Report, which has been prepared by Bushfire Prone Planning and included in **Appendix D**. The proposal was assessed against all requirements bushfire protection measures and is compliant.
Noise	The potential noise impact of the proposed development on the surrounding area required further assessment.	An assessment of the potential noise impacts was undertaken for two scenarios; normal operations and worst-case operations. An Acoustic Assessment was prepared by Lloyd George Acoustics Pty Ltd in response (refer **Appendix E**)..
Emissions	N/A	The conversion from diesel to a BESS facility will result in no emissions and so no further management is required.
Waste Management	N/A	There is no anticipated waste as a result of the conversion from diesel to a BESS facility for power generation. Construction waste, if any, will be removed from the site.
Aboriginal Cultural Heritage	There was no significance found with regard to Aboriginal Cultural Heritage, per the Aboriginal Cultural Heritage Inquiry System	N/A

6.0 Conclusion

The proposed Battery Energy Storage System is intended to provide a superior peaking power solution. The development will provide opportunities for improved stability in relation to energy storage and discharge at peak times.

This application seeks approval to develop the BESS as works that would comfortably fit within the approved unlisted use for a ‘power station’. The development will facilitate future growth of industry and represents additional investment in electrical infrastructure. The development will not be visually intrusive, noting the battery enclosures are smaller than the existing diesel generators.

The development application is considered to be consistent with the zoning and overarching local planning strategy, and does not have an impact on any environmental matters. As outlined in this report, the proposal is consistent with the relevant planning framework.

Approval and implementation of the proposal will be a positive contribution and will assist the State in meeting growing energy demand.

We look forward to working with the Regional Development Assessment Panel to facilitate approval for the proposed development.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Appendix A

DA Forms, Checklists, Certificate of Title

Government of Western Australia
Development Assessment Panels

DAP FORM 1

Notice of Development Application to be Determined by a Development Assessment Panel

Planning and Development Act 2005
Planning and Development (Development Assessment Panel) Regulations 2011 – regulations 7, 10 and 21

Application Details

To	*Name of local government and/or Western Australian Planning Commission* Shire of Dardanup	
Planning Scheme(s)	*Name of planning scheme(s) that applies to the prescribed land* Greater Bunbury Region Scheme; Shire of Dardanup Town Planning Scheme No. 3	
Land	*Lot number, street name, town/suburb* Lot 504 (5) Hardisty Court, Picton East	
Certificate of Title (provide copy)	*Volume Number* 2731	*Folio* 685
	Location Number	*Plan / Diagram Number* 59719
Details of development application made to responsible authority	*Summary of Proposal* Conversion of diesel generation power station to a Battery Energy Storage System (BESS).	
Development Use	*Residential / Commercial / Industrial / Rural / Mixed Use / Other* Industrial	
Estimated cost of development (GST Exc)	$ 9.9m	

Part A – Acknowledgement by Applicant and Landowner

Mandatory Application	☐ I give notice that I understand that this is a mandatory Development Assessment Panel application *(regulation 5)*
Optional Application	☒ I give notice that I have elected to have the development application that accompanies this form determined by a Development Assessment Panel *(regulation 6)*
Delegated Application	☐ I give notice that I understand that this is an application of a class delegated to a Development Assessment Panel for determination *(regulation 9)*

Applicant Details (to be completed and signed by applicant)

- By completing this notice, I declare that all the information provided in this application is true and correct.
- I understand that the information provided in this notice, and attached forming part of the development application will be made available to the public on the Development Assessment Panel and local government websites.

Name	Fabian Jas	
Company	Taylor Burrell Barnett	
Address	*Street Number/PO Box number, street name, suburb, state, postcode* PO Box 7130 Cloisters Square Perth WA 6850	
Contact Details	*Email* fabian@tbbplanning.com.au	*Phone* 0429 700 081
Signature		*Date* 15/02/2024

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Landowner Details (to be completed and signed if landowner is different from applicant)

- By completing this notice, consent is provided to submitting this application.
- If there are more than two landowners, please provide all relevant information on a separate page.
- Signatures must be provided by all registered proprietors or by an authorised agent as shown on the Certificate of Title.
- Alternatively, a letter of consent, which is signed by all registered proprietors or by the authorised agent, can be provided.
- Companies, apart from sole directors, are required to provide signatories for two directors, a director and the company seal or a director and a company secretary.

Company (if applicable)	Tesla Corporation Management Pty Ltd	
Contact Details	*Email* ben.tan@teslacorp.com.au	*Phone* 0432 647 485
Address	*Street Number/PO Box number, street name, suburb, state, postcode* PO Box 2082 Yokine WA 6060	
Name/s	Ben Tan	
Title/s	*Landowner/Sole Director/Director* *(2 signatures required)*	*Additional Landowner/ Director/Secretary* *(if applicable)*
Signature/s		
Date	15 February 2024	

Part B – Acknowledgement by Local Government

Responsible Authority	☐ Local Government (LG) ☐ * Western Australian Planning Commission (WAPC) ☐ * Dual – Local Government and Western Australian Planning Commission ☐ Department of Finance – *Public Primary School Applications*	
* WAPC/DUAL reporting details	*If WAPC or DUAL is selected, please provide details of relevant provision (or within covering letter)*	
Fees for applications *(DAP Regulations - Schedule 1)*	$ Amount that has been paid by the applicant $ Amount to be paid by local government *(delegated applications only - regulation 22)*	
Statutory Timeframe *(regulation 12)*	☐ 60 days (advertising not required) ☐ 90 days (advertising required or other scheme provision)	
LG Reference Number		
Name of planning officer *(Report Writer)*		
Position/Title		
Contact Details	*Email*	*Phone*
Planning Officer's Signature		*Date*

Please refer to the [Guidance Note: Lodging a DAP Application](#) for further information.

GOVERNMENT OF WESTERN AUSTRALIA

Greater Bunbury Region Scheme
Form 1
Application for Planning Approval

Western Australian Planning Commission

Owner/s details

Registered proprietor/s (landowner/s) or the authorised agent's details **must** be provided in this section. If there are more than two landowners please provide all relevant information on a separate page. Signature/s must be provided by all registered proprietors or by an authorised agent. **Alternatively**, a letter of consent, which is signed by all registered proprietors or by the authorised agent, can be provided.

Full name	Tesla Corporation Management Pty Ltd
Company/agency (if applicable)	Tesla Corporation Management Pty Ltd
ACN/ABN (if applicable)	
Postal address	PO Box 2082
Town/suburb	Yokine
Postcode	6060
Signature	The ~~landowner/s or~~ authorised agent consets to the applicant submitting this application
Date	10/01/2024
Print name and position	Ben Tan

(if signing on behalf of a company or agency)

Applicant details

Name/company	Taylor Burrell Barnett
Contact person	Fabian Jas
Postal address	PO Box 7130 Cloisters Square
Town/suburb	Perth
Postcode	6850
Fax	
Email	fabian@tbbplanning.com.au
Applicant signature	
Date	08/01/2024
Print name and position	Fabian Jas - Senior Consultant

(if signing on behalf of a company or agency)

Property details

Certificate of title description of land:		Lot No	504	Location No	-
Plan or Diagram	DP 59719	Vol	2731	Folio	685
Certificate of title description of land:		Lot No		Location No	
Plan or Diagram		Vol		Folio	

Title encumbrances (e.g. easements, restrictive covenants)	
Locality of development (house no., street name, suburb, etc)	5 Hardisty Court, Picton East 6229
Nearest street intersection	Hardisty Court and Delmarco Drive
Existing building/land use	Diesel generation power station
Description of proposed development and/or use	Conversion of diesel generation power station to a Battery Energy Storage System (BESS).
Nature of any existing buildings and/or use	Diesel generation power station
Approximate cost of proposed development (excl. gst) $	$9.9 million
Estimated time of completion	Up to 12 months from date of approval

Is the development within a designated bushfire prone area? **Y/N**

If yes, please identify and address the bushfire risk (e.g. by including a BAL assessment(s) or BAL Contour Map and a Bushfire Management Plan with the application). Alternatively a short statement justifying why SPP 3.7 does not apply should be included with the application.

Office use only

Acceptance Officer's Initials		Date Received	
Local government reference No.		Commission reference No.	

Version: 8.9 (April 2016)

The information and plans provided with this application may be made available by the WAPC for public viewing in connection with the application.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Shire of Dardanup

APPLICATION FOR DEVELOPMENT APPROVAL

Town Planning Scheme No. 3

FORM 110

Date stamp

Part 1 Owner Details

Full Name
Tesla Corporation Management Pty Ltd

ABN (if applicable)

Postal Address
PO Box 2082
Yokine WA 6060

Phone
0432 647 485

Mobile
0432 647 485

Phone A/H

Fax

Email
ben.tan@teslacorp.com.au

Contact person for correspondence
Ben Tan

Signature

Date
10/01/2024

Signature

Date

The signature of the owner(s) is required on all applications. This application will not proceed without that signature. For the purposes of signing this application an owner includes the persons referred to in the Planning and Development (Local Planning Schemes) Regulations 2015 Schedule 2 clause 62(2).

Part 2 Applicant Details (if different from owner)

Full Name
Taylor Burrell Barnett

Postal Address
PO Box 7130 Cloisters Square
Perth WA 6850

Phone
9226 4276

Mobile

Phone A/H

Fax

Email
fabian@tbbplanning.com.au

Contact person for correspondence
Fabian Jas

Signature

Date
08/01/2024

Part 3 Property Details

Lot No	Street No	Street Name
504	5	Hardisty Court

Suburb	Post Code
Picton East	6229

Nearest street intersection

Hardisty Court and Delmarco Drive

Plan or Diagram Number	Certificate of Title – Vol/Fol
DP 59719	2731/685

Title encumbrances (e.g. easements, restrictive covenants)

N/A

Part 4 Proposed Development

Nature of development	X	Works		Use		Works and Use
Is an exemption from approval claimed for part of the development?		Yes	X	No		
If yes, is the exemption for:		Works		Use		

Description of proposed works and/or land use

Works - conversion of diesel generation power station to a Battery Energy Storage System (BESS).

Description of exemption claimed (if relevant)

Nature of existing buildings and/or land use

Diesel generation power station

Approximate cost of proposed development	Estimated time of completion
$9.9 million	Up to 12 months from date of approval

Is the development within a designated bushfire prone area?	X	Yes		No

If yes, please identify and address the bushfire risk (eg by including a BAL assessment(s) or BAL Contour Map and a Bushfire Management Plan with the application). Alternatively, a short statement justifying why SPP 3.7 does not apply should be included with the application.

Part 5 OFFICE USE ONLY

Acceptance Officer's initials	Date received

Local Government Reference No

Part 6 Return form to

Shire of Dardanup
Planning Department
1 Council Drive/PO Box 7016
EATON WA 6232

Phone: (08) 9724 0300 Fax: (08) 9724 0091
Email: records@dardanup.wa.gov.au

Shire of Dardanup

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Shire of Dardanup

APPLICATION CHECKLIST

APPLICATION CHECKS	CHECK	OFFICE USE ONLY	OFFICER COMMENTS
Plans submitted must contain the following:			
Application signed by landowner and applicant	☑	☐	
Site plan containing:			
• Existing and proposed buildings	☑	☐	
• Setbacks of all buildings from boundaries	☑	☐	
• Driveways and crossovers	☑	☐	
• Car parking bay location and dimensions	☑	☐	
• Contours or spot levels	☐	☐	
• Retaining walls – bottom and top of wall heights	☐	☐	
• Existing and proposed fencing	☑	☐	
• Existing vegetation to be retained and removed	☐	☐	
• Bin storage and collection	☐	☐	
• Screened clothes drying areas	☐	☐	
Floor plan(s) or proposed buildings(s)	☑	☐	
Elevation plans containing:			
• Materials, colours and finishes	☐	☐	
• A plan for each building elevation	☑	☐	
Drainage plan containing:			
• Method of stormwater disposal	☐	☐	
• Stormwater calculations	☐	☐	
Location and level of soakwells			
• Pipe sizes	☐	☐	
• Location and size of swale/basin	☐	☐	
• Cross section of swale/basin	☐	☐	
Landscaping Plan			
• Landscaping Plan for landscaping on the Lot, with a list of plant species, size and location of plants	☐	☐	
• Verge Landscaping Plan	☐	☐	
Other:			
• Waste management	☑	☐	
• Staffing levels	☑	☐	
• Hours/days of operation	☑	☐	
• Justification for setback reduction	☐	☐	
• Justification for oversized building	☐	☐	
• Certificate of title for the Lot under application, and information regarding easements	☑	☐	

• BAL assessment, if the Lot is in a Bushfire Prone Area	☑	☐	
• If Form 87 (neighbours consent) is submitted with the proposal, it needs to be signed by all relevant landowners; and the proposal and all plans are also to be signed by neighbours	☐	☐	

Site Plan = a legible, neatly drawn and scaled plan no bigger than A3 size (Plans larger than A3 size are requested to be provided in electronic .PDF format).

Development Plans = professionally drawn plans and elevations of buildings no bigger than A3 printed size (Plans larger than A3 size are requested to be provided in electronic .PDF format).

Text = a comprehensive written submission which address issues relevant to the proposal that cannot be described on the plan.

TITLE NUMBER	
Volume	Folio
2731	**685**

WESTERN AUSTRALIA

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts
REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 504 ON DEPOSITED PLAN 59719

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

TESLA CORPORATION MANAGEMENT PTY LTD OF LEVEL 34, 2 THE ESPLANADE, PERTH
(T L772119) REGISTERED 1/11/2011

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. L139033 NOTIFICATION CONTAINS FACTORS AFFECTING THE WITHIN LAND. LODGED 13/11/2009.
2. O787898 MORTGAGE TO NATIONAL AUSTRALIA BANK LTD REGISTERED 30/6/2021.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

--END OF CERTIFICATE OF TITLE--

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

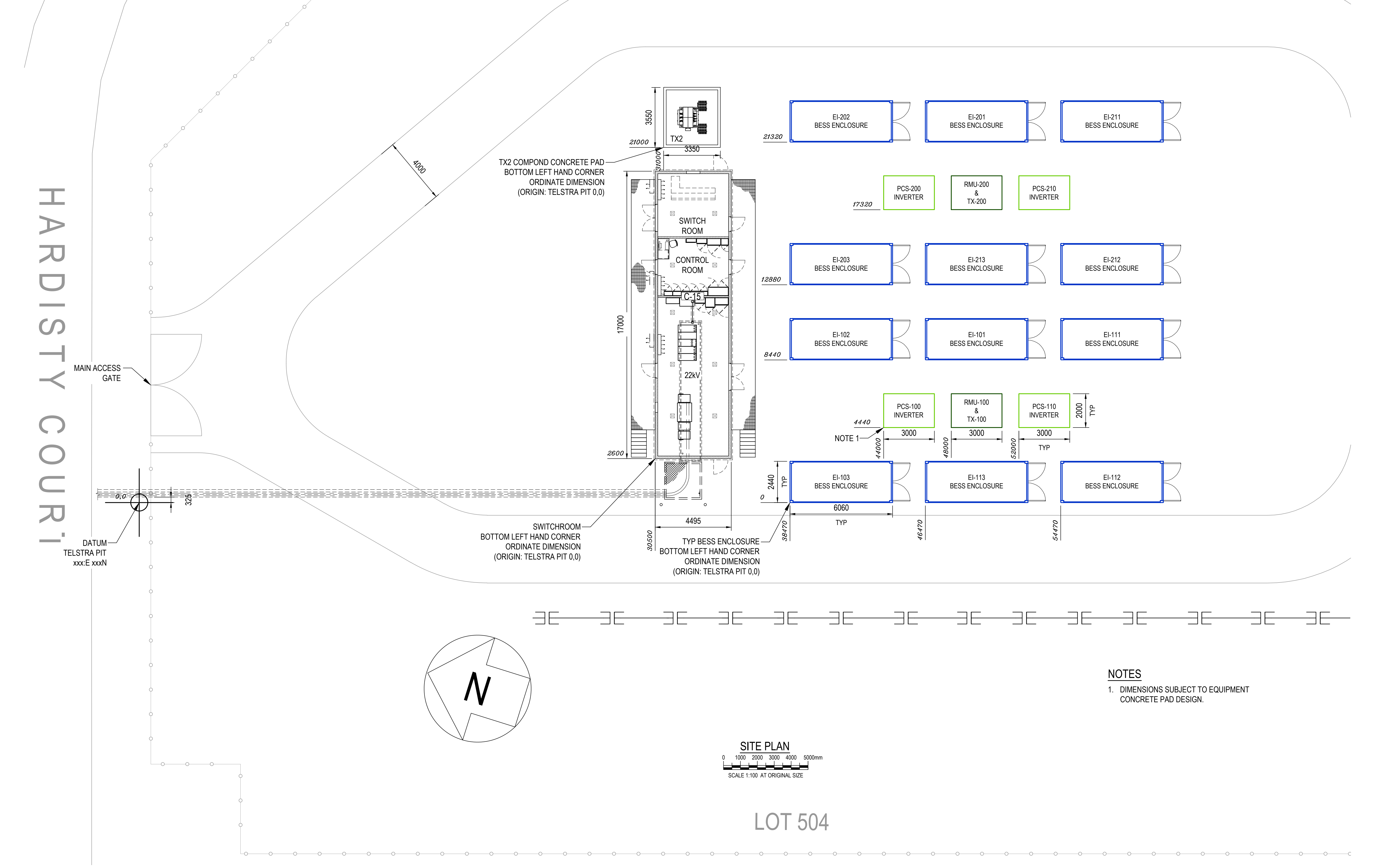
SKETCH OF LAND:	DP59719
PREVIOUS TITLE:	1454-799
PROPERTY STREET ADDRESS:	5 HARDISTY CT, PICTON EAST.
LOCAL GOVERNMENT AUTHORITY:	SHIRE OF DARDANUP

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Appendix B

Development Plans and Elevations

(Appendix ORD: 12.2.2B - Under Separate E-Cover)



DRAWING No.	REFERENCE DRAWING	No.	DATE	REVISION	DRN	CHK	APP	No.	DATE	REVISION	DRN	CHK	APP
x								A	23.08.23	ISSUED FOR REVIEW	JFC	DG	GM

TESLA Corporation

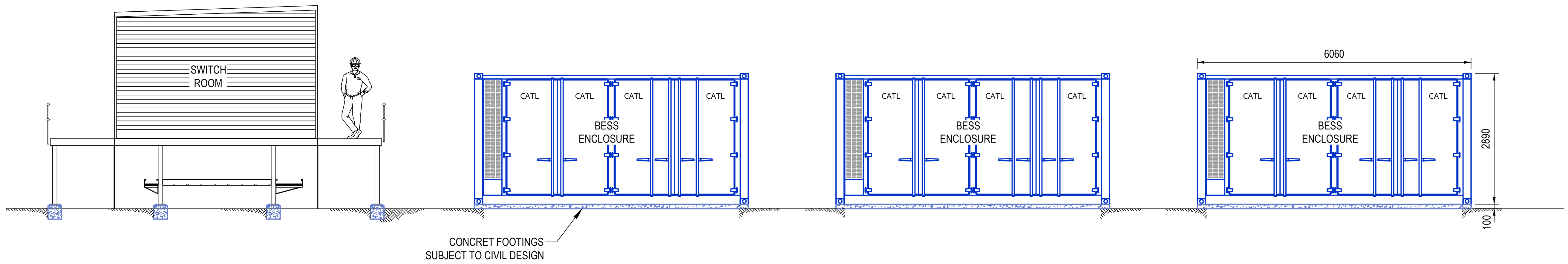
Petro Min Engineers
Consulting Electrical Engineers
Mining & Oil and Gas
Suite 2.4, Level 2 9 Bowman Street
South Perth
Western Australia 6151
Phone: +61 08 9367 5244
ABN: 43 579 882 598
Email: admin@petromineng.com.au

DRAWN	JFC	DATE	AUG 2023
CHECKED	DG	DATE	AUG 2023
DESIGNED	PME	DATE	AUG 2023
JOB	8582		
CAD FILE:	8582-E-800_A.DWG		

CLIENT: TESLA CORPORATION Pty Ltd
PROJECT: PICTON - HARRIS ROAD, DARDANUP
TITLE: BESS UPGRADE
SITE GENERAL ARRANGEMENT
SHEET: A1 | SCALE: N/A | REV: A
DRG No.: 8582-E-800

FILE NAME: 8582-E-800_A.dwg PLOT DATE: 23/08/2023 4:07:46 PM BY: John Clare

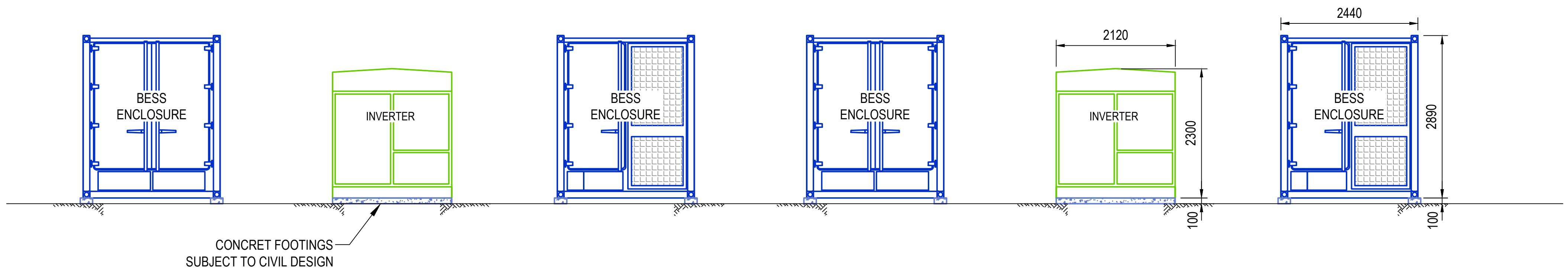
(Appendix ORD: 12.2.2B - Under Separate E-Cover)



SIDE ELEVATION - A

0 500 1000 1500 2000 2500mm

SCALE 1:50 AT ORIGINAL SIZE



END ELEVATION - B

0 500 1000 1500 2000 2500mm

SCALE 1:50 AT ORIGINAL SIZE

NOTES

1. DIMENSIONS SUBJECT TO FINAL DESIGN.

DRAWING No.	REFERENCE DRAWING	No.	DATE	REVISION	DRN	CHK	APP	No.	DATE	REVISION	DRN	CHK	APP
8582-E-800	SITE GENERAL ARRANGEMENT							A	23.08.23	ISSUED FOR REVIEW	JFC	DG	GM

TESLA Corporation

Petro Min Engineers
Consulting Electrical Engineers
Mining & Oil and Gas
Suite 2.4, Level 2 9 Bowman Street
South Perth
Western Australia 6151
Phone: +61 08 9367 5244
ABN: 43 579 882 598
Email: admin@petromineng.com.au

DRAWN	JFC	DATE	AUG 2023
CHECKED	DG	DATE	AUG 2023
DESIGNED	PME	DATE	AUG 2023
JOB	8582		
CAD FILE:	8582-E-800,801 BESS VERSION 1.DWG		

CLIENT TESLA CORPORATION Pty Ltd

PROJECT PICTON - HARRIS ROAD, DARDANUP

TITLE BESS UPGRADE
ELEVATION VIEWS

SHEET A1 | SCALE N/A | REV A

DRG No. 8582-E-801

FILE NAME: 8582-E-800,801 Bess Version 1.dwg PLOT DATE: 13/02/2024 4:02:20 PM BY: John Clare

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Appendix C

Bushfire Management Plan

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: 5 Hardisty Court, Picton East

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 22 Month November Year 2023

Report author or reviewer: Kathy Nastov

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☐ Level 3 practitioner ☑

If accredited please provide the following.

BPAD accreditation number: 27794 Accreditation expiry: Month August Year 2024

Bushfire management plan version number: 1.0

Bushfire management plan date: Day 24 Month January Year 2024

Client/business name: Ben Tan/Tesla Corporation Management Pty Ltd

	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	✔	
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the bushfire protection criteria elements)?		✔

Is the proposal any of the following (see SPP 3.7 for definitions)?	Yes	No
Unavoidable development (in BAL-40 or BAL-FZ)		✔
Strategic planning proposal (including rezoning applications)		✔
High risk land-use	✔	
Vulnerable land-use		✔

None of the above ☑

Note: Only if one (or more) of the above answers in the tables is yes should the decision maker (e.g. local government or the WAPC) refer the proposal to DFES for comment.

Why has it been given one of the above listed classifications (E.g. Considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

The proposed development is considered a 'high-risk' land use as defined by SPP 3.7 and its associated Guidelines.
Method 2 has been applied to determine the separation distance for the applied <10kW/m2 heat flux APZ.

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

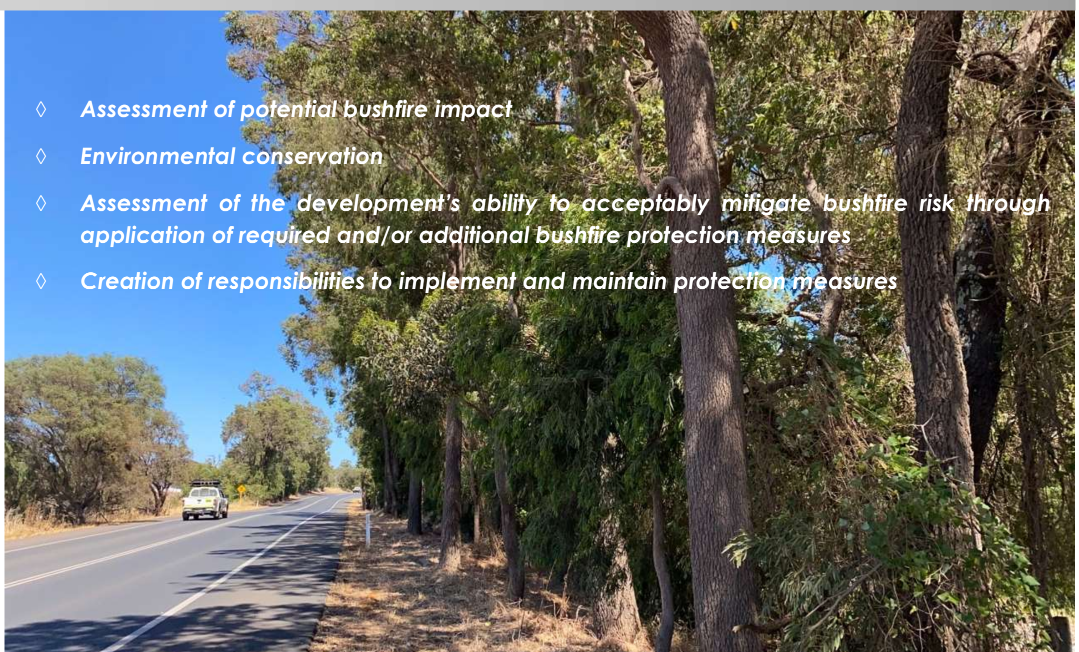
Signature of report author or reviewer: K. Nastov

Date: 24/01/2024

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Tesla Corporation Management Pty Ltd

Bushfire Management Plan (BMP)



- *Assessment of potential bushfire impact*
- *Environmental conservation*
- *Assessment of the development's ability to acceptably mitigate bushfire risk through application of required and/or additional bushfire protection measures*
- *Creation of responsibilities to implement and maintain protection measures*

Produced to meet the relevant requirements of STATE PLANNING POLICY 3.7 Planning in Bushfire Prone Areas & Guidelines

5 Hardisty Court, Picton East

Shire of Dardanup

Development Application - High Risk Land Use

24 January 2024

Job Reference No: 230997

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

BPP GROUP PTY LTD T/A BUSHFIRE PRONE PLANNING

ACN: 39 166 551 784 | ABN: 39 166 551 784

LEVEL 1, 159-161 JAMES STREET
GUILDFORD WA 6055

PO BOX 388
GUILDFORD WA 6935

08 6477 1144 | admin@bushfireprone.com.au

BUSHFIRE PRONE PLANNING

DOCUMENT CONTROL

PREPARATION		
Author:	Joy Graeber	
Reviewed:	Kathy Nastov (BPAD Level 3 No. 27794)	

VERSION HISTORY		
Version	Status/Details	Date
1.0	Original	24 January 2024
-	-	

BMP (Master) Template v9.17

DISTRIBUTION					
Destination		Version	No. Copies	Hard Copy	Electronic Copy
Person	Email				
Ben Tan	Ben.tan@teslacorp.com.au	1.0	1	☐	☒
		-		☐	☐

Limitations: *The protection measures that will be implemented based on information presented in this Bushfire Management Plan are minimum requirements and they do not guarantee that buildings or infrastructure will not be damaged in a bushfire, persons injured, or fatalities occur either on the subject site or off the site while evacuating.*

This is substantially due to the unpredictable nature and behaviour of fire and fire weather conditions. Additionally, the correct implementation of the required protection measures (including bushfire resistant construction) and any other required or recommended measures, will depend upon, among other things, the ongoing actions of the landowners and/or operators over which Bushfire Prone Planning has no control.

All surveys, forecasts, projections and recommendations made in this report associated with the proposed development are made in good faith based on information available to Bushfire Prone Planning at the time. All maps included herein are indicative in nature and are not to be used for accurate calculations.

Notwithstanding anything contained therein, Bushfire Prone Planning will not, except as the law may require, be liable for any loss or other consequences whether or not due to the negligence of their consultants, their servants or agents, arising out of the services provided by their consultants.

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SUMMARY STATEMENTS

THIS DOCUMENT – STATEMENT OF PURPOSE

The Bushfire Management Plan (BMP)

The BMP sets out the required package of bushfire protection measures to lessen the risks associated with a bushfire event. It establishes the responsibilities to implement and maintain these measures.

The BMP also identifies the potential for any negative impact on any environmental, biodiversity and conservation values that may result from the application of bushfire protection measures or that may limit their implementation.

Risks Associated with Bushfire Events

The relevant risks are the potential for loss of life, injury, or destroyed or damaged assets which results in personal loss and economic loss. For a given site, the level of that risk to persons and assets (the exposed elements) is a function of the potential threat levels generated by the bushfire hazard, and the level of exposure and vulnerability of the at risk elements to the threats.

Bushfire Protection Measures

The required package of protection measures is established by *State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7)*, its associated *Guidelines* and any other relevant guidelines or position statements published by the Department of Planning, Lands and Heritage. These measures are limited to those considered by the WA planning authorities as necessary to be addressed for the purpose of land use planning. They do not encompass all available bushfire protection measures as many are not directly relevant to the planning approval stage. For example:

- Protection measures to reduce the vulnerability of buildings to bushfire threats is primarily dealt with at the building application stage. They are implemented through the process of applying the Building Code of Australia (Volumes 1 and 2 of the national Construction Code) in accordance with WA building legislation and the application of construction requirements based on a building's level of exposure - determined as a Bushfire Attack Level (BAL) rating); or
- Protection measures to reduce the threat levels of consequential fire (ignited by bushfire and involving combustible materials surrounding and within buildings) and measures to reduce the exposure and vulnerability of elements at risk exposed to consequential fire, are not specifically considered.

The package of required bushfire protection measures established by the Guidelines includes:

- The requirements of the bushfire protection criteria which consist of:
    - Element 1: Location (addresses threat levels).
    - Element 2: Siting and Design of Development (addresses exposure levels of buildings).
    - Element 3: Vehicular Access (addresses exposure and vulnerability levels of persons).
    - Element 4: Water (addresses vulnerability levels of buildings).
    - Element 5: Vulnerable Tourism Land Uses (addresses exposure and vulnerability as per Elements 1-4 but in use specific ways and with additional considerations of persons exposure and vulnerability).
- The requirement to develop Bushfire Emergency Plans / Information for 'vulnerable' land uses for persons to prepare, respond and recover from a bushfire event (this addresses vulnerability levels).
- The requirement to assess bushfire risk and incorporate relevant protection measures into the site emergency plans for 'high risk' land uses (this addresses threat, exposure and vulnerability levels).

Compliance of the Proposed Development or Use with SPP 3.7 Requirements

The BMP assesses the capacity of the proposed development or use to implement and maintain the required 'acceptable' solutions and any additionally recommended bushfire protection measures - or its capacity to satisfy the policy intent through the justified application of additional bushfire protection measures as supportable 'alternative' solutions.

THE PROPOSED DEVELOPMENT/USE – BUSHFIRE PLANNING COMPLIANCE SUMMARY		
Environmental Considerations		**Assessment Outcome**
Will land with identified environmental, biodiversity and conservation values limit the full application of the required bushfire protection measures?		No
Will land with identified environmental, biodiversity and conservation values need to be managed in the implementation and maintenance of the bushfire protection measures - but not limit their application?		No
Required Bushfire Protection Measures The Acceptable Solutions of the Bushfire Protection Criteria (Guidelines)		**Assessment Outcome**
Element	The Acceptable Solutions	
1: Location	A1 Location	Fully Compliant
	A1.1 Development location	Fully Compliant
2: Siting and Design of Development	A2 Siting and Design of Development	Fully Compliant
	A2.1 Asset Protection Zone (APZ)	Fully Compliant
3: Vehicular Access	A3 Vehicular Access	Fully Compliant
	A3.1 Public roads	Fully Compliant
	A3.2a Multiple access routes	Fully Compliant
	A3.2b Emergency access way	N/A
	A3.3 Through-roads	N/A
	A3.4a Perimeter roads	N/A
	A3.4b Fire service access route	N/A
	A3.5 Battle-axe legs	N/A
	A3.6 Private driveways	Fully Compliant
4: Water	A4 Water	Fully Compliant
	A4.1 Identification of future water supply	N/A
	A4.2 Provision of water for firefighting purposes	Fully Compliant
Other Documents Establishing Bushfire Protection Measure Variations or Additions		**Assessment Outcome**

A 'Planning Approval' or a 'Notice of Determination' which contains 'Conditions' to be met.	N/A
A DPLH/WAPC 'Position Statement'	N/A
Bushfire Management Plan Guidance for the Dampier Peninsula (DPLH 2021 Rev B)	N/A
Other 'Bushfire Planning' Documents to Be Produced This necessity for additional documents is determined by the proposed development/use type and the requirements established by SPP 3.7 and the associated Guidelines (as amended). They may be produced concurrently or subsequent to the BMP. Relevant actions will be identified within Section 6 'Responsibilities for Implementation of Bushfire Protection Measures.	**Required**
Bushfire Emergency Plan: An operational document presenting prevent, prepare, respond and recover procedures and associated actions. As necessary, supporting information to justify determinations is included.	No
Bushfire Emergency Information (Poster): As a concise response information poster for certain vulnerable land uses.	No
Bushfire Emergency Information (Content): As content for inclusion into the Site's Emergency Plan for certain high risk land uses:	No
Bushfire Risk Assessment and Management Report:	Yes

The proposed development is considered a 'high-risk' land use as defined by SPP 3.7 and its associated Guidelines.

This triggers the requirement, through the development of a Risk Assessment and Management Report to:

- Identify the level of exposure and vulnerability of any onsite stored materials and liquids to bushfire attack mechanisms (threats);
- Identify any potential source of ignition threat the use may present to adjoining and/or adjacent bushfire prone vegetation; and
- Recommend protection measures that can be incorporated into the site operations emergency plan as necessary.

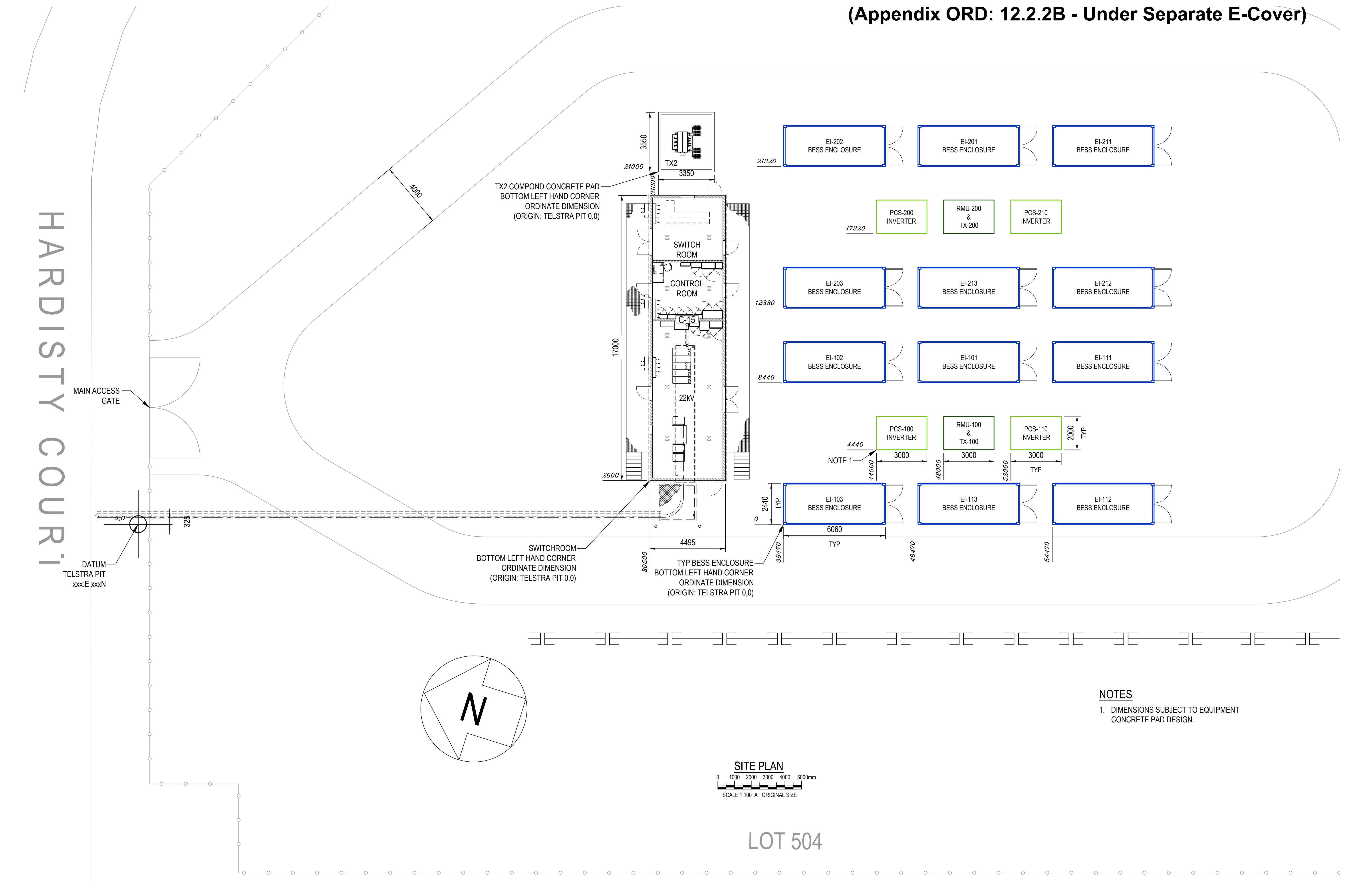
A Bushfire Risk Management Report has been prepared by Bushfire Prone Planning along with this BMP.

1 PROPOSAL DETAILS AND THE BUSHFIRE MANAGEMENT PLAN

1.1 The Proposed Development/Use Details, Plans and Maps

<table>
<tr><td colspan="2">The Proposal's Planning Stage
For which certain bushfire planning documents are required to accompany the planning application.</td><td>Development Application</td></tr>
<tr><td colspan="2">The Subject Land/Site</td><td>Lot 504 (5) Hardisty Court, Picton East. Shire of Dardanup</td></tr>
<tr><td colspan="2">Total Area of Subject Lot/Site</td><td>5740 m²</td></tr>
<tr><td colspan="2">Number of Additional Lots Created</td><td>N/A</td></tr>
<tr><td rowspan="2">Primary Proposed Construction</td><td>Type(s)</td><td>Electricity generation</td></tr>
<tr><td>NCC Classification</td><td>N/A</td></tr>
<tr><td colspan="2">The 'Specific' Land Use Type for Bushfire Planning
When applicable, this classification establishes a requirement to conduct assessments and develop documents that are additional to this Bushfire Management Plan.</td><td>High Risk Land Use</td></tr>
<tr><td colspan="2">Factors Determining the 'Specific Bushfire Planning' Land Use Type</td><td>The land use will store combustible materials and/or flammable hazardous materials onsite that may be exposed and vulnerable to ignition from the direct attack mechanisms of bushfire (flame contact, radiant heat and embers).
Business operations/activities may include those that are a potential source of ignition for onsite or offsite combustible/flammable materials, including bushfire prone vegetation.</td></tr>
<tr><td colspan="3">Description of the Proposed Development/Use</td></tr>
<tr><td colspan="3">Development of a 'BESS' (Battery Energy Storage System) and associated control room and inverters within an existing industrial area.</td></tr>
</table>

(Appendix ORD: 12.2.2B - Under Separate E-Cover)



NOTES

1. DIMENSIONS SUBJECT TO EQUIPMENT CONCRETE PAD DESIGN.

DRAWING No.	REFERENCE DRAWING	No.	DATE	REVISION	DRN	CHK	APP	No.	DATE	REVISION	DRN	CHK	APP
x								A	23.08.23	ISSUED FOR REVIEW	JFC	DG	GM

TESLA Corporation

Petro Min Engineers
Consulting Electrical Engineers
Mining & Oil and Gas
Suite 2.4, Level 2 9 Bowman Street
South Perth
Western Australia 6151
Phone: +61 08 9367 5244
ABN: 43 579 882 598
Email: admin@petromineng.com.au

DRAWN JFC — DATE AUG 2023
CHECKED DG — DATE AUG 2023
DESIGNED PME — DATE AUG 2023
JOB 8582
CAD FILE: 8582-E-800_A.DWG

CLIENT TESLA CORPORATION Pty Ltd
PROJECT PICTON - HARRIS ROAD, DARDANUP
TITLE BESS UPGRADE SITE GENERAL ARRANGEMENT
SHEET A1 — SCALE N/A — REV A
DRG No. 8582-E-800

FILE NAME: 8582-E-800_A.dwg PLOT DATE: 23/08/2023 4:07:46 PM BY: John Clare

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Proposed Development

Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

------ LEGEND ------

Subject Site
Cadastral

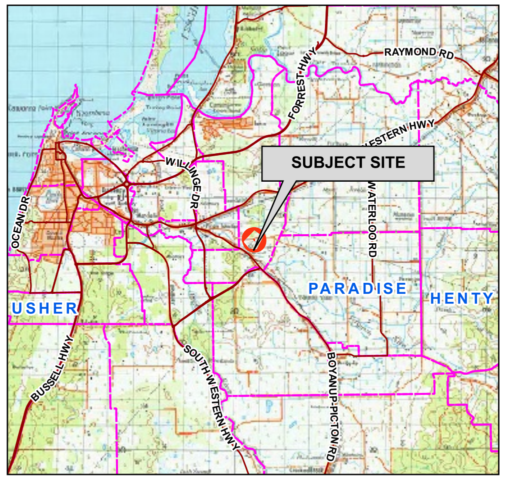
Buildings

BESS Enclosure
Control room
Inverter

0 20 40 60 80

Metres

------ LOCALITY ------



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Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map by: 29-11-2023
SCALE (A3): 1 : 1500

BUSHFIRE PRONE PLANNING

230997_Fig1-2_DEV_5 Hardisty Court Picton East.qgz

Figure 1-3

Location Map

Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

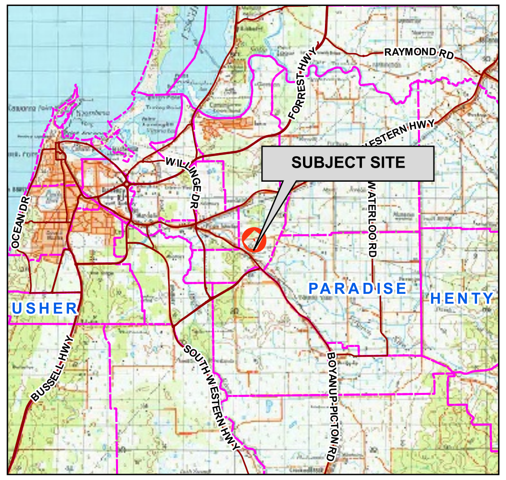
------ LEGEND ------

- Subject Site
- LGA
- Localities_Suburb
- Reserves

0 100 200 300 400 500

Metres

------ LOCALITY ------



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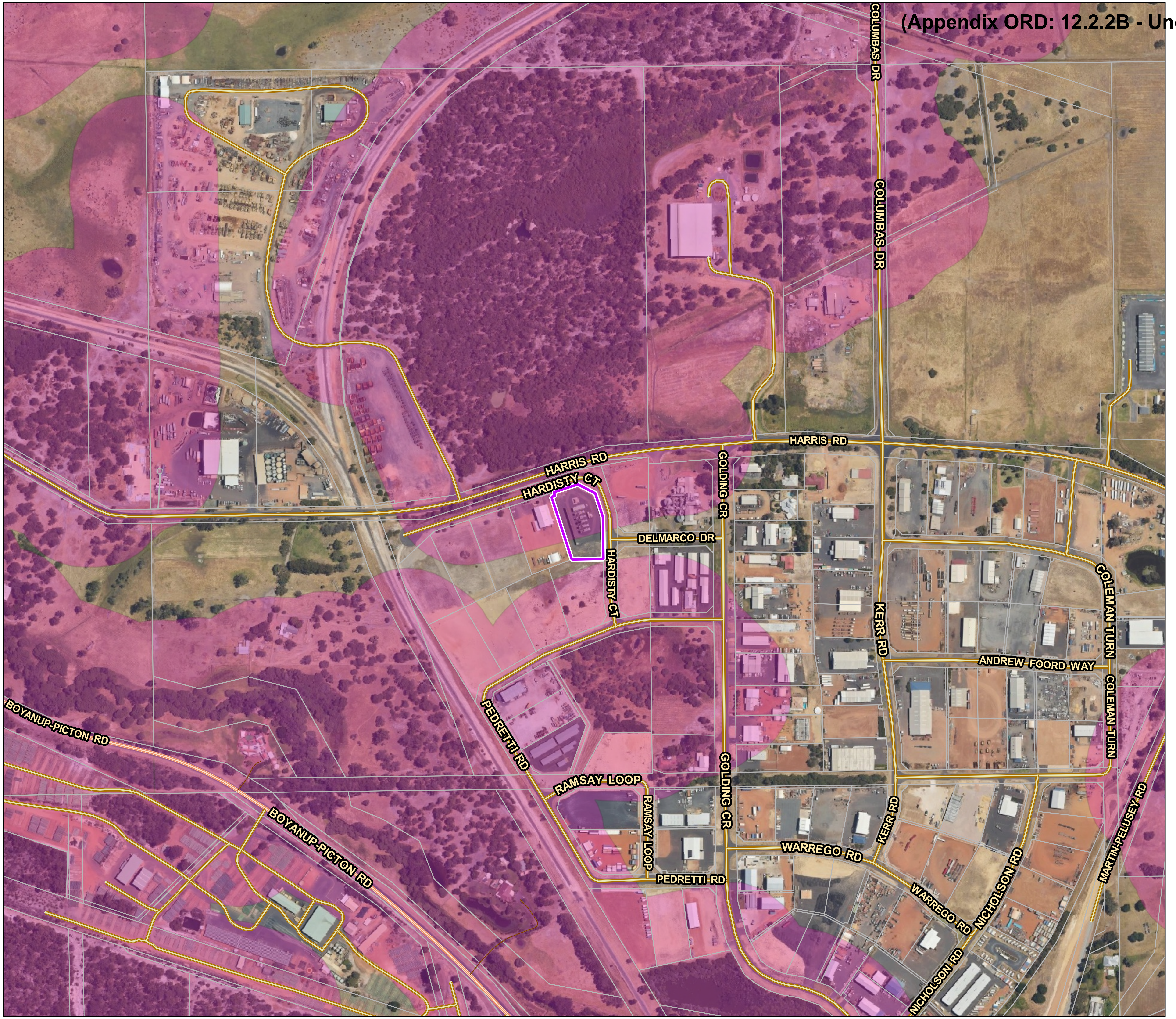
Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: 29-11-2023
SCALE (A3): 1 : 15000

BUSHFIRE PRONE PLANNING

230997_Fig1-3_LOC_5 Hardisty Court Picton East.qgz

Disclaimer and Limitation: This map has been prepared for bushfire management planning purposes only. All depicted areas, contours and any dimensions shown are subject to survey. Bushfire Prone Planning does not guarantee that this map is without flaw of any kind and disclaims all liability for any errors, loss or other consequence which may arise from relying on any information depicted.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)



Bushfire Prone Area

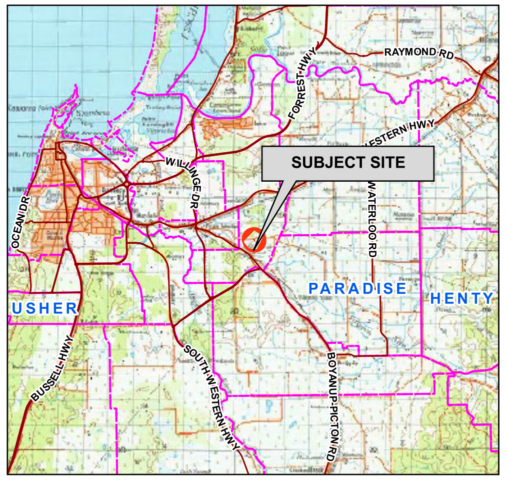
Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

------ LEGEND ------

Subject Site
Cadastral
Bushfire Prone Areas 2021

0 50 100 150 200 250
Metres

------ LOCALITY ------



N

AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: 29-11-2023
SCALE (A3): 1 : 5000

230997_Fig1-4_BPA_5 Hardisty Court Picton East.qgz

WHERE SPP 3.7 AND THE GUIDELINES ARE TO APPLY – DESIGNATED BUSHFIRE PRONE AREAS

All higher order strategic planning documents, strategic planning proposals, subdivisions and development applications located in designated bushfire prone areas need to address SPP 3.7 and its supporting Guidelines. This also applies where an area is not yet designated as bushfire prone but is proposed to be developed in a way that introduces a bushfire hazard.

For development applications where only part of a lot is designated as bushfire prone and the proposed development footprint is wholly outside of the designated area, the development application will not need to address SPP 3.7 or the Guidelines. (Guidelines DPLH 2021 v1.4, s1.2).

For subdivision applications, if all the proposed lots have a BAL-LOW indicated, a BMP is not required. (Guidelines DPLH 2021 v1.4, s5.3.1).

1.2 The Bushfire Management Plan (BMP)

1.2.1 Commissioning and Purpose

Landowner / proponent:	Tesla Corporation Management Pty Ltd
Bushfire Prone Planning commissioned to produce the BMP by:	Ben Tan
Purpose of the BMP:	To assess the proposal's ability to meet all relevant requirements established by State Planning Policy 3.7: Planning in Bushfire Prone Areas (SPP 3.7), the associated 'Guidelines and any relevant Position Statements; and To satisfy the requirement for the provision of a Bushfire Management Plan to accompany the development application.
BMP to be submitted to:	Shire of Dardanup

1.2.1 Other Documents with Implications for Development of this BMP

This section identifies any known assessments, reports or plans that have been conducted and prepared previously, or are being prepared concurrently, and are relevant to the planned proposal for the subject. They potentially have implications for the assessment of bushfire threats and the identification and implementation of the protection measures that are established by this Bushfire Management Plan.

Table 1.4: Other relevant documents that may influence threat assessments and development of protection measures.

RELEVANT DOCUMENTS					
Document	Relevant	Currently Exists	To Be Developed	Copy Provided by Proponent / Developer	Title
Structure Plan	No	No	No	N/A	-
Bushfire Management Plan	Yes	Yes	No	N/A	5 Hardisty Court, Picton East (BMP) – Prepared by Bushfire Prone Planning Jan 2024.
Implications for this BMP: None					
Bushfire Emergency Plan or Information	No	No	No	N/A	-
Bushfire Risk Assessment and Management Report	Yes	Yes	No	N/A	5 Hardisty Court, Picton East Bushfire Risk Report, Prepared by Bushfire Prone Planning Jan 2024.
Implications for the BMP: Additional protection measures that have been identified in the Bushfire Risk Report have been included within the BMP.					
Environmental Asset or Vegetation Survey	No	N/A	N/A	N/A	-
Landscaping and Revegetation Plan	No	N/A	N/A	N/A	-

Land Management Agreement	No	N/A	N/A	N/A	-

2 BUSHFIRE PRONE VEGETATION – ENVIRONMENTAL & ASSESSMENT CONSIDERATIONS

2.1 Environmental Considerations – 'Desktop' Assessment

This 'desktop' assessment must not be considered as a replacement for a full Environmental Impact Assessment. It is a summary of potential environmental values at the subject site, inferred from information contained in listed datasets and/or reports, which are only current to the date of last modification.

These data sources must be considered indicative where the subject site has not previously received a site-specific environmental assessment by an appropriate professional.

Many bushfire prone areas also have high biodiversity values. Consideration of environmental priorities within the boundaries of the land being developed can avoid excessive or unnecessary modification or clearing of vegetation. Approval processes (and exemptions) apply at both Commonwealth and State levels.

Any 'modification' or 'clearing' of vegetation to reduce bushfire risk is considered 'clearing' under the ***Environmental Protection Act 1986*** (EP Act) and requires a clearing permit under the ***Environmental Protection (Clearing of Native Vegetation) Regulations 2004*** (Clearing Regulations) – unless for an exempt purpose.

Clearing native vegetation is an offence, unless done under a clearing permit or the clearing is for an exempt purpose. Exemptions are contained in the EP Act or are prescribed in the Clearing Regulations (note: these do not apply in environmentally sensitive areas).

The ***Department of Water and Environmental Regulation*** (DWER) is responsible for issuing 'clearing' permits and the framework for the regulation of clearing. Approvals under other legislation, from other agencies, may also be required, dependent on the type of flora or fauna present.

Local Planning Policy or Local Biodiversity Strategy: Natural areas that are not protected by the above Act and Regulation (or any other National or State Acts) may be protected by a local planning policy or local biodiversity strategy. Permission from the local government will be required for any modification or removal of native vegetation in these Local Natural Areas (LNA's). Refer to the relevant local government for detail.

For further Information refer to Guidelines v1.4, the Bushfire and Vegetation Factsheet - WAPC, Dec 2021 and https://www.der.wa.gov.au/our-work/clearing-permits

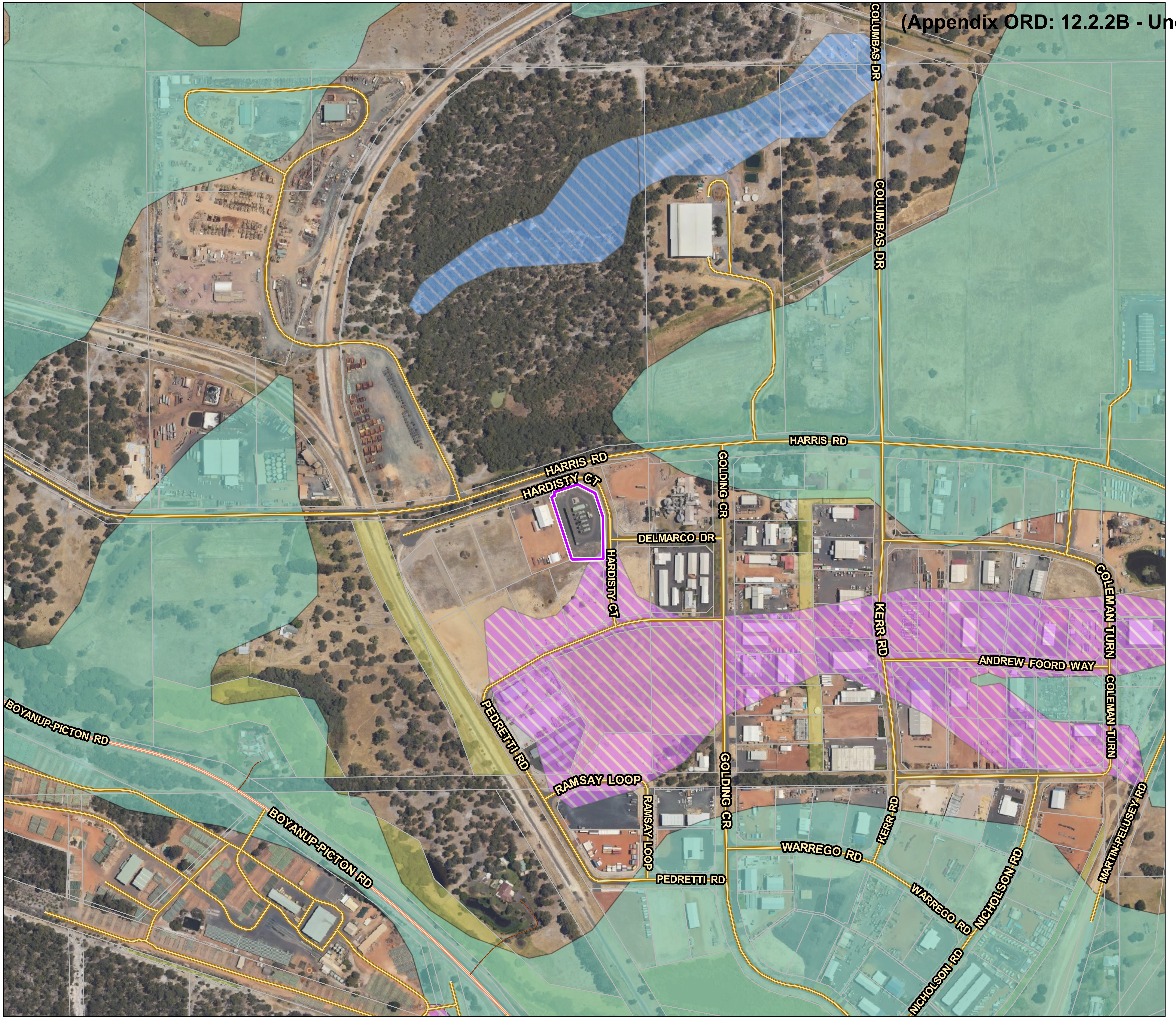


Figure 3

Environmental Considerations Map

Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

------ LEGEND ------

Subject Site
Cadastral

DBCA Legislated Lands and Waters

Section 5(1)(h) Reserve

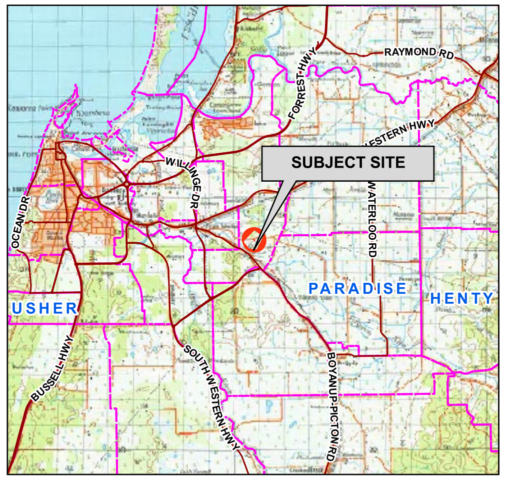
Geomorphic Wetlands

Dampland
Palusplain
Sumpland
Reserves

0 50 100 150 200 250

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: 29-11-2023
SCALE (A3): 1 : 5000

BUSHFIRE PRONE PLANNING

230997_Fig1-4_ENV_5 Hardisty Court Picton East.qgz

2.1.1 Declared Environmentally Sensitive Areas (ESA)

IDENTIFICATION OF RELEVANT ENVIRONMENTALLY SENSITIVE AREAS							
ESA Class	Relevant to Proposal	Influence on Bushfire Threat Levels and / or Application of Bushfire Protection Measures	Relevant Dataset	Information Source(s) Applied to Identification of Relevant Vegetation			Further Action Required
				Dataset	Landowner or Developer	Environmental Asset or Vegetation Survey	
Wetlands and their 50m Buffer (Ramsar, conservation category and nationally important)	Yes	No	DBCA-010 and 011, 019, 040, 043, 044	☒	☐	☐	None
Bush Forever	No	No	DPLH-022, SPP 2.8	☒	☐	☐	None
Threatened and Priority Flora + 50m Continuous Buffer	Unknown	Unlikely	DBCA-036	Restricted Scale of Data Available (security)	☐	☐	Data not obtained - confirm with relevant agency
Threatened Ecological Community	Unknown	Unlikely	DBCA-038		☐	☐	Data not obtained - confirm with relevant agency
Heritage Areas National / World	No	No	Relevant register or mapping	☒	☐	☐	None
Environmental Protection (Western Swamp Tortoise) Policy 2002	No	No	DWER-062	☒	☐	☐	None

DESCRIPTION OF THE IDENTIFIED ENVIRONMENTALLY SENSITIVE AREAS:

Further consultation with relevant authority is required regarding accurate accounts of threatened and priority flora as well as threatened ecological communities within the site as this data has restricted access.

2.1.2 Other Protected Vegetation on Public Land

IDENTIFICATION OF PROTECTED VEGETATION ON PUBLIC LAND							
Land with Environmental, Biodiversity, Conservation and Social Values	Relevant to Proposal	Influence on Bushfire Threat Levels and / or Application of Bushfire Protection Measures	Relevant Dataset	Information Source(s) Applied to Identification of Relevant Vegetation			Further Action Required
				Dataset	Landowner or Developer	Environmental Asset or Vegetation Survey	
Legislated Lands (tenure includes national park/reserve, conservation park, crown reserve and state forest)	Yes	No	DBCA-011	☒	☐	☐	None
Conservation Covenants	Unknown	Unlikely	DPIRD-023	Only Available to Govt.	☐	☐	Data not obtained - confirm with relevant agency
National World Heritage Areas	No	No	-	☒	☐	☐	None
Designated Public Open Space	No	No	-	☒	☐	☐	None

DESCRIPTION OF THE IDENTIFIED AREA(S) OF VEGETATION

Proponent may require further consultation with relevant authorities to obtain specific site information regarding Conservation Covenants within the site.

2.1.3 Response of Proposed Development to Identified Environmental Limitations

Consideration of the implications that identified protected areas of vegetation (i.e., those with environmental and subject to conservation) have for the proposed development.

PROPOSED DEVELOPMENT RESPONSE TO IDENTIFIED 'PROTECTED' VEGETATION	
The existence of 'protected' areas of vegetation has implications for the ability of the proposed development to reduce potential bushfire impact through modification or removal of vegetation.	No
Application of Design and/or Construction Responses to Limit Vegetation Modification or Removal	
Modify the development location to reduce exposure by increasing separation distance.	No
Redesign development, structure plan or subdivision.	No
Reduction of lot yield where this can increase available separation distances.	No
Cluster development to limit modification or removal of vegetation.	No
Construct building(s) to the requirements corresponding to higher BAL ratings to reduce required separation distances.	No

2.2 Bushfire Assessment Considerations

2.2.1 Planned Onsite Vegetation Landscaping

Identification of areas of the subject site planned to be landscaped, creating the potential for increased or decreased bushfire hazard for proposed development.

PLANNED LANDSCAPING	
Relevant to Proposal:	No

2.2.2 Planned / Potential Offsite Rehabilitation or Re-Vegetation

Identification of areas of land adjacent to the subject site on which re-vegetation (as distinct from natural re-generation) will or may occur and is likely to present a greater bushfire hazard for proposed development.

POTENTIAL RE-VEGETATION PROGRAMS		
Land with Environmental, Biodiversity, Conservation and Social Values	Relevant to Proposal	Description
Riparian Zones / Foreshore Areas	No	
Wetland Buffers	No	
Legislated Lands	No	
Public Open Space	No	
Road Verges	No	
Other	No	

2.2.3 Identified Requirement to Manage, Modify or Remove Onsite or Offsite Vegetation

Identification of native vegetation subject to management, modification or removal.

REQUIREMENT TO MANAGE, MODIFY OR REMOVE NATIVE VEGETATION	
Has a requirement been identified to manage, modify or remove **onsite** native vegetation to establish the required bushfire protection measures on the subject site?	No
Is approval, from relevant state government agencies and/or the local government, to modify or remove **onsite** native vegetation required? (Note: if 'Yes' evidence of its existence should be provided in this BMP).	No
Has a requirement been identified to manage, modify or remove **offsite** native vegetation to establish the required bushfire protection measures on the subject site?	No
Is written approval required, from relevant state government agencies and/or the local government, that permits the landowner, or another identified party, to modify or remove **offsite** bushfire prone vegetation and/or conduct other works, to establish an identified bushfire protection measure(s)? If 'Yes', appropriate evidence of the approval or how it is to be established, shall be provided in this BMP as an addendum.	No

Is a written management agreement required that states the obligation of the landowner, or another responsible party, to manage defined areas of **offsite** bushfire prone vegetation, in perpetuity, to ensure the conditions of no fire fuels and/or low threat vegetation and/or vegetation managed in a minimal fuel condition, continue to be met? If 'Yes', appropriate evidence of the agreement or how it is to be established, shall be provided in this BMP as an addendum.	No

2.2.4 Variations to Assessed Areas of Classified Vegetation to be Applied

FOR THE PROPOSED DEVELOPMENT SITUATIONS TO BE ACCOUNTED FOR IN ASSESSING THE POTENTIAL BUSHFIRE IMPACT (BAL)	
Area(s) of land will be subject to future vegetation rehabilitation or re-vegetation that will require a change to a higher threat classification of vegetation on that land to. (Note: this is not regeneration to the mature natural state which is accounted for in the 'existing state' assessment in accordance with AS 3959:2018).	No
Modification of existing area(s) of classified vegetation due to the implementation of the proposed development and/or prior to the site's occupancy or use. This modification will require a change to a lower threat classification (or exclusion from classification) for that area of vegetation.	No
Complete removal of existing area(s) of classified vegetation due to the implementation of the proposed development and/or prior to the site's occupancy or use. This modification will require an exclusion from classification for that area of vegetation.	No

3 BUSHFIRE ATTACK LEVEL (BAL) ASSESSMENT

BUSHFIRE ATTACK LEVELS (BAL) - UNDERSTANDING THE RESULTS

The potential transfer (flux/flow) of radiant heat from the bushfire to a receiving object is measured in kW/m^2. The AS 3959:2018 BAL determination methodology establishes the ranges of radiant heat flux that correspond to each bushfire attack level. These are identified as BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ.

The bushfire performance requirements for certain classes of buildings are established by the Building Code of Australia (Vol. 1 & 2 of the NCC). The BAL will establish the bushfire resistant construction requirements that are to apply in accordance with AS 3959:2018 - *Construction of buildings in bushfire prone areas* and the NASH Standard – *Steel framed construction in bushfire areas (NS 300 2021),* whose solutions are deemed to satisfy the NCC bushfire performance requirements.

DETERMINED BAL RATINGS

A BAL Certificate can be issued for a determined BAL. A BAL can only be classed as 'determined' for an existing or future building/structure when:

1. It's final design and position on the lot are known and the stated separation distance from classified bushfire prone vegetation exists and can justifiably be expected to remain in perpetuity; or

2. It will always remain subject to the same BAL regardless of its design or position on the lot after accounting for any regulatory or enforceable building setbacks from lot boundaries as relevant and necessary (e.g., R-codes, restrictive covenants, defined building envelopes) or the retention of any existing classified vegetation either onsite or offsite.

If the BMP derives determined BAL(s), the BAL Certificate(s) required for submission with building applications can be provided, using the BMP as the assessment evidence.

INDICATIVE BAL RATINGS

A BAL Certificate cannot be issued for an indicative BAL. A BAL will be classed as 'indicative' for an existing or future building/structure when the required conditions to derive a determined BAL are not met.

This class of BAL rating indicates what BAL(s) could be achieved and the conditions that need to be met are stated.

Converting the indicative BAL into a determined BAL is conditional upon the currently unconfirmed variable(s) being confirmed by a subsequent assessment and evidential documentation. These variables will include the future building(s) location(s) being established (or changed) and/or classified vegetation being modified or removed to establish the necessary vegetation separation distance. This may also be dependent on receiving approval from the relevant authority for that modification/removal.

BAL RATING APPLICATION – PLANNING APPROVAL VERSUS BUILDING APPROVAL

1. **Planning Approval**: SPP.3.7 establishes that where BAL- LOW to BAL-29 will apply to relevant future construction (or existing structures for proposed uses), the proposed development may be considered for approval (dependent on the other requirements of the relevant policy measures being met). That is, BAL40 or BAL-FZ are not acceptable on planning grounds (except for certain limited exceptions).

   Because planning is looking forward at what can be achieved, as well as looking at what may currently exist, both determined and indicative BAL ratings are acceptable assessment outcomes on which planning decisions can be made (including conditional approvals).

2. **Building Approval:** The Building Code of Australia (Vol. 1 & 2 of the NCC) establishes that relevant buildings in bushfire prone areas must be constructed to the bushfire resistant requirements corresponding to the BAL rating that is to apply to that building. Consequently, a determined BAL rating and the BAL Certificate is required for a building permit to be issued - an indicative BAL rating is not acceptable.

3.1 BAL Assessment Summary (Contour Map Format)

INTERPRETATION OF THE BAL CONTOUR MAP

The BAL contour map is a diagrammatic representation of the results of the bushfire attack level assessment.

The map presents different coloured contours extending out from the areas of classified vegetation. Each contour represents a set range of radiant heat flux that potentially will transfer to an exposed element (building, person or other defined element), when it is located within that contour.

Each of the set ranges of radiant heat flux corresponds to a different BAL rating as defined by the AS 3959:2018 BAL determination methodology.

The width of each shaded BAL contour will vary dependant on both the BAL rating and the relevant parameters (calculation inputs) for the subject site. Their width represents the minimum and maximum vegetation separation distances that correspond to each BAL rating (refer to the relevant table below for these distances).

The areas of classified vegetation to be considered in developing the BAL contours, are those that will remain at the intended end state of the subject development once earthworks, clearing and/or landscaping and re-vegetation have been completed. Variations to this statement that may apply include:

- Both pre and post development BAL contour maps are produced; and/or
- Each stage of a development is assessed independently.

3.1.1 BAL Determination Methodology and Location of Data and Results

<table>
<tr><th colspan="6">LOCATION OF DATA & RESULTS</th></tr>
<tr><td colspan="2">BAL Determination Methodology</td><td colspan="3">Location of the Site Assessment Data</td><td>Location of the Results</td></tr>
<tr><td rowspan="2">AS 3959:2018</td><td rowspan="2">Applied to Assessment</td><td rowspan="2">Classified Vegetation and Topography Map(s)</td><td colspan="2">Calculation Input Variables</td><td rowspan="2">Assessed Bushfire Attack Levels and/or Radiant Heat Levels</td></tr>
<tr><td>Summary Data</td><td>Detailed Data with Explanatory and Supporting Information</td></tr>
<tr><td>Method 1 (Simplified)</td><td>Yes</td><td>Figure 3.1</td><td>Table 3.1</td><td>Appendix A1</td><td rowspan="2">Table 3.1
Table 3.3 / BAL Contour Map</td></tr>
<tr><td>Method 2 (Detailed)</td><td>Yes</td><td>Figure 3.1</td><td>Table 3.1</td><td>Appendix A2</td></tr>
<tr><td colspan="6">Reasons for the Application of the Method 2 Procedure</td></tr>
<tr><td>1.</td><td colspan="5">A more specific result is sought.</td></tr>
<tr><td colspan="6">Identification of the specific issues associated with the site and/or proposed development that have necessitated the use of the Method 2 procedure:
The Guidelines for Planning in Bushfire Prone Areas require a BAL-29 APZ regardless of the vulnerability of the asset or its ability to comply with AS 3959 construction standards. A 10kW/m2 APZ has been applied as an appropriate maximum acceptable heat flux exposure for the asset.</td></tr>
</table>

3.1.2 BAL Ratings Derived from the Contour Map

Table 3.1: Indicative and determined BAL(s) for existing and/or proposed building works.

BUSHFIRE ATTACK LEVEL FOR EXISTING/PLANNED BUILDINGS/STRUCTURE [1]		
Building/Structure Description	Indicative BAL [2]	Determined BAL [2]
BESS Enclosure	N/A	BAL-12.5
Control Room	N/A	BAL-12.5
Inverter	N/A	BAL-12.5
[1] The assessment data used to derive the BAL ratings is sourced from Table 3.1 and Figure 3.2 'BAL Contour Map'. [2] Refer to the start of Section 3 for an explanation of indicative versus determined BAL ratings.		

3.1.3 Site Assessment Data Applied to Construction of the BAL Contour Map(s)

RELEVANT CLASSIFIED VEGETATION	
Identification of Classified Vegetation that is Relevant to the Production of the BAL Contour Map(s)	Relevant Vegetation Map
The relevant vegetation will be all areas of classified vegetation that exist at the time of the site assessment – both within the subject site (onsite) and external to the subject site (offsite).	Figure No.3.1
Supporting Assessment Details: None Required.	

BUSHFIRE PRONE PLANNING

Table 3.2: The calculation inputs applied to determining the site specific separation distances corresponding to levels of potential radiant heat transfer (including BAL's).

SUMMARY OF CALCULATION INPUT VARIABLES APPLIED TO THE DETERMINATION OF SEPARATION DISTANCES CORRESPONDING TO RADIANT HEAT LEVELS [1]												
Applied BAL Determination Method		METHOD 1 - SIMPLIFIED PROCEDURE (AS 3959:2018 CLAUSE 2.2) AND METHOD 2 - DETAILED PROCEDURE (AS 3959:2018 APPENDIX B)										
The Calculation Variables Corresponding to the BAL Determination Method Applied												
Methods 1 and 2		Method 1		Method 2								
Vegetation Classification		FDI	Effective Slope		Site Slope	FFDI or GFDI	Flame Temp.	Elevation of Receiver	Flame Width	Fireline Intensity	Flame Length	Modified View Factor
			Applied Range	Determined								
Area	Class		degree range	degrees	degrees		K	metres	metres	kW/m	metres	% Reduction
1	(A) Forest	80	Upslope or flat 0	flat 0	flat 0	80	1090	Default	Default	Default	Default	Default
2	(D) Scrub	80	Upslope or flat 0	flat 0	flat 0	80	1090	Default	Default	Default	Default	Default
3	(G) Grassland	80	Upslope or flat 0	flat 0	flat 0	110	1090	Default	Default	Default	Default	Default
4	Excluded cl 2.2.3.2(e & f)	N/A	N/A	-	-	-	-	-	-	-	-	-

[1] All data and information supporting the determination of the classifications and values stated in this table and any associated justification, is presented in Appendix A.

Where the values are stated as 'default' these are either the values stated in AS 3959:2018, Table B1 or the values calculated as intermediate or final outputs through application of the equations of the AS 3959:2018 BAL determination methodology. They are not values derived by the assessor.

Table 3.3: Vegetation separation distances corresponding to the radiant heat levels illustrated as BAL contours in Figure 3.2.

THE CALCULATED VEGETATION SEPARATION DISTANCES (METRES) CORRESPONDING TO THE STATED LEVEL OF RADIANT HEAT FLUX [1]									
Vegetation Classification		Separation Distances Corresponding to Stated Level of Radiant Heat (metres)							
		Bushfire Attack Level						Maximum Radiant Heat Flux	
Area	Class	BAL-FZ	BAL-40	BAL-29	BAL-19	BAL12.5	BAL-LOW	10 kW/m^2	2 kW/m^2
1	(A) Forest	<16	16-<21	21-<31	31-<42	42-<100	>100	>48.9	-
2	(D) Scrub	<10	10-<13	13-<19	19-<27	27-<100	>100	>32.9	-
3	(G) Grassland	<6	6-<8	8-<12	12-<17	17-<50	>50	>21.2	-
4	Excluded cl 2.2.3.2(e & f)	-	-	-	-	-	-	-	-

[1] All calculation input variables are presented in Table 3.2. A copy of the radiant heat calculator output for each area of classified vegetation is presented in Appendix A3.

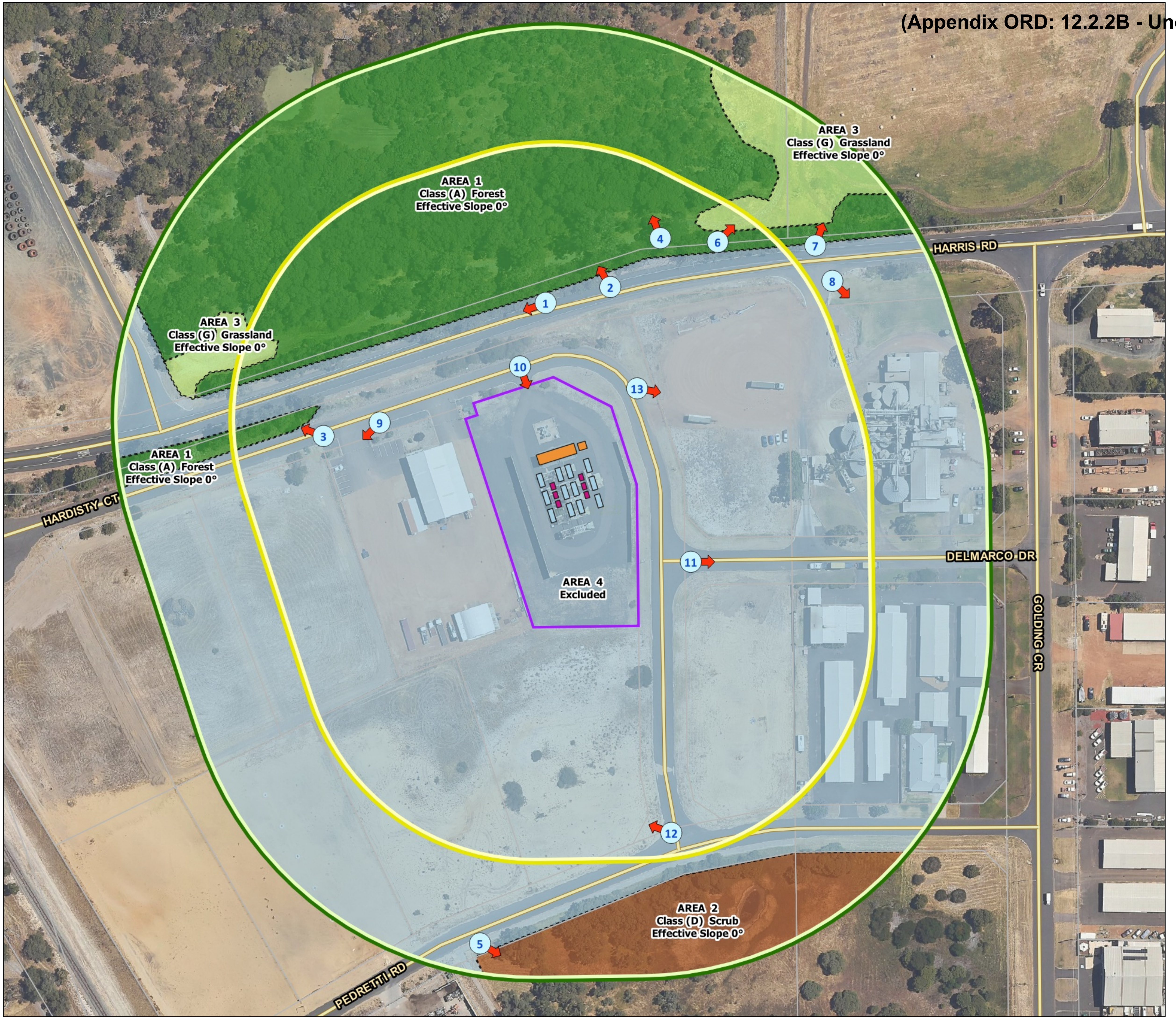
[2] The BAL-LOW rating is not defined by the level of radiant heat flux. It applies when the vegetation separation distance is 100m or 50m for the Grassland vegetation classification.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Figure 3

Classified Vegetation & Topography (Existing)

Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP



------ LEGEND ------

- Subject Site
- Cadastral
- Legend Entry Photo
- 150m Assessment Area
- 100m Assessment Area

Buildings

- BESS Enclosure
- Control room
- Inverter

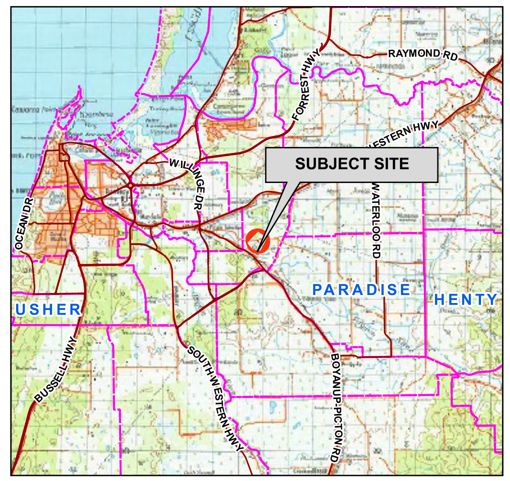
Classified Vegetation

- Class A - Forest
- Class G - Grassland
- Exclusion 2.2.3.2

0 20 40 60 80

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: 29-11-2023
SCALE (A3): 1 : 1500

BUSHFIRE PRONE PLANNING

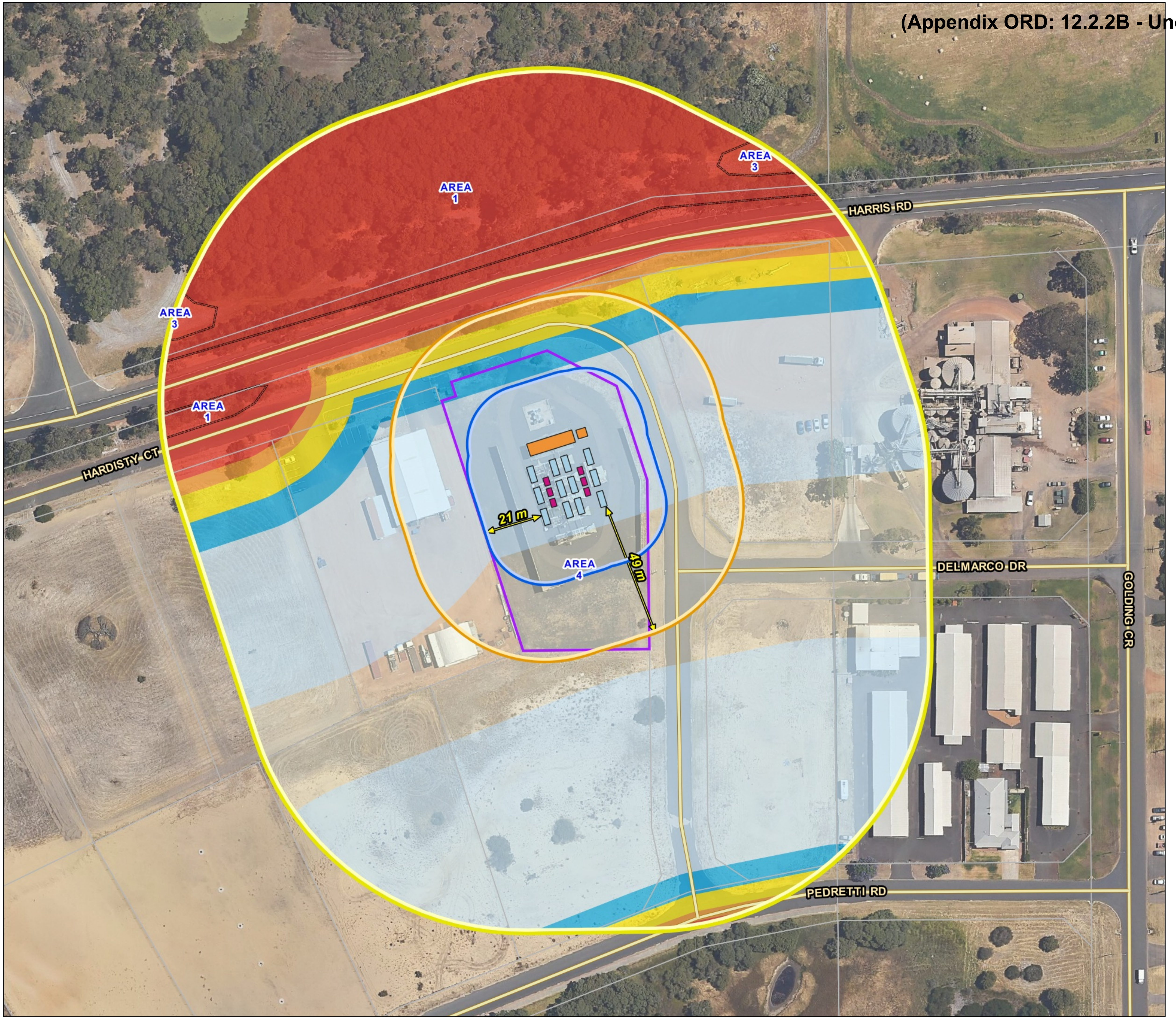
230997_Fig3-1_VEG_5 Hardisty Court Picton East.qgz

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Figure 3-2

BAL Contour Map

Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP



------ LEGEND ------

- Subject Site
- Cadastral
- 100m Assessment Area
- 49m 10Kw APZ
- 21m BAL29 APZ

Buildings

- BESS Enclosure
- Control room
- Inverter

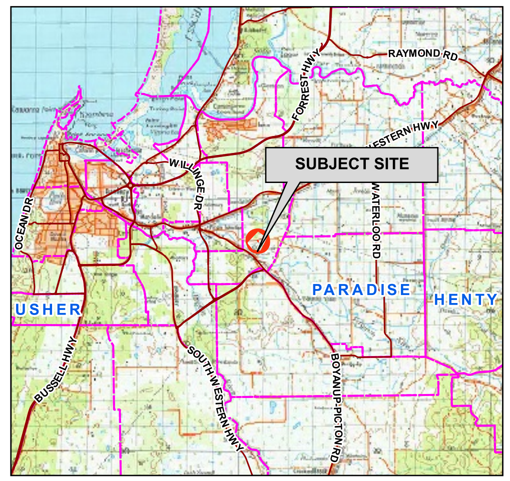
Bushfire Attack Levels

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW

0 20 40 60 80

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: 30-11-2023
SCALE (A3): 1 : 1250

BUSHFIRE PRONE PLANNING

230997_Fig3-2_BAL_5 Hardisty Court Picton East.qgz

4 IDENTIFICATION OF BUSHFIRE HAZARD ISSUES

The Guidelines for Planning in Bushfire Prone Areas (WAPC 2021 v1.4), Appendix 5, establish that the application of this section of the BMP is intended to support ***strategic planning*** proposals. At the strategic planning stage there will typically be insufficient proposed development detail to enable all required assessments, including the assessment against the bushfire protection criteria. **Strategic Planning Proposals** For strategic planning proposals this section of the BMP will identify: • Issues associated with the level of the threats presented by any identified bushfire hazard; • Issues associated with the ability to implement sufficient and effective bushfire protection measures to reduce the exposure and vulnerability levels (of elements exposed to the hazard threats), to a tolerable or acceptable level; and • Issues that will need to be considered at subsequent planning stages. **All Other Planning Proposals** For all other planning stages, this BMP will address what are effectively the same relevant issues but do it within the following sections: • Section 2 – Bushfire Prone Vegetation - Environmental and Assessment Considerations: Assess environmental, biodiversity and conservation values; • Section 3 – Potential Bushfire Impact: Assess the bushfire threats with the focus on flame contact and radiant heat; and • Section 5 – Assessment Against the Bushfire Protection Criteria (including the guidance provided by the *Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2'):* Assess the ability of the proposed development to apply the required bushfire protection measures thereby enabling it to be considered for planning approval for these factors.	
Is the proposed development a strategic planning proposal?	No

5 ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA (GUIDELINES V1.4)

5.1 Bushfire Protection Criteria Elements Applicable to the Proposed Development/Use

APPLICATION OF THE CRITERIA, ACCEPTABLE SOLUTIONS AND PERFORMANCE ASSESSMENT

The criteria are divided into five elements – location, siting and design, vehicular access, water and vulnerable tourism land uses. Each element has an intent outlining the desired outcome for the element and reflects identified planning and policy requirements in respect of each issue.

The example acceptable solutions (bushfire protection measures) provide one way of meeting the element's intent. Compliance with these automatically achieves the element's intent and provides a straightforward pathway for assessment and approval.

Where the acceptable solutions cannot be met, the ability to develop design responses (as alternative solutions that meet bushfire performance requirements) is an alternative pathway that is provided by addressing the applicable performance principles (as general statements of how best to achieve the intent of the element).

A merit based assessment is established by the SPP 3.7 and the Guidelines as an additional alternative pathway along with the ability of using discretion in making approval decisions (sections 2.5, 2.6 and 2.7). This is formally applied to certain development (minor and unavoidable – sections 5.4.1 and 5.7). Relevant decisions by the State Administrative Tribunal have also supported this approach more generally.

Elements 1 – 4 should be applied for all strategic planning proposals, subdivision or development applications, except for vulnerable tourism land uses which should refer to Element 5. Element 5 incorporates the bushfire protection criteria in Elements 1 – 4 but caters them specifically to tourism land uses. (Guidelines DPLH 2021v1.4)

The Bushfire Protection Criteria	Applicable to the Proposed Development/Use
Element 1: Location	Yes
Element 2: Siting and Design	Yes
Element 3: Vehicular Access	Yes
Element 4: Water	Yes
Element 5: Vulnerable Tourism Land Uses	No

5.2 Local Government Variations to Apply

Local governments may add to or modify the acceptable solutions to recognise special local or regional circumstances (e.g., topography / vegetation / climate). These are to be endorsed by both the WAPC and DFES before they can be considered in planning assessments. (Guidelines DPLH 2021v1.4).

Do endorsed regional or local variations to the acceptable solutions apply to the assessments against the Bushfire Protection Criteria for the proposed development /use?	No

5.3 Assessment Statements for Element 1: Location

LOCATION	
Element Intent	To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use achieves the intent of this element by being fully compliant with all applicable acceptable solutions.
Pathway Applied to Provide an Alternative Solution	N/A

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

Solution Component Check Box Legend	☑ Relevant & met	☒ Relevant & not met	⦸ Not relevant

E1 Location			**Compliant:**	Yes
A1.1 Development location	**Applicable:**	Yes	**Compliant:**	Yes

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE GUIDELINES

☑ ☐ ☐ The development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL-29 or below.

Supporting Assessment Details:

The development is situated in area that is subject to BAL ratings not exceeding BAL-29. Refer to Figure 3.2 within this report for reference.

ASSESSMENTS APPLYING THE GUIDANCE ESTABLISHED BY THE WAPC ELEMENT 1 & 2 POSITION STATEMENT (2019)

"Consideration should be given to the site context where 'area' is the land both within and adjoining the subject site. The hazards remaining within the site should not be considered in isolation of the hazards adjoining the site, as the potential impact of a bushfire will be dependent on the wider risk context, including how a bushfire could affect the site and the conditions for a bushfire to occur within the site."

Strategic Planning Proposals: Consider the threat levels from any vegetation adjoining and within the subject site for which the potential intensity of a bushfire in that vegetation would result in it being classified as an Extreme Bushfire Hazard Level (BHL). Identify any proposed design strategies to reduce these threats.

Structure Plans (lot layout known) and Subdivision Applications: As for strategic planning proposals but within the subject site the relevant threat levels to consider are the radiant heat levels represented by BAL-FZ and BAL-40 ratings.

The planning proposal is a development application, consequently the referenced position statement is not applicable to the Element 1 assessment.

5.4 Assessment Statements for Element 2: Siting and Design

SITING AND DESIGN OF DEVELOPMENT	
Element Intent	To ensure that the siting and design of development minimises the level of bushfire impact. (BPP Note: not building/construction design)
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use achieves the intent of this element by being fully compliant with all applicable acceptable solutions.
Pathway Applied to Provide an Alternative Solution	N/A

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

Solution Component Check Box Legend ☑ Relevant & met ☒ Relevant & not met ⃠ Not relevant

E2 Siting and Design of Development		**Compliant:**	Yes
A2.1 Asset Protection Zone (APZ)	**Applicable:** Yes	**Compliant:**	Yes

APZ DIMENSIONS – DIFFERENCES IN REQUIREMENTS FOR PLANNING ASSESSMENTS COMPARED TO IMPLEMENTATION

A key required bushfire protection measure is to reduce the exposure of buildings/infrastructure (as exposed vulnerable elements at risk), to the direct bushfire threats of flame contact, radiant heat and embers and the indirect threat of consequential fires that result from the subsequent ignition of other combustible materials that may be constructed, stored or accumulate in the area surrounding these structures. This reduces the associated risks of damage or loss.

This is achieved by separating buildings (and consequential fire fuels as necessary) from areas of classified bushfire prone vegetation. This area of separation surrounding buildings is identified as the Asset Protection Zone (APZ) and consists of no vegetation and/or low threat vegetation or vegetation continually managed to a minimal fuel condition. The required separation distances will vary according to the site specific conditions and local government requirements.

The APZ dimensions stated and/or illustrated in this Report can vary dependent on the purpose for which they are being identified.

> *Note: Appendix B 'Onsite Vegetation Management' provides further information regarding the different APZ dimensions that can be referenced, their purpose and the specifications of the APZ that are to be established and maintained on the subject lot.*

THE 'PLANNING BAL-29' APZ DIMENSIONS

Purpose: To provide evidence of the development or use proposal's ability to achieve minimum vegetation separation distances. To achieve 'acceptable solution' planning approval for this factor, it must be demonstrated that the minimum separation distances corresponding to a maximum level of radiant transfer to a building of 29 kW/m^2, either exist or can be implemented (with certain exceptions). These separation distances are the 'Planning BAL-29' APZ dimensions.

The 'Planning BAL-29' APZ is not necessarily the size of the APZ that must be physically implemented and maintained by a landowner. Rather, its sole purpose is to identify if an acceptable solution for planning approval can be met.

THE 'REQUIRED' APZ DIMENSIONS

Purpose: Establishes the dimensions of the APZ to be physically implemented by the landowner on their lot: These will be the minimum required separation distances from the subject building(s) to surrounding bushfire prone vegetation (identified by type and associated ground slope). These are established by:

A. The 'BAL Rating APZ' of the subject building(s) when distances are greater than 'B' below (except when 'B' establishes a maximum distance); or

B. The 'Local Government' APZ' derived from the Firebreak/Hazard Reduction Notice when distances are greater than 'A' above, other than when a maximum distance is established, in which case this will apply; or

C. A combination of 'A' and 'B'.

> *Within this Report/Plan it is the **'Planning BAL-29' APZ** that will be identified on maps, diagrams and in tables as necessary – unless otherwise stated.*
>
> *The **'Required' APZ** dimension information will be presented in Appendix B1.1 and on the Property Bushfire Management Statement, when required to be included for a development application.*

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE GUIDELINES	
☑ ☐ ☐	**APZ Width:** The proposed (or a future) habitable building(s) on the lot(s) of the proposed development - or an existing building for a proposed change of use – can be (or is) located within the developable portion of the lot and be surrounded by a 'Planning BAL-29' APZ of the required dimensions (measured from any external wall or supporting post or column to the edge of the classified vegetation), that will ensure their exposure to the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2.
☐ ☐ ⦸	**Restriction on Building Location:** It has been identified that the current developable portion of a lot(s) provides for the proposed future (or a future) building/structure location that will result in that building/structure being subject to a BAL-40 or BAL-FZ rating. Consequently, it may be considered necessary to impose the condition that a restrictive covenant to the benefit of the local government pursuant to section 129BA of the Transfer of Land Act 1893, is to be placed on the certificate(s) of title of the proposed lot(s) advising of the existence of a restriction on the use of that portion of land (refer to Code F3 of Model Subdivision Conditions Schedule, WAPC June 2021 and Guidelines s5.3.2).
☐ ☐ ⦸	**APZ Location:** The required dimensions for a 'Planning BAL-29' APZ can be contained solely within the boundaries of the lot(s) on which the proposed (or a future) habitable building(s) - or an existing building(s) for a proposed change of use – is situated.
☑ ☐ ☐	**APZ Location:** The required dimensions for a 'Planning BAL-29' APZ can be partly established within the boundaries of the lot(s) on which the proposed (or a future) habitable building(s) - or an existing building(s) for a proposed change of use – is situated. The balance of the APZ would exist on adjoining land that satisfies the exclusion requirements of AS 3959:2018 cl 2.2.3.2 for non-vegetated areas and/or low threat vegetation and/or vegetation managed in a minimal fuel condition.
☐ ☐ ⦸	**APZ Location:** It can be justified that any adjoining (offsite) land forming part of a 'Planning BAL-29' APZ will: • If non-vegetated, remain in this condition in perpetuity; and/or • If vegetated, be low threat vegetation or vegetation managed in a minimal fuel condition in perpetuity.

☑ ☐ ☐	**APZ Management:** The area of land (within each lot boundary), that is to make up the required 'Landowner' APZ dimensions (refer to Appendix B, Part B1), can and will be managed in accordance with the requirements of the Guidelines Schedule 1 'Standards for Asset Protection Zones' (refer to Appendix B).
☐ ☐ ⃠	**Staged Subdivision:** The subdivision proposes development in stages and each stage is to comply with the relevant bushfire protection criteria. A balance lot is created or classified vegetation within a subsequent stage will be removed and/or modified and/or be subject to ongoing management, to ensure that proposed lots within the current stage of the subdivision achieve a development site subject to 29 kW/m^2 or below. The planned approach for achieving the required outcome is described in the supporting assessment details below.
☑ ☐ ☐	**Firebreak/Hazard Reduction Notice:** Any additional requirements established by the relevant local government's annual notice to install firebreaks and manage fuel loads (issued under s33 of the Bushfires Act 1954), can and will be complied with.

Supporting Assessment Details:

The ability to establish the 'Planning BAL-29' APZ dimensions is illustrated in Figure 3.2. No vegetation needs to be managed within the lot boundaries or outside the lot boundary.

The areas of land that exists outside the proposed lot that are still part of the 'Planning BAL-29' APZ, consist of:

- Roads
- Unvegetated verges or low threat verge vegetation
- Parking bays
- Landscaped public open space managed by local government.
- Adjacent lots with no existing vegetation and planned industrial construction and associated managed landscaping.

As outlined in section 5.7 as well as the Risk Management Report, an additional protection measure of a larger recommended APZ has been established due to the development being high risk. Refer to figure 3.2 within this report for the dimensions of the additional APZ.

ASSESSMENTS APPLYING THE GUIDANCE ESTABLISHED BY THE WAPC ELEMENT 1 & 2 POSITION STATEMENT (2019)

Strategic Planning Proposals: "At this planning level there may not be enough detail to demonstrate compliance with this element. The decision-maker may consider this element is satisfied where A1.1 is met."

Structure Plans (lot layout known) and Subdivision Applications: "Provided that Element 1 is satisfied, the decision-maker may consider approving lot(s) containing BAL-40 or BAL-FZ under the following scenarios.

The planning proposal is a development application, consequently the referenced position statement is not applicable to the proposed development.

5.5 Assessment Statements for Element 3: Vehicular Access

VEHICULAR ACCESS	
Element Intent	To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use achieves the intent of this element by being fully compliant with all applicable acceptable solutions.
Pathway Applied to Provide an Alternative Solution	N/A

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

The technical construction requirements for access types and components, and for each firefighting water supply component, are also presented in Appendices C and D. The local government will advise the proponent where different requirements are to apply and when any additional specifications such as those for signage and gates are to apply (these are included in the relevant appendix if requested by the local government).

Solution Component Check Box Legend	☑ Relevant & met	☒ Relevant & not met	⃠ Not relevant

E3 Vehicular Access			**Compliant:**	Yes
A3.1 Public roads	**Applicable:**	Yes	**Compliant:**	Yes

☑ ☐ ☐	The technical construction requirements of vertical clearance and weight capacity (Guidelines, Table 6) can and will be complied with (Refer also to Appendix C in this BMP).
☑ ☐ ☐	All other applicable technical requirements of trafficable width, gradients and curves, are required to be in "accordance with the class of road as specified in the IPWEA Subdivision Guidelines, Liveable Neighbourhoods, Ausroad Standards and/or any applicable standard in the local government area" (Guidelines, Table 6 and E3.1. Refer also to Appendix C in this BMP). The assessment conducted for the bushfire management plan indicates that it is likely that the proposed development can and will comply with the requirements. However, the applicable class of road, the associated technical requirements and subsequent proposal compliance, will need to be confirmed with the relevant local government and/or Main Roads WA.
☑ ☐ ☐	A traversable verge is available adjacent to classified vegetation (Guidelines, E3.1), as recommended.

Supporting Assessment Details:

Hardisty Court and Harris Road are likely to comply with the associated technical road requirements. There are no new public roads to be constructed with this development.

A3.2a Multiple access routes	**Applicable**:	Yes	**Compliant**:	Yes

☑ ☐ ☐ For each lot, two-way public road access is provided in two different directions to at least two different suitable destinations with an all-weather surface.

☑ ☐ ☐ The two-way access is available at an intersection no greater than 200m from the relevant boundary of each lot, via a no-through road.

☐ ☐ ⦸ The two-way access is not available at an intersection within 200m from the relevant boundary of each lot. However, the available no-through road satisfies the established exemption for the length limitation in every case. These requirements are:

- Demonstration of no alternative access (refer to A3.3 below);
- The no-through road travels towards a suitable destination; and
- The balance of the no-through road that is greater than 200m from the relevant lot boundary is within a residential built-out area or is potentially subject to radiant heat levels from adjacent bushfire prone vegetation that correspond to the BAL-LOW rating (<12.5 kW/m^2).

Supporting Assessment Details:

Two-way access is available at an intersection less than 200m from the lot boundary. Hardisty court is intersected by Delmarco Road that leads through to Goulding leading to Harris Road which heads west to the city centre of Bunbury. Alternatively, following Hardisty Court to Pedretti leads south to wards Bunbury outer ring road.

A3.2b Emergency access way	**Applicable**:	No	**Compliant**:	N/A

☐ ☐ ⦸ The proposed or existing EAW provides a through connection to a public road.

☐ ☐ ⦸ The proposed or existing EAW is less than 500m in length and will be signposted and gated (remaining unlocked) to the specifications stated in the Guidelines and/or required by the relevant local government.

☐ ☐ ⦸ The technical construction requirements for widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.2b. Refer also to Appendix C in this BMP), can and will be complied with.

☐ ☐ ⦸ The subdivision proposes development in stages and each stage is to comply with the relevant bushfire protection criteria.

A temporary EAW is planned to facilitate the staging arrangements of a subdivision as an interim second access route until the required second access route is constructed as a public road in a subsequent stage.

The planned approach for achieving the required outcome is described in the supporting assessment details below.

Supporting Assessment Details:

None required.

A3.3 Through-roads	**Applicable**:	No	**Compliant**:	N/A

☐ ☐ ⦸ A no-through public road is necessary as no alternative road layout exists due to site constraints.

☐ ☐ ⦸ The no-through public road length does not exceed the established maximum of 200m to an intersection providing two-way access (Guidelines, E3.3).

☐ ☐ ⃠	The no-through public road exceeds 200m but satisfies the exemption provisions of A3.2a as demonstrated in A3.2a above.
☐ ☐ ⃠	The public road technical construction requirements (Guidelines, Table 6 and E3.1. Refer also to Appendix C in this BMP), can and will be complied with as established in A3.1 above.
☐ ☐ ⃠	The turnaround area requirements (Guidelines, Figure 24) can and will be complied with.

Supporting Assessment Details:

None required.

A3.4a Perimeter roads	**Applicable**:	No	**Compliant**:	N/A

☐ ☐ ⃠	The proposed greenfield or infill development consists of 10 or more lots (including those that are part of a staged subdivision) and therefore should have a perimeter road. This is planned to be installed.
☐ ☐ ⃠	The proposed greenfield or infill development consists of 10 or more lots (including those that are part of a staged subdivision). However, it is not required on the established basis of: • The vegetation adjoining the proposed lots is classified Class G Grassland; • Lots are zoned rural living or equivalent; • It is demonstrated that it cannot be provided due to site constraints; or • All lots have existing frontage to a public road.
☐ ☐ ⃠	The technical construction requirements of widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.4a) can and will be complied with.

Supporting Assessment Details:

None required.

A3.4b Fire service access route	**Applicable**:	No	**Compliant**:	N/A

☐ ☐ ⃠	The FSAR can be installed as a through-route with no dead ends, linked to the internal road system every 500m and is no further than 500m from a public road.
☐ ☐ ⃠	The technical construction requirements of widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.4b. Refer also to Appendix C in this BMP), can and will be complied with.
☐ ☐ ⃠	The FSAR can and will be signposted. Where gates are required by the relevant local government, the specifications can be complied with.
☐ ☐ ⃠	Turnaround areas (to accommodate type 3.4 fire appliances) can and will be installed every 500m on the FSAR.

Supporting Assessment Details:

None required.

A3.5 Battle-axe access legs	**Applicable**:	No	**Compliant**:	N/A

☐ ☐ ⃠	A battle-axe leg cannot be avoided due to site constraints.

☐ ☐ ⃠	The proposed development is in a reticulated area and the battle-axe access leg length from a public road is no greater than 50m. No technical requirements need to be met.
☐ ☐ ⃠	The proposed development is not in a reticulated area. The technical construction requirements for widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.5. Refer also to Appendix C in this BMP), can and will be complied with.
☐ ☐ ⃠	Passing bays can and will be installed every 200m with a minimum length of 20m and a minimum additional trafficable width of 2m.

Supporting Assessment Details

None required.

A3.6 Private driveways	**Applicable**:	Yes	**Compliant**:	Yes

☑ ☐ ☐	The private driveway to the most distant external part of the development site is within a lot serviced by reticulated water, is accessed via a public road with a speed limit of 70 km/hr or less and has a length is no greater than 70m (measured as a hose lay). No technical requirements need to be met.
☑ ☐ ☐	The technical construction requirements for widths, clearances, capacity, gradients and curves (Guidelines, Table 6 and E3.6. Refer also to Appendix C in this BMP), can and will be complied with.
☐ ☐ ⃠	Passing bays can and will be installed every 200m with a minimum length of 20m and a minimum additional trafficable width of 2m.
☑ ☐ ☐	The turnaround area requirements (Guidelines, Figure 28, and within 30m of the habitable building) can and will be complied with.

Supporting Assessment Details:

The driveway within the lot is less than 200m in length and forms a loop around the lot providing adequate access and turn around space for emergency vehicles. The internal driveway complies with the technical construction standards.

5.6 Assessment Statements for Element 4: Water

WATER	
Element Intent	To ensure water is available to enable people, property and infrastructure to be defended from bushfire.
Proposed Development/Use – Relevant Planning Stage	(Do) Development application other than for a single dwelling, ancillary dwelling or minor development
Element Compliance Statement	The proposed development/use achieves the intent of this element by being fully compliant with all applicable acceptable solutions.
Pathway Applied to Provide an Alternative Solution	N/A

Acceptable Solutions - Assessment Statements

All details of acceptable solution requirements are established in the Guidelines for Planning in Bushfire Prone Areas, DPLH v1.4 (Guidelines) and apply the guidance established by the Position Statement: 'Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design' (WAPC Nov 2019) and the 'Bushfire Management Plan Guidance for the Dampier Peninsula' (WA Department of Planning, Lands and Heritage, 2021 Rev B) as relevant. These documents are available at https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas.

The technical construction requirements for access types and components, and for each firefighting water supply component, are also presented in Appendices C and D. The local government will advise the proponent where different requirements are to apply and when any additional specifications such as those for signage and gates are to apply (these are included in the relevant appendix if requested by the local government).

Solution Component Check Box Legend	☑ Relevant & met	☒ Relevant & not met	⃠ Not relevant

E4 Water			**Compliant:**	Yes
A4.1 Identification of future firefighting water supply	**Applicable:**	No	**Compliant:**	N/A

☐ ☐ ⃠	It can be demonstrated that reticulated or sufficient non-reticulated water for firefighting can be provided at the subdivision and/or development application stage in accordance with the specifications of the relevant water supply authority or the requirements of Schedule 2.

Supporting Assessment Details:

None required.

A4.2 Provision of water for firefighting purposes	**Applicable:**	Yes	**Compliant:**	Yes

☑ ☐ ☐	A reticulated water supply is available to the proposed development. The existing hydrant connection(s) are provided in accordance with the specifications of the relevant water supply authority.
☐ ☐ ⃠	A reticulated water supply will be available to the proposed development. Hydrant connection(s) can and will be provided in accordance with the specifications of the relevant water supply authority.
☐ ☐ ⃠	A static water supply (tank) for firefighting purposes will be installed on the lot that is additional to any water supply that is required for drinking and other domestic purposes.
☐ ☐ ⃠	A strategic water supply (tank or tanks) for firefighting purposes will be installed within or adjacent to the proposed development that is additional to any water supply that is required for drinking and other domestic purposes. The required land will be ceded free of cost to the local government and the lot or road reserve where the tank is to be located will be identified on the plan of subdivision.

☐ ☐ ⃠	The strategic static water supply (tank or tanks) will be located no more than 10 minutes travel time from a subject site (at legal road speeds).
☑ ☐ ☐	The technical requirements (location, number of tanks, volumes, design, construction materials, pipes and fittings), as established by the Guidelines (A4.2, E4 and Schedule 2) and/or the relevant local government, can and will be complied with.

Supporting Assessment Details:

Hydrants are currently installed immediately outside the site boundary, at the northern entry gate and at the intersection of Delmarco Drive and Hardisty Court.

Refer to information contained in Appendix D for the firefighting water supply specifications and technical requirements.

5.7 Additional Bushfire Protection Measures to be Implemented

The following bushfire protection measures are recommended to be implemented and maintained. They are additional to, or a variation of, those established by the relevant acceptable solutions applied to the proposed development/use within Sections 5 of this BMP (as applicable to the proposed development).

The intent of their application is to improve the bushfire performance of the proposed development/use and reduce residual risk levels to persons and property from a bushfire event.

The development of these additional and/or varied protection measures originates the following potential sources (not exhaustive):

1. Out of the relevant merit based assessment when the Section titled 'Non-compliance – Additional Assessments' has been used in this BMP;
2. Out of the relevant performance based assessment when Section titled 'Non-compliance – Additional Assessments' has been used in this BMP;
3. Out of the development of any other required bushfire planning documents. These include a Bushfire Emergency Plan and the Bushfire Risk Assessment and Management Report;
4. Out of any additional bushfire planning guidance documents or position statements issued by the WA Department of Planning, Lands and Heritage;
5. From any 'Conditions' which may be applied to a 'Planning Approval' or a 'Notice of Determination; or
6. As a recommendation from the bushfire consultant.

The following table summarises the requirements/recommendations with the detail provided in the following sections.

When necessary, the implementation responsibility for these additional protection measures will be stated in Section 6 of this BMP and included in other operational documents as relevant.

SUMMARY OF ADDITIONAL BUSHFIRE PROTECTION MEASURES TO BE IMPLEMENTED					
No.	Description of the Protection Measure to Apply to the Proposed Development	BRR Ref.	Risk Reducing Component Being Applied		Implementation Priority Rating
			Type	Protection Principle	

1	The Site Operating Procedures (document title pending) should contain the following information:
	• Smoking restrictions or designated smoking locations.
	• Procedures regarding vegetation management and accidental ignition prevention.
	• Heavy equipment is not to be operated where long grass (>100mm) or heavy leaf litter is present, particularly during the bushfire season (see the Local Government Prohibited Burning Period).
	• Servicing of battery energy storage systems should not take place on days of Extreme or Catastrophic Fire Danger Rating, except where the system is experiencing malfunction or abnormal behaviour.
	• The following procedures should be completed prior to the bushfire season (see the Local Government Prohibited Burning Period):
	  o Scheduled maintenance to assets, emergency equipment, or fire detection/prevention systems.
	  o Scheduled housekeeping to remove excess leaf litter/debris from assets around the facility.
	  o The ongoing requirements outlined in the Bushfire Management Plan.
	The Emergency Management Plan and any Emergency Response Guide (FES-ERG) should contain procedures for isolation, shut-down, fail safe or management of critical/high-risk plant, equipment, and utilities, and their advised triggers.
		1.9	Threat Reduction	Prevent bushfire ignition by controlling heat energy sources.	High

2	The following additional requirements apply to the Asset Protection Zone: • A BAL-12.5 APZ is acceptable for Class 10a buildings which do not contain hazardous or flammable materials. • Class 10a buildings containing hazardous or flammable materials will apply the same APZ requirements as BESS cabinets (below).	4.3 7.3	Exposure Reduction –Buildings/Structures	Separation from Bushfire Threats	Highest

	• An APZ is to be established around BESS components and infrastructure. This APZ will ensure exposure to the bushfire hazard threat of radiant heat will be limited to a maximum radiant heat flux of 10 kW/m2 (calculated with an assumed flame temperature of 1090K) by providing the required separation distances from the bushfire hazard. • The 10m portion of the APZ immediately around BESS cabinets must be entirely and permanently non-vegetated (sealed, compacted limestone, gravel, mineral earth etc). • BESS cabinets are recommended to be sited on concrete slabs or other sealed, non-combustible surface. • No landscape planting (revegetation) should occur within the APZ to the extent of the lot boundary.				
3	Class 10a buildings which do not contain hazardous or flammable materials should be sited >6m from BESS cabinets. If a Class 10a building does contain hazardous or flammable materials, it should be sited >10m from BESS cabinets. All non-structural combustible materials are to be removed within 10m of BESS components and infrastructure. This includes but is not limited to; waste, leaf litter, machinery, grasses, vehicles, fuel, furniture, and timber. When storage of flammable items or materials are stored on site temporarily (for maintenance etc), separation distances must be complied with. This requirement is to be included in the Site Operating Procedures document.	4.7 7.7	Exposure Reduction –Buildings/Structures	Separation from Bushfire Threats	High
4	Where the decision maker requests a visual buffer (vegetation barrier), the following requirements apply: • A Landscape Management Plan will be required. • Low flammability plants should be selected, with an emphasis on tightly held platy or smooth barks and limited leaf litter accumulation. The Landscape Management Plan should outline the species selection. • The trunk of any planted tree should be located >1.5 the mature height of that tree from BESS cabinets (this need not apply to Class 10 buildings). It is therefore practical that shorter species are selected. • Shrubs may not be planted under trees. This may require a staggered design to achieve full a visual barrier.	4.11 7.11	Exposure Reduction –Buildings/Structures	Shielding from Bushfire Threats	Medium

	• Vegetation should be a minimum of 10m from BESS infrastructure. This may be confined by the lot boundary, so is a recommendation only. • Surface and near-surface fuels including grasses, low shrubs, and leaf litter must be strictly maintained. The specifications of Schedule 1 of the Guidelines for Planning in Bushfire Prone Areas v1.4 apply.				
5	Cabling and plumbing beyond the <10kW/m2 APZ, or beyond footprint of buildings or constructed assets, are recommended to be installed underground, or shielded with non-combustible material (or enclosed) where practical. This does not apply to any connections to the external power network or substations.	4.12 7.12	Exposure Reduction –Buildings/Structures	Shielding from Bushfire Threats	Lowest
6	For any future Class 10a buildings, include non-combustible structural elements where practical. In particular, avoid: polycarbonate (sheeting and skylights), softwoods (<650 kg/m3 density at 12% moisture content), and fibrous materials.	11.3	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	Lowest
7	It is recommended non-combustible elements are used for structural and supporting/associated constructions wherever practical. This includes sheds, lean-tos, verandas, shade screening, lattice, garden edging, fencing etc.	11.4 14.4	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	Medium
8	Where electrical cabling, or gas or liquid piping, contacts the ground or any arrangement of associated structures creates a 'pocket' for accumulation of debris, this should be rectified by design or filling with non-combustible material such as mineral earth. Consideration should be given to making the arrangement self-cleaning through wind action to the greatest extent possible. These measures will reduce accumulation and/or make the management (clearing) of accumulated debris easier. E.g. cable raking to be 100mm above ground.	14.8	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	Medium
9	Any subfloor cavities must have exposed subfloor spaces enclosed, sealed with non-combustible material, or be ember screened. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	11.11 14.11	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	High

10	The detailed design of any Class 10a Buildings should be reviewed to ensure it is possible for them to be fully enclosed. The manufacturer or appropriate engineers should be contacted to enquire if it is possible to apply ember screening to intake/exhaust/air conditioning vents and other paths of entry to the interior cavity or accessing any combustible elements of BESS cabinets. This ember screening would be applicable to the exterior of the battery cabinet, not internal components. The intention is to prevent both ember ingress and debris accumulation. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	11.12 14.12	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	High
11	Any Class 10a buildings must have ember screening/sealants installed on any gaps, penetrations, and external glazed elements. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	11.13	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	Medium
12	External doors (if present) should be self-closing.	14.15	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	Lowest
13	Review *FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems* for additional measures applicable to the development.	14.16	Vulnerability Reduction – Buildings/Structures	Applies Design and Construction (Materials) to Improve Resilience to Bushfire Threats	Medium
14	Automatic fire detection and suppression systems should be installed and maintained, as appropriate to the BESS details and recommended by the manufacturer.	14.19	Vulnerability Reduction – Buildings/Structures	Establish/Improve Firefighting Capability	Highest
15	Ongoing requirements established in this Risk Assessment and Section 5.7 of the associated Bushfire Management Plan, must be included in operational documents.	11.21 14.22	Vulnerability Reduction – Buildings/Structures	Ensure Effectiveness Of Applied Protection Measures is Maintained	Medium

6 RESPONSIBILITY CHECKLISTS FOR THE IMPLEMENTATION AND MANAGEMENT OF BUSHFIRE PROTECTION MEASURES

The following sections and their associated tables establish:

- The bushfire protection measures that shall be initially implemented and those requiring ongoing maintenance to the stated requirements;
- The persons responsible for the implementation and maintenance of the required bushfire protection measures; and
- The persons responsible and the timing for compliance certification when required.

The necessity for the BMP to contain this information is established by the *Guidelines for Planning in Bushfire Prone Areas* (Version 1.4, WAPC 2021) in Appendices 3 and 5.

6.1 Developer Responsibilities Prior to Issue of Certificates of Title for New Lots

TABLE 6.1(A) REQUIRED BUSHFIRE PROTECTION MEASURES - IMPLEMENTATION ACTIONS (SUBJECT TO COMPLIANCE CHECK TO BE CONDUCTED BY A BUSHFIRE CONSULTANT)	
1	For the entire area, ensure any retained vegetation can be regarded as 'low threat' when considering the relevant parameters of extent, connectivity, flammability, moisture or fuel load as per AS 3959:2018 s2.2.3.2. The requirements established by the following will also apply: • The standards established for an Asset Protection Zone (APZ) by the *Guidelines for planning in bushfire prone areas,* DPLH, 2021 v1.4, Schedule 1; or • The standards established for an Asset Protection Zone (APZ) by the relevant local government's requirements set out in a section 33 notice under the Bush Fires Act 1954 (annual firebreak/fuel load notice); or • An alternative standard in a gazetted local planning scheme; or If native vegetation is required to be modified or removed, ensure that approval has been received from the relevant authority (refer to the applicable local government for advice).
2	Construct the private driveways to comply with the technical requirements referenced in the BMP.
3	Implement the bushfire protection measures that have been established within Section 5.7 of this BMP as measures additional to those established by the acceptable solutions.

6.2 Landowner / Operator Responsibilities Prior To Commencement of Operation

TABLE 6.2(A)

REQUIRED BUSHFIRE PROTECTION MEASURES - IMPLEMENTATION ACTIONS

(SUBJECT TO COMPLIANCE CHECK TO BE CONDUCTED BY A BUSHFIRE CONSULTANT)

1	Prior to occupancy/operation establish the 'Required' Asset Protection Zone (APZ) around habitable buildings (and other structures as required) to satisfy: • The minimum required dimensions established in Appendix B1; and • The standards established by the *Guidelines for planning in bushfire prone areas,* DPLH, 2021 v1.4, Schedule 1; or • The standards established for an Asset Protection Zone (APZ) by the relevant local government's requirements set out in a section 33 notice under the Bush Fires Act 1954 (annual firebreak/fuel load notice); or • An alternative standard in a gazetted local planning scheme; or • The additional protections measures established in section 5.7 of this report. If native vegetation is required to be modified or removed, ensure that approval has been received from the relevant authority (refer to the applicable local government for advice).
2	Prior to operation, construct the private driveways to comply with the technical requirements referenced in the BMP.
3	For the 'high risk land use' there is an outstanding obligation, created by Guidelines and consequently this Bushfire Management Plan, for a 'Bushfire Risk Assessment and Management Report' to be produced. Additional protection measures that have been identified in the Report, are to be incorporated into the operation's site emergency plan (produced by the operator to address all potential emergencies).
4	Implement the additional bushfire protection measures that have been established within Section 5.7 of this BMP as measures additional to those established by the acceptable solutions.

6.3 Landowner / Operator Responsibilities – Ongoing Management

TABLE 6.3 REQUIRED BUSHFIRE PROTECTION MEASURES – ONGOING MANAGEMENT ACTIONS	
1	Maintain the 'Required' Asset Protection Zone (APZ) around habitable buildings (and other structures as required) to satisfy: • The minimum required dimensions established in Appendix B1; and • The standards established by the *Guidelines for planning in bushfire prone areas,* DPLH, 2021 v1.4, Schedule 1; or • The standards established for an Asset Protection Zone (APZ) by the relevant local government's requirements set out in a section 33 notice under the Bush Fires Act 1954 (annual firebreak/fuel load notice); or • An alternative standard in a gazetted local planning scheme; or • The additional protections measures established in section 5.7 of this report.
2	Comply with The Shire of Dardanup Fire Prevention Order issued under s33 of the Bush Fires Act 1954. Check the notice annually for any changes.
3	Maintain vehicular access routes within the lot to comply with the technical requirements referenced in the BMP and the relevant local government's annual firebreak / hazard reduction notice.
4	Ensure that builders engaged to construct dwellings/additions and/or other relevant structures on the lot, are aware of the existence of this approved Bushfire Management Plan (BMP). The plan identifies that the development site is within a designated bushfire prone area and states the indicative (or determined) BAL rating(s) that may (or will) be applied to buildings/structures. A BAL assessment report may be required to confirm determined ratings and will be required when ratings are indicative. BAL certificates will need to be issued to accompany building applications. Compliance with the Building Code of Australia (Volumes 1 and 2 of the National Construction Code), will require certain bushfire resistant construction requirements be applied to residential buildings in bushfire prone areas (i.e., Class 1, 2 and 3 and associated Class 10a buildings and decks). The deemed to satisfy solutions that will meet the relevant bushfire performance requirements are found in AS 3959 – Construction of Building in Bushfire Prone Areas (as amended) and the NASH Standard - Steel Framed Construction in Bushfire Areas (as amended). As an additional bushfire protection measure, other classes of buildings may also be required to comply with these construction requirements when established by the relevant authority or if identified as an additional bushfire protection measure within the BMP. The BMP may also establish that construction requirements to be applied will be those corresponding to a specified higher BAL rating. When applicable, these requirements will be identified in Section 5.7.
5	Ensure all future buildings the landowner has responsibility for, are designed and constructed in full compliance with: • The bushfire resistant construction requirements of the Building Code of Australia (Volumes 1 and 2 of the National Construction Code), as established by the Building Regulations 2012 (WA Building Act 2011); and • Any additional bushfire protection measures this Bushfire Management Plan has established are to be implemented.

6	Maintain the additional bushfire protection measures that have been established within Section 5.7 of this BMP as measures additional to those established by the acceptable solutions.
7	Ensure the ongoing implementation of the BMP, including providing successive landowners with a copy of the BMP and making them aware of the responsibilities it contains.

6.4 Local Government Responsibilities – Ongoing Management

TABLE 6.4 REQUIRED BUSHFIRE PROTECTION MEASURES – ONGOING MANAGEMENT ACTIONS	
1	To be aware of the potential consequences of any significant changes in the local government's management of land, of which they have vested control (including re-vegetation), that could have an adverse impact on the determined BAL ratings that apply to adjacent existing or future buildings and where: • The determined BAL ratings have been established by an existing BMP or a BAL Assessment; and • The BAL has been correctly determined with appropriate consideration of what might reasonably be expected to potentially change in the future with regards to the classification of the vegetation being altered and/or management of the relevant area of vegetation.

APPENDIX A: DETAILED BAL ASSESSMENT DATA AND SUPPORTING INFORMATION

A1: BAL Assessment Inputs Common to the Method 1 and Method 2 Procedures

A1.1: FIRE DANGER INDICES (FDI/FDI/GFDI)

When using Method 1 the relevant FDI value required to be applied for each state and region is established by AS 3959:2018, Table 2.1. Each FDI value applied in Tables 2.4 – 2.7 represents both the Forest Fire Danger Index (FFDI) and a deemed equivalent for the Grassland Fire Danger Index (GFDI), as per Table B2 in Appendix B. When using Method 2, the relevant FFDI and GFDI are applied.

The values may be able to be refined within a jurisdiction, where sufficient climatological data is available and in consultation with the relevant authority.

Relevant Jurisdiction:	WA	Region:	Whole State	Method 1	Applied FDI:	80

A1.2: VEGETATION ASSESSMENT AND CLASSIFICATION

Vegetation Types and Classification

In accordance with AS 3959:2018 Clauses 2.2.3 and C2.2.3.1, all vegetation types within 100 metres of the 'site' (defined as "the part of the allotment of land on which a building stands or is to be erected"), are identified and classified. Any vegetation more than 100 metres from the site that has influenced the classification of vegetation within 100 metres of the site, is identified and noted. The maximum excess distance is established by AS 3959: 2018 Clause 2.2.3.2 and is an additional 100 metres.

Classification is also guided by the Visual Guide for Bushfire Risk Assessment in WA (WA Department of Planning February 2016) and any relevant FPA Australia practice notes.

Modified Vegetation

The vegetation types have been assessed as they will be in their natural mature states, rather than what might be observed on the day. Vegetation destroyed or damaged by a bushfire or other natural disaster has been assessed on its expected re-generated mature state. Modified areas of vegetation can be excluded from classification if they consist of low threat vegetation or vegetation managed in a minimal fuel condition, satisfying AS 3959:2018 Clause 2.2.3.2(f), and there is sufficient justification to reasonable expect that this modified state will exist in perpetuity.

The Influence of Ground Slope

Where significant variation in effective slope exists under a consistent vegetation type, these will be delineated as separate vegetation areas to account for the difference in potential bushfire behaviour, in accordance with AS 3959:2018 Clauses 2.2.5 and C2.2.5.

THE INFLUENCE OF VEGETATION GREATER THAN 100 METRES FROM THE SUBJECT SITE	
Vegetation area(s) within 100m of the site whose classification has been influenced by the existence of bushfire prone vegetation from 100m – 200m from the site:	None
Assessment Statement:	No vegetation types exist close enough, or to a sufficient extent, within the relevant area to influence classification of vegetation within 100 metres of the subject site.

VEGETATION AREA 1						
Classification	**A. FOREST**					
Types Identified	Low open forest A-04					
Exclusion Clause	N/A					
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees		
Foliage Cover of Tallest Plant Layer	30-70%	Shrub/Heath Height	1-2m	Tree Height	Up to 30m	
Justification Comments	Low open forest with a mix of species composition creating a ground layer, a mid-storey and a taller trees. Tree species are dominated by Peppermint Trees, Melaleuca, Eucalyptus, and some Shea Oak. Higher levels of ground fuel from leaf litter and dry grasses.					
Post Development Assumptions:	N/A					

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<table>
<tr><th colspan="8">VEGETATION AREA 2</th></tr>
<tr><td>Classification</td><td colspan="7">D. SCRUB</td></tr>
<tr><td>Types Identified</td><td colspan="7">Open scrub D-14</td></tr>
<tr><td>Exclusion Clause</td><td colspan="7">N/A</td></tr>
<tr><td>Effective Slope</td><td>Determined</td><td colspan="2">flat 0 degrees</td><td colspan="2">Applied Range (Method 1)</td><td colspan="2">Upslope or flat 0 degrees</td></tr>
<tr><td>Foliage Cover of Tallest Plant Layer</td><td colspan="2">10-30%</td><td>Shrub/Heath Height</td><td>>2m</td><td colspan="2">Tree Height</td><td>-</td></tr>
<tr><td>Justification Comments</td><td colspan="7">A small area of melaleucas within an isolated patch of vegetation. Tall grasses underneath.</td></tr>
<tr><td colspan="2">Post Development Assumptions:</td><td colspan="6">N/A</td></tr>
<tr><td colspan="8">
</td></tr>
<tr><td colspan="4">PHOTO ID: 5</td><td colspan="4"></td></tr>
</table>

VEGETATION AREA 3						
Classification	**G. GRASSLAND**					
Types Identified	Tussock grassland G-22	Sown pasture G-26				
Exclusion Clause	N/A					
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees		
Foliage Cover of Tallest Plant Layer	-	Shrub/Heath Height	<2m	Tree Height	-	
Justification Comments	Areas of unmanaged grassland with large areas of grassland used for grazing livestock.					
Post Development Assumptions:	N/A					

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VEGETATION AREA 3					
Exclusion Clause	2.2.3.2 (e) non-vegetated areas and (f) vegetation managed in a minimal fuel condition.				
Effective Slope	Determined	-	Applied Range (Method 1)	-	
Foliage Cover of Tallest Plant Layer	-	Shrub/Heath Height	-	Tree Height	-
Justification Comments	Excluded areas include those that are permanently non-vegetated such as roads, footpaths, driveways, car parks and buildings. As well as areas of low bushfire threat such as maintained lawns and road verges, patches of gravel or dirt that are to be developed.				
Post Development Assumptions:	N/A				

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PHOTO ID: 11

	
PHOTO ID: 12	PHOTO ID: 13

A1.3: EFFECTIVE SLOPE

EXPLAINING THE ASSESSMENT METHODOLOGY APPLIED BY BUSHFIRE PRONE PLANNING

DEFINITION: Effective slope is "the slope under that classified vegetation which most influences the bushfire attack" (AS 3959:2018, Clause 1.5.11).

"The effective slope under the classified vegetation is not the same as the average slope for the land surrounding the site of the proposed building. The effective slope is that slope which most significantly influences bushfire behaviour" (AS 3959:2018, Clause CB4).

The slope is described as upslope, flat or downslope when viewed from an exposed element (e.g., building) and looking towards the vegetation. It is measured in degrees.

[Note: Additional relevant guidance provided by AS 3959:2018 and NSW RFS, Planning for Bushfire Protection (2019) is incorporated into the applied assessment methodology and is presented at the end of this explanation.]

COMPOUND SLOPES UNDER VEGETATION AND DETERMINING SLOPE SIGNIFICANCE

Non-Linear Slopes: When the slope of ground under the vegetation out to the distance to be assessed (100 m or further if necessary), is not a straight line or nearly straight line slope, then it is made up of several different slopes i.e., it is a compound slope. The different slope angles and lengths must be factored into the determination of the effective slope value to be applied. Different slopes will potentially influence the bushfire rate of spread and intensity, both increasing and decreasing it.

Significant Slope: The AS 3959:2018 bushfire attack level determination methodology, with default inputs, models a fully developed bushfire. Therefore, a 'significant' slope is one that will significantly influence bushfire behaviour. To be 'significant' the length of the slope must be 'sufficient' to support a fully developed fire on that slope. The angle of a significant slope could be the determined effective slope for the area of classified vegetation if it is the one that 'most influences the bushfire attack'.

Sufficient Slope Length: Is a slope that will, as a minimum, allow the entire flame depth (flaming zone) of a fully developed fire (100m flame width) to exist on that slope.

The expected flame depth of a fully developed bushfire is a function of the length of time the flaming phase will exist on a section of the fuel bed (the 'residence time') and the bushfire's 'rate of spread'. For a given rate of spread, longer residence times result in greater flame depths. Greater flame depths are correlated with greater flame temperatures and greater flows of radiant heat.

The primary factors that will increase the residence time are:

- Heavier fine fuel loads of grass, leaf litter, twigs, bark etc less than 6mm in width and existing within the surface and near surface layers (and elevated fuel layers when contiguous with the base layers); and
- A greater percentage of larger fine fuels within the fuel load.

The primary factors that increase the rate of spread (apart from fire weather factors), include finer fuels, drier fuels, horizonal continuity of fuel and steeper upward ground slope in the direction of fire travel.

Example values:

- Residence Time: Grassfire 5 – 15 seconds, Forest fire 25 -50 seconds.
- Rate of Spread: Grassfires of a few km/hr are considered fast moving, 5-10 km/hr is common and fastest in the order of 25km/hr. Forest fire typically recorded in metres/hour with 1-1.5 km/hr being considered fast moving and fastest in the order of 3–4 km/hr.
- Flame Depth: More typically, a few metres for grasses to tens of metres for forest fires.

An Isolated Slope: For scenarios where there is a single significant slope (based on the above criteria) additional consideration would need to be given to the time and distance consumed by a bushfire still in its 'developing' phase. This will require due consideration be given to how it is potentially ignited i.e., from a single or multiple points, as this will influence the time and distance required to fully develop. For such scenarios, a normally significant slope may not be sufficiently long. It may be necessary to determine the potential bushfire impact more accurately by justifying the application of a lesser effective slope, or a lower threat vegetation classification, or calculating a reduced headfire width (using short fire run modelling).

Determined Effective Slope: Only a 'significant' slope can potentially be the effective slope by itself. In which case, for a defined vegetation area, the worst significant slope under that vegetation is to apply.

The table below indicates Bushfire Prone Planning's considerations in assessing short and/or compound slopes to determine the effective slope.

Slope Length (m)	Considered a Significant Slope	Considerations in Determining the Effective Slope
< 5	No	The single length of slope can be ignored.
5-20	No	The influence of the slope, even though reduced, must still be recognised to an appropriate degree by the determined effective slope.
20-30	Possibly Not – But Requires Justification	Consider likely bushfire hazard threat levels (direct attack mechanisms) within the general assessment area as influenced by local topography, vegetation extents and types. Consider the potential for preheating and ignition source impacts from bushfire on adjoining or nearby land onto vegetation on the subject slope. Isolated slopes of this length are less likely to be considered significant. Consider if vegetation on the slope is likely be ignited by a single ignition point or is multipoint ignition possible from bushfire an adjoining slopes or the surrounding area. Single point ignition will require a fire to travel further before being fully developed (DFES considers less than 100m fire runs may be considered a short fire run for forest, woodland and scrub vegetation classifications). If considered not significant, the influence of the slope, even though reduced, must still be recognised to an appropriate degree by the determined effective slope.
>30	Yes	Will likely always be a significant slope (unless isolated – in which case, justifying the application of a lesser effective slope, or a lower threat vegetation classification, or calculating a reduced headfire width.

BPP Approach - Slope Variation Within Areas of Vegetation

Where a significant variation in effective slope exists under a consistent vegetation type, these will be delineated as separate vegetation areas to account for the difference in potential bushfire behaviour and impact, in accordance with AS 3959:2018 clauses 2.2.5 and C2.2.5.

Effective Slope Variation Due to Multiple Development Sites

When the effective slope, under a single area of bushfire prone vegetation, will vary significantly relative to multiple proposed development sites (exposed elements), then the effective slopes corresponding to each of the different locations, are separately identified. The relevant (worst case) effective slope is determined in the direction corresponding to the potential directions of fire spread towards the subject building(s).

AS 3959:2018 EFFECTIVE SLOPE DETERMINATION - GUIDANCE

The Standard presents a broad set of guidance statements that indicate the intent of deriving an effective slope value for use in calculations, rather than detailing the 'in the field' determination process. These include:

- Highlighting the importance of the value by stating "The slope of the land under the classified vegetation has a direct influence on the rate of fire spread, severity of the fire and the ultimate level of radiant heat flux" (Clause C2.2.5). [Note: A common rule of thumb is that for every 10 degrees of upslope, a fire will double its rate of spread if moving in the direction of the prevailing wind. Fires travel slower down a slope].

- It may be necessary to consider the slope under the classified vegetation for distances greater than 100 m in order to determine the effective slope for that vegetation classification.

- "Where there is more than one slope within the classified vegetation, each slope shall be individually assessed, and the worst case Bushfire Attack Level shall apply" (Clause 2.2.5).

NSW RFS 2019, PLANNING FOR BUSHFIRE PROTECTION - APPENDIX A1.5 - ADDITIONAL DETERMINATION GUIDANCE

- "In identifying the effective slope, it may be found that there are a variety of slopes covering different distances within the vegetation. The effective slope is considered to be the slope under the vegetation which will most significantly influence the bushfire behaviour for each aspect. This is usually the steepest slope. In situations where this is not the case, the proposed approach must be justified".
- "Vegetation located closest to an asset may not necessarily be located on the effective slope".

SITE ASSESSMENT DETAILS - EXPLANATION & JUSTIFICATION

The effective slopes determined from the site assessment are recorded in Table 3.2 of this Bushfire Management Plan.

A1.4: SEPARATION DISTANCE

Measuring

The separation distance is the distance in the horizontal plane between the receiver (building/structure or area of land being considered) and the edge of the classified vegetation (AS 3959:2018, clause 2.2.4)

The relevant parts of a building/structure from which the measurement is taken is the nearest part of an external wall or where a wall does not exist, the supporting posts or columns. Certain parts of buildings are excluded including eaves and roof overhangs.

The edge of the vegetation, for forests and woodlands, will be determined by the unmanaged understorey rather than either the canopy (drip line) or the trunk (AS 3959:2018, clause C2.2.5).

Measured Separation Distance as a Calculation Input

If a separation distance can be measured because the location of the building/structure relative to the edge of the relevant classified vegetation is known, this figure can be entered into the BAL calculation. The result is a determined BAL rating.

Assumed Separation Distance as a Calculation Input

When the building/structure location within the lot is not known, an assumed building location may be applied that would establish the closest positioning of the building/structure relative to the relevant area of vegetation.

The assumed location would be based on a factor that puts a restriction on a building location such as:

- An established setback from the boundary of a lot, such as a residential design code setback or a restrictive covenant; or
- Within an established building envelope.

The resultant BAL rating would be indicative and require later confirmation (via a Compliance Report) of the building/structure actual location relative to the vegetation to establish the determined BAL rating.

Separation Distance as a Calculation Output

With the necessary site specific assessment inputs and using the AS 3959:2018 bushfire modelling equations, the range of separation distances that will correspond to each BAL rating (each of which represents a range of radiant heat flux), can be calculated. This has application for bushfire planning scenarios such as:

- When the separation distance cannot be measured because the exact location of the exposed element (i.e., the building, structure or area), relative to classified vegetation, is yet to be determined.

  In this scenario, the required information is the identification of building locations onsite that will correspond to each BAL rating. That is, indicative BAL ratings can be derived for a variety of potential building/structure locations; or

- The separation distance is known for a given building, structure or area (and a determined BAL rating can be derived), but additional information is required regarding the exposure levels (to the transfer of radiant heat from a bushfire), of buildings or persons, that will exist at different points within the subject site.

The calculated range of separation distances corresponding to each BAL rating can be presented in a table and/or illustrated as a BAL Contour Map – whichever is determined to best fit the purpose of the assessment.

For additional information refer to the information boxes in Section 3 'Bushfire Attack Levels (BAL) - Understanding the Results and Section 3.2. 'Interpretation of the BAL Contour Map'.

SITE ASSESSMENT DETAILS - EXPLANATION & JUSTIFICATION

For the subject development/use the applicable separation distances values are derived from calculations applying the assessed site data. They are an output value, not an input value and therefore are not presented or justified in this appendix.

The derived values are presented in Section 3, Table 3.1 and illustrated as a BAL contour map in Figure 3.2.

A2: BAL Calculator – Copy of Input/Output Values

Method 2 principles have been used to determine Recommended APZ dimensions for the proposed infrastructure, corresponding to radiant heat flux of 10Kw/m² for Forest at 0° effective slope, Scrub at 0° effective slope and Grassland at 0° effective slope. Note that 1090K flame temperature was used as the development is not considered a vulnerable land use.

FLAMESOL
FPA AUSTRALIA

Calculated November 30, 2023, 2:06 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	2.4 km/h
Vegetation classification	Forest	Flame length	19.8 m
Understorey fuel load	25 t/ha	Flame angle	52 °, 61 °, 69 °, 73 °, 74 ° & 81 °
Total fuel load	35 t/ha	Elevation of receiver	7.8 m, 8.65 m, 9.24 m, 9.460000000000001 m, 9.51 m & 9.77 m
Vegetation height	n/a	Fire intensity	43,400 kW/m
Effective slope	0 °	Transmissivity	0.863, 0.841, 0.8110000000000001, 0.786, 0.773 & 0.716
Site slope	0 °	Viewfactor	0.6085, 0.4531, 0.3066, 0.2086, 0.1696 & 0.0458
Flame width	100 m	Minimum distance to < 40 kW/m²	16.1 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	21.5 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	30.6 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	41.9 m
		Minimum distance to < 10 kW/m²	48.9 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

BUSHFIRE PRONE PLANNING

FLAMESOL FPA AUSTRALIA

Calculated November 30, 2023, 2:07 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	4.16 km/h
Vegetation classification	Scrub	Flame length	11.62 m
Understorey fuel load	25 t/ha	Flame angle	53 °, 63 °, 72 °, 76 °, 78 ° & 83 °
Total fuel load	25 t/ha	Elevation of receiver	4.64 m, 5.18 m, 5.52 m, 5.64 m, 5.68 m & 5.77 m
Vegetation height	m	Fire intensity	53,815 kW/m
Effective slope	0 °	Transmissivity	0.878, 0.862, 0.838, 0.8139999999999999, 0.8 & 0.735
Site slope	0 °	Viewfactor	0.5988, 0.4419, 0.2962, 0.2016, 0.1638 & 0.0446
Flame width	100 m	Minimum distance to < 40 kW/m²	9.6 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	13 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	19.3 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	27.5 m
		Minimum distance to < 10 kW/m²	32.9 m

Rate of Spread - Catchpole et al. 1998
Flame length - Byram, 1959
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

FLAMESOL FPA AUSTRALIA

Calculated January 24, 2024, 11:48 am (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Understorey fuel load	4.5 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	4.5 t/ha	Elevation of receiver	2.78 m, 3.08 m, 3.28 m, 3.36 m, 3.38 m & 3.42 m
Vegetation height	n/a	Fire intensity	33,247 kW/m
Effective slope	0 °	Transmissivity	0.887, 0.877, 0.861, 0.841, 0.829 & 0.755
Site slope	0 °	Viewfactor	0.5823, 0.4291, 0.29, 0.1946, 0.158 & 0.0434
Flame width	100 m	Minimum distance to < 40 kW/m²	5.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	7.9 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	11.7 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	17.3 m
		Minimum distance to < 10 kW/m²	21.2 m

Rate of Spread - Noble et al. 1980
Flame length - Purton, 1982
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

APPENDIX B: ADVICE - ONSITE VEGETATION MANAGEMENT - THE APZ

THE ASSET PROTECTION ZONE (APZ) – DESCRIPTION AND OBJECTIVES

Description: The asset protection zone (APZ) is the area of land surrounding a building or structure on which any combustible materials will be located and/or managed to reduce the potential impact of the direct and indirect attack mechanisms (threats) of bushfire, and therefore reduce the associated risks of building/structure damage or loss, to acceptable levels.

When cultivated and/or natural vegetation exists within the zone it must present low potential threat levels from the direct fire attack mechanisms of flame contact, radiant heat and ember attack and fire driven wind, and the indirect attack mechanisms of debris accumulation, surface fire, tree strike and consequential fire.

The required low threat levels will be achieved as the result of factors that include persistent higher fuel moisture contents, lower flammability and/or minimal fuel loads, due to either limiting the existence of these fuels through removal and/or modification, and the subsequent ongoing management (reduction) of fuel loads.

When a bushfire attack level (BAL) is required to be determined for a building/structure to establish its bushfire construction requirements, the condition of the vegetation within the APZ must satisfy the requirements established by *clause 2.2.3.2 of AS 3959:2018 Construction of buildings in bushfire prone areas* - to be excluded from classification.

For other combustible structures/materials within the APZ, lower threat levels will be the result of factors such as their appropriate use, lowered vulnerability and location relative to the primary building/structure to be protected.

Objectives: The primary objectives of establishing a low threat area surrounding buildings/structures are to create that performs the following functions:

1. To establis an APZ of specified dimensions ensure the building is sufficiently separated from the identified bushfire hazard to limit the impact of its direct attack mechanisms. The required dimensions of the APZ must:

   - Remove the potential for direct flame contact on the building;

   - Reduce the level of radiant heat to which the building is exposed. The APZ dimensions should ensure that the potential level of radiant heat impact corresponds to the level of vulnerability of the building/structure - as determined by the degree to which bushfire resistant construction has been applied (or not). For example, when constructed to the requirements corresponding to its determined exposure to radiant heat (measured as a bushfire attack level) in accordance with AS 3959 or the NASH Standard.

   - Ensure some reduction in the threat level of the ember/burning debris attack mechanism when higher threat vegetation types are present in the vicinity. Note, the reduction in some scenarios will be minimal given the produced quantity, type, survival time and consequent distance that certain embers/burning debris can travel.

     Be aware of that research has identified that consequential fire, ignited by embers, is the primary cause (>80%) of building loss in past Australian bushfire events. In bushfire prone areas, the importance of applying protection measures to prevent ember entry to buildings/structures and minimising the existence of consequential fire fuels cannot be overstated.

2. To ensure any combustible fuels (debris and structures) or trees that remain within the APZ will be managed and located to limit the potential impact of the indirect attack mechanisms of bushfire by:

   - Minimising the accumulation of debris on, within and around buildings/structures to limit this source of fuel for consequential fires that will result in the direct fire attack mechanisms of flames and greater radiant heat existing closer to the buildings/structures, even though the bushfire hazard exists at a greater distance away;

   - To prevent surface fire moving through the APZ and closer to buildings/structures than the fire in the bushfire hazard itself can;

- Prevent fire weakened or windblown trees/branches impacting buildings/structures and allowing ember/burning debris entry;
- To ensure other combustible materials that can result in a consequential fire ignited by embers/burning debris), within both the APZ and parts of the building, are eliminated, minimised and/or appropriately located or protected (the explanatory notes in the Guidelines provide some guidance for achieving this objective and other sources are available); and

3. To provide a defendable space for firefighting activities.

B1: Asset Protection Zone (APZ) Dimensions

APZ DIMENSIONS – DIFFERENCES IN REQUIREMENTS FOR PLANNING ASSESSMENTS COMPARED TO IMPLEMENTATION

THE 'PLANNING BAL-29' APZ DIMENSIONS

The 'Planning BAL-29' APZ is not necessarily the size of the APZ that must be physically implemented and maintained by a landowner. Rather, its purpose is to identify if an acceptable solution for planning approval can be met i.e., can a specified minimum separation distance from bushfire prone vegetation exist.

An assessment against the Bushfire Protection Criteria is conducted for planning approval purposes. To satisfy 'A2.1: Asset Protection Zone', it must be demonstrated that certain minimum separation distances between the relevant building/structure and different classes of bushfire prone vegetation, either exist or can be created and will remain in perpetuity. These minimum separation distances determine the 'Planning BAL-29' APZ dimensions.

Dimensions: The minimum dimensions are those that will ensure the potential radiant heat impact on subject buildings does not exceed 29 kW/m^2. These dimensions will vary dependent on the vegetation classification, the slope of the land they are growing on and certain other factors specific to the subject site.

Note: For certain purposes associated with vulnerable land uses, the 'Planning BAL-29' APZ may be replaced with dimensions corresponding to radiant heat impact levels of 10 kW/m^2 and 2 kW/m^2 and calculated using 1200K flame temperature.

Location: The identified 'Planning BAL-29' APZ must not extend past lot boundaries onto land the landowner has no control over either now or potentially at some point in the future. Limited exceptions include:

- When adjoining land is not vegetated (e.g., built out, roads, carparks, drainage, rock, water body etc.);
- When adjoining land currently or, will in the short term, contain low threat vegetation and or vegetation managed in a minimal fuel condition as per AS 3959:2018 cl. 2.2.3.2. It must be reasonable (justifiable) to expect this low threat vegetation and/or level of management will continue to exist or be conducted in perpetuity and require no action from the owner of the subject lot.

  Such areas of land include formally managed areas of vegetation (e.g., public open space / recreation areas / services installed in a common section of land). For specific scenarios, evidence of the formal commitment to manage these areas to a certain standard may be required and would be included in the BMP.

  These areas of land can also be part of the required APZ on a neighbouring lot for which the owner of that lot has a recognised responsibility to establish and maintain; and
- When there is a formalised and enforceable capability and responsibility created for the subject lot owner, or any other third party, to manage vegetation on land they do not own in perpetuity. This would be rare, and evidence of the formal authority would be included in the BMP.

The bushfire consultant's 'Supporting Assessment Detail', that is presented in the assessment against the acceptable solution A2.1, will identify and justify how any adjoining land within the 'Planning BAL-29 APZ will meet the APZ standards. Or otherwise, explain how this condition cannot be met.

THE 'BAL RATING' APZ DIMENSIONS

The applicable BAL rating will have been stated in the BAL Assessment Data section of the BAL Assessment Report or BMP (as relevant). The BAL rating can be assessed as 'determined' or 'indicative' or be 'conditional', dependent of the specific conditions associated with the site and the stage of assessment or planning. It is the eventual assessment of the 'Determined' BAL that will establish both the BAL rating that is to apply and its corresponding 'BAL Rating' APZ dimensions.

Dimensions: The minimum dimensions of the 'BAL Rating' APZ to be established and maintained will be those that correspond to the determined BAL rating for the subject building/structure that has accounted for surrounding vegetation types, the slope of the land they are growing on and certain other factors specific to the subject site and surrounding land.

Establishing the 'BAL Rating' APZ will ensure that the potential radiant heat exposure of the building/structure will be limited to the level that the applied construction requirements are designed to resist when that building/structure is required to be constructed to the standard corresponding to the Determined BAL.

Note: For certain purposes associated with vulnerable land uses, the 'BAL Rating' APZ dimensions may be replaced with dimensions corresponding to the specific radiant heat impact levels of 10 kW/m² and 2 kW/m² and calculated using 1200K flame temperature.

Location: The same conditions will apply as for the 'Planning BAL-29' APZ.

THE 'LOCAL GOVERNMENT' APZ DIMENSIONS

Some Local Government's establish the dimensions of the APZ that must be established surrounding buildings in their annual Firebreak/Hazard Reduction Notice. Or for a specific site they may establish a maximum allowable dimension (typically that corresponding to BAL-29). When established, the landowner will need to be comply with these.

THE 'REQUIRED' APZ DIMENSIONS

This is the APZ that is to be established and maintained by the landowner within the subject lot and surrounding the subject building(s). It will be identified on the Property Bushfire Management Statement when it is required to be included in this Report/Plan.

Dimensions: The 'Required APZ' dimensions are the minimum (or maximum when relevant) distances away from the subject building(s) that the APZ must extend. These distances will not necessarily be the same all around the building(s). They can vary and are dependent on the different vegetation types (and their associated ground slope) that can exist around the building(s), and specific local government requirements. The dimensions to implement are determined by:

A. The 'BAL Rating APZ' of the subject building(s) when distances are greater than 'B' below (except when 'B' establishes a maximum distance); or

B. The 'Local Government' APZ' derived from the Firebreak/Hazard Reduction Notice when distances are greater than 'A' above, other than when a maximum distance is established, in which case this will apply; or

C. A combination of 'A' and 'B'.

Location: The same conditions will apply as for the 'Planning BAL-29' APZ.

B1.1: THE APZ DIMENSIONS REQUIRED TO BE IMPLEMENTED BY THE LANDOWNER

DETERMINATION OF THE 'REQUIRED' APZ DIMENSIONS TO BE IMPLEMENTED AND MAINTAINED BY LANDOWNER WITHIN THEIR LOT

Relevant Asset(s)	Vegetation Classification [Refer to Fig 3.1]		Minimum Required Separation Distances from Building to Vegetation (metres)							
			Established by the 'BAL Rating' APZ Dimension					Established by the "Local Government' APZ Dimension		The 'Required' APZ Dimensions [see note]
			Determined Radiant Heat Impact	Stated 'Indicative' or 'Conditional' BAL				Firebreak / Hazard Reduction Notice	Maximum Allowed	
	Area	Class	10 kW/m2	BAL-29	BAL-19	BAL-12.5	BAL-LOW		N/A	
BESS Cabinets and associated infrastructure	1	(A) Forest	48.9	21	31	42	100	20	-	48.9
	2	(D) Scrub	32.9	13	19	27	100		-	32.9
	3	(G) Grassland	20.3	8	12	17	50		-	21.2
	4	Excluded cl 2.2.3.2(e & f)	-	-	-	-	-		-	-

Note: The 'Required' APZ Dimension corresponding to each area of vegetation is the greater of the 'BAL Rating' or the 'Firebreak/Hazard Reduction Notice' APZ dimensions - unless a local government maximum distance(s) is established as a result of their environmental assessment of the subject site. The area of the APZ will also be limited to the subject lot boundary unless otherwise justified in this Report/Plan. Final determination of the dimensions will require that any indicative or conditional BAL becomes a 'Determined' BAL.

B2: The Standards for the APZ as Established by the Guidelines (DPLH, v1.4)

Within the Guidelines (source: https://www.wa.gov.au/government/document-collections/state-planning-policy-37-planning-bushfire-prone-areas), the management Standards are established by:

- Schedule 1: Standards for Asset Protection Zones (see extract below) established by the Guidelines; and
- The associated explanatory notes (Guidelines E2) that address (a) managing an asset protection zone (APZ) to a low threat state (b) landscaping and design of an asset protection zone and (c) plant flammability.

Guidelines for Planning in Bushfire Prone Areas

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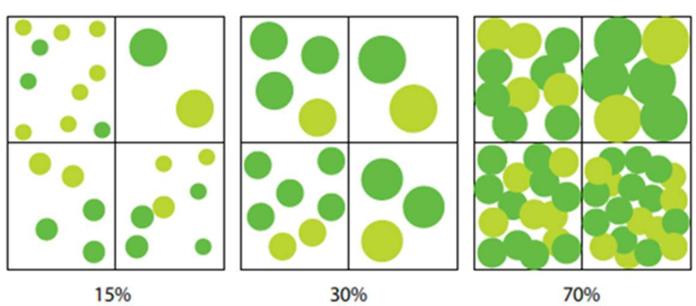
ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

OBJECT	REQUIREMENT
Fences within the APZ	• Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959).
Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness)	• Should be managed and removed on a regular basis to maintain a low threat state. • Should be maintained at <2 tonnes per hectare (on average). • Mulches should be non-combustible such as stone, gravel or crushed mineral earth or wood mulch >6 millimetres in thickness.
Trees* (>6 metres in height)	• Trunks at maturity should be a minimum distance of six metres from all elevations of the building. • Branches at maturity should not touch or overhang a building or powerline. • Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation. • Canopy cover within the APZ should be <15 per cent of the total APZ area. • Tree canopies at maturity should be at least five metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ.

Figure 19: Tree canopy cover – ranging from 15 to 70 per cent at maturity



Shrub* and scrub* (0.5 metres to six metres in height). Shrub and scrub >6 metres in height are to be treated as trees.	• Should not be located under trees or within three metres of buildings. • Should not be planted in clumps >5 square metres in area. • Clumps should be separated from each other and any exposed window or door by at least 10 metres.
Ground covers* (<0.5 metres in height. Ground covers >0.5 metres in height are to be treated as shrubs)	• Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above. • Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.
Grass	• Grass should be maintained at a height of 100 millimetres or less, at all times. • Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
Defendable space	• Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
LP Gas Cylinders	• Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building. • The pressure relief valve should point away from the house. • No flammable material within six metres from the front of the valve. • Must sit on a firm, level and non-combustible base and be secured to a solid structure.

** Plant flammability, landscaping design and maintenance should be considered – refer to explanatory notes*

B3: The Standards for the APZ as Established by the Local Government

Refer to the firebreak / hazard reduction notice issued annually (under s33 of the Bushfires Act 1954) by the relevant local government. It may state Standards that vary from those established by the Guidelines and that have been endorsed by the WAPC and DFES as per Section 4.5.3 of the Guidelines.

A copy of the applicable notice is not included here as they are subject to being reviewed and modified prior to issuing each year. Refer to ratepayers notices and/or the local government's website for the current version.

B4: Vegetation and Areas Excluded from Classification - Ensure Continued Exclusion

AS 3959:2018 establishes the methodology for determining a bushfire attack level (BAL). The methodology includes the classification of the subject site's surrounding vegetation according to their 'type' and the application of the corresponding relevant bushfire behaviour models to determine the BAL.

Certain vegetation can be considered as low threat or managed in a minimal fuel condition and can be excluded from classification. Where this has occurred in assessing the site, the extract from AS3959:2018 below states the requirements that must continue to exist for the vegetation on those areas of land to be excluded from classification (including the size of the vegetation area if relevant to the assessment).

15 AS 3959:2018

2.2.3.2 *Exclusions—Low threat vegetation and non-vegetated areas*

The following vegetation shall be excluded from a BAL assessment:

(a) Vegetation of any type that is more than 100 m from the site.

(b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified vegetation.

(c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other or of other areas of vegetation being classified vegetation.

(d) Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.

(e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

(f) Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks.

NOTES:

1 Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).

2 A windbreak is considered a single row of trees used as a screen or to reduce the effect of wind on the leeward side of the trees.

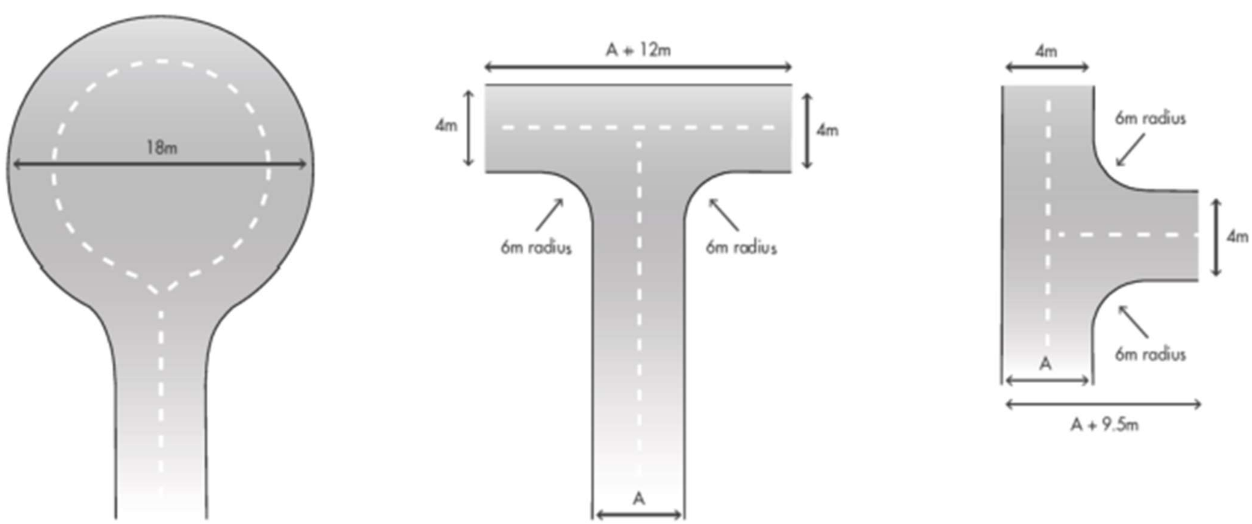
APPENDIX C: TECHNICAL REQUIREMENTS FOR VEHICULAR ACCESS

The design/layout requirements for access are established by the acceptable solutions of the Guidelines (DPLH, 2021 v1.4) Element 3 and vary dependent on the access component, the land use and the presence of 'vulnerable' persons. Consequently, the best reference source are the Guidelines. The technical requirements that are fixed for all components and uses are presented in this appendix.

GUIDELINES TABLE 6, EXPLANATORY NOTES E3.3 & E3.6 AND RELEVANT ACCEPTABLE SOLUTIONS

Technical Component	Vehicular Access Types / Components			
	Public Roads	Emergency Access Way [1]	Fire Service Access Route [1]	Battle-axe and Private Driveways [2]
Minimum trafficable surface (m)	In accordance with A3.1	6	6	4
Minimum Horizontal clearance (m)	N/A	6	6	6
Minimum Vertical clearance (m)	4.5			
Minimum weight capacity (t)	15			
Maximum Grade Unsealed Road [3]	As outlined in the IPWEA Subdivision Guidelines	1:10 (10%)		
Maximum Grade Sealed Road [3]		1:7 (14.3%)		
Maximum Average Grade Sealed Road		1:10 (10%)		
Minimum Inner Radius of Road Curves (m)		8.5		

Turnaround Area Dimensions for No-through Road, Battle-axe Legs and Private Driveways [4]



Passing Bay Requirements for Battle-axe leg and Private Driveway

When the access component length is greater than the stated maximum, passing bays are required every 200m with a minimum length of 20m and a minimum additional trafficable width of 2m (i.e. the combined trafficable width of the passing bay and constructed private driveway to be a minimum 6m).

Emergency Access Way – Additional Requirements

Provide a through connection to a public road, be no more than 500m in length, must be signposted and if gated, gates must be open the whole trafficable width and remain unlocked.

[1] To have crossfalls between 3 and 6%.

[2] Where driveways and battle-axe legs are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

[3] Dips must have no more than a 1 in 8 (12.5% or 7.1 degree) entry and exit angle.

[4] The turnaround area should be within 30m of the main habitable building.

APPENDIX D: TECHNICAL REQUIREMENTS FOR FIREFIGHTING WATER SUPPLY

D1: Reticulated Areas – Hydrant Supply

The Guidelines state "where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority."

The main scheme water suppliers / authorities in WA are The Water Corporation, AqWest – Bunbury Water Corporation and Busselton Water Corporation. Various local authority exists in other non-scheme and regional areas. However, most existing fire hydrants are connected to Water Corporation water mains.

Consequently, the hydrant location specifications from The Water Corporation's 'No 63 Water Reticulation Standard' (Ver 3 Rev 15) are provided in the extract below with the key distances relevant to bushfire planning assessments being highlighted. This Standard is deemed to be the baseline criteria for developments and should be applied unless different local water supply authority conditions apply. Other applicable specification will be found in the Standard.

Note: The maximum distance from a hydrant to the rear of a lot/building is generally interpreted as not applicable to large lot sizes where the maximum distance becomes an impractical limitation i.e., typically rural residential areas.

Design Standard DS 63
Water Reticulation Standard

WATER

2.2.1.5 Appurtenances

c. Hydrants

Hydrants shall be screw-down hydrant with built-in isolation valve and installed only on DN100 or larger pipes. Hydrants shall be located:

- so that the maximum distance between a hydrant and the rear of a building envelope, (or in the absence of a building envelope the rear of the lot) shall be 120m;
- so that spacing (as measured by hose-run) between hydrants in non-residential or mixed use areas shall be maximized and no greater than 100m;
- so that spacing (as measured by hose-run) between hydrants in residential areas with lots per dwelling <10,000m² shall be maximized and no greater than 200m;
- so that spacing between hydrants (as measured by hose-run) in rural residential areas where minimum lots per dwelling is >10,000 m² (1ha) shall be maximized and no greater than 400m;
- centrally along the frontage of a lot to avoid being under driveways, unless the lot features a frontage 6m or less, in which case it shall be placed to the side opposite the driveway;
- at lots that have the widest frontage in the local area;
- where appropriate at the truncation of road junctions or intersections so that they can serve more than one street and can be readily located;
- on both sides of the major roads at staggered intervals where there are mains on both sides of the road;
- at major intersections on dual multi-lane roads, where two hydrants are to be sited on diagonally opposite corners;
- hydrants should be located at least 20m from traffic calming devices i.e., median slow points or chokers, chicanes, mini traffic circles, and intersection 'pop-outs' to ensure traffic is not impeded;
- in a position not less than 10m from any high voltage main electrical distribution equipment such as transformers and distribution boards, liquefied petroleum gas or other combustible storage;
- directly on top of the main using a tee unless proved to be impractical.

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D2: Non-Reticulated Areas – Static Supply

For specified requirements, refer to the Guidelines Element 4: Water – Acceptable Solution A4.2 , Explanatory Notes E4 (that provide water supply establishment detail under the headings of water supply; independent water and power supply; strategic water supplies, alternative water sources and location of water tanks) and the technical requirements established by Schedule 2 (reproduced below).

SCHEDULE 2: WATER SUPPLY DEDICATED FOR BUSHFIRE FIREFIGHTING PURPOSES

2.1 Water supply requirements

Water dedicated for firefighting should be provided in accordance with Table 7 below, and be in addition to water required for drinking purposes.

Table 7: Water supply dedicated for bushfire firefighting purposes

PLANNING APPLICATION	NON-RETICULATED AREAS
Development application	10,000L per habitable building
Structure Plan / Subdivision: Creation of 1 additional lot	10,000L per lot
Structure Plan / Subdivision: Creation of 3 to 24 lots	10,000L tank per lot **or** 50,000L strategic water tank
Structure Plan / Subdivision: Creation of 25 lots or more	50,000L per 25 lots or part thereof Provided as a strategic water tank(s) or 10,000L tank per lot

2.2 Technical requirements

2.2.1 Construction and design

An above-ground tank and associated stand should be constructed of non-combustible material. The tank may need to comply with AS/NZS 3500.1:2018.

Below ground tanks should have a 200mm diameter access hole to allow tankers or emergency service vehicles to refill direct from the tank, with the outlet location clearly marked at the surface. The tank may need to comply with AS/NZS 3500.1:2018. An inspection opening may double as the access hole provided that the inspection opening meets the requirements of AS/NZS 3500.1:2018. If the tank is required under the BCA as part of fire hydrant installation, then the tank will also need to comply with AS 2419.

Where an outlet for an emergency service vehicle is provided, then an unobstructed, hardened ground surface is to be supplied within four metres of any water supply.

2.2.2 Pipes and fittings

All above-ground, exposed water supply pipes and fittings should be metal. Fittings should be located away from the source of bushfire attack and be in accordance with the applicable section below, unless otherwise specified by the local government.

2.2.2.1 Fittings for above-ground water tanks:

- Commercial land uses: 125mm Storz fitting; or
- Strategic water tanks: 50mm or 100mm (where applicable and adapters are available) male camlock coupling with full flow valve; or
- Standalone water tanks: 50mm male camlock coupling with full flow valve; or
- Combined water tanks: 50mm male camlock coupling with full flow valve or a domestic fitting, being a standard household tap that enables an occupant to access the water supply with domestic hoses or buckets for extinguishing minor fires.

2.2.2.2 Remote outlets

In certain circumstances, it may be beneficial to have the outlet located away from the water supply. In such instances in which a remote outlet is to be used, the applicant should consult the local government and DFES on their proposal.

EXAMPLE CONSTRUCTION AND FITTINGS	
	
Strategic 47,000 Litre Concrete Tank & Protected Fittings	
	
10,000 Litre Concrete Tank	Storz and Camlock Couplings
	
Full Flow 50mm Ball Valve	Full Flow 50mm Gate Valve and Male Camlock

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Appendix D

Bushfire Risk Report

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Tesla Corporation Management
Pty Ltd
Picton East

BUSHFIRE PRONE
PLANNING

Bushfire Risk Report

Assessments of Risk Levels and Risk Management

5 Hardisty Court, Picton East

Shire of Dardanup

22 January 2024

Job Reference No: 230997

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Limitations: *The protection measures contained in this Bushfire Risk – Assessment and Management Report, are considered to be minimum requirements and they do not guarantee that buildings or infrastructure will not be damaged in a bushfire, persons injured, or fatalities occur either on the subject site or off the site while evacuating. This is substantially due to the unpredictable nature and behaviour of fire and fire weather conditions. Additionally, the correct implementation of the recommended protection measures will depend upon, among other things, the ongoing actions of the landowners and/or operators over which Bushfire Prone Planning has no control.*

All surveys, forecasts, projections, and recommendations made in this report associated with the proposed development are made in good faith based on information available to Bushfire Prone Planning at the time. All maps included herein are indicative in nature and are not to be used for accurate calculations.

Notwithstanding anything contained therein, Bushfire Prone Planning will not, except as the law may require, be liable for any loss or other consequences whether or not due to the negligence of their consultants, their servants or agents, arising out of the services provided by their consultants.

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1 REPORT USE GUIDANCE - FOR MANAGERS & DECISION MAKERS

LOCATION OF KEY INFORMATION	
The applied risk assessment process as pre-requisite reading to assist with understanding the assessments and the presentation of the results.	Section 2 and Appendices 1 & 2
The assessed bushfire risk levels and the relative contribution of each primary factor contributing to that risk.	Section 3
The BAL contour map illustrating the Bushfire Attack Levels (BAL's) impacting the site.	Section 4.3
The recommended additional bushfire protection measures and their implementation priority rating.	Section 4.2.1
Identified additional issues and advice provided for consideration by management.	Section 4.2.2

SECTION 5 - THE ASSESSMENT OF BUSHFIRE RISK

For the Tesla Battery Picton East site, the risk assessment derives defined levels of risk associated with a bushfire event within the immediate and broader surrounding landscape, to the identified elements at risk (i.e., relevant classes of persons and property).

The adopted assessment approach applies a methodology that considers bushfire risk to be determined as a consequence of the interaction of three factors:

1. The bushfire hazard (which presents varying threats and threat levels);
2. The levels of exposure of each element at risk to those threats; and
3. The levels of vulnerability of each element at risk to those threats.

The assessment considers both the current level of risk (inherent), and the potential level of risk (residual) should proactive management be able to implement the recommended additional bushfire protection measures.

The assessment is largely qualitative in nature but incorporates quantitative processes and information when relevant and available. This results in the derivation of 'indicative' bushfire risk levels.

The assessment is conducted by a bushfire planning consultant with practical bushfire event management experience and relevant accreditation. An important objective is to present understandable and practical protection measures that can be justifiably applied by management.

SECTION 6 - THE ASSESSMENT OF BUSHFIRE RISK MANAGEMENT

Assessments are conducted that consider how well two defined pathways for implementing both the required and any additionally recommended bushfire protection measures, are being applied. Guidance for best practice application of these measures is provided. The two pathways are:

1. The application of 'informative' risk management mechanisms which include:
    a. The organised application and maintenance of all applicable bushfire protection measures through a range of operational documents, as relevant to a site and its use; and
    b. The development and application of advice to inform management's planning of future modifications and/or development of a site and its use. This is necessary where bushfire risk mitigation measures are necessary inputs to design and construction.
2. The application of 'regulatory' risk management mechanisms that are to be complied with. These include operating and construction regulations and standards, and relevant planning authority guidelines/standards.

*****

2 INTRODUCTION

2.1 THE ASSESSED ASSET AND ITS USE

The proposed CATL EnerC+ Packs batteries will be used to store excess power which can be fed back into the grid during periods of high demand. This will help to stabilise the grid and reduce the need for fossil fuel powered "peaker plants".

The 22kV project includes 12 battery energy storage systems (BESS), 4 inverters and a control/switch room. No storage/maintenance sheds are proposed, however their potential presence has been considered within this assessment to account for this option. The site will be unstaffed, excepting occasional maintenance.

The development is proposed within the Picton East Industrial Area, which is under ongoing development. Neighbouring lots are either cleared and slashed of re-emergent grasses or developed, generally to a trafficable hardstand to support warehousing and industry. The local road network has been installed to support the future traffic (both vehicle type and volume).

CONDUCTING THE ASSESSMENT

A site assessment was conducted to analyse the location:.

- Identify the vegetation and potential impact on the proposed infrastructure;
- The regional ember hazard able to impact the site;
- The road network and access/egress options; and
- Topography in relation to potential fire behaviour.

2.2 ESTABLISHING THE REPORT OBJECTIVES

The applied risk assessment process (refer to s2.3 and Appendix 1), and the methodology used to inform the management of risk (refer to s2.4), provide a flexible platform for producing the required evaluations and reporting.

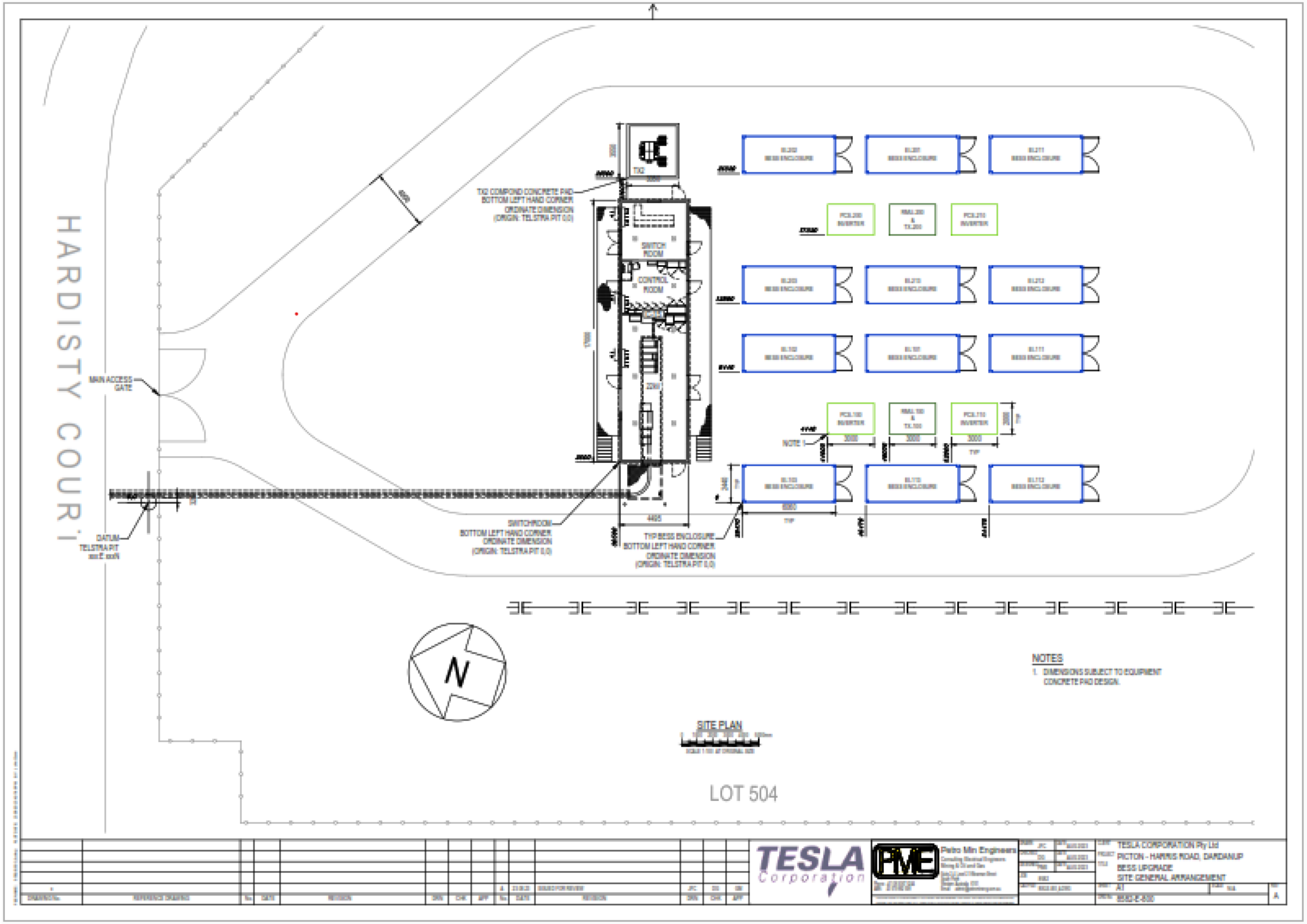
It can account for all types of development and use and be constructed to deliver the required management and decision making information.

Consequently, to ensure the required information outcomes are met, the specific objectives for the subject site need to be identified to guide the report development.

These objectives are established in the checklist on the following page.

CHECKLIST ESTABLISHING THE REPORT OBJECTIVES TO BE MET FOR THE SUBJECT SITE					
AVAILABLE OBJECTIVES			THE OBJECTIVES TO BE MET	THE OBJECTIVES TO BE MET ARE ESTABLISHED BY: The Owner and/or Operator of Subject Site in Discussion with the Bushfire Consultant	THE OBJECTIVES TO BE MET ARE ESTABLISHED BY: The 'Planning' Bushfire Management Plan Being Concurrently Produced
RISK ASSESSMENT					
Hazard	Identify all bushfire hazards with potential to impact the subject site.		✓		✓
Risk Levels	Assess inherent bushfire risk levels, for each identified element at risk, by accounting for existing and/or planned implementation of bushfire protection measures, along with all other interacting factors.		✓		✓
	Assess residual bushfire risk levels, for each identified element at risk, by additionally accounting for implementation of recommended bushfire protection measures, along with all other interacting factors.		✓		✓
RISK MANAGEMENT					
Compliance	Assess current compliance and/or future compliance capability against the 'mandatory' bushfire risk management mechanisms. Note for operating standards, assessment is restricted to the requirements that have direct relevance to a bushfire event. These can include: • Separation from bushfire prone vegetation (APZ/firebreaks); • Access/egress for firefighting services/site occupants, including firebreaks; and • Firefighting water supply & delivery for structure and surrounds fire, not the bushfire.	Planning Guidelines/Standards - for development & uses on bushfire prone land			✓
		Operating Standards / Regulations			
		Construction Standards - for buildings in bushfire areas			
Recommendations	Recommend additional bushfire protection measures to be implemented and their priority.		✓		✓
	Identify the relevant planning and/or site operations documents in which the recommended bushfire protection measures should be included.		✓	✓	
Advice	Provide specific advice to inform planning for design and construction.		✓	✓	
	Provide general advice that identifies issues for management to consider.		✓	✓	

Figure 2.1: Site diagram/plan – include enough offsite scale as necessary.



2.3 BUSHFIRE RISK AND THE APPLIED ASSESSMENT PROCESS

THE RELEVANT RISKS

For this Bushfire Risk Report, the relevant risk is the potential for loss of life, injury, or destroyed or damaged assets which results in personal loss and economic loss due to disruption of services and/or repair or replacement of buildings and infrastructure. The source of the risk is a potential bushfire event as a natural hazard.

THE APPLIED RISK ASSESSMENT PROCESS

Bushfire Prone Planning (BPP) has adapted the concept for 'Understanding Disaster Risk' as recognised by the United Nations Office for Disaster Risk Reduction [46].

In applying this concept, bushfire risk can be considered a consequence of the interaction of bushfire hazard threats and the exposure and vulnerability of the elements at risk from those threats (i.e., the 'exposed elements' which can include various classes of persons and/or property).

The level of risk associated with bushfire will be reduced by applying bushfire protection measures that:

- Reduce the number and/or level of hazard threats; and/or
- Reduce the level of exposure and/or vulnerability of the elements at risk.

The risk assessment process framework is shown in Figure 2.2 and additional detail is presented in Appendix 1.

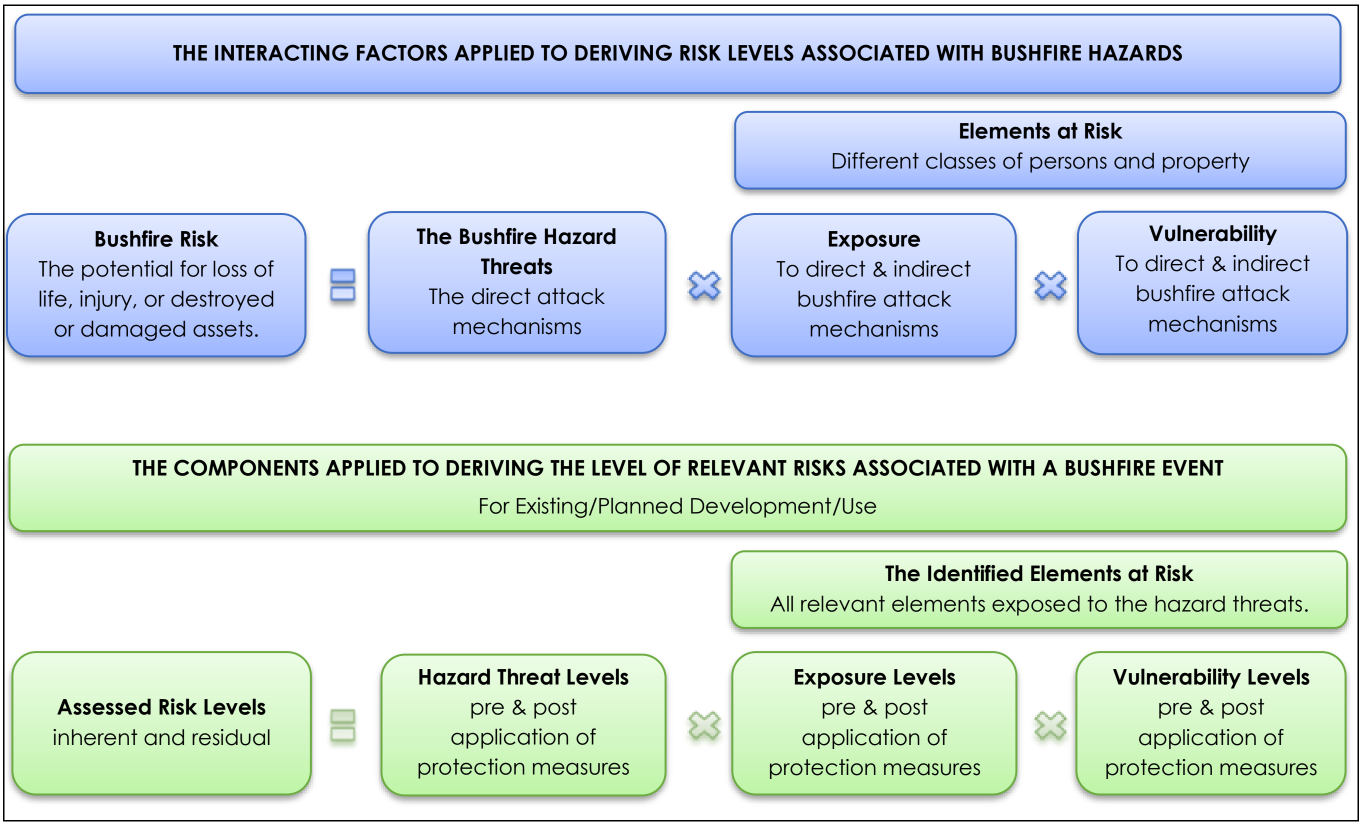
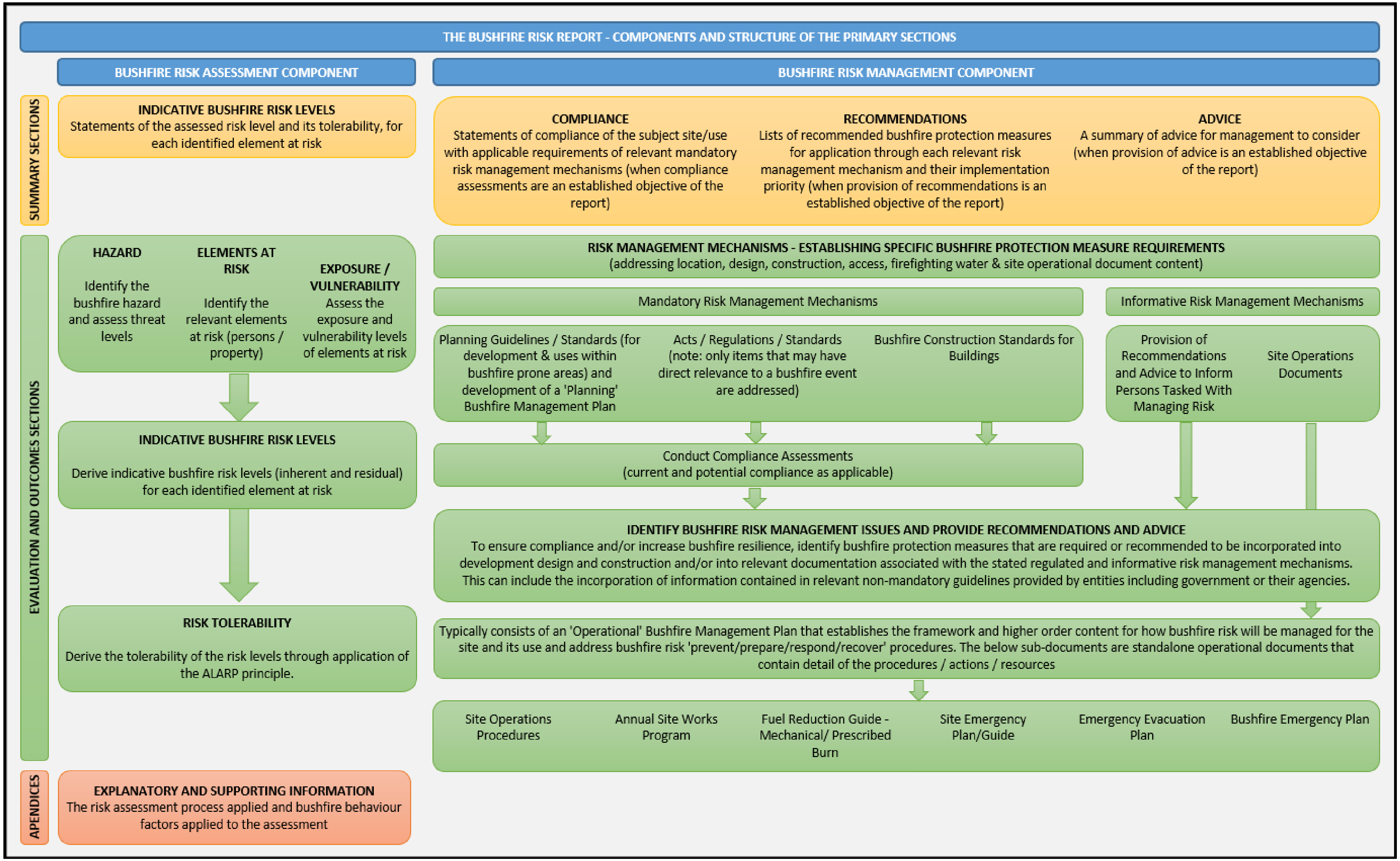


Figure 2.2: The framework of the applied bushfire risk assessment process.

2.4 REPORT STRUCTURE OVERVIEW



3 SUMMARY: BUSHFIRE RISK ASSESSMENT

The Summary: Presents the outcomes of the risk assessment process conducted for the subject site and use and presented in Section 5.

Appendix 1: Explains the bushfire risk level analysis and tolerance methodologies applied, along with the terminology used.

The Worst Case: For each identified element at risk, the worst assessed risk level is stated, along with its tolerability. This will correspond to the worst levels of bushfire hazard threats, and exposure and vulnerability of the element to those threats. Refer to Section 3.2. for the relative contributions of each component that has been assessed as the primary drivers of the level of risk associated with a bushfire event.

Indicative Risk: When the assessed bushfire risk levels are stated as 'indicative', rather than 'determined', they have been derived through the application of a largely qualitative assessment process that applies quantitative information when it exists exist. Refer to Appendix A1.3 for explanatory and supporting information.

3.1 THE BUSHFIRE RISK LEVELS (INDICATIVE)

THE ASSESSED BUSHFIRE RISK LEVEL AND ITS TOLERABILITY					
ASSESSED ELEMENTS AT RISK [1]	LEVEL OF RISKS ASSOCIATED WITH A BUSHFIRE EVENT [2]		TOLERABILITY OF THE BUSHFIRE RISK LEVEL (ALARP) [3]		
	Inherent Risk	Residual Risk	Inherent Risk Tolerability	Residual Risk Tolerability	Adjusted Residual Risk Tolerability
Persons on access/egress routes in vehicles	VL3	VL3	Acceptable	Acceptable	N/A
Buildings/Structures - NCC classes 1-10	M7	L5	Tolerable but NOT ALARP	Acceptable	N/A
Built infrastructure assets	L6	L4	ACCEPTABLE but NOT ALARP	Acceptable	N/A

Note 1: Refer to Section 5.2.

Note 2: Refer to Appendices A1.1 and A1.3.3 and the Glossary for explanatory and supporting information. The Bushfire Risk Level is not the risk of a bushfire event occurring. The relevant risks are those associated with a bushfire event and to which the assessed elements at risk are potentially subjected.

Inherent risk accounts for the risk reducing impact of bushfire protection measures already or planned to be implemented. Residual risk additionally accounts for any protection measures recommended for implementation by the bushfire consultant.

Note 3: Refer to Appendix A1.3.6 for explanatory and supporting information and adjustment justification when applicable.

3.2 DERIVATION OF THE BUSHFIRE RISK LEVELS

BUSHFIRE HAZARD THREAT LEVEL AND EXPOSURE AND VULNERABILITY LEVELS OF ELEMENTS AT RISK						
ASSESSED ELEMENTS AT RISK [2]	THE INTERACTING FACTORS FROM WHICH THE BUSHFIRE RISK LEVEL IS DERIVED [1]					
	ASSESSED INHERENT LEVELS [3]			ASSESSED RESIDUAL LEVELS [3]		
	Bushfire Hazard Threat [Section 5.1]	Exposure of Element at Risk [Section 5.3]	Vulnerability of Element at Risk [Section 5.4]	Bushfire Hazard Threat [Section 5.1]	Exposure of Element at Risk [Section 5.3]	Vulnerability of Element at Risk [Section 5.4]
Persons on access/egress routes in vehicles	Low	Low	Very Low	Low	Low	Very Low
Buildings/Structures - NCC classes 1-10		Moderate	High		Low	Moderate
Built infrastructure assets		Moderate	Moderate		Low	Low

Note 1: Refer to Appendix 1 and Appendix 2 for explanatory and supporting information.

Note 2: Refer to Section 5.2.

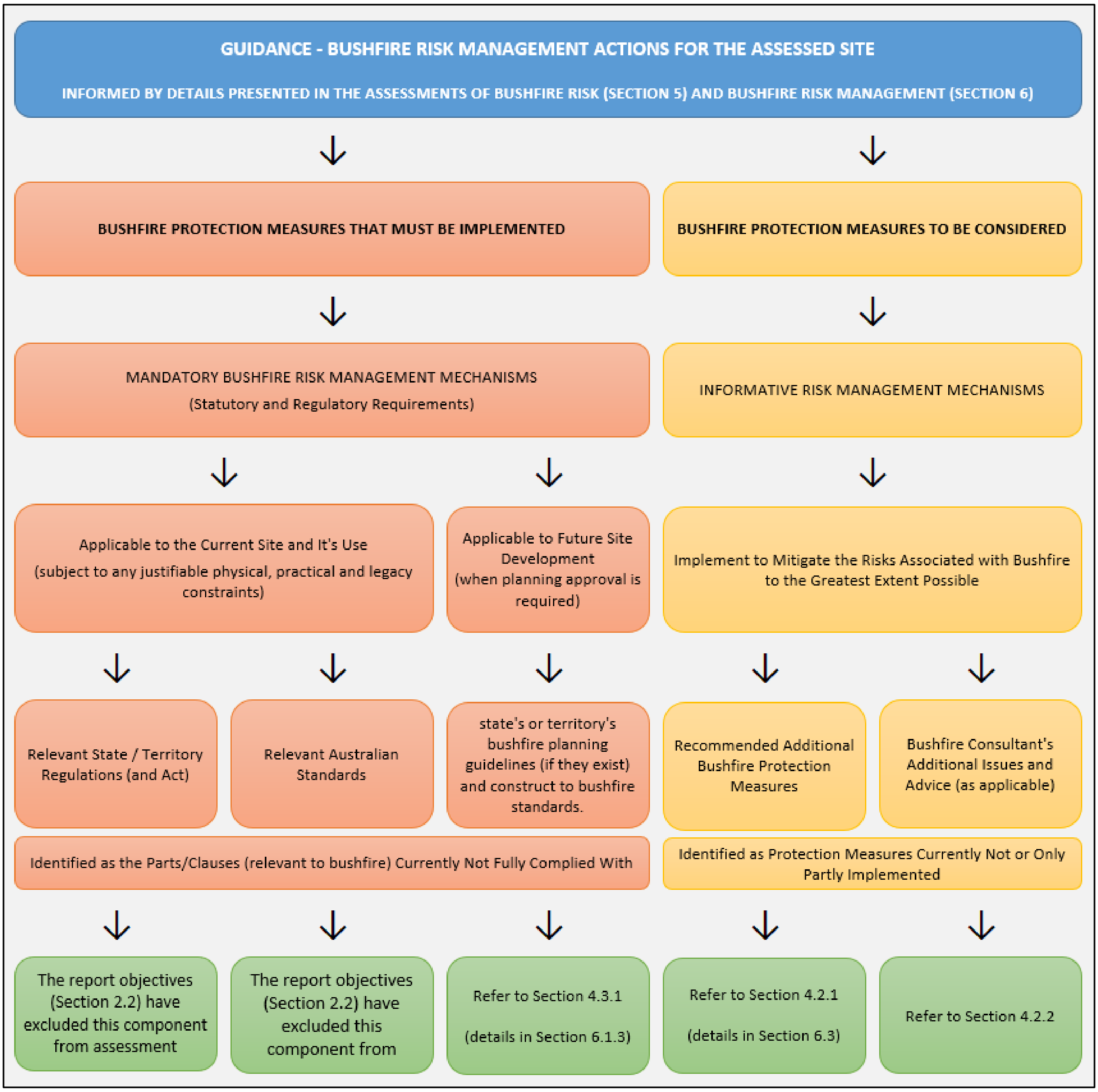
Note 3: Refer to Appendix A1.3.3. Inherent levels account for the threat/exposure/vulnerability reducing impact of applying existing and planned bushfire protection measures. Residual levels additionally account for any protection measures recommended by the bushfire consultant.

4 SUMMARY: BUSHFIRE RISK MANAGEMENT

4.1 MANAGEMENT ACTIONS TO BE ADDRESSED

The following diagram identifies:

1. The components associated with the mandatory and informative risk management mechanisms; and
2. The location within this summary that presents their corresponding bushfire protection measures as:
   a) Those currently not fully implemented that must be implemented; and
   b) Those that are recommended to be implemented.



4.2 INFORMATIVE MECHANISMS – RECOMMENDED ACTIONS

4.2.1 ADDITIONAL BUSHFIRE PROTECTION MEASURES - RECOMMENDED BY THE BUSHFIRE CONSULTANT

4.2.1.1 THREAT REDUCING MEASURES - BUSHFIRE HAZARD

<table>
<tr><th colspan="5">BUSHFIRE HAZARD THREAT REDUCTION
RECOMMENDED ADDITIONAL BUSHFIRE PROTECTION MEASURES</th></tr>
<tr><th>The Protection Mechanism</th><th>Ref No</th><th>Brief Description [1]</th><th>Recommendation Details</th><th>Implementation Priority Rating [2]</th></tr>
<tr><td>Prevent bushfire ignition by managing heat energy sources</td><td>1.9</td><td>Robust and effective site operational procedures</td><td>The Site Operating Procedures (document title pending) should contain the following information:
• Smoking restrictions or designated smoking locations.
• Procedures regarding vegetation management and accidental ignition prevention.
• Heavy equipment is not to be operated where long grass (>100mm) or heavy leaf litter is present, particularly during the bushfire season (see the Local Government Prohibited Burning Period).
• Servicing of battery energy storage systems should not take place on days of Extreme or Catastrophic Fire Danger Rating, except where the system is experiencing malfunction or abnormal behaviour.
• The following procedures should be completed prior to the bushfire season (see the Local Government Prohibited Burning Period):
o Scheduled maintenance to assets, emergency equipment, or fire detection/prevention systems.
o Scheduled housekeeping to remove excess leaf litter/debris from assets around the facility.
o The ongoing requirements outlined in the Bushfire Management Plan.
The Emergency Management Plan and any Emergency Response Guide (FES-ERG) should contain procedures for isolation, shut-down, fail safe or management of critical/high-risk plant, equipment, and utilities, and their advised triggers.</td><td>High</td></tr>
<tr><td colspan="5">[1] The full description of each bushfire protection measure and the detail of the assessment is presented in Section 5.1.4
[2] Refer to Appendix A1.2.5 for implementation priority rating explanation.</td></tr>
</table>

4.2.1.2 EXPOSURE REDUCING MEASURES –STRUCTURES/ASSETS

STRUCTURES/ASSETS EXPOSURE REDUCTION RECOMMENDED ADDITIONAL BUSHFIRE PROTECTION MEASURES				
The Protection Mechanism	Ref No	Brief Description [1]	Recommendation Details	Implementation Priority Rating [2]
Establish sufficient separation from relevant bushfire hazard threats	4.3 7.3	Landscaping - asset protection zone (APZ)	The following additional requirements apply to the Asset Protection Zone: • A BAL-12.5 APZ is acceptable for Class 10a buildings which do not contain hazardous or flammable materials. • Class 10a buildings containing hazardous or flammable materials will apply the same APZ requirements as BESS cabinets (below). • An APZ is to be established around BESS components and infrastructure. This APZ will ensure exposure to the bushfire hazard threat of radiant heat will be limited to a maximum radiant heat flux of 10 kW/m2 (calculated with an assumed flame temperature of 1090K) by providing the required separation distances from the bushfire hazard. • The 10m portion of the APZ immediately around BESS cabinets must be entirely and permanently non-vegetated (sealed, compacted limestone, gravel, mineral earth etc). • BESS cabinets are recommended to be sited on concrete slabs or other sealed, non-combustible surface. • No landscape planting (revegetation) should occur within the APZ to the extent of the lot boundary.	Highest
	4.7 7.7	Separation from stored and constructed combustible items (consequential fire fuels)	Class 10a buildings which do not contain hazardous or flammable materials should be sited >6m from BESS cabinets. If a Class 10a building does contain hazardous or flammable materials, it should be sited >10m from BESS cabinets. All non-structural combustible materials are to be removed within 10m of BESS components and infrastructure. This includes but is not limited to; waste, leaf litter, machinery, grasses, vehicles, fuel, furniture, and timber. When storage of flammable items or materials are stored on site temporarily (for maintenance etc), separation distances must be complied with. This requirement is to be included in the Site Operating Procedures document.	High
Establish shielding from	4.11 7.11	Planted vegetation barrier	Where the decision maker requests a visual buffer (vegetation barrier), the following requirements apply: • A Landscape Management Plan will be required.	Medium

STRUCTURES/ASSETS EXPOSURE REDUCTION RECOMMENDED ADDITIONAL BUSHFIRE PROTECTION MEASURES				
The Protection Mechanism	Ref No	Brief Description [1]	Recommendation Details	Implementation Priority Rating [2]
relevant bushfire hazard threats			• Low flammability plants should be selected, with an emphasis on tightly held platy or smooth barks and limited leaf litter accumulation. The Landscape Management Plan should outline the species selection. • The trunk of any planted tree should be located >1.5 the mature height of that tree from BESS cabinets (this need not apply to Class 10 buildings). It is therefore practical that shorter species are selected. • Shrubs may not be planted under trees. This may require a staggered design to achieve full a visual barrier. • Vegetation should be a minimum of 10m from BESS infrastructure. This may be confined by the lot boundary, so is a recommendation only. • Surface and near-surface fuels including grasses, low shrubs, and leaf litter must be strictly maintained. • The specifications of Schedule 1 of the Guidelines for Planning in Bushfire Prone Areas v1.4 apply.	
	4.12 7.12	Shield operation critical non-structural elements	Cabling and plumbing beyond the <10kW/m2 APZ, or beyond footprint of buildings or constructed assets, are recommended to be installed underground, or shielded with non-combustible material (or enclosed) where practical. This does not apply to any connections to the external power network or substations.	Lowest

[1] The full description of each bushfire protection measure, the detail of the assessment and any recommendation, is presented in Section 5.3.2. and Section 5.3.3

[2] Refer to Appendix A1.2.5 for implementation priority rating explanation.

4.2.1.3 VULNERABILITY REDUCING MEASURES – STRUCTURES/ASSETS

STRUCTURES/ASSETS VULNERABILITY REDUCTION RECOMMENDED ADDITIONAL BUSHFIRE PROTECTION MEASURES				
The Protection Mechanism	Ref No	Brief Description [1]	Recommendation Details	Implementation Priority Rating [2]
Construction design and materials	11.3	Construction materials for external and internal cavity building elements	For any future Class 10a buildings, include non-combustible structural elements where practical. In particular, avoid: polycarbonate (sheeting and skylights), softwoods (<650 kg/m3 density at 12% moisture content), and fibrous materials.	Lowest
	11.4 14.4	Construction materials for consequential fire fuels	It is recommended non-combustible elements are used for structural and supporting/associated constructions wherever practical. This includes sheds, lean-tos, verandas, shade screening, lattice, garden edging, fencing etc.	Medium
	14.8	Minimise re-entrant detail to minimise debris and ember accumulation	Where electrical cabling, or gas or liquid piping, contacts the ground or any arrangement of associated structures creates a 'pocket' for accumulation of debris, this should be rectified by design or filling with non-combustible material such as mineral earth. Consideration should be given to making the arrangement self-cleaning through wind action to the greatest extent possible. These measures will reduce accumulation and/or make the management (clearing) of accumulated debris easier. E.g. cable raking to be 100mm above ground.	Medium
	11.11 14.11	Minimise construction cavities to minimise debris and ember accumulation	Any subfloor cavities must have exposed subfloor spaces enclosed, sealed with non-combustible material, or be ember screened. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	High
	11.12 14.12	Minimise external openings to limit flame / radiant heat / ember / debris entry	The detailed design of any Class 10a Buildings should be reviewed to ensure it is possible for them to be fully enclosed. The manufacturer or appropriate engineers should be contacted to enquire if it is possible to apply ember screening to intake/exhaust/air conditioning vents and other paths of entry to the interior cavity or accessing any combustible elements of BESS cabinets. This ember screening would be applicable to the exterior of the battery cabinet, not internal components. The intention is to prevent both ember ingress and debris accumulation. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	High

STRUCTURES/ASSETS VULNERABILITY REDUCTION RECOMMENDED ADDITIONAL BUSHFIRE PROTECTION MEASURES				
The Protection Mechanism	Ref No	Brief Description [1]	Recommendation Details	Implementation Priority Rating [2]
	11.13	Screen and seal gaps and penetrations	Any Class 10a buildings must have ember screening/sealants installed on any gaps, penetrations, and external glazed elements. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.	Medium
	14.15	Shutter external doors and windows	External doors (if present) should be self-closing.	Lowest
	14.16	Construction materials for critical non-structural elements	Review *FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems* for additional measures applicable to the development.	Medium
Availability of a firefighting response capability	14.19	Firefighting equipment passively operated	Automatic fire detection and suppression systems should be installed and maintained, as appropriate to the BESS details and recommended by the manufacturer.	Highest
Manage and maintain effectiveness of applied protection measures	11.21 14.22	Formal documents created to guide and enforce management	Ongoing requirements established in this Risk Assessment and Section 5.7 of the associated Bushfire Management Plan, must be included in operational documents.	Medium

[1] The full description of each bushfire protection measure, the detail of the assessment and any recommendation, is presented in Sections 5.4.2 & 5.4.3

[2] Refer to Appendix A1.2.5 for implementation priority rating explanation.

4.2.2 ADDITIONAL ISSUES AND ADVICE FOR CONSIDERATION

This section presents items the bushfire consultant has identified as being:

- Issues that are additional to or not specifically addressed within the assessment of bushfire risk management conducted in Section 6; and
- Advice for dealing with these issues or other issues that require emphasising, for consideration by management.

No relevant additional issues have been identified for the subject facility/premises.

4.3 MAPS TO INFORM MANAGEMENT

The data required to derive bushfire attack levels has been collected and the BAL separation distances calculated in assessing the establishment, both currently and potentially, of the exposure reducing bushfire protection mechanism of increasing separation from the bushfire hazard.

From this information, BAL contour maps can be produced. These maps can visually illustrate both the current situation and what might be achieved, regarding the potential impact of the flame contact, radiant heat transfer, and to a lesser extent, the ember/firebrand bushfire direct attack mechanisms.

These maps are an effective way to quickly convey important information to management, hence their inclusion in this summary risk management section of the report.

Other maps may be included in this section when it is considered they are useful and effective at providing relevant risk management information to property owners/operators.

4.3.1 BUSHFIRE ATTACK LEVEL (BAL) CONTOUR MAP

INFORMATION TO ASSIST INTERPRETATION OF THE BAL CONTOUR MAP

The Modelling Methodology (Calculations) Applied: AS 3959:2018 establishes the Bushfire Attack Level (BAL) determination methodology that will be applied to the relevant vegetation. When applicable, other bushfire behaviour models may be applied, and their application would be identified and justified in this report.

The Relevant Vegetation: This will be bushfire prone vegetation existing on the 'Subject Land + 150m Extent' that is classified according to the AS 3959:2018 BAL determination methodology. The classified vegetation maps and supporting vegetation photos and calculation data is presented in Appendix 6;

BAL Contour Map: The levels of potential flame contact and radiant heat transfer are assessed as bushfire attack levels and presented as a 'BAL Contour Map'. The levels to which any element at risk (e.g., a building), whose location on the map is identified, can be derived from this map.

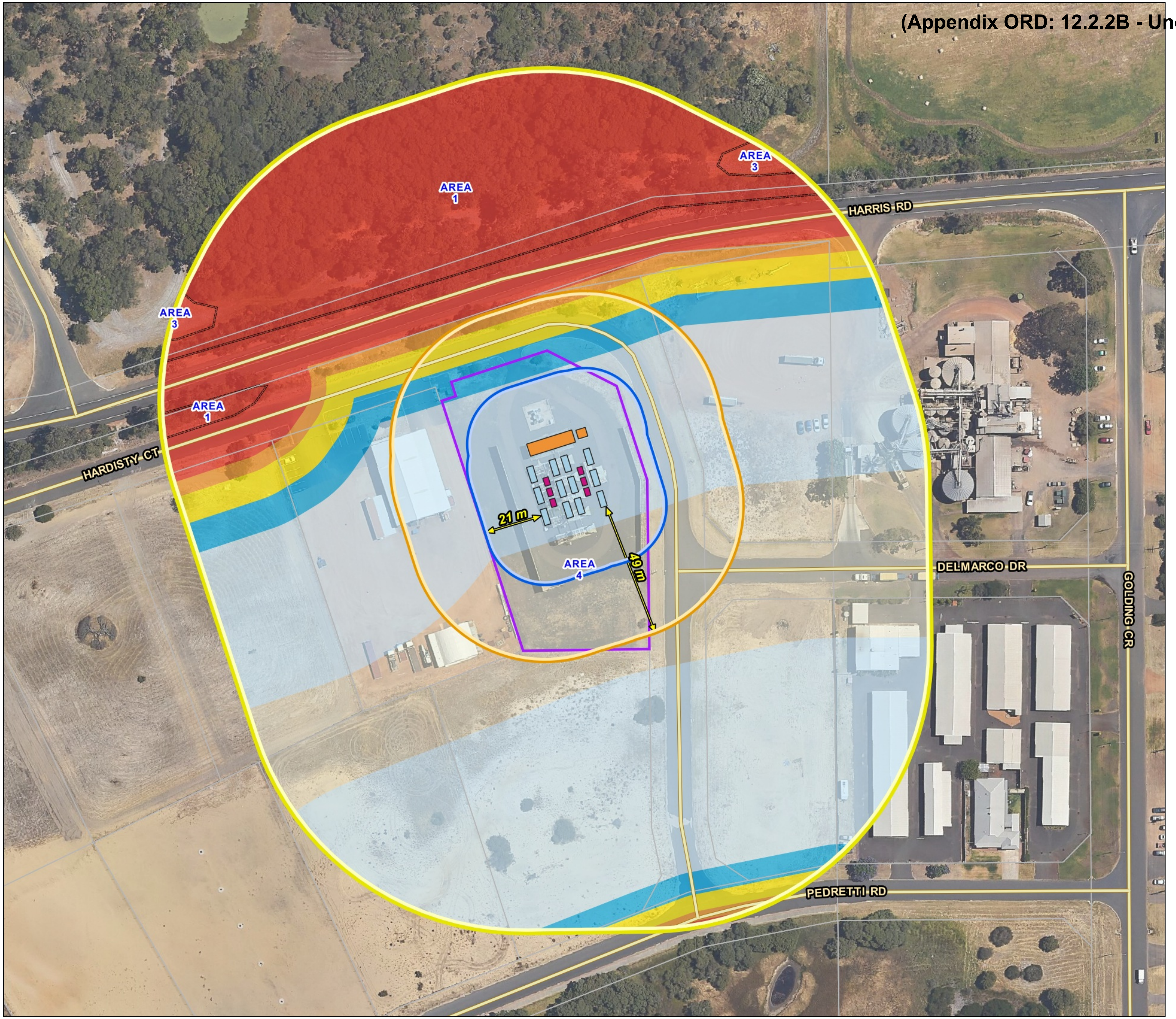
The map(s) illustrate the site-specific separation distances from classified vegetation that will correspond to each Bushfire Attack Level (BAL) as coloured contours.

The BAL Contours: The contours, each of varying widths, extend out from each area of classified vegetation. Each different contour represents a set range of potential radiant heat transfer (in kW/m^2) to an element at risk located within the contour and is stated as a BAL rating.

The Vegetation Separation Distances: The horizontal distances from the edge of the classified vegetation to the start and the end of each different BAL contour, represent the separation distances (between the classified vegetation and the element at risk), that will correspond to that BAL rating for that site. The calculated distances have accounted for site specific vegetation types, ground slopes and other relevant input variables. These separation distances can also be presented in a table.

In addition to BAL rating separation distances, a distance that corresponds to singular levels of radiant heat transfer such as 2 kW/m^2 and 10 kW/m^2, may also be presented for specific purposes including proposed vulnerable land uses; and

The Applicable BAL Rating: Any element at risk (as the receiver of the radiant heat), that exists wholly or partly within a given contour, will be subject to that BAL rating. The rating establishes the applicable bushfire construction standard requirements. These ratings can also be applied to the derivation of flame contact and radiant heat transfer levels when required as a component of bushfire risk assessment.



BAL Contour Map

Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

------ LEGEND ------

- Subject Site
- Cadastral
- 100m Assessment Area
- 49m 10Kw APZ
- 21m BAL29 APZ

Buildings

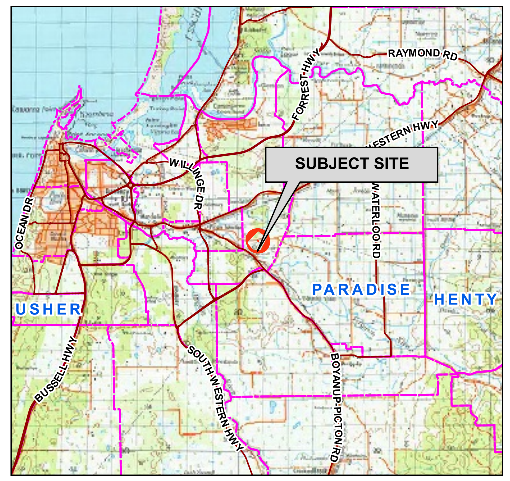
- BESS Enclosure
- Control room
- Inverter

Bushfire Attack Levels

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW

0 20 40 60 80
Metres

------ LOCALITY ------



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AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: 30-11-2023
SCALE (A3): 1 : 1250

230997_Fig3-2_BAL_5 Hardisty Court Picton East.qgz

5 BUSHFIRE RISK ASSESSMENT

5.1 THE BUSHFIRE HAZARD THREAT LEVEL ASSESSMENT (THE SURROUNDING LANDSCAPE)

INFORMATION TO ASSIST INTERPRETATION

AREA OF LAND TO BE ASSESSED AS THE SURROUNDING LANDSCAPE

The assessment for this report considers the surrounding landscape to be comprised of two parts:

1. The subject site and all land surrounding the subject land extending out to 150 metres as the 'Subject Land + 150m Extent'; and
2. The land surrounding the 'Subject Land + 150m Extent' extending out to the maximum distance that will be established by one or more of the following factors:
   - The distance away from the subject land that will result in an area of land that, when supporting bushfire prone vegetation, is of sufficient size such that a large-scale bushfire can develop (landscape scale fire);
   - The distance away from the subject land from which the bushfire direct attack mechanism of embers/ burning debris may reasonably be expected impact the subject land. This is highly dependent on the 'category' of vegetation present regarding its potential ember/burning debris threat (refer to Appendix 2 for explanatory information); and/or
   - The distance away from the subject land that contains the road network that persons in vehicles (including emergency services) would traverse in evacuating or accessing the subject land in the event of a bushfire.

To achieve the required assessment outcomes a maximum distance of 5 km from the subject land is likely to be considered sufficient, with this distance being reduced when the vegetation categories presenting the higher ember/burning debris threat level do not exist.

ASSESSMENT PURPOSE

To identify whether the land surrounding the existing or proposed development and its use contains the physical factors necessary for any of the following scenarios to exist:

1. The potential exists for the bushfire hazard threat of embers/burning debris to impact elements at risk on the subject land. It is particularly important this threat is identified when any vegetation planned to be retained and/or established on the subject land and within 100 metres (the 'Subject Land + 150m Extent') may not present this threat - or at least not to the same level. Refer to Appendices A1.3 and A1.6 for additional information.

   Note: Scientific research indicates that at least 80% of building losses from past Australian bushfires can be attributed to ember/firebrand attack (mostly in isolation but also in combination with radiant heat), and the resultant consequential fires. It is a very important threat to be identified; and/or

2. The potential exists for development of a large-scale bushfire event(s) that can impact the subject land because the necessary extent of bushfire prone vegetation exists. Such events may increase the severity of bushfire behaviour within the 'Subject Land + 150m Extent' vegetation, consequently increasing the levels of all bushfire hazard threats impacting elements at risk; and/or
3. The potential exists for development of dynamic fire behaviours and deep flaming that are associated with extreme bushfire events (including pyroconvective events). Dynamic fire propagation arises from complex interactions between the terrain, the atmosphere, and the fire (refer to Appendix 3 for additional information).

   Extreme bushfire events have the potential to impact subject land through generating fire driven strong winds, increasing erratic fire behaviour and increasing the levels of all bushfire hazard threats impacting elements at risk.; and/or

4. The potential exists for increased levels of bushfire hazard threats, to persons in vehicles who need to move through this area of land (i.e., persons evacuating from the subject land and emergency services), thereby increasing level of risks associated with bushfire.

5.1.1 DETERMINATION OF THE ASSESSMENT EXTENT TO BE APPLIED

THE SURROUNDING LANDSCAPE ASSESSMENT EXTENT	
BASIS FOR DETERMINATION	
The vegetation categories identified surrounding the subject land include significant extents and continuity of those that contain trees with bark hazards. These present the potential for developing significant ember/burning debris threat levels. These threats are either medium (up to 5km) and/or long distance (greater than 5km) spotting. [1]	
The vegetation categories identified surrounding the subject land only include those that have the potential for shorter distance spotting (ember/burning debris attack) of up to 500-750m. [1]	✓
The distance away from the subject land that contains the road network that persons in vehicles would traverse in evacuating or accessing the subject land in the event of a bushfire, has determined the assessment extent.	
Assessment Comments: The presence of predominately marri and peppermint trees with less than 10% jarrah trees in the complex of vegetation categorised as 'Tree-1'presents a potential medium range threat for the ember/burning debris bushfire direct attack mechanism. This vegetation category exists over limited areas and is interspersed with pastured farmland, road networks and built-up areas on relatively flat terrain, therefore further than 2 km from the subject land will not be assessed. Bark fuels are the most significant contributor to this threat. The bark of the occasional jarrah is fibrous, long strand, easily dislodged and has the potential for high density medium range spotting (ignition of fires ahead of a fire front). This can result in the quicker expansion of the flaming area and generates potential sources of ignition for any consequential fire fuels (i.e., buildings/structures and any combustible fuels in proximity to them). Other barks, specifically marri and tuart bark when long unburnt (typically >15yrs) has loose fibrous bark and can produce profuse embers up to 700 metres. These embers can rapidly accumulate and provide the ignition source for consequential fire. Peppermint and banksia trees have tight stringy bark, therefore will produce very little short distance embers. Melaleucas (paper bark) fit in the same category as peppermint and banksia trees.	
The extent of land surrounding the subject land that is to be considered as being the surrounding landscape for assessment purposes:	**Approximately 2 km**
Note 1: Refer to Appendix 2 and Appendix 3 for additional information.	

5.1.2 IDENTIFICATION OF THE VEGETATION CATEGORIES PRESENT

Vegetation categories are established to enable a comprehensive assessment of the type and severity of the bushfire attack mechanisms (i.e., the bushfire threats), potentially generated by bushfire prone vegetation on surrounding land. This enables variations in vegetation composition and structure to be more appropriately accounted for in the determination of the levels of risk associated with a local bushfire event.

The variations in potential threat level ranges corresponding to each vegetation category in the table below are the result of these differences.

The 'Categories' are necessarily different to the vegetation 'Classifications' applied in the BAL determination methodology of AS 3959:2018. The Standard is applied to determination of construction requirements and primarily considers the flame contact and radiant heat attack mechanisms and does not fully address ember/firebrand attack or other threats levels.

VEGETATION CATEGORIES IDENTIFIED IN THE SURROUNDING LANDSCAPE (AND CORRESPONDING POTENTIAL THREAT LEVEL RANGES)		
Vegetation Category [1 & 2]	Assessment Comments	Potential Threat Level Range [2]
Tree-1	To the north and west. These areas support a complex marri, peppermint, tuart, banksia, paper bark, minor jarrah and various other eucalypt trees with associated shrub understorey (not always present). The species composition varies across locations. Jarrah is persistent but not dominant.	Moderate to Extreme
Tree-2	Not identified.	Moderate to Extreme
Tree/Shrub	These areas support a mixture of taller shrub type vegetation but also contain trees as a taller but less frequent vegetation type within the complex.	Moderate to Very High
Shrub	Not identified within the 2km assessment area.	Low to Moderate
Grass	These areas support a range of broadleaf and grass pasture species. Some are managed more intensively and are stocked more regularly, and therefore eaten down – or are part of usage rotations involving horticultural cropping. Others have various levels of management but will generally have some form of material reduction during the year or have inherently low fuel loads due to regular disturbance and/or lower quality soils.	Low to Moderate
No/Low Threat	Example These areas of land support or contain: • Built-up industrial areas. • Road and rail network.	None to Low
Note 1: Refer to Figure 5.1: Surrounding landscape – the identified vegetation categories. **Note 2:** Refer to Appendix 5 for a description of the criteria that establish the vegetation categories, the base bushfire hazard scenario and the potential threat levels and the application of these levels.		

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

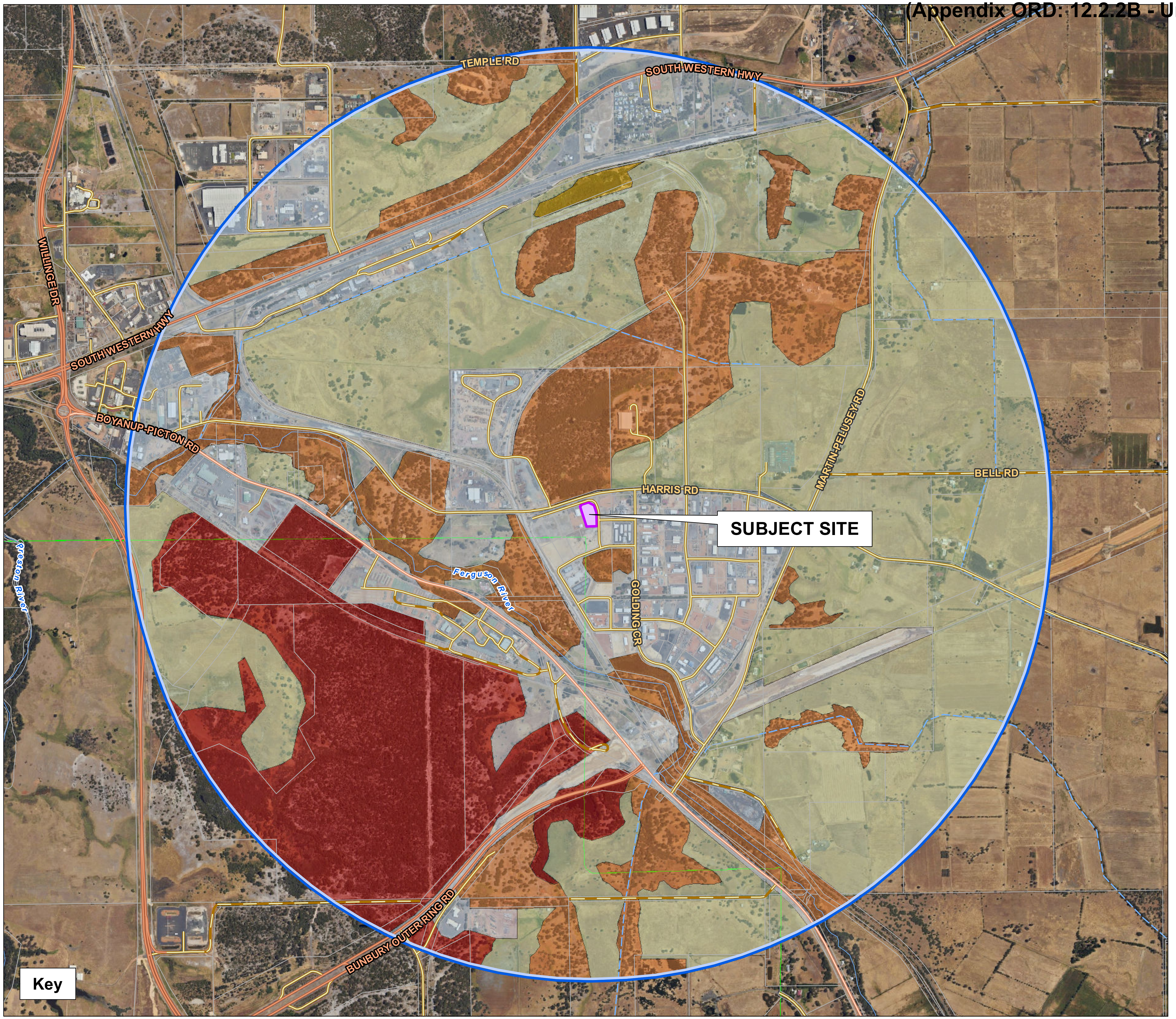


Figure 5.1

Surrounding Landscape Vegetation Categories Map

Lot 504 on Plan 057919, Area : 5740 sq m
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

------ LEGEND ------

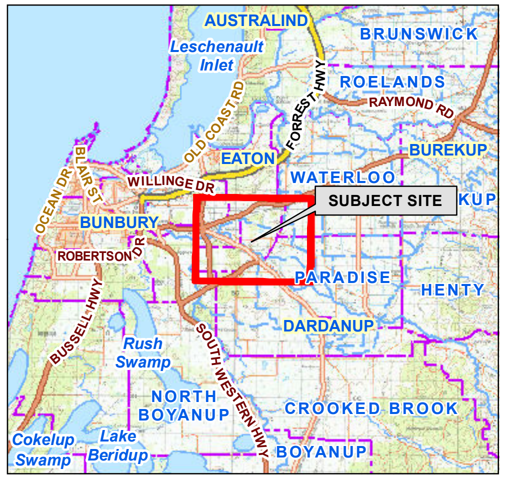
Subject Site
Other Lots
2 km Buffer

Vegetation Categories

Tree-1
Tree-2
Tree/Shrub
Grass
No/Low Threat

0 1,000
Metres

------ LOCALITY ------



Aerial Imagery : Landgate/SLIP
Image Date : Feb 2022

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map compiled by: Ian Ross 25/01/2024
Map updated by: Neil 25/01/2024
A3 Scale 1:16,000

BUSHFIRE PRONE PLANNING

Map Document Path / Name: K:\Projects\Jobs 2023\230997 - 5 Hardisty Court, Picton East (BMP BRMP)\Mapping\MXD\230997_Fig5-1_VEG-CAT-Hardisty-Picton-East.mxd

5.1.3 ASSESSMENT OF PHYSICAL FACTORS THAT MODIFY BUSHFIRE HAZARD THREAT LEVELS

5.1.3.1 VEGETATION EXTENT AND CONTINUITY FACTORS

EXTENT AND CONTINUITY OF IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY THREAT LEVELS						
Relevant Physical Factors [1,4 & 6]	Vegetation Location Within the Surrounding Landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of the Threat Level [4 & 5]
The extent of vegetation is sufficient to support a fully developed bushfire but insufficient to result in an extreme bushfire event. [4] Note: Vegetation within the 'Subject Land + 150m Extent' is only assessed independently of the surrounding vegetation when it is sufficiently isolated. If the relevant area of vegetation is not isolated or can support an extreme bushfire event (see next physical factor) the assessment response will be N/A.	The 'Subject Land + 150m Extent'.	A. FOREST	Tree-1	Partially Exists	Limited areas of forest exist within 150 metres from the subject site. The forest fuels to the north are separated by a local road and other low bushfire threat areas, being non-vegetated, roads, rail line and built-up areas.	Minor Decrease
		B. WOODLAND	Tree-1			
		D. SCRUB	Tree-2	N/A		Select.
		D. SCRUB	Tree/Shrub	Partially Exists	To the north, an area of melaleucas exist (bordered by forest) extending from 100 metres to 150 metres form the subject site. The south is a small area of melaleuca (paperbark) located 120 metres from the subject site. The small area of vegetation is approximately 130m x 200m.	Significant Decrease
		C. SHRUBLAND	Shrub	N/A	-	N/A
		G. GRASSLAND	Grass	Limited	A small area to the northeast exist within 150 metres from the subject site	Significant Decrease
	The Land Surrounding the 'Subject Land + 150m Extent'		Tree-1	Partially Exists	Limited areas of forest exist greater than 150 metres to 2 kilometres from the subject site. The forest fuels to the north, west and southwest are constraint by developments and pastured paddocks.	Significant Decrease
			Tree-2	N/A	-	N/A
			Tree/Shrub	Limited	Within 2 kilometres, there are small pockets of melaleucas to the north and in the riparian zone to the west.	Minor Decrease

EXTENT AND CONTINUITY OF IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY THREAT LEVELS						
Relevant Physical Factors [1,4 & 6]	Vegetation Location Within the Surrounding Landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of the Threat Level [4 & 5]
			Shrub	N/A	-	N/A
			Grass	Insignificant / Unlikely to Occur	Fragmented pasture areas exist within 2 kilometres from the subject site. Large areas of grassland are grazed.	Neutral
The extent of vegetation is sufficient to support large active flaming zones (landscape scale fire). This presents one of the physical factors required for the development of an extreme bushfire event. [6]	The 'Subject Land + 150m Extent'.	A. FOREST	Tree-1	Limited	There is limited forest fuel to the north within the 150 metre extent. There are no other forest fuels within the 150 metres from the subject site.	Minor Decrease
		B. WOODLAND	Tree-1			
		D. SCRUB	Tree-2	N/A		
		D. SCRUB	Tree/Shrub	Limited	A small area of melaleucas exist within an isolated patch amongst the forest fuels.	Significant Decrease
		C. SHRUBLAND	Shrub	N/A	-	N/A
		G. GRASSLAND	Grass	Limited	There is a small area of pasture to the north of the subject site. The grassland is separated form the subject site by a low bushfire threat, being a local road.	Neutral
	The Land Surrounding the 'Subject Land + 150m Extent'		Tree-1	Limited	Approximately 30% of the 2km assessment zone consists of this vegetation. The vegetation extends beyond the 2km assessment area to the north and west.	Minor Decrease
			Tree-2	N/A	-	N/A
			Tree/Shrub	Limited	Approximately 10% melaleucas within the 2km assessment zone to the north and west.	Minor Decrease
			Shrub	N/A	-	N/A
			Grass	Limited	Pastured paddocks exist within the 2km assessment zone, however there are low threat separation areas, industrial area development between the subject site and grassland vegetation.	Significant Decrease
The bushfire fuels are continuous. Fire can		A. FOREST	Tree-1	Substantially Exists	The forest fuels are connected to large areas of pasture, grassland fuels to the north.	Minor Decrease
		B. WOODLAND	Tree-1			

EXTENT AND CONTINUITY OF IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY THREAT LEVELS

Relevant Physical Factors [1,4 & 6]	Vegetation Location Within the Surrounding Landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of the Threat Level [4 & 5]
spread uninterrupted and not be slowed by the intermittent absence of fuels. This presents one of the physical factors required for the development of an extreme bushfire event. [6]	The 'Subject Land + 150m Extent'.	D. SCRUB	Tree-2	N/A	To the east the forest fuels are discontinuous. There is a low bushfire threat area, industrial development, separating the forest fuels within 1km from the subject site. There are areas of pasture closer to the subject site.	N/A
		D. SCRUB	Tree/Shrub	Limited	To the north the limited area of melaleucas are predominately bordered by forest fuels. To the west melaleuca are predominantly in the creek line and are in areas separated by grassland fuels.	Significant Decrease
		C. SHRUBLAND	Shrub	N/A	-	N/A
		G. GRASSLAND	Grass	Substantially Exists	A small area of grassland (pasture) to the north is connected the forest fuels. The grassland is connected to the broader landscape.	Major Decrease
	The Land Surrounding the 'Subject Land + 150m Extent'		Tree-1	Substantially Exists	Within 2km, the forest fuels are fragmented by roads, railway line and industrial development.	Significant Decrease
			Tree-2	N/A	-	N/A
			Tree/Shrub	Partially Exists	Partially exist to the north and limited areas to the west (riparian zone)	Significant Decrease
			Shrub	N/A	-	N/A
			Grass	Partially Exists	Large areas are grazed paddocks separated by road networks and industrial development.	Minor Decrease

Note 1: Refer to Appendix 2 for additional information.

Note 2: Refer to Figure 5.1 Surrounding landscape – the identified vegetation categories.

Note 3: Refer to Appendix A6.4.2 for the map of classified (AS 3959:2018) bushfire prone vegetation and topography within the 'Subject Land + 150m Extent'. The identified classified vegetation that best corresponds to the categorised vegetation will be specific to the subject land and its surrounds and is identified in this column.

Note 4: Refer to Appendix 5 for a description of the criteria that establish the vegetation categories and their potential threat level range.

Note 5: The modification rating is derived for the identified area of vegetation/land after conducting a qualitative assessment of the existence of the relevant physical factor. It is applied to deriving an 'Indicative Threat Level' from the 'Potential Threat Level Range' associated with each vegetation category.

Note there is a base bushfire fuels, terrain and fire weather assumption that has been applied in establishing the 'Potential Threat Level' ranges. It is a scenario of a sufficiently large area of bushfire prone vegetation, with continuous fuels, on flat to undulating terrain with no slopes greater than ten degrees, that can support a fully developed bushfire. It is also

EXTENT AND CONTINUITY OF IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY THREAT LEVELS						
Relevant Physical Factors [1,4 & 6]	Vegetation Location Within the Surrounding Landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of the Threat Level [4 & 5]
assumed to be possible for the most adverse (catastrophic) fire weather to occur. This scenario establishes the midpoint of the 'Potential Threat Level Range'. Refer to Appendix 5 for additional explanatory and supporting information. **Note 6:** A physical factor with identified links (from bushfire research) to dynamic bushfire propagation and subsequent development of extreme bushfire events, including the development of pyroconvective, coupled atmosphere events. Refer to Appendix 3 for additional information.						

5.1.3.2 VEGETATION FUEL LOAD/ARRANGEMENT/BARK HAZARD FACTORS

FUEL LOAD/ARRANGEMENT/BARK HAZARD OF IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY INDICATIVE THREAT LEVELS						
Relevant Physical Factors [1 & 6]	Vegetation Location Within the Surrounding landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of Indicative Threat Level [4 & 5]
Managed Fuel Loads Evidence that management of fuel loads is planned, conducted regularly and enforced. Includes prescribed burning programs.	The 'Subject Land + 150m Extent'.	A. FOREST	Tree-1	Does Not Exist	The subject lot is managed (no fuel). Extending to 150m from the subject site in managed, cleared for development or building constructed and properties managed. Road verges are managed by slashing.	Significant Decrease
		B. WOODLAND	Tree-1			
		D. SCRUB	Tree-2	N/A		N/A
		D. SCRUB	Tree/Shrub	Limited	There is no evidence these areas are being managed.	Minor Decrease
		C. SHRUBLAND	Shrub	N/A	-	N/A
		G. GRASSLAND	Grass	Partially Exists	Grassland on road verges are slashed and there is evidence of surrounding pasture is grazed.	Significant Decrease
	The Land Surrounding the 'Subject Land + 150m Extent'		Tree-1	Limited	Road verges are slashed to control tree encroachment. There is no evidence of forest fuels being managed.	Minor Decrease
			Tree-2	N/A	-	Select.
			Tree/Shrub	Partially Exists	There is no evidence these areas are being managed other than understory being grazed or for hay production.	Significant Decrease
			Shrub	N/A	-	N/A
			Grass	Substantially Exists	Grassland on road verges are slashed and there is evidence of surrounding pasture is grazed and for hay production.	Significant Decrease
Adverse Fuel Loads and Arrangement [6] Fuel loads heavier than a normal range for the category or are uncharacteristic for the category; and/or	The 'Subject Land + 150m Extent'.	A. FOREST	Tree-1	Does Not Exist	The fuels loads are below the national standard (AS 3959) however may exceed the 15-20t/ha. Fuels in this region due to poor soil types generally will not accumulate excessive fuels.	Neutral
		B. WOODLAND	Tree-1			
		D. SCRUB	Tree-2	N/A		N/A
		D. SCRUB	Tree/Shrub	Limited	This vegetation to the south, 130m x 200m area will accumulate expected fuel loads for scrub and may exceed 15-20 t/ha	Neutral
		C. SHRUBLAND	Shrub	N/A	-	N/A
		G. GRASSLAND	Grass	Does Not Exist	There is evidence that the small are of grassland is grazed.	Minor Decrease

FUEL LOAD/ARRANGEMENT/BARK HAZARD OF IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY INDICATIVE THREAT LEVELS						
Relevant Physical Factors [1 & 6]	Vegetation Location Within the Surrounding landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of Indicative Threat Level [4 & 5]
Worst case fuel arrangement exists. [Where heavy forest fuel types with loads in excess of 15-20 t/ha exist, the potential for vorticity-driven lateral spread exists (as a dynamic fire behaviour) if the required terrain characteristics are present].	The Land Surrounding the 'Subject Land + 150m Extent'		Tree-1	Limited	Road verges are slashed to control tree encroachment. There is no evidence of forest fuels being managed. This region usually does not support excessive fuel loads due to poor sandy soil types, however may exceed 15-20t/ha.	Minor Increase
			Tree-2	N/A	-	N/A
			Tree/Shrub	Partially Exists	This vegetation has evidence of stock grazing, the vegetation is degraded and unlikely accumulate fuels greater than detailed in AS 3959 and 15-20t/ha. If stock removed from this vegetation, fuel loads will increase.	Minor Increase
			Shrub	N/A	-	N/A
			Grass	Does Not Exist	Grassed areas 1are generally grazed or partially managed	Significant Decrease
Bark Hazard The presence of high threat level bark hazards with potential for high levels of ember/burning debris production (spotting density) and long burnout times (travel distance).	The 'Subject Land + 150m Extent'.	A. FOREST	Tree-1	Partially Exists	Trees within this area are generally tight barked and coarse loose fibrous bark. However, occasional stringy bark trees exist.	Neutral
		B. WOODLAND	Tree-1			
		D. SCRUB	Tree-2	N/A		N/A
		D. SCRUB	Tree/Shrub	Partially Exists	Trees/shrub within this area is predominately paperbark and tight bark.	Neutral
		C. SHRUBLAND	Shrub	N/A	-	N/A
		G. GRASSLAND	Grass	N/A	Any spotting from a grass fire will be short distance and is normally consumed by the fire front.	N/A
	The Land Surrounding the 'Subject Land + 150m Extent'		Tree-1	Select.	Trees within this area are generally tight barked and coarse loose fibrous bark. However, occasional stringy bark trees exist.	Neutral

FUEL LOAD/ARRANGEMENT/BARK HAZARD OF IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY INDICATIVE THREAT LEVELS						
Relevant Physical Factors [1 & 6]	Vegetation Location Within the Surrounding landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of Indicative Threat Level [4 & 5]
			Tree-2	N/A	-	N/A
			Tree/Shrub	Partially Exists	Trees/shrub within this area is predominately paperbark and tight bark.	Neutral
			Shrub	N/A	-	N/A
			Grass	N/A	Any spotting from a grass fire will be short distance and is normally consumed by the fire front.	N/A

Note 1: Refer to Appendix 2 for additional information.

Note 2: Refer to Figure 5.1 Surrounding landscape – the identified vegetation categories.

Note 3: Refer to Appendix A6.4.2 for the map of classified (AS 3959:2018) bushfire prone vegetation and topography within the 'Subject Land + 150m Extent'. The identified classified vegetation that best corresponds to the categorised vegetation will be specific to the subject land and its surrounds and is identified in this column.

Note 4: Refer to Appendix 5 for a description of the criteria that establish the vegetation category and its indicative threat level.

Note 5: The modification rating is derived for the identified area of vegetation/land after conducting a qualitative assessment of the existence of the relevant physical factor. It is applied to determining a 'Modified Indicative Threat Level' from the ranges of 'Indicative Threat Level' ranges that correspond to each vegetation category (refer to Appendix 5).

Note there is a base bushfire fuels, terrain and fire weather assumption that has been applied in establishing the initial 'Indicative Threat Level' ranges. It is a scenario of a sufficiently large area of bushfire prone vegetation, with continuous fuels, on flat to undulating terrain with no slopes greater than ten degrees, that can support a fully developed bushfire. It is assumed to be possible for the most adverse (catastrophic) fire weather to occur.

Note 6: A physical factor with identified links (from bushfire research) to dynamic bushfire propagation and subsequent development of extreme bushfire events, including the development of pyroconvective, coupled atmosphere events. Refer to Appendix 3 for additional information.

5.1.3.3 TERRAIN FACTORS

<table>
<tr><th colspan="7">GROUND SLOPE AND SLOPE LENGTH UNDER IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY INDICATIVE THREAT LEVELS</th></tr>
<tr><th>Relevant Physical Factors [1 & 6]</th><th>Vegetation Location Within the Surrounding landscape [2]</th><th>Vegetation Classification AS 3959:2018 [3]</th><th>Vegetation Category [4]</th><th>Existence of Physical Factor</th><th>Assessment Comments (As Needed)</th><th>Resultant Modification of Indicative Threat Level [4 & 5]</th></tr>
<tr><td rowspan="11">Effective Slopes ≥ 10 Degrees
Vegetation exists, at least partially, on terrain of 10 degrees or greater ground slope and of sufficient length (see slope length factor), that will increase fire rates of spread and consequent fire intensity.</td><td rowspan="6">The 'Subject Land + 150m Extent'.</td><td>A. FOREST</td><td>Tree-1</td><td rowspan="2">Does Not Exist</td><td rowspan="3">The terrain is relatively flat. There are no slopes of sufficient length to increase fir behaviour.</td><td rowspan="2">Neutral</td></tr>
<tr><td>B. WOODLAND</td><td>Tree-1</td></tr>
<tr><td>D. SCRUB</td><td>Tree-2</td><td>N/A</td><td>N/A</td></tr>
<tr><td>D. SCRUB</td><td>Tree/Shrub</td><td>Does Not Exist</td><td>The terrain is relatively flat. There are no slopes of sufficient length to increase fir behaviour.</td><td>Neutral</td></tr>
<tr><td>C. SHRUBLAND</td><td>Shrub</td><td>N/A</td><td>-</td><td>N/A</td></tr>
<tr><td>G. GRASSLAND</td><td>Grass</td><td>Does Not Exist</td><td>The terrain is relatively flat. There are no slopes of sufficient length to increase fir behaviour.</td><td>Neutral</td></tr>
<tr><td colspan="2" rowspan="5">The Land Surrounding the 'Subject Land + 150m Extent'</td><td>Tree-1</td><td>Does Not Exist</td><td>The terrain is relatively flat. There are no slopes of sufficient length to increase fire behaviour.</td><td>Neutral</td></tr>
<tr><td>Tree-2</td><td>N/A</td><td>-</td><td>N/A</td></tr>
<tr><td>Tree/Shrub</td><td>Does Not Exist</td><td>The terrain is relatively flat. There are no slopes of sufficient length to increase fire behaviour.</td><td>Neutral</td></tr>
<tr><td>Shrub</td><td>N/A</td><td>-</td><td>N/A</td></tr>
<tr><td>Grass</td><td>Does Not Exist</td><td>The terrain is relatively flat. There are no slopes of sufficient length to increase fire behaviour.</td><td>Neutral</td></tr>
<tr><td>Effective Slopes ≥ 20 Degrees [6]
Vegetation exists, at least partially, on steep terrain of 20 degrees or greater ground slope and of</td><td>The 'Subject Land + 150m Extent'.</td><td colspan="5">There are no areas within 2 kms of the subject site that have effective slopes greater than 20 degrees</td></tr>
</table>

BUSHFIRE PRONE PLANNING

GROUND SLOPE AND SLOPE LENGTH UNDER IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY INDICATIVE THREAT LEVELS						
Relevant Physical Factors [1 & 6]	Vegetation Location Within the Surrounding landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of Indicative Threat Level [4 & 5]
sufficient length (see slope length factor). The presence of ridges able to present steep leeward slopes to exposed elements is an additional component of this factor.	The Land Surrounding the 'Subject Land + 150m Extent'		There are no areas within 2 kms of the subject site that have effective slopes greater than 20 degrees			
Sufficient Length of Steep Slopes The identified 20 degree and greater slopes can support the entire flame depth of a fully developed fire.	The 'Subject Land + 150m Extent'.				There are no areas within 2 kms of the subject site that have effective slopes greater than 20 degrees	
	The Land Surrounding the 'Subject Land + 150m Extent'					
Note 1: Refer to Appendix 2 for additional information. **Note 2:** Refer to Figure 5.1 Surrounding landscape – the identified vegetation categories. **Note 3:** Refer to Appendix A6.4.2 for the map of classified (AS 3959:2018) bushfire prone vegetation and topography within the 'Subject Land + 150m Extent'. The identified classified vegetation that best corresponds to the categorised vegetation will be specific to the subject land and its surrounds and is identified in this column. **Note 4:** Refer to Appendix 5 for a description of the criteria that establish the vegetation category and its indicative threat level.						

GROUND SLOPE AND SLOPE LENGTH UNDER IDENTIFIED VEGETATION CATEGORIES – POTENTIAL TO MODIFY INDICATIVE THREAT LEVELS						
Relevant Physical Factors [1 & 6]	Vegetation Location Within the Surrounding landscape [2]	Vegetation Classification AS 3959:2018 [3]	Vegetation Category [4]	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of Indicative Threat Level [4 & 5]
Note 5: The modification rating is derived for the identified area of vegetation/land after conducting a qualitative assessment of the existence of the relevant physical factor. It is applied to determining a 'Modified Indicative Threat Level' from the ranges of 'Indicative Threat Level' ranges that correspond to each vegetation category (refer to Appendix 5). Note there is a base bushfire fuels, terrain and fire weather assumption that has been applied in establishing the initial 'Indicative Threat Level' ranges. It is a scenario of a sufficiently large area of bushfire prone vegetation, with continuous fuels, on flat to undulating terrain with no slopes greater than ten degrees, that can support a fully developed bushfire. It is assumed to be possible for the most adverse (catastrophic) fire weather to occur. **Note 6:** A physical factor with identified links (from bushfire research) to dynamic bushfire propagation and subsequent development of extreme bushfire events, including the development of pyroconvective, coupled atmosphere events. Refer to Appendix 3 for additional information. **Note 7:** Refer to Figure 5.3: Surrounding landscape - terrain slope map.						

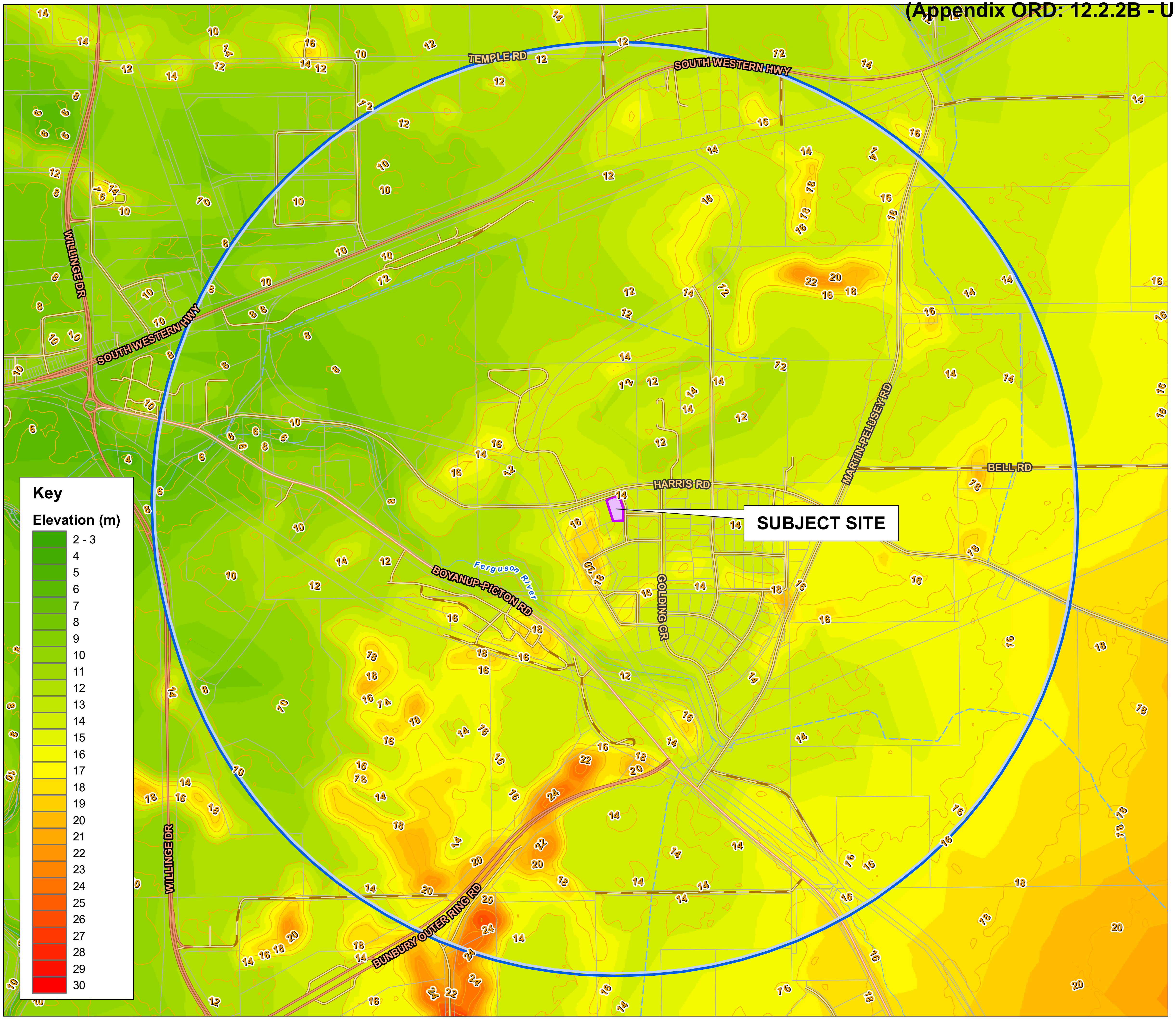


Figure 5.2

Surrounding Landscape Terrain Elevation Map

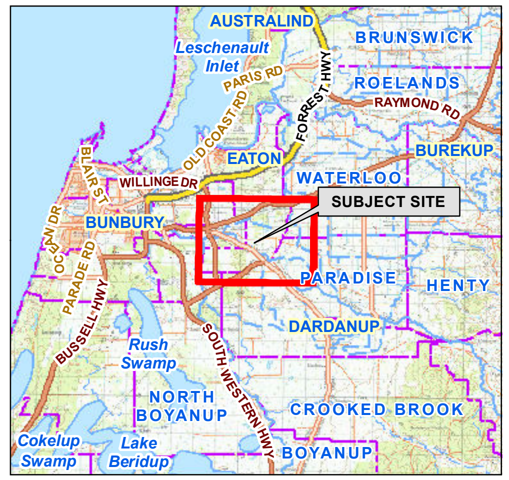
Lot 504 on Plan 057919, Area : 5740 sq m
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

------ LEGEND ------

- Subject Site
- Other Lots
- 2 km Buffer

0 1,000
Metres

------ LOCALITY ------



N

Aerial Imagery : Landgate/SLIP
Image Date : Feb 2022

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map compiled by: Ian Ross 24/01/2024
Map updated by: Neil 24/01/2024
A3 Scale 1:16,000

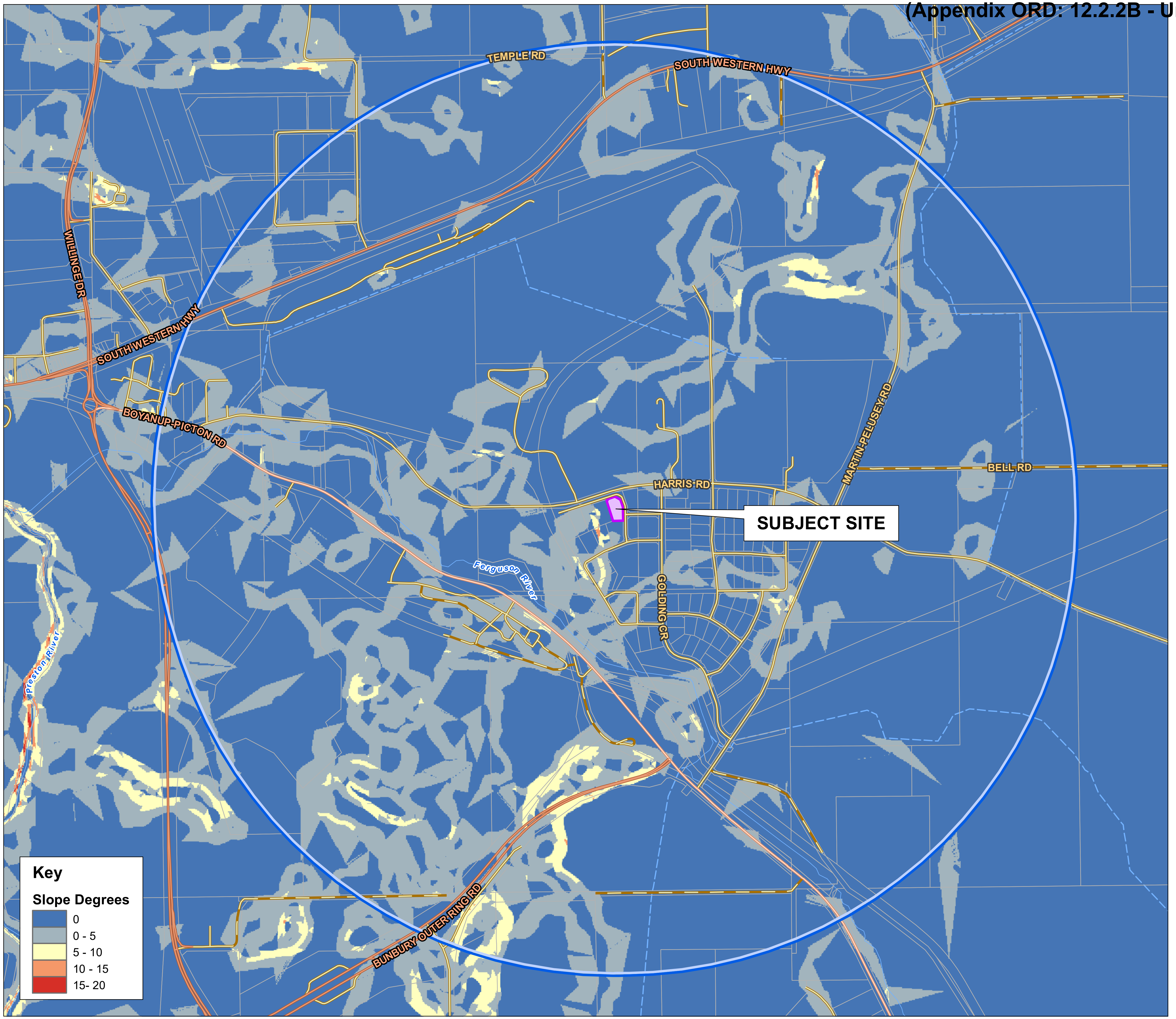
BUSHFIRE PRONE PLANNING

Map Document Path / Name: K:\Projects\Jobs 2023\230997 - 5 Hardisty Court, Picton East (BMP BRMP)\Mapping\MXD\230997_Fig5-2_DEM_5-Hardisty-Picton-East.mxd

Figure 5.3

Surrounding Landscape Terrain Slope Map

Lot 504 on Plan 057919, Area : 5740 sq m
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP

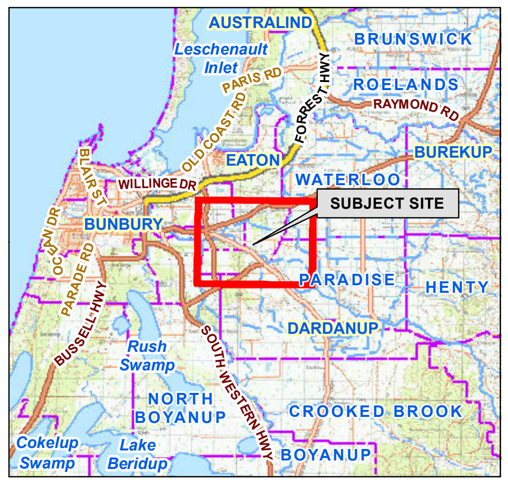


------ LEGEND ------

Subject Site
Other Lots
2 km Buffer

0 1,000
Metres

------ LOCALITY ------



Aerial Imagery : Landgate/SLIP
Image Date : Feb 2022

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Mercator Units: Metre
Map compiled by: Ian Ross 24/01/2024
Map updated by: Neil 24/01/2024
A3 Scale 1:16,000

BUSHFIRE PRONE PLANNING

Map Document Path / Name: K:\Projects\Jobs 2023\230997 - 5 Hardisty Court, Picton East (BMP BRMP)\Mapping\MXD\230997_Fig5-3_SLOPE_5-Hardisty-Picton-East.mxd

5.1.3.4 FIRE WEATHER FACTORS

The purpose of including consideration of fire weather factors in the surrounding landscape assessment is to be able to account for those scenarios in which the most adverse (catastrophic) fire weather conditions are either (a) cannot occur; or (b) highly unlikely to occur and this can be fully justified. Otherwise, such conditions are accounted for in the 'Indicative Threat Levels' stated for each category of vegetation in Appendix 5.

FIRE WEATHER CONSIDERATIONS - POTENTIAL TO MODIFY INDICATIVE THREAT LEVELS			
Relevant Physical Factor	Existence of Physical Factor	Assessment Comments (As Needed)	Resultant Modification of Indicative Threat Level [1]
Associated with intensification of fire behaviour			
Location has persistent strong synoptic winds (i.e., not fire driven)	Possible to Occur	Experiences strong winds from the west	Neutral
Very low relative humidity and very high ambient air temperature	Possible to Occur	Very likely during the summer months	Minor Increase
Associated with development of dynamic fire propagation behaviours, intensification of fire behaviour, and development of extreme bushfire events. [2]			
Wind speeds in excess of approximately 20 km/hr and wind direction within 30-40 degrees of ridge/scarp features – increasing the potential for vorticity-driven lateral spread.	N/A	No ridge or scarp features exist within the assessment area.	N/A
Due to weather factors, fuel moisture contents can dry to around 5% or less.	Possible to Occur	Can occur during the summer months	Minor Increase
Atmospheric instability creating opportunity for atmospheric coupling and violent pyroconvection. [3]	Limited	Very unlikely to occur due to the fragmented landscape surrounds.	Neutral

Note 1: The modification rating is derived for the identified area of vegetation/land after conducting a qualitative assessment of the existence of the relevant physical factor. It is applied to determining a 'Modified Indicative Threat Level' from the ranges of 'Indicative Threat Level' ranges that correspond to each vegetation category (refer to Appendix 5).

Note there is a base bushfire fuels, terrain and fire weather assumption that has been applied in establishing the 'Indicative Threat Level' ranges. It is a scenario of a sufficiently large area of bushfire prone vegetation, with continuous fuels, on flat to undulating terrain with no slopes greater than ten degrees, that can support a fully developed bushfire. It is assumed to be possible for the most adverse (catastrophic) fire weather to occur.

Note 2: Refer to Appendix 3 for additional information.

Note 3: Regarding the potential for a pyroconvective fire event to occur, the default assumption is that most locations will have the potential for vertical movement of air without any resistance to that movement (e.g. temperature inversion), as one of the typical requirements for such an event to occur.

It is not sufficiently risk averse to assume that atmospheric instability is unlikely to exist. Different temperature air masses can always interact as a consequence of the passage of different weather systems at any location. Justifying a variation to this is outside the scope of this assessment.

5.1.3.5 ASSESSMENT SUMMARY - THE BUSHFIRE HAZARD THREAT LEVEL TO BE APPLIED (INDICATIVE)

THE BUSHFIRE HAZARD OF THE SURROUNDING LANDSCAPE – DERIVATION OF THE THREAT LEVEL (INDICATIVE)							
Vegetation Location Within the Surrounding Landscape	Identified Vegetation Categories	Potential Threat Level Range	Assessed Potential for the Modification of the Threat Level by Each Stated Physical Factor				The Assessed Threat Level
			Vegetation Extent and Continuity	Fuel Load / Arrangement and Bark Hazard	Terrain - Ground Slope and Slope Length	Fire Weather	
(Section 5.1)	(Figure 5.1 & Appendix 5)	(Appendix 5)	(Section 5.1.3.1)	(Section 5.1.3.2)	(Section 5.1.3.3)	(Section 5.1.3.4)	
The 'Subject Land + 150m Extent'	Tree-1	Moderate to Extreme	Minor Decrease	Neutral	Neutral	Neutral	High
	Tree-2	Moderate to Extreme	N/A	N/A	N/A	N/A	N/A
	Tree/Shrub	Moderate to High	Significant Decrease	Neutral	Neutral	Neutral	Moderate
	Shrub	Low to Moderate	N/A	N/A	N/A	N/A	N/A
	Grass	Low to Moderate	Significant Decrease	Significant Decrease	Neutral	Neutral	Low
	No/Low Threat	None to Low					
The Land Surrounding the 'Subject Land + 150m Extent'	Tree-1	Moderate to Extreme	Significant Decrease	Neutral	Neutral	Neutral	Moderate
	Tree-2	Moderate to Extreme	N/A	N/A	N/A	N/A	N/A
	Tree/Shrub	Moderate to High	Minor Decrease	Neutral	Neutral	Neutral	Moderate
	Shrub	Low to Moderate	N/A	N/A	N/A	N/A	N/A
	Grass	Low to Moderate	Minor Increase	N/A	Neutral	Neutral	Moderate
	No/Low Threat	None to Low					Moderate
THE DERIVED THREAT LEVEL TO APPLY (INDICATIVE) [1]			**Very Low** ☐	**Low** ☐	**Moderate** ☒	**High** ☐	**Extreme** ☐

Note 1: Derived qualitatively by considering the assessed potential threat level for each identified category of vegetation and the relative extents of each category. The highest level will be applied unless it is associated with a less significant extent of vegetation.

ASSESSMENT SUMMARY COMMENTS

Vegetation surrounding the subject site is fragmented by the developing industrial area, roads and rail line. The surrounding grassland is largely managed by grazing or hay production (baled hay). The predominately pasture (grassland) will unlikely contribute to ember attack. The small area of Scrub (melaleucas) to the south, being restricted in size, during a bushfire event will potentially produce minor embers. Other areas to the north and west will potentially produce embers and limited firebrands.

The predominant threat will be from the north will be moderate to high ember attack with limited fire brands.

5.1.4 DERIVATION OF INHERRENT / RESIDUAL THREAT LEVELS - PROTECTION MEASURE APPLICATION ANALYSIS

For each identified bushfire hazard, an assessment is conducted that considers the effectiveness and application status of all available threat reducing bushfire protection measures that are listed under their applicable bushfire protection mechanism. This information is subsequently applied to deriving threat levels applied to deriving risk levels.

5.1.4.1 PROTECTION MEASURES - IDENTIFICATION AND APPLICATION STATUS

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE THREAT LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – PREVENT BUSHFIRE IGNITION AND/OR SEVERITY BY MANAGING THE FUELS: Eliminate or reduce vegetation fuel loads, modify their properties (vegetation types and fuel arrangement). Maintain the measures over time to eliminate bushfire or lower the severity of fire behaviours and the consequent threat levels. Desired and mandatory environmental conservation will likely always be the most significant limitation to applying the mechanism.</td></tr>
<tr><td>1.1</td><td>Remove Offsite Bushfire Fuel: Remove fuel permanently by clearing bushfire prone vegetation - only when permission and relevant agreements for removal have been established with the landowner and relevant authorities.</td><td>Very High</td><td>No</td><td>Partly</td><td>Unknown</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Off site vegetation is not in the control of the subject site landowner. The site is within an ongoing industrial/warehousing precinct, which has been permanently cleared of bushfire prone vegetation. Remnant vegetation is not expected to be modified.
Recommendation Details: Not Applicable</td></tr>
<tr><td>1.2</td><td>Reduce Offsite Bushfire Fuel - Prescribed Burning: Planned hazard reduction when permission and relevant agreements to conduct and maintain have been established with the landowner and relevant authorities.</td><td>High</td><td>No</td><td>No</td><td>Unknown</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Off site vegetation is not in the control of the subject site landowner. The local vegetation does not show signs of recent burns (prescribed or uncontrolled).
Recommendation Details: Not Applicable</td></tr>
<tr><td>1.3</td><td>Reduce Offsite Bushfire Fuel - Mechanical: Modify composition of vegetation types and/or the arrangement of fuels and maintain the modification over time e.g. reduce canopy, limit higher threat bark types (e.g. stringy, ribbon), minimise 'ladder' fuels'. Will likely require permission and relevant agreements to conduct and maintain from the landowner and relevant authorities.</td><td>High</td><td>No</td><td>Partly</td><td>Yes</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Off site vegetation is not in the control of the subject site landowner. Some lots within the industrial precinct have not yet been developed, but are slashed to prevent classified vegetation (grassland) re-establishing.
Recommendation Details: Not Applicable</td></tr>
</table>

	PROTECTION MEASURES AVAILABLE TO REDUCE THREAT LEVELS	Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
1.4	**Remove Onsite Bushfire Fuel:** Remove fuel permanently by clearing bushfire prone vegetation – only after the necessary approvals from relevant authorities have been obtained.	Very High	Yes	Yes	No	No
Assessment Comments: The subject lot is a sealed hardstand entirely clear of vegetation. *Recommendation Details:* Not Applicable						
1.5	**Reduce Onsite Bushfire Fuel - Prescribed Burning:** Planned hazard reduction only after the necessary approvals from relevant authorities have been obtained.	High	N/A	N/A	N/A	N/A
Assessment Comments: The subject lot is a sealed hardstand entirely clear of vegetation. *Recommendation Details:* Not Applicable						
1.6	**Reduce Onsite Bushfire Fuel - Mechanical:** Modify composition of vegetation types and/or the arrangement of fuels and maintain the modification over time e.g. reduce canopy, limit higher threat bark types (e.g. stringy, ribbon), minimise 'ladder' fuels'. Approvals from relevant authorities regarding environmental considerations may be required.	High	N/A	N/A	N/A	N/A
Assessment Comments: The subject lot is a sealed hardstand entirely clear of vegetation. *Recommendation Details:* Not Applicable						
1.7	**Reduce Road Verge Fuel:** Road verges of designated evacuation routes are subject to fuel load reduction, tree management and ongoing maintenance when an authority exists to conduct and maintain.	Medium	No	Yes	Yes	No
Assessment Comments: Most road verges are managed to low threat, being mulched, sealed, or slashed. The northern verge of Hardisty Road is partially managed, with slashing of grasses and pruning of trees visible. *Recommendation Details:* Not Applicable						
1.8	**Enforce Compliance with Local Government Property Management Directives:** Inform landowners of the high level of enforcement that will be applied by the relevant authority.	High	No	Yes	No	No
Assessment Comments: All lots within the industrial precinct are currently compliant with the Local Government Firebreak Notice. *Recommendation Details:* Not Applicable						

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE THREAT LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – PREVENT BUSHFIRE IGNITION BY MANAGING HEAT ENERGY SOURCES: The use of measures that control the existence of potential ignition sources. This includes human actions and/or faulty or poorly designed equipment. Natural causes of ignition (lightning) cannot be controlled and will remain an unmanageable limitation.</td></tr>
<tr><td>1.9</td><td>Robust and Effective Site Operational Procedures: Apply fire safe principles to site operation procedures including:
• Eliminating or reducing the potential for open air creation of fire, embers or sparks; and
• Closing identified high risk operations when a bushfire event exists.
• Ensure safe practices are carried out via appropriate guidelines, protocols, signage and education.</td><td>Medium</td><td>Yes</td><td>No</td><td>Unknown</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Operating procedures document has not yet been prepared. The site is unstaffed so ongoing procedures may not be comprehensive.
Recommendation Details: The Site Operating Procedures (document title pending) should contain the following information:
• Smoking restrictions or designated smoking locations.
• Procedures regarding vegetation management and accidental ignition prevention.
• Heavy equipment is not to be operated where long grass (>100mm) or heavy leaf litter is present, particularly during the bushfire season (see the Local Government Prohibited Burning Period).
• Servicing of battery energy storage systems should not take place on days of Extreme or Catastrophic Fire Danger Rating, except where the system is experiencing malfunction or abnormal behaviour.
• The following procedures should to be completed prior to the bushfire season (see the Local Government Prohibited Burning Period):
  o Scheduled maintenance to assets, emergency equipment, or fire detection/prevention systems.
  o Scheduled housekeeping to remove excess leaf litter/debris from assets around the facility.
  o The ongoing requirements outlined in the Bushfire Management Plan.
The Emergency Management Plan and any Emergency Response Guide (FES-ERG) should contain procedures for isolation, shut-down, fail safe or management of critical/high-risk plant, equipment, and utilities, and their advised triggers.</td></tr>
<tr><td>1.10</td><td>Develop Planning and Management Procedures for Prescribed Burning: Ensure proper management of hazard reduction burning to prevent ignition of unintended fuels.</td><td>Medium</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="7">Assessment Comments: No vegetation will be present onsite.
Recommendation Details: Not Applicable</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE THREAT LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>1.11</td><td>Design and Construct Equipment to Prevent Airborne Ignition: Apply fire safe design principles to equipment, vehicles, and energy transmission etc. Design to control rate of energy release and eliminate/reduce potential for open air creation of fire, embers or sparks.</td><td>Medium</td><td>Yes</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: All equipment must meet minimum national and state standards and guidelines. Due to the nature of the site, control of ignition sources will be stringent. Accidental ignition is instead managed through operating procedures (Measure 1.9).
Recommendation Details: Not Applicable</td></tr>
<tr><td>1.12</td><td>Actively Enforce Activity Restrictions: Impose restrictions on source of ignition operations by enforcing total fire bans.</td><td>Medium</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Total fire bans will be complied with. Total fire ban exemptions will be applied for, if necessary for site functionality.
Recommendation Details: See Measure 1.9.</td></tr>
<tr><td>1.13</td><td>Monitor and Penalise Illegal Activity: Reduce arson events as sources of ignition by monitoring and publicising enforcement of penalties.</td><td>Medium</td><td>No</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Legal penalties are in place and enforced by law. The developer does not have control over legal enforcement.
Recommendation Details: Not Applicable</td></tr>
<tr><td>1.14</td><td>Bushfire Awareness and ‘Good Practices’ Education: Educate persons to reduce the occurrence of accidental ignitions in vegetation by persons and/or vehicles, including in road reserves.</td><td>Medium</td><td>Yes</td><td>No</td><td>Yes</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Activities which may result in fire are prohibited onsite. Contractors and staff are required to complete inductions and/or be escorted, and follow the operating procedures per Measure 1.9.
Recommendation Details: Not Applicable</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM - PREVENT BUSHFIRE IGNITION BY MANAGING INTERACTIONS OF HEAT ENERGY SOURCES AND FUELS: The use of measures that control the interaction of heat sources and fuels.</td></tr>
<tr><td>1.15</td><td>Barriers (Shielding) between Ignition Sources and Fuels: Utilise physical barriers (shielding) between bushfire fuels and heat energy sources such as electricity generation / transmission, fuel supplies, stored flammable products etc.
Examples include appropriate walls, enclosures, and underground transmission of electricity or liquid/gas fuels.</td><td>Medium</td><td>Yes</td><td>No</td><td>No</td><td>Yes</td></tr>
</table>

<table>
<tr><th rowspan="2" colspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE THREAT LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td colspan="7">Assessment Comments: Batteries and associated infrastructure are part of the site layout and will be required to have a sufficient APZ installed that flame contact and excessive radiant heat will not occur. This has been addressed in Measure 7.3. Any ignition of offsite vegetation would be due to embers or flaming debris/firebrands, which shielding is not effective against, except internal to the battery cabinets themselves. Ember screening of battery cabinets is required through Measure 14.13 which will reduce the capacity for such embers to escape a compromised battery cabinet.

Recommendation Details: See Measure 14.13.</td></tr>
<tr><td>1.16</td><td>Equipment Design and Construction to Reduce Heat Transfer: Through design (e.g., insulation) and materials, control heat energy transfer via conduction, convection and radiation.</td><td>Medium</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: All equipment must meet minimum national and state standards and guidelines. Due to the nature of the site, control of ignition sources will be stringent. The CATL EnerC+ Packs product is designed in compliance with relevant standards:
• NFPA 855: Standard for the Installation of Stationary Energy Storage Systems
• UL 9540: Energy Storage System Requirements
• UL 9540A: Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
• IEC 62619:2022 - Secondary cells and batteries containing alkaline or other non-acid electrolytes which has been adopted by Standards Australia as AS IEC 62619:2023.
Recommendation Details: See Measure 14.16.</td></tr>
<tr><td>1.17</td><td>Separation Distance Between Ignition Sources and Fuels: Establish sufficient separation distance between bushfire fuels and heat energy sources such as electricity generation / transmission, fuel supplies, stored flammable products etc.</td><td>Medium</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Batteries and associated infrastructure are part of the site layout and will be required to have a sufficient APZ installed that flame contact and excessive radiant heat will not occur. This has been addressed in Measure 7.3.

Recommendation Details: See Measure 7.3.</td></tr>
<tr><td colspan="7">Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.2.4 for explanation and defining.
Note 2: Protection Measure Application Status:
• Possible: Protection measures that can potentially be applied to the proposed development/use.
• Fully or Partly Exists: A current state assessment of protection measures already implemented by existing components of the proposed development/use. The status of current implementation can also be fully or partly. These measures are accounted for in assessing ‘inherent’ risk levels (refer to Glossary).
• Currently Planned: Protection measures that:
    • Are incorporated into the site plans;</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE THREAT LEVELS	Effectiveness Rating [1]	Application Status [2]			
		Possible	Exists	Planned	Additionally Recommend

- Exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), alternative solutions and any additional recommended protection measures - for which a responsibility for their implementation has been created and approved; and/or
- Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), that can be met and for which a responsibility for their implementation can be created in the BMP.

These planned measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).

- **Additionally Recommend:** Protection measures that:
  - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and comprise alternative solutions and/or additional recommended protection measures (that can and should be implemented in the opinion of the bushfire consultant), and for which a responsibility for their implementation can be created in the BMP; and/or
  - Are developed in the process of producing this risk assessment and management report and for which a responsibility for their implementation can be created in the BMP.

These additionally recommended measures, along with existing and planned measures, are accounted for in assessing 'residual' risk levels (refer to Glossary).

5.1.4.2 PROTECTION MEASURES - EFFECTIVENESS AND NUMBER APPLIED

For the identified bushfire hazard, the numbers of both available and potentially applied bushfire protection measures are summarised and the effectiveness of each measure at reducing threat levels is stated. This information is subsequently applied to assess the ability of applied protection measures to reduce threat levels. Refer to Appendix 1 for explanatory and supporting information.

THREAT REDUCING PROTECTION MEASURE ANALYSIS								
The Protection Mechanism	Effectiveness Rating [1]	Numbers of Protection Measures						
		Total Available	Application Status [2]					
			Possible	Fully Exists	Partly Exists	Currently Planned	Additionally Recommen	
Prevent Bushfire Ignition and/or Severity by Managing the Fuels	Very High	2			1			
	High	5		1	1	1		
	Medium	1		1		1		
	Not Relevant							
Prevent Bushfire Ignition by Managing Heat Energy Sources	Very High							
	High							
	Medium	6	4	1		3	2	
	Not Relevant							
Prevent Bushfire Ignition by Managing Interactions of Heat Energy Sources and Fuels	Very High							
	High							
	Medium	3	3			2	3	
	Not Relevant							
Number Analysis	Very High	2			1			
	High	5		1	1	1		
	Medium	10	7	2		6	5	
	Not Relevant							
	Totals	17	7	3	2	7	5	

Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.3.4 for explanation and defining.

Note 2: Protection Measure Application Status: Refer to table footnotes in the preceding section.

5.1.4.3 PROTECTION MEASURES - THREAT REDUCING POTENTIAL

For the identified bushfire hazard, the potential for applied bushfire protection measures to reduce threat levels is assessed as a function of:

- The number of bushfire protection measures that can be applied compared to the number available; and
- The weighting applied to each protection measure that indicates how effective it can be at reducing hazard threat levels.

ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE BUSHFIRE HAZARD THREAT LEVELS [1]			
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF AN INHERENT THREAT LEVEL [2]			
Bushfire Direct Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind
Very Significant	Significant	Moderate	Very Significant
Significant			
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF A RESIDUAL THREAT LEVEL [3]			
Bushfire Direct Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind
Very Significant	Significant	Significant	Very Significant
Very Significant			

Note 1: Refer to Appendix A1.2 for explanatory and supporting information.

Note 2: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: Refer to Appendix 2 for explanatory and supporting information.

5.1.5 OUTCOMES OF THE BUSHFIRE HAZARD THREAT LEVEL ASSESSMENT

The preceding bushfire hazard assessments have enabled the derivation of the inherent and residual threat levels. These assessments are:

1. The derived bushfire hazard threat level (indicative) that has accounted for the identified vegetation categories in the surrounding landscape and the existence (or otherwise) of relevant physical factors that can intensify bushfire behaviour resulting in increased threat levels; and
2. The assessed threat reducing potential of applied bushfire protection measures.

The resultant inherent and residual threat levels (each applying to a different stage of bushfire protection measure application), are 'indicative' rather than 'determined' as they are derived through a qualitative assessment process (refer to Appendices A1.3.1 and A1.3.2 for explanatory and supporting information).

These threat levels, in combination with the corresponding assessed exposure and vulnerability levels for each of the assessed elements at risk, are later applied to deriving the inherent and residual bushfire risk levels.

BUSHFIRE HAZARD THREAT LEVEL ASSESSMENT OUTCOMES (INDICATIVE) [1]					
THE IDENTIFIED BUSHFIRE HAZARD - VEGETATION CATEGORIES AND POTENTIAL THREAT LEVEL RANGES [2]					
Tree-1	Tree-2	Tree/Shrub	Shrub	Grass	No/Low Threat
Moderate to Extreme	Moderate to Extreme	Moderate to Very High	Low to Moderate	Low to Moderate	None to Low

THE ASSESSED BUSHFIRE HAZARD THREAT LEVEL [3]				
Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☒

THE ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE BUSHFIRE HAZARD THREAT LEVELS [4]	
APPLICATION OF EXISTING AND PLANNED PROTECTION MEASURES	APPLICATION OF EXISTING, PLANNED AND RECOMMENDED PROTECTION MEASURES
Significant	Very Significant
RESULTANT INHERENT THREAT LEVEL [5]	RESULTANT RESIDUAL THREAT LEVEL [5]
Low	Low

Note 1: Refer to Appendix 1 for explanatory information.

Note 2: Assessment located in Section 5.1.2.

Note 3: Assessment located in Section 5.1.3.

Note 4: Assessment located in Section 5.1.4.

Note 5: Refer to A1.3.3 for explanatory information.

Assessment Comments: The additional recommendations relate to preventing ignition of offsite vegetation due to onsite events/activity, as the site and local industrial precinct is clear of vegetation.

5.2 THE IDENTIFIED ELEMENTS AT RISK

THE IDENTIFIED ELEMENTS AT RISK AND SUBJECT TO ASSESSMENT			
Possible Types	Exists on Subject Site and is Exposed to Bushfire Hazard Threats	Bushfire Risk Report Objectives Establish Requirement to Assess	Description
Persons located onsite and temporarily offsite as part of site operations - includes occupants, staff, visitors and persons on day trips offsite (e.g. tourism)			
Persons on access/egress routes (roads, driveways, access ways) in vehicles:		✓	The site is proposed to be unstaffed. Persons on access/egress routes has been assessed for Emergency Services and any staff temporarily onsite for maintenance etc.
Buildings - NCC Classes 1 to 9 - residential, offices, shops (retail/services), warehouses, carparks, factories, workshops, laboratories, public buildings.			
Buildings or Structures – NCC Class 10 - non-habitable – shed, carport, garage, fence, retaining wall etc.		✓	Permanent habitable buildings are not currently proposed. The assessment considers maintenance and storage sheds (Class 10a) which may be present onsite.
Park Vans – Long Term Installations – park vans with or without associated additions.			
Non-Building Accommodation - caravan / camper trailer / tent.			
Built Infrastructure Assets – structures associated with telecommunications / power generation / transport / water supply etc.	✓		Battery cabinets and associated infrastructure. The 22kV project includes 12 BESS battery storage enclosures, 4 inverters and control/switch room.
Materials Stored Outdoors – as part of recycling and/or waste management operations.			
Livestock/Animals - as part of commercial or private operations (saleyards / events / wildlife sanctuaries).			

5.3 EXPOSURE LEVEL ASSESSMENT – BUSHFIRE PROTECTION MEASURE ANALYSIS

For each stated element at risk and each relevant bushfire hazard, an assessment is conducted that considers the effectiveness and application status of all available exposure reducing bushfire protection measures that are listed under their applicable bushfire protection mechanism. This information is subsequently applied to deriving exposure levels.

5.3.1 PERSONS ON ACCESS/EGRESS ROUTES IN VEHICLES

5.3.1.1 PROTECTION MEASURES - IDENTIFICATION AND APPLICATION STATUS

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk: Persons on Access / Egress Routes in Vehicles	Access Route Description: Local road network - applicable to Emergency Services.					
THE PROTECTION MECHANISM - ESTABLISH SUFFICIENT SEPARATION FROM RELEVANT BUSHFIRE HAZARD THREATS: To utilise distance away from relevant bushfire hazard threats (primarily flames, radiant heat and tree strike/obstruction) while traversing an access/egress route in a vehicle to lower the exposure of persons for the expected time on the route.						
3.1	**Locate Access/Egress Routes Away from Adjacent Hazards:** Existing or to be installed vehicular access/egress route components (roads, access ways, and driveways) are positioned to maximise the distance away from any adjacent bushfire prone vegetation where possible.	High	No	Yes	No	No
Assessment Comments: The site is within an existing and expanding industrial precinct. Multiple egress routes exist which travel either through low threat areas, or are bounded by fragmented grassland or low density woodland. *Recommendation Details:* Not Applicable						
3.2	**Egress Routes Located to Ensure Driving Away from Hazard:** Existing or to be installed vehicular access/egress route components (roads, access ways, and driveways) are positioned so that the direction of egress is away from the hazard into lower threat areas.	Very High	No	Yes	No	No
Assessment Comments: Egress routes all travel away from the primary bushfire hazard, being the forest vegetation north of Harris Road. *Recommendation Details:* Not Applicable						
3.3	**Greater Road Width:** Wider roads will allow for a greater separation distance between traversing vehicles and the bushfire hazard. The incorporation of non-vegetated and trafficable road verges/shoulders and adjacent footpaths can also safely increase effective separation for slower moving vehicles.	High	No	Partly	Yes	No

<table>
<tr><th colspan="4" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td>Persons on Access / Egress Routes in Vehicles</td><td>Access Route Description</td><td colspan="6">Local road network - applicable to Emergency Services.</td></tr>
<tr><td colspan="9">Assessment Comments: Roads are minimum 7m and generally 8m wide to support the heavy vehicles associated with industrial uses. Shoulders in developed areas are mountable due to sealed footpaths, which are expected to be expanded throughout the industrial precinct as lots are developed.
Recommendation Details: Not Applicable</td></tr>
<tr><td>3.4</td><td colspan="3">Reduce and Maintain Road Verge Fuel to a Low Threat State: Road verges, or part off, support low threat vegetation or vegetation is removed or reduced and maintained to a minimal fuel condition to increase the separation distance from the bushfire hazard. This is practical when an authority exists to conduct the management and will have greater threat reducing impact as a protection measure, if there is certainty it will be carried out.</td><td>Medium</td><td>No</td><td>Partly</td><td>Yes</td><td>No</td></tr>
<tr><td colspan="9">Assessment Comments: Most road verges are managed to low threat, being mulched, sealed, or slashed. The northern verge of Hardisty Road is partially managed, with slashing of grasses and pruning of trees visible.
Recommendation Details: Not Applicable</td></tr>
<tr><td colspan="9">THE PROTECTION MECHANISM – ESTABLISH SHIELDING FROM RELEVANT BUSHFIRE HAZARD THREATS: To utilise constructed or natural shielding to reduce the exposure of persons, traversing the access/egress routes, to relevant bushfire threats (primarily flames, radiant heat and embers). To assist with ensuring the level of exposure to the threats is survivable for the expected time on the route while travelling in a vehicle.</td></tr>
<tr><td>3.5</td><td colspan="3">Ensure Evacuation Vehicle Types Provide a Degree of Protection: People can only tolerate low levels of radiant heat without some protection. Vehicles provide some protection from low intensity fires (if they stay on cleared area and remain in the vehicle) but they will not protect people in moderate to intense grass fires or in any location where scrub or forest adjoin the road.
Protection provided by vehicles with predominantly metal bodies (including roof) and able to be enclosed (glass window), while limited is also still significant. It is particularly significant when compared to other potentially available modes of transport on roads (e.g. open top/backed vehicles, motorbikes, bicycles and being on foot).
The availability such vehicles of required capacity can contribute to reduced exposure to the bushfire threats for persons on access/egress routes.</td><td>Medium</td><td>No</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="9">Assessment Comments: The site will be unstaffed, except occasional maintenance. Vehicles accessing the site in a bushfire event will be Emergency Services, with vehicles which provide a measure of protection.
Recommendation Details: Not Applicable</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS				Effectiveness Rating [1]	Application Status [2]			
					Possible	Exists	Planned	Additionally Recommend
Element at Risk	Persons on Access / Egress Routes in Vehicles	Access Route Description	Local road network - applicable to Emergency Services.					

Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.2.4 for explanation and defining.

Note 2: Protection Measure Application Status:

- **Possible:** Protection measures that can potentially be applied to the proposed development/use.
- **Fully or Partly Exists**: A current state assessment of protection measures already implemented by existing components of the proposed development/use. The status of current implementation can also be fully or partly. These measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).
- **Currently Planned:** Protection measures that:
    - Are incorporated into the site plans;
    - Exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), alternative solutions and any additional recommended protection measures - for which a responsibility for their implementation has been created and approved; and/or
    - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), that can be met and for which a responsibility for their implementation can be created in the BMP.

  These planned measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).
- **Additionally Recommend:** Protection measures that:
    - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and comprise alternative solutions and/or additional recommended protection measures (that can and should be implemented in the opinion of the bushfire consultant), and for which a responsibility for their implementation can be created in the BMP; and/or
    - Are developed in the process of producing this risk assessment and management report and for which a responsibility for their implementation can be created in the BMP.

  These additionally recommended measures, along with existing and planned measures, are accounted for in assessing 'residual' risk levels (refer to Glossary).

5.3.1.2 PROTECTION MEASURES - EFFECTIVENESS AND NUMBER APPLIED

For the stated element at risk, the numbers of both available and potentially applied bushfire protection measures are summarised and the effectiveness of each measure at reducing exposure levels is stated (refer to Appendix 1 for explanatory and supporting information).

This information is applied in the following section of this report to the derivation of the potential for applied bushfire protection measures to reduce the exposure of the relevant element at risk to bushfire hazard threats.

EXPOSURE REDUCING PROTECTION MEASURE ANALYSIS							
Element at Risk	Persons on Access / Egress Routes in Vehicles						
The Protection Mechanism	Effectiveness Rating [1]	Numbers of Protection Measures					
		Total Available	Application Status [2]				
			Possible	Fully Exists	Partly Exists	Currently Planned	Additionally Recommen
Establish Sufficient Separation from Relevant Bushfire Hazard Threats	Very High	1		1			
	High	2		1	1		
	Medium	1			1	1	
	Not Relevant						
Establish Shielding from Relevant Bushfire Hazard Threats	Very High						
	High						
	Moderate	1		1			
	Not Relevant						
Number Analysis	Very High	1		1			
	High	2		1	1		
	Medium	2		1	1	1	
	Not Relevant						
	Totals	5		3	2	1	
Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.3.4 for explanation and defining. Note 2: Protection Measure Application Status: Refer to table footnotes in the preceding section.							

5.3.1.3 PROTECTION MEASURES - EXPOSURE REDUCING POTENTIAL

For the stated element at risk the potential for applied bushfire protection measures to reduce exposure levels is assessed as a function of:

- The number of bushfire protection measures that can be applied compared to the number available; and
- The weighting applied to each protection measure that indicates how effective it can be at reducing the exposure of elements at risk.

ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE EXPOSURE TO BUSHFIRE HAZARD THREATS [1]							
Element at Risk	Persons On Access/Egress Routes in Vehicles						
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF AN INHERENT EXPOSURE LEVEL [2]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Very Significant	Significant	Moderate	Significant	N/A	Very Significant	Significant	Very Significant
Significant				Very Significant			
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF A RESIDUAL EXPOSURE LEVEL [3]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Very Significant	Significant	Moderate	Significant	N/A	Very Significant	Significant	Very Significant
Significant				Very Significant			

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: Refer to Appendix 2 for explanatory and supporting information.

Assessment Comments: No recommendations are applicable. The inherent and residual risk are the same.

As the site is intended to be unstaffed, the relevant persons on access routes are Emergency Services.

5.3.1.4 ASSESSED EXPOSURE LEVEL - INHERENT AND RESIDUAL

The preceding bushfire protection measure analysis has enabled the derivation of the inherent and residual exposure levels. These exposure levels are indicative as they are derived through a qualitative assessment process. In combination with the corresponding assessed threat and vulnerability levels, they will be applied to deriving the inherent and residual bushfire risk levels.

ASSESSED EXPOSURE LEVELS (INDICATIVE) POST APPLICATION OF EXPOSURE REDUCING BUSHFIRE PROTECTION MEASURES [1]							
ELEMENT AT RISK		Persons On Access/Egress Routes in Vehicles					
BUSHFIRE ATTACK MECHANISMS [2]		INHERENT EXPOSURE LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	Low
	Radiant Heat [4]	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Embers / Burning Debris	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☐	Moderate ☐	High ☐	Extreme ☐	
	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Tree Strike / Obstruction	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	
	Consequential (Secondary) Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
BUSHFIRE ATTACK MECHANISMS [2]		RESIDUAL EXPOSURE LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	Low
	Radiant Heat [4]	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Embers / Burning Debris	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☐	Moderate ☐	High ☐	Extreme ☐	
	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Tree Strike / Obstruction	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	
	Consequential (Secondary) Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix 2 for explanatory and supporting information.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: The level of exposure to flames and radiant heat is derived from the assessed indicative BAL ratings (refer to the BAL contour map). The exposure levels applied are BAL-LOW/Very Low Exposure, BAL-12.5/Low Exposure, BAL-19/Moderate Exposure, BAL-29/High Exposure, BAL-40 and BAL-FZ/Extreme Exposure.

5.3.2 BUILDINGS AND STRUCTURES - NCC CLASSES 1-10

5.3.2.1 PROTECTION MEASURES - IDENTIFICATION AND APPLICATION STATUS

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk:</td><td colspan="6">Buildings/Structures - NCC Classes 1-10</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – ESTABLISH SUFFICIENT SEPARATION FROM RELEVANT BUSHFIRE HAZARD THREATS: To reduce exposure to the relevant direct and indirect attack mechanisms of bushfire by locating buildings and attached/adjacent structures at sufficient distances away from the bushfire hazard and consequential fire fuels. The required distances will be dependent on the assessed threat levels and the degree of bushfire resilience that exists or is planned to be incorporated into the exposed elements through design and construction.</td></tr>
<tr><td>4.1</td><td>Siting of Buildings/Structures Considering Potential High Wind Exposure: Site buildings and attached/adjacent structures in locations that have less exposure to terrain influenced prevailing synoptic winds, and particularly those locations with potential for significant terrain/bushfire threat intensification interactions (refer to Appendix 3).
Avoid the top and sides of ridges. Strong winds can directly or indirectly (airborne materials/debris) cause damage to the external building envelope, potentially allowing flame, radiant heat and ember entry.</td><td>High</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: The local area is largely flat to gently undulating (<5 degrees) Siting has little impact on wind exposure.
Recommendation Details: Not Applicable</td></tr>
<tr><td>4.2</td><td>Designed Location of Non-Vegetated Areas and/or Managed Open Space: Non-vegetated land uses include footpaths, paved areas, roads, parking, open drainage channels, and major services delivery (power, water, gas) installed in common corridors.
Managed open space is land for public or private use on which the vegetation is either low threat due to type or situation or is continually managed in a minimal fuel condition. This can include public open space providing recreation facilities.
Use these design elements to create or increase separation from any bushfire prone vegetation by positioning them adjacent to the bushfire hazard.</td><td>Very High</td><td>No</td><td>Partly</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: The roads and neighbouring land use provides for the non- vegetated zone surrounding the site. The areas clear of vegetation offsite are out of control of the site developers.
Onsite management has been addressed previously in Section 5.1 with the removal and maintenance of flammable material/vegetation.</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk:</td><td colspan="6">Buildings/Structures - NCC Classes 1-10</td></tr>
<tr><td colspan="7">Recommendation Details: Not Applicable</td></tr>
<tr><td>4.3</td><td>Landscaping - Asset Protection Zone (APZ): Ensure an APZ is established surrounding the relevant element(s) at risk to create the required separation distance from the bushfire hazard to protect against the direct attack mechanisms of flame contact and radiant heat and reduce exposure to embers.

In addition to providing separation from the direct bushfire attack mechanisms, the nature of the APZ design and management requirements is intended to minimise the potential impact of the indirect bushfire attack mechanisms of surface fire attack, debris production and accumulation, tree strike and consequential fire (refer to Appendix 2).

This is achieved by ensuring the APZ contains low threat vegetation; and/or has potential fire fuels managed in a minimal fuel condition; and/or contains non-vegetated areas (e.g. footpaths, paved areas, driveways, parking, swimming pools etc) and/or limits the presence/location of constructed/stored combustible items.

For different States and local government areas, APZ establishment and maintenance guides ideally need to be local environment specific. Some authorities establish general requirements while specific requirements may also be established through site specific management documents (e.g. bushfire management plan).

The required dimensions of the APZ will correspond to the maximum level of radiant heat the exposed element is to be exposed to – or a greater distance if it is stipulated by a relevant authority.

As a minimum avoid dimensions (separation distances) that correspond to BAL-FZ and BAL-40 ratings for any given site/vegetation combination of relevant parameters. This will also apply to BAL-29 separation distances if flame length modelling indicates potential contact due to specific site and effective slope configurations.

The location of an APZ should be entirely within the boundaries of each lot so that landowners can have control and responsibility for its implementation and maintenance. Exceptions exist for instances where adjoining land is not vegetated or it can be justified that the fire fuels will be managed in a minimal fuel, low threat state on an ongoing basis, in perpetuity.</td><td>Very High</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Class 10a structures will apply the APZ consistent with BESS cabinets and associated infrastructure, per Measure 7.3. The structures are not for habitable purposes and this APZ is intended to protect any electrical components and hazardous material stored within Class 10 structures from excessive heat flux. There is no planned landscaping on-site that will include vegetation of any kind.
Recommendation Details: Class 10a structures will apply the APZ consistent with BESS cabinets and associated infrastructure, per Measure 7.3.
A BAL-12.5 APZ is acceptable for Class 10a buildings which do not contain hazardous or flammable materials.</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk:</td><td colspan="6">Buildings/Structures - NCC Classes 1-10</td></tr>
<tr><td>4.4</td><td>Landscaping - Tree Location: Use separation to minimise the potential for debris accumulation and tree strike damage to the building/structures that will allow flame, radiant heat and ember entry to internal spaces. Principles to apply are:
The buildings/structures are separated from trees (or trees from buildings) by a distance of at least 1.5 times the height of the tallest tree; and
Trees that produce significant quantities of debris (fine fuels) during the bushfire season should be located a sufficient distance away from vulnerable exposed elements to ensure debris cannot drop and accumulate within at least 4m of buildings/structures or be likely to be relocated by wind to closer than 4m to buildings / structures. Avoid planting trees with ribbon or stringy bark (ember/firebrand production).
If the minimum distance cannot be achieved with an existing tree either remove the tree or at least ensure tree branches are sufficiently separated from buildings and attached/adjacent structures (at a minimum to not overhang) to ensure branches cannot fall onto or be blown onto the buildings/structures.</td><td>Medium</td><td>Yes</td><td>Yes</td><td>Yes</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Refer section 4.3 above, no landscaping is planned or recommended. No trees are within 1.5x their mature height from assets: Peppermint 45m away (<20m mature height) and Jarrah/Marri 60m away (<25m mature height).

Recommendation Details: Not Applicable</td></tr>
<tr><td>4.5</td><td>Separation from Stored Flammable Products - Gas in Cylinders: To reduce the potential for gas flaring or explosion (consequential fire), installation of LPG cylinders is to apply as a minimum, the principles and requirements established in AS 1596 'The Storage and Handling of LP Gas'. Readily available guidance is provided by CSIRO Best Practice Bushfire Guide (https://research.csiro.au/bushfire/new-builds/water-electricity-gas/) and WA Dept. Mines, Industry, Regulation and Safety 'LP Gas cylinder safety in bushfire prone areas' (https://www.commerce.wa.gov.au/publications/lp-gas-cylinder-safety-bushfire-prone-areas).

Otherwise, the required separation distance is 6m from any combustible materials.

Heat from bushfire or consequential fire can be sufficient to cause cylinder pressure to reach critical levels and the pressure relief valve release large quantities of gas (flare). If the cylinder falls over the pressure relief valve may not function correctly, and the cylinder may rupture (explosion).</td><td>Medium</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="7">Assessment Comments: No planned storage of such products. Any LPG will be stored in compliance with AS 1596.

Recommendation Details: Not Applicable</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk:	Buildings/Structures - NCC Classes 1-10					
4.6	**Separation from Stored Flammable Products – Fuels / Other Hazardous Materials (Consequential Fire Fuels):** Establish sufficient separation distance between these consequential fire fuels and buildings/structures. The required separation distance will be dependent on the fuel and storage type.	High	Yes	No	Yes	No
Assessment Comments: Fuel and other hazardous material will not be stored on site, except during the construction phase. Where Class 10a buildings contain hazardous or flammable materials, Measure 4.7 will increase this separation. *Recommendation Details:* Not Applicable						
4.7	**Separation from Stored and Constructed Combustible Items (Consequential Fire Fuels):** These consequential fire fuels include: • Stored Combustible Items - Heavy Fuels (>6mm diameter) e.g. building materials, packaging materials, firewood, branches, sporting/playground equipment, outdoor furniture, rubbish bins etc; • Stored Combustible Items – Large Heavy Fuels e.g. vehicles, caravans, boats and large quantities of dead vegetation materials stored as part of site use; • Constructed Combustible Items – Heavy Fuels e.g. landscaping structures including fences, screens, walls, plastic water tanks; and • Constructed Combustible Items – Large Heavy Fuels e.g. adjacent buildings/structures including houses, sheds, garages, carports. (Note: If the adjacent structure is constructed to BAL-29 requirements or greater and can implement a significant number of additional bushfire protection measures associated with reducing exposure and vulnerability, these minimum separation distances could be reduced by 30%) [31]. *Apply the rule of thumb [13] "assume flames produced from a consequential fire source will be twice as high as the object itself … where the consequential fire source is a structure, then the maximum eave height is a reasonable measure of maximum height".* Apply the following separation distances from the subject building/structure as a multiple of the height of the consequential fire source and dependent on the bushfire construction standard applied to the building/structure [13 and 31]: • At least six times the height when the building/structure construction incorporates design and materials that is only intended to resist low levels of radiant heat up to 12.5 kW/m^2) and no flame contact;	High	Yes	No	Unknown	Yes

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk:	Buildings/Structures - NCC Classes 1-10					
	• Between 4 and 6 six times the height when the building/structure construction incorporates design and materials intended to resist radiant heat up to 29 kW/m² and no flame contact. • Between 2 and 4 times the height when the building/structure construction incorporates design and materials intended to resist up to 40kW/m² and potential flame contact. • Less than 2 times the height when the building/structure construction incorporates design and materials intended to resist extreme levels of radiant heat and flame contact. • Zero separation distance is required if the building/structure is separated by a non-combustible FRL 60/60/60 rated wall, or the potential consequential fire source is fully enclosed by the building/structure.					
Assessment Comments: The design and layout of the facility has been determined by the relevant designer/engineer and are assumed to be appropriate in reducing the risk of structure-to-structure (or asset) fire. *Recommendation Details:* Class 10a buildings which do not contain hazardous or flammable materials should be sited >6m from BESS cabinets. If a Class 10a building does contain hazardous or flammable materials, it should be sited >10m from BESS cabinets.						
THE PROTECTION MECHANISM – ESTABLISH SHIELDING FROM RELEVANT BUSHFIRE HAZARD THREATS: Reduce exposure the direct bushfire attack mechanisms of flame, radiant heat, surface migration of embers and to a potentially limited extent, fire driven wind - by shielding buildings and attached/adjacent structures or other consequential fire fuels. To also reduce exposure to the indirect attack mechanism of debris accumulation against buildings/structures and other consequential fire fuels.						
4.8	**Constructed Barrier – Shielding from Bushfire:** Walls, fences and/or landforms to shield the subject building/structure from direct and indirect bushfire attack mechanisms and reduce the potential impact. Must be constructed using appropriate fire resistant / non-combustible construction materials (e.g. masonry, steel, earthworks). These are to withstand the impact of direct bushfire attack mechanisms for the required period of time. Apply the bushfire construction standards for external walls subject to the assessed level of radiant heat or flame contact to which the barrier will be exposed (or otherwise to BAL-FZ requirements). These are established by AS 3959:2018 [4] and/or the NASH Standard [33] and additionally informed by the research report 'Research and Investigation into the Performance of Residential Boundary Fencing Systems in Bushfires.' [29]	High	Yes	No	No	No
Assessment Comments: The measure is not cost-effective for the scale which would be required to be effective (functional height and perimeter), and the radiant heat flux exposure of the assets (maximum 10kW/m2 radiant heat flux). Barriers (solid fencing) could limit leaf litter or firebrands/embers entering the site, but could also trap them from blowing through the site. *Recommendation Details:* Not Applicable						

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk:</td><td colspan="6">Buildings/Structures - NCC Classes 1-10</td></tr>
<tr><td>4.9</td><td>Constructed Barrier - Shielding from Consequential Fire: Applicable to all consequential fire fuel sources. Install a non-combustible barrier (including complete enclosure when appropriate), of required robustness, that can perform the following as relevant:
Reduce the exposure of the subject building/structure to the threats of consequential fire; and/or
Reduce the exposure of the consequential fire fuels to the bushfire hazard.</td><td>High</td><td>Yes</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Consequential fire sources are addressed in Measure 7.7.
Recommendation Details: Not Applicable</td></tr>
<tr><td>4.10</td><td>Natural Landforms Barrier: Use existing natural landforms to reduce buildings/structures exposure to radiant heat, and lower wind speeds (prevailing synoptic and/or fire driven).</td><td>High</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="7">Assessment Comments: No appropriate landforms exist.
Recommendation Details: Not Applicable</td></tr>
<tr><td>4.11</td><td>Planted Vegetation Barrier: Use appropriate species (lower flammability) of hedges and trees strategically to reduce (to varying extents) buildings/structures exposure to radiant heat, to filter/trap embers and firebrands, and to lower wind speeds (prevailing synoptic and/or fire driven).</td><td>Medium</td><td>Yes</td><td>No</td><td>No</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Vegetation is not recommended within the APZ to remove the capacity for surface fire and production of debris (leaf litter etc).
Recommendation Details: See Measure 7.11.</td></tr>
<tr><td>4.12</td><td>Shield Operation Critical Non-Structural Elements: These are vulnerable elements essential to the continued operation of the building/structure which are potentially exposed to the attack mechanisms of both bushfire and consequential fire. These elements include cabling and plumbing associated with power delivery, data transmission, fuel and water transport.
When the use of fire rated materials to the degree necessary is not possible or practical, the application of non-combustible shielding can be applied to reduce exposure to the threats. Shielding includes underground installation.</td><td>Medium</td><td>Yes</td><td>Unknown</td><td>No</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Any Class 10a buildings are not intended to contain such components. All high-risk components will be positioned such that they are subject to a maximum 10kW/m2 radiant heat flux.
Recommendation Details: See Measure 7.12.</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk:	Buildings/Structures - NCC Classes 1-10					

Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.2.4 for explanation and defining.

Note 2: Protection Measure Application Status:

- **Possible:** Protection measures that can potentially be applied to the proposed development/use.
- **Fully or Partly Exists**: A current state assessment of protection measures already implemented by existing components of the proposed development/use. The status of current implementation can also be fully or partly. These measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).
- **Currently Planned:** Protection measures that:
  - Are incorporated into the site plans;
  - Exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), alternative solutions and any additional recommended protection measures - for which a responsibility for their implementation has been created and approved; and/or
  - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), that can be met and for which a responsibility for their implementation can be created in the BMP.

  These planned measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).
- **Additionally Recommend:** Protection measures that:
  - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and comprise alternative solutions and/or additional recommended protection measures (that can and should be implemented in the opinion of the bushfire consultant), and for which a responsibility for their implementation can be created in the BMP; and/or
  - Are developed in the process of producing this risk assessment and management report and for which a responsibility for their implementation can be created in the BMP.

  These additionally recommended measures, along with existing and planned measures, are accounted for in assessing 'residual' risk levels (refer to Glossary).

5.3.2.2 PROTECTION MEASURES - EFFECTIVENESS AND NUMBER APPLIED

For the stated element at risk, the numbers of both available and potentially applied bushfire protection measures are summarised and the effectiveness of each measure at reducing exposure levels is stated (refer to Appendix 1 for explanatory and supporting information).

This information is applied in the following section of this report to the derivation of the potential for applied bushfire protection measures to reduce the exposure of the relevant element at risk to bushfire hazard threats.

EXPOSURE REDUCING PROTECTION MEASURE ANALYSIS							
Element at Risk	Buildings / Structures - NCC Classes 1-10						
The Protection Mechanism	Effectiveness Rating [1]	Numbers of Protection Measures					
		Total Available	Application Status [2]				
			Possible	Fully Exists	Partly Exists	Currently Planned	Additionally Recommen
Establish Sufficient Separation from Relevant Bushfire Hazard Threats	Very High	2	1	1	1	1	1
	High	3	3	1		1	1
	Medium	2	1	1		1	
	Not Relevant						
Establish Shielding from Relevant Bushfire Hazard Threats	Very High						
	High	3	2				
	Medium	2	2				2
	Not Relevant						
Number Analysis	Very High	2	1	1	1	1	1
	High	6	5	1		1	1
	Moderate	4	3	1		1	2
	Not Relevant						
	Totals	12	9	3	1	3	4
Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.3.4 for explanation and defining. Note 2: Protection Measure Application Status: Refer to table footnotes in the preceding Section.							

5.3.2.3 PROTECTION MEASURES - EXPOSURE REDUCING POTENTIAL

For the stated element at risk the potential for applied bushfire protection measures to reduce exposure levels is assessed as a function of:

- The number of bushfire protection measures that can be applied compared to the number available; and
- The weighting applied to each protection measure that indicates how effective it can be at reducing the exposure of elements at risk.

ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE EXPOSURE TO BUSHFIRE HAZARD THREATS [1]							
Element at Risk	Buildings/Structures - NCC Classes 1-10						
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF AN INHERENT EXPOSURE LEVEL [2]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Very Significant	Significant	Moderate	Significant	Significant	Very Significant	Very Significant	Moderate
Significant				Significant			
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF A RESIDUAL EXPOSURE LEVEL [3]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Very Significant	Very Significant	Significant	Significant	Very Significant	Very Significant	Very Significant	Significant
Very Significant				Very Significant			

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: Refer to Appendix 2 for explanatory and supporting information.

Assessment Comments: The current condition and siting of the lot is effective in reducing direct and indirect bushfire exposures. Recommendations are to define setbacks from onsite hazards (BESS cabinets) and vegetation.

5.3.2.4 ASSESSED EXPOSURE LEVEL - INHERENT AND RESIDUAL

The preceding bushfire protection measure analysis has enabled the derivation of the inherent and residual exposure levels. These exposure levels are indicative as they are derived through a qualitative assessment process. In combination with the corresponding assessed threat and vulnerability levels, they will be applied to deriving the inherent and residual bushfire risk levels.

ASSESSED EXPOSURE LEVELS (INDICATIVE) POST APPLICATION OF EXPOSURE REDUCING BUSHFIRE PROTECTION MEASURES [1]							
	ELEMENT AT RISK	Buildings and Structures – NCC Classes 1-10					
BUSHFIRE ATTACK MECHANISMS [2]		INHERENT EXPOSURE LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	Moderate
DIRECT	Radiant Heat [4]	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
DIRECT	Embers / Burning Debris	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
DIRECT	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Tree Strike / Obstruction	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Consequential (Secondary) Fire	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	
BUSHFIRE ATTACK MECHANISMS [2]		RESIDUAL EXPOSURE LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	Low
DIRECT	Radiant Heat [4]	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
DIRECT	Embers / Burning Debris	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
DIRECT	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Tree Strike / Obstruction	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Consequential (Secondary) Fire	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix 2 for explanatory and supporting information.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: The level of exposure to flames and radiant heat is derived from the assessed indicative BAL ratings (refer to the BAL contour map). The exposure levels applied are BAL-LOW/Very Low Exposure, BAL-12.5/Low Exposure, BAL-19/Moderate Exposure, BAL-29/High Exposure, BAL-40 and BAL-FZ/Extreme Exposure.

5.3.3 BUILT INFRASTRUCTURE ASSETS

5.3.3.1 PROTECTION MEASURES - IDENTIFICATION AND APPLICATION STATUS

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – ESTABLISH SUFFICIENT SEPARATION FROM RELEVANT BUSHFIRE HAZARD THREATS: To reduce exposure to the relevant direct and indirect attack mechanisms of bushfire by locating buildings and attached/adjacent structures at sufficient distances away from the bushfire hazard and consequential fire fuels. The required distances will be dependent on the assessed threat levels and the degree of bushfire resilience that exists or is planned to be incorporated into the exposed elements through design and construction.</td></tr>
<tr><td>7.1</td><td>Siting of Buildings/Structures Considering Potential High Wind Exposure: Site buildings and attached/adjacent structures in locations that have less exposure to terrain influenced prevailing synoptic winds, and in particular, those locations with potential for significant terrain/bushfire threat intensification interactions (refer to Appendix 3).
Avoid the top and sides of ridges. Strong winds can directly or indirectly (airborne materials/debris) cause damage to the external building envelope, potentially allowing flame, radiant heat and ember entry.</td><td>High</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: The local area is largely flat to gently undulating (<5 degrees) Siting has little impact on wind exposure.
Recommendation Details: Not Applicable</td></tr>
<tr><td>7.2</td><td>Designed Location of Non-Vegetated Areas and/or Managed Open Space: Non-vegetated land uses include footpaths, paved areas, roads, parking, open drainage channels, and major services delivery (power, water, gas) installed in common corridors.
Managed open space is land for public or private use on which the vegetation is either low threat due to type or situation or is continually managed in a minimal fuel condition. This can include public open space providing recreation facilities.
Use these design elements to create or increase separation from any bushfire prone vegetation by positioning them adjacent to the bushfire hazard.</td><td>Very High</td><td>No</td><td>Partly</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: The roads and neighbouring land use provides for the non- vegetated zone surrounding the site. The areas clear of vegetation offsite are out of control of the site developers.
Onsite management has been addressed previously in Section 5.1 with the removal and maintenance of flammable material/vegetation.</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td colspan="7">Recommendation Details: Not Applicable</td></tr>
<tr><td>7.3</td><td>Landscaping - Asset Protection Zone (APZ): Ensure an APZ is established surrounding the relevant element(s) at risk to create the required separation distance from the bushfire hazard to protect against the direct attack mechanisms of flame contact and radiant heat and reduce exposure to embers.

In addition to providing separation from the direct bushfire attack mechanisms, the nature of the APZ design and management requirements is intended to minimise the potential impact of the indirect bushfire attack mechanisms of surface fire attack, debris production and accumulation, tree strike and consequential fire (refer to Appendix 2).

This is achieved by ensuring the APZ contains low threat vegetation; and/or has potential fire fuels managed in a minimal fuel condition; and/or contains non-vegetated areas (e.g. footpaths, paved areas, driveways, parking, swimming pools etc) and/or limits the presence/location of constructed/stored combustible items.

For different States and local government areas, APZ establishment and maintenance guides ideally need to be local environment specific. Some authorities establish general requirements while specific requirements may also be established through site specific management documents (e.g. bushfire management plan).

The required dimensions of the APZ will correspond to the maximum level of radiant heat the exposed element is to be exposed to – or a greater distance if it is stipulated by a relevant authority.

As a minimum avoid dimensions (separation distances) that correspond to BAL-FZ and BAL-40 ratings for any given site/vegetation combination of relevant parameters. This will also apply to BAL-29 separation distances if flame length modelling indicates potential contact due to specific site and effective slope configurations.

The location of an APZ should be entirely within the boundaries of each lot so that landowners can have control and responsibility for its implementation and maintenance. Exceptions exist for instances where adjoining land is not vegetated or it can be justified that the fire fuels will be managed in a minimal fuel, low threat state on an ongoing basis, in perpetuity.</td><td>Very High</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: BESS technologies are continuing to develop and the critical heat flux thresholds of assets may vary slightly between engineering designs. The exterior and structural components of battery cabinets are non-combustible, generally being metal, fibrous cement, mineral wool etc. A battery (CATL EnerC+ Packs) is an approximately sea container-sized cabinet with a series of battery racks installed. A single battery rack consists of battery cells (each cell connected into a module), and a control box with chiller. Power and computer cabling is associated within and between racks. These are the relevant components regarding potential for fire.</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					
• Individual batteries have been found to be highly resistant to conductive heat. Applied temperatures exceeding 400 degrees Celsius destroyed, but did not ignite, running battery cells. See *UL 9540A Test Method for Evaluating Thermal Runaway Fire Propagation in Cell Energy Storage Systems, Third Edition* (UL LLC; 8 July 2020). Other trigger/failure conditions must be met for battery cells to ignite (mechanical rupture, flame contact, product failure etc). • Control boxes are computers which will apply thermal throttling and thermal shutdown if internal temperatures exceed a determined threshold. Once a computer system is shut down in this scenario, the threshold is expected to be that of the cabling (below). • Associated cabling (both power transmission and computer). Common electrical cabling reaches its critical point at >12kWm2 (Kaczorek-Chrobak et al. 2007). Electrical cabling and components are expected to exceed this standard, being industrial and high capacity, however the 12kW threshold is adopted for the highest potential vulnerability. *Recommendation Details:* An APZ is to be established around BESS components and infrastructure. This APZ will ensure exposure to the bushfire hazard threat of radiant heat will be limited to a maximum radiant heat flux of 10 kW/m2 (calculated with an assumed flame temperature of 1090K) by providing the required separation distances from the bushfire hazard. The 10m portion of the APZ immediately around the assets must be entirely and permanently non-vegetated (sealed, compacted limestone, gravel, mineral earth etc). BESS cabinets are recommended to be sited on concrete slabs or other sealed, non-combustible surface. No landscape planting (revegetation) should occur within the APZ to the extent of the lot boundary.						
7.4	**Landscaping - Tree Location:** Use separation to minimise the potential for debris accumulation and tree strike damage to the building envelop potentially allowing flame, radiant heat and ember entry to internal spaces. • The buildings/structures are separated from trees (or trees from buildings) by a distance of at least 1.5 times the height of the tallest tree. • Trees that produce significant quantities of debris (fine fuels) during the bushfire season should be located a sufficient distance away from vulnerable exposed elements to ensure debris cannot drop and accumulate within at least 4m of buildings/structures or be likely to be relocated by wind to closer than 4m to buildings / structures. • If the minimum distances cannot be achieved with an existing tree either remove the tree or at least ensure tree branches are sufficiently separated from buildings and attached/adjacent structures (at a minimum to not overhang) to ensure branches cannot fall onto or be blown onto the buildings/structures.	Medium	Yes	Yes	Yes	No
Assessment Comments: Refer section 7.3 above, no landscaping is planned or recommended. No trees are within 1.5x their mature height from assets: Peppermint 45m away (<20m mature height) and Jarrah/Marri 60m away (<25m mature height). *Recommendation Details:* Not Applicable						

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					
7.5	**Separation from Stored Flammable Products - Gas in Cylinders:** To reduce the potential for gas flaring or explosion (consequential fire), installation of LPG cylinders is to apply as a minimum, the principles and requirements established in AS 1596 'The Storage and Handling of LP Gas'. Readily available guidance is provided by CSIRO Best Practice Bushfire Guide (https://research.csiro.au/bushfire/new-builds/water-electricity-gas/) and WA Dept. Mines, Industry, Regulation and Safety 'LP Gas cylinder safety in bushfire prone areas' (https://www.commerce.wa.gov.au/publications/lp-gas-cylinder-safety-bushfire-prone-areas). Otherwise, the required separation distance is 6m from any combustible materials. Heat from bushfire or consequential fire can be sufficient to cause cylinder pressure to reach critical levels and the pressure relief valve release large quantities of gas (flare). If the cylinder falls over the pressure relief valve may not function correctly, and the cylinder may rupture (explosion).	Medium	N/A	N/A	N/A	N/A
Assessment Comments: No planned storage of such products. Any LPG will be stored in compliance with AS 1596. *Recommendation Details:* Not Applicable						
7.6	**Separation from Stored Flammable Products – Fuels / Other Hazardous Materials (Consequential Fire Fuels):** Establish sufficient separation distance between these consequential fire fuels and buildings/structures. The required separation distance will be dependent on the fuel and storage type.	High	Yes	Yes	No	No
Assessment Comments: All infrastructure will be installed to manufacturers specification, including separation distances. Fuel and other hazardous material will not be stored on site. *Recommendation Details:* Not Applicable						
7.7	**Separation from Stored and Constructed Combustible Items (Consequential Fire Fuels):** These consequential fire fuels include: • Stored Combustible Items - Heavy Fuels e.g. building materials, packaging materials, rubbish bins etc; • Stored Combustible Items – Large Heavy Fuels e.g. vehicles, caravans and large quantities of dead vegetation materials stored as part of site use; • Constructed Combustible Items – Heavy Fuels e.g. landscaping structures including fences, screens, walls, plastic water tanks; and • Constructed Combustible Items – Large Heavy Fuels e.g. adjacent buildings/structures including houses, sheds, garages, carports. (Note: If the adjacent structure is constructed to BAL-29 requirements or greater and can	High	Yes	No	Yes	Yes

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					
	implement a significant number of additional bushfire protection measures associated with reducing exposure and vulnerability, these minimum separation distances could be reduced by 30%) [31]. *Apply the rule of thumb [13] "assume flames produced from a consequential fire source will be twice as high as the object itself … where the consequential fire source is a structure, then the maximum eave height is a reasonable measure of maximum height".* Apply the following separation distances from the subject building/structure as a multiple of the height of the consequential fire source and dependent on the construction standard applied to the building/structure [13 and 31]: • At least six times the height when the building/structure construction incorporates design and materials that is only intended to resist low levels of radiant heat up to 12.5 kW/m^2) and no flame contact; • Between 4 and 6 six times the height when the building/structure construction incorporates design and materials intended to resist radiant heat up to 29 kW/m^2 and no flame contact. • Between 2 and 4 times the height when the building/structure construction incorporates design and materials intended to resist up to 40kW/m^2 and potential flame contact. • Less than 2 times the height when the building/structure construction incorporates design and materials intended to resist extreme levels of radiant heat and flame contact. • Zero separation distance is required if the building/structure is separated by a non-combustible FRL 60/60/60 rated wall, or the potential consequential fire source is fully enclosed by the building/structure.					
Assessment Comments: The design and layout of the facility has been determined by the relevant designer/engineer and are assumed to be appropriate in reducing the risk of structure-to-structure (or asset) fire. *Recommendation Details:* All non-structural combustible materials are to be removed within 10m of assets. This includes but is not limited to; waste, leaf litter, machinery, grasses, vehicles, fuel, furniture, and timber. When storage of flammable items or materials are stored on site temporarily (for maintenance etc), separation distances must be complied with. This requirement is to be included in the Site Operating Procedures document.						
THE PROTECTION MECHANISM – ESTABLISH SHIELDING FROM RELEVANT BUSHFIRE HAZARD THREATS: To shield buildings and attached/adjacent structures (or other consequential fire fuels) from the direct bushfire attack mechanisms of flame, radiant heat, surface fire and surface migration of embers. To also reduce exposure to the indirect attack mechanism of debris accumulation against buildings/structures and other consequential fire fuels and wind attack.						
7.8	**Constructed Barrier – Shielding from Bushfire:** Walls, fences and/or landforms to shield the subject building/structure from direct and indirect bushfire attack mechanisms and reduce the potential impact of these.	High	Yes	No	No	No

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td></td><td>Must be constructed using appropriate fire resistant / non-combustible construction materials (e.g. masonry, steel, earthworks). These are to withstand the impact of direct bushfire attack mechanisms for the required period of time.
Apply the bushfire construction standards for external walls subject to the assessed level of radiant heat or flame contact to which the barrier will be exposed (or otherwise to BAL-FZ requirements). These are established by AS 3959:2018 [4] and/or the NASH Standard [33] and additionally informed by the research report 'Research and Investigation into the Performance of Residential Boundary Fencing Systems in Bushfires.' [29]</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Assessment Comments: The measure is not cost-effective for the scale which would be required to be effective (functional height and perimeter), and the radiant heat flux exposure of the assets (maximum 10kW/m2 radiant heat flux). Barriers (solid fencing) could limit leaf litter or firebrands/embers entering the site, but could also trap them from blowing through the site.
Recommendation Details: Not Applicable</td></tr>
<tr><td>7.9</td><td>Constructed Barrier - Shielding from Consequential Fire: Applicable to all consequential fire fuel sources. Install a non-combustible barrier (including complete enclosure when appropriate), of required robustness, that can perform the following as relevant:
• Reduce the exposure of the subject building/structure to the threats of consequential fire; and/or
• Reduce the exposure of the consequential fire fuels to the bushfire hazard.</td><td>High</td><td>Yes</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Consequential fire sources are addressed in Measure 7.7.
Recommendation Details: Not Applicable</td></tr>
<tr><td>7.10</td><td>Natural Landforms Barrier: Use existing natural landforms to reduce buildings/structures exposure to radiant heat, and lower wind speeds (prevailing synoptic and/or fire driven).</td><td>High</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="7">Assessment Comments: No appropriate landforms exist.
Recommendation Details: Not Applicable</td></tr>
<tr><td>7.11</td><td>Planted Vegetation Barrier: Use appropriate hedges and trees strategically to reduce (to varying extents) buildings/structures exposure to radiant heat, to filter/trap embers and firebrands, and to lower wind speeds (prevailing synoptic and/or fire driven).</td><td>Medium</td><td>Yes</td><td>No</td><td>No</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Vegetation is not recommended within the APZ to remove the capacity for surface fire and production of debris (leaf litter etc).</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					
Recommendation Details: Where the decision maker requests a visual buffer (vegetation barrier), the following requirements apply: • A Landscape Management Plan will be required. • Low flammability plants should be selected, with an emphasis on tightly held platy or smooth barks and limited leaf litter accumulation. The Landscape Management Plan should outline the species selection. • The trunk of any planted tree should be located >1.5 the mature height of that tree from BESS cabinets (this need not apply to Class 10 buildings). It is therefore practical that shorter species are selected. • Shrubs may not be planted under trees. This may require a staggered design to achieve full a visual barrier. • Vegetation should be a minimum of 10m from BESS infrastructure. This may be confined by the lot boundary, so is a recommendation only. • Surface and near-surface fuels including grasses, low shrubs, and leaf litter must be strictly maintained. • The specifications of Schedule 1 of the Guidelines for Planning in Bushfire Prone Areas v1.4 apply.						
7.12	**Shield Operation Critical Non-Structural Elements:** These are vulnerable elements essential to the continued operation of the building/structure which are potentially exposed to the attack mechanisms of both bushfire and consequential fire. These elements include cabling and plumbing associated with power delivery, data transmission, fuel and water transport. When the use of fire rated materials to the degree necessary is not possible or practical, the application of non-combustible shielding can be applied to reduce exposure to the threats. Shielding includes underground installation.	Medium	Yes	Unknown	No	Yes
Assessment Comments: All high-risk components will be positioned such that they are subject to a maximum 10kW/m2 radiant heat flux. *Recommendation Details:* Cabling and plumbing beyond the <10kW/m2 APZ, or beyond footprint of buildings or constructed assets, are recommended to be installed underground, or shielded with non-combustible material (or enclosed) where practical. This does not apply to any connections to the external power network or substations.						
Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.2.4 for explanation and defining. **Note 2: Protection Measure Application Status:** • **Possible:** Protection measures that can potentially be applied to the proposed development/use. • **Fully or Partly Exists:** A current state assessment of protection measures already implemented by existing components of the proposed development/use. The status of current implementation can also be fully or partly. These measures are accounted for in assessing 'inherent' risk levels (refer to Glossary). • **Currently Planned:** Protection measures that: • Are incorporated into the site plans;						

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE EXPOSURE LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="5">Built Infrastructure Assets</td></tr>
<tr><td colspan="7">

- Exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), alternative solutions and any additional recommended protection measures - for which a responsibility for their implementation has been created and approved; and/or
- Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), that can be met and for which a responsibility for their implementation can be created in the BMP.

These planned measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).

- **Additionally Recommend:** Protection measures that:
  - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and comprise alternative solutions and/or additional recommended protection measures (that can and should be implemented in the opinion of the bushfire consultant), and for which a responsibility for their implementation can be created in the BMP; and/or
  - Are developed in the process of producing this risk assessment and management report and for which a responsibility for their implementation can be created in the BMP.

These additionally recommended measures, along with existing and planned measures, are accounted for in assessing 'residual' risk levels (refer to Glossary).
</td></tr>
</table>

5.3.3.2 PROTECTION MEASURES - EFFECTIVENESS AND NUMBER APPLIED

For the stated element at risk, the numbers of both available and potentially applied bushfire protection measures are summarised and the effectiveness of each measure at reducing exposure levels is stated (refer to Appendix 1 for explanatory and supporting information).

This information is applied in the following section of this report to the derivation of the potential for applied bushfire protection measures to reduce the exposure of the relevant element at risk to bushfire hazard threats.

EXPOSURE REDUCING PROTECTION MEASURE ANALYSIS								
Element at Risk	Built Infrastructure Assets							
The Protection Mechanism	Effectiveness Rating [1]	Numbers of Protection Measures						
		Total Available	Application Status [2]					
			Possible	Fully Exists	Partly Exists	Currently Planned	Additionally Recommen	
Establish Sufficient Separation from Relevant Bushfire Hazard Threats	Very High	2	1		1	1	1	
	High	3	3	2		1	1	
	Medium	2	1	1		1		
	Not Relevant							
Establish Shielding from Relevant Bushfire Hazard Threats	Very High							
	High	3	2					
	Medium	2	2				2	
	Not Relevant							
Number Analysis	Very High	2	1		1	1	1	
	High	6	5	2		1	1	
	Medium	4	3	1		1	2	
	Not Relevant							
	Totals	12	9	3	1	3	4	

Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.3.4 for explanation and defining.

Note 2: Protection Measure Application Status: Refer to table footnotes in the preceding section.

5.3.3.3 PROTECTION MEASURES - EXPOSURE REDUCING POTENTIAL

For the stated element at risk the potential for applied bushfire protection measures to reduce exposure levels is assessed as a function of:

- The number of bushfire protection measures that can be applied compared to the number available; and
- The weighting applied to each protection measure that indicates how effective it can be at reducing the exposure of elements at risk.

ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE EXPOSURE TO BUSHFIRE HAZARD THREATS [1]							
Element at Risk	Built Infrastructure Assets						
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF AN INHERENT EXPOSURE LEVEL [2]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Very Significant	Significant	Moderate	Significant	Significant	Very Significant	Very Significant	Moderate
Significant				Significant			
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF A RESIDUAL EXPOSURE LEVEL [3]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Very Significant	Very Significant	Significant	Significant	Very Significant	Very Significant	Very Significant	Significant
Very Significant				Very Significant			

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: Refer to Appendix 2 for explanatory and supporting information.

Assessment Comments: The current condition and siting of the lot is effective in reducing direct and indirect bushfire exposures. Recommendations are to define setbacks from onsite hazards (BESS cabinets) and vegetation.

5.3.3.4 ASSESSED EXPOSURE LEVEL - INHERENT AND RESIDUAL

The preceding bushfire protection measure analysis has enabled the derivation of the inherent and residual exposure levels. These exposure levels are indicative as they are derived through a qualitative assessment process. In combination with the corresponding assessed threat and vulnerability levels, they will be applied to deriving the inherent and residual bushfire risk levels.

ASSESSED EXPOSURE LEVELS (INDICATIVE) POST APPLICATION OF EXPOSURE REDUCING BUSHFIRE PROTECTION MEASURES [1]							
	ELEMENT AT RISK	Built Infrastructure Assets					
BUSHFIRE ATTACK MECHANISMS [2]		INHERENT EXPOSURE LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	Moderate
	Radiant Heat [4]	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
	Embers / Burning Debris	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Tree Strike / Obstruction	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	
	Consequential (Secondary) Fire	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	
BUSHFIRE ATTACK MECHANISMS [2]		RESIDUAL EXPOSURE LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	Low
	Radiant Heat [4]	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Embers / Burning Debris	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
	Tree Strike / Obstruction	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	
	Consequential (Secondary) Fire	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix 2 for explanatory and supporting information.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: The level of exposure to flames and radiant heat is derived from the assessed indicative BAL ratings (refer to the BAL contour map). The exposure levels applied are BAL-LOW/Very Low Exposure, BAL-12.5/Low Exposure, BAL-19/Moderate Exposure, BAL-29/High Exposure, BAL-40 and BAL-FZ/Extreme Exposure.

5.4 VULNERABILITY LEVEL ASSESSMENT – BUSHFIRE PROTECTION MEASURE ANALYSIS

For each stated element at risk an assessment is conducted that considers the effectiveness and application status of all available vulnerability reducing bushfire protection measures that are listed under their applicable bushfire protection mechanism. This information is subsequently applied to deriving vulnerability levels.

5.4.1 PERSONS ON ACCESS/EGRESS ROUTES (IN VEHICLES) OR PATHWAYS

5.4.1.1 PROTECTION MEASURES - IDENTIFICATION AND APPLICATION STATUS

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Persons On Access/Egress Routes In Vehicles	Access/Egress Route ID	Local road network - applicable to Emergency Services.			
THE PROTECTION MECHANISM – LOWER RISK ROAD CONSTRUCTION (DESIGN AND MATERIALS): The application of as many of the following protection measures as possible ensures a greater level of safety for users and lowers the associated risk when roads need to be used to evacuate to a safer offsite location in potentially high stress situations within a threatening environment. Safety for persons using the route is increased through reducing the likelihood of vehicle/terrain or vehicle/vehicle accidents and the ability to maintain travelling speed.						
10.1	**Greater Road Width:** Ensure appropriate width roads are installed. Wider roads allow safer passing of the anticipated traffic that can be travelling in both directions (e.g. emergency services travelling towards the emergency event). The effectiveness of road width to reduce vulnerability is also a function of the required carriage capacity - which may be increased by the proposed development/use when it will increase traffic intensity. The incorporation of non-vegetated and trafficable road verges/shoulders and adjacent footpaths can also be considered to increase effective width for slower moving vehicles (providing additional separation from the hazard and passing opportunities).	High	No	Partly	Yes	No
Assessment Comments: Roads are minimum 7m and generally 8m wide to support the heavy vehicles associated with industrial uses. Shoulders in developed areas are mountable due to sealed footpaths, which are expected to be expanded throughout the industrial precinct as lots are developed. *Recommendation Details:* Not Applicable						
10.2	**Lower Road Gradient:** Ensure appropriate road gradients are available. Lower gradients help ensure traction and speed can be maintained. Steep gradients can also be associated with driver visibility. Appropriate gradients will depend on the constructed surface materials and the weights and tractive capability of expected vehicle types.	Medium	No	Yes	No	No
Assessment Comments: The local topography is flat to undulating. There are no road sections with traction or visibility issues due to slope.						

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Persons On Access/Egress Routes In Vehicles — Access/Egress Route ID: Local road network - applicable to Emergency Services.					
Recommendation Details: Not Applicable						
10.3	**Greater Road Clearance:** Ensure appropriate clearance can exist and is established. Sufficient horizontal and vertical clearances from obstructions ensure unhindered movement of all possible vehicle types;	Medium	No	Yes	No	No
Assessment Comments: The minimum horizontal clearance is the road width of 7-8m. Powerlines and limited numbers of trees abut the road but do not overhang the road. *Recommendation Details:* Not Applicable						
10.4	**Stable Road Surfaces:** Ensure that roads are constructed of materials that will provide the necessary traction (also a function of gradient), can support the weight of all expected vehicle types and remain operational in all weather. The required supportive capacity also applies to associated structures such as bridges.	Medium	No	Yes	No	No
Assessment Comments: All local roads are sealed public roads designed to support the heavy vehicles associated with industrial uses. Any internal roads (driveways) will be sealed hardstand (concrete or bitumen). *Recommendation Details:* Not Applicable						
10.5	**Driver Visibility and Road Ahead Signage:** Ensure that road design provides high levels of visibility ahead (in the absence of smoke and embers) and informative signage indicating relevant 'up ahead' route information (includes information stating distance to turnaround area for narrow roads in more remote locations). Good visibility is associated with the avoidance of 'blind' corners and crests to the greatest extent possible.	Medium	No	Yes	No	No
Assessment Comments: The local road network has low speed limits and intersections are signed with 'Stop' or 'Give Way' signs. The industrial precinct has broad verges particularly at intersections to allow for clear visibility for heavy vehicles. *Recommendation Details:* Not Applicable						
10.6	**Shorter Road Length:** Shorter distances to safer locations reduce the length of time persons remain vulnerable to bushfire threats.	High	No	Yes	No	No
Assessment Comments: Multiple large low threat areas (subject to BAL-LOW) exist within the local industrial precinct, which are reached within 1 minute (<1km) of travel. Beyond the immediate area, the Picton centre can be reached within 3 minutes (2.5km) of travel. *Recommendation Details:* Not Applicable						

<table>
<tr><th colspan="5" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td colspan="2">Element at Risk</td><td>Persons On Access/Egress Routes In Vehicles</td><td>Access/Egress Route ID</td><td colspan="6">Local road network - applicable to Emergency Services.</td></tr>
<tr><td>10.7</td><td colspan="4">Interconnected Road Network to Provide Route Options: Ensuring that the design of the road network provides through roads and avoids dead-end roads, provides the choice of alternative routes to for minimising close contact with a bushfire event. Otherwise, vehicles and persons can be trapped.</td><td>Very High</td><td>No</td><td>Partly</td><td>No</td><td>No</td></tr>
<tr><td colspan="10">Assessment Comments: Two way access is available from the intersection of Hardisty Court and Delmarco Drive, approximately 125m from the site entry. After this point, regular intersections are available within the local road network and all are through-roads.
Recommendation Details: Not Applicable</td></tr>
<tr><td colspan="10">THE PROTECTION MECHANISM – EVACUEES ARE SELF-SUFFICIENT AND HAVE LOCAL AWARENESS AND OWN TRANSPORT: The ‘type’ of persons that will be present on the site of the proposed development/use influences their degree of vulnerability to both bushfire threats and to risk associated with vehicular accidents in a stressful environment.
Persons that have local knowledge, are self-supportive, have their own transport and are physically and mentally capable present the lowest degree of vulnerability for this factor.
This contrasts with persons who can be considered ‘vulnerable’ and are likely to be less capable or effective at making the required decisions and carrying out the required actions in the timeframe required. They are likely to be dependent on others for both information and transport and will not have any local knowledge.</td></tr>
<tr><td>10.8</td><td colspan="4">Self Sufficient Persons with Local Awareness: The site use and location increases the likelihood these are the type of persons that will be present on the site.</td><td>High</td><td>No</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="10">Assessment Comments: The site is intended to be unstaffed. Persons onsite during a bushfire emergency will be Emergency Services, who will be aware of the local area.
Recommendation Details: Not Applicable</td></tr>
<tr><td>10.9</td><td colspan="4">Onsite Persons Have Own Transport: There is no need to have arrangements in place for external provision of evacuation vehicles. Transport will always be available.</td><td>High</td><td>No</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="10">Assessment Comments: The site is intended to be unstaffed. Persons onsite during a bushfire emergency will be Emergency Services, who will have their vehicles immediately available.
Recommendation Details: Not Applicable</td></tr>
<tr><td colspan="10">Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.2.4 for explanation and defining.
Note 2: Protection Measure Application Status:
• Possible: Protection measures that can potentially be applied to the proposed development/use.</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS				Effectiveness Rating [1]	Application Status [2]			
					Possible	Exists	Planned	Additionally Recommend
Element at Risk	Persons On Access/Egress Routes In Vehicles	Access/Egress Route ID	Local road network - applicable to Emergency Services.					

- **Fully or Partly Exists**: A current state assessment of protection measures already implemented by existing components of the proposed development/use. The status of current implementation can also be fully or partly. These measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).
- **Currently Planned:** Protection measures that:
    - Are incorporated into the site plans;
    - Exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), alternative solutions and any additional recommended protection measures - for which a responsibility for their implementation has been created and approved; and/or
    - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), that can be met and for which a responsibility for their implementation can be created in the BMP.

  These planned measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).
- **Additionally Recommend:** Protection measures that:
    - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and comprise alternative solutions and/or additional recommended protection measures (that can and should be implemented in the opinion of the bushfire consultant), and for which a responsibility for their implementation can be created in the BMP; and/or
    - Are developed in the process of producing this risk assessment and management report and for which a responsibility for their implementation can be created in the BMP.

  These additionally recommended measures, along with existing and planned measures, are accounted for in assessing 'residual' risk levels (refer to Glossary).

5.4.1.2 PROTECTION MEASURES - EFFECTIVENESS AND NUMBER APPLIED

For the stated element at risk, the numbers of both available and potentially applied bushfire protection measures are summarised and the effectiveness of each measure at reducing vulnerability levels is stated (refer to Appendix 1 for explanatory and supporting information).

This information is applied in the following section of this report to the derivation of the potential for applied bushfire protection measures to reduce the vulnerability of the relevant element at risk to bushfire hazard threats.

VULNERABILITY REDUCING PROTECTION MEASURE ANALYSIS							
Element at Risk	Persons on Access/Egress Routes in Vehicles						
Access/Egress Route ID	Local road network - applicable to Emergency Services.						
The Protection Mechanism	Effectiveness Rating [1]	Numbers of Protection Measures					
		Total Available	Application Status [2]				
			Possible	Fully Exists	Partly Exists	Currently Planned	Additionally Recommen
Lower Risk Road Construction (Design and Materials)	Very High	1			1		
	High	2		1	1	1	
	Medium	4		4			
	Not Relevant						
Evacuees are Self-Sufficient and Have Local Awareness and Own Transport	Very High						
	High	2		2			
	Medium						
	Not Relevant						
Number Analysis	Very High	1			1		
	High	4		3	1	1	
	Medium	4		4			
	Not Relevant						
	Totals	9		7	2	1	
Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.3.4 for explanation and defining. Note 2: Protection Measure Application Status: Refer to table footnotes in the preceding section.							

5.4.1.3 PROTECTION MEASURES - VULNERABILITY REDUCING POTENTIAL

For the stated element at risk the potential for applied bushfire protection measures to reduce vulnerability levels is assessed as a function of:

- The number of bushfire protection measures that can be applied compared to the number available; and
- The weighting applied to each protection measure that indicates how effective it can be at reducing the vulnerability of elements at risk.

ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE VULNERABILITY TO BUSHFIRE HAZARD THREATS [1]	
Element at Risk	Persons on Access/Egress Routes in Vehicles
Access/Egress Route ID	Local road network - applicable to Emergency Services.
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF VULNERABILITY LEVELS [2]	
REDUCTION IN THE INHERENT VULNERABILITY LEVEL	REDUCTION IN THE RESIDUAL VULNERABILITY LEVEL
Very Significant	Very Significant

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

5.4.1.4 ASSESSED VULNERABILITY LEVEL - INHERENT AND RESIDUAL

The preceding bushfire protection measure analysis has enabled the derivation of the inherent and residual vulnerability levels. These vulnerability levels are indicative as they are derived through a qualitative assessment process. In combination with the corresponding assessed threat and exposure levels, they will be applied to deriving the inherent and residual bushfire risk levels.

ASSESSED VULNERABILITY LEVELS (INDICATIVE) POST APPLICATION OF EXPOSURE REDUCING BUSHFIRE PROTECTION MEASURES [1]				
ELEMENT AT RISK	Persons Located Onsite and Temporarily Offsite			
Access/Egress Route ID	Local road network - applicable to Emergency Services.			
THE INHERENT VULNERABILITY LEVEL [2]				
Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐
THE RESIDUAL VULNERABILITY LEVEL [2]				
Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐
Note 1: Refer to Appendix 1 for explanatory and supporting information. **Note 2:** Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.				

Assessment Comments: No recommendations are applicable. The inherent and residual risk are the same.

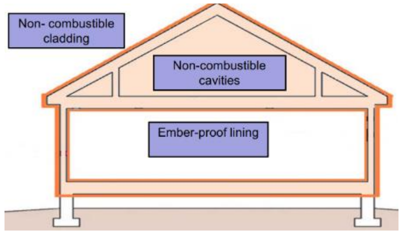
The site is intended to be unstaffed. Persons onsite during a bushfire emergency will be Emergency Services, who will be aware of the local area and have their vehicles immediately available.

The road network is clear, well maintained, and has multiple egress options and destinations available. Low threat areas (subject to BAL-LOW) can be reached immediately without travelling through bushfire prone vegetation.

5.4.2 BUILDINGS AND STRUCTURES (NCC CLASSES 1-10)

5.4.2.1 PROTECTION MEASURES - IDENTIFICATION AND APPLICATION STATUS

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Buildings/Structures - NCC Classes 1-10</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – CONSTRUCTION DESIGN AND MATERIALS: Increase bushfire resilience through the application of beneficial design and construction, including using non-combustible materials and minimising the use of vulnerable materials, to the greatest extent possible. Practicality and cost will be key considerations in determining the viability of applying protection measures in differing scenarios, but this should be determined with due consideration of threat levels and the importance of the elements at risk.
The constructed systems should utilise the following properties to the greatest extent possible: <u>reliability</u> (which requires their durability over time, low maintenance and being unlikely to change over time), <u>robustness</u> (which limits damage spread from minor sources, continues to protect when thermally loaded and protects vulnerable elements), <u>resilience</u> (which enables their return to a functional state following an overload) and <u>redundancy</u> (which ensures the fate of the subject building/structure is not reliant on the effective performance of a single element). Refer to the glossary for additional explanation.
The mechanism is also applicable to constructed consequential fire fuels.</td></tr>
<tr><td>11.1</td><td>Construct to AS 3959:2018 [4]: Apply the specified requirements to construction. These are intended to reduce the risk of building ignition from bushfire direct attack mechanisms. Note that the indirect attack mechanisms and the threats presented by consequential fire fuels are not specifically considered.
"The standard is primarily concerned with improving the ability of buildings … to better withstand attack from bushfire thus giving a measure of protection to the building occupants (until the fire front passes), as well as to the building itself".
The AS 3959 approach adopts a strategy that relies on the integrity of the building's exterior envelope (i.e., the cladding of roof/wall/eaves, floor supporting structures/flooring and all penetrations) to resist all bushfire exposure conditions and environmental actions thereby protecting all structural construction elements behind it, including allowable combustible materials. It provides protection by:
• Using specified materials that provide ignition resistance (tolerance of radiant heat and flames). Higher BAL ratings impose increased construction requirements for these exterior envelope materials;
• Specifying precise gap control (applicable to all bushfire attack levels) for the exterior envelope of the building to prevent ember entry); and
• Attached and adjacent structures (within 6m) must also comply with the Standard.</td><td>High</td><td>No</td><td>No</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Structures (storage sheds and switchrooms etc) do not have a general structure which can comply with AS 3959 or NASH.</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					
Recommendation Details: Not Applicable						
11.2	**Construct to NASH Standard [33]:** Apply the specified requirements to construction. The Standard: *"Sets out acceptable construction requirements for residential and low-rise buildings in bushfire prone areas to reduce the risk of ignition from bushfire attack involving embers, radiant heat and direct flame impingement using non-combustible materials. Buildings constructed in accordance with this Standard are intended to provide a sheltering envelope during the passage of a bushfire flame front. They do not constitute 'last resort' private bushfire shelters as defined in the NCC. The Standard is based on achieving ignition resistance through non-combustible construction using conventional building materials and a level of redundancy to provide a high level of performance in extreme bushfire events and an increased probability that unattended buildings will survive such events."* Key attributes of the Standard include: • Materials used anywhere on the building envelope (see shaded part of diagram below), must be non-combustible except for a small amount allowed externally that includes flooring, window frames, doors and external decorative trim. The building envelope is comprised of a framed roof/ceiling system, an external wall system and a floor system;  • The same construction requirements apply for all BAL ratings up to BAL-40 (except for external doors and windows which apply AS 3959 requirements). An additional benefit of this is the built in resistance to the direct attack mechanisms of consequential fire when lower BAL ratings apply. • It does not rely on eliminating ember entry to the roof space, wall cavities and floor system as these are non-combustible construction. Embers only need to be kept from entering the internal living/operating spaces. • It is ember tolerant without unrealistic workmanship, supervision and maintenance requirements; • The combination of a non-combustible cladding and cavities is a robust solution that enables the building to be configured so that failure or damage to one element does not lead to the inevitable failure of the building or a breach of the habitable envelope; and	Very High	No	No	No	No

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					
	• Attached and adjacent structures (within 6m) must also comply with the Standard.					
Assessment Comments: NASH is not a relevant standard as it is to ensure a tenable internal environment. There will no regular staffing of the site. *Recommendation Details:* Not Applicable						
11.3	**Construction Materials for External and Internal Cavity Building Elements:** Except for internal living or operation spaces, to the degree necessary, utilise materials resistant to fire attack mechanisms of flame and radiant heat (preferably non-combustible) for all relevant building elements, including wall, roof, floor, supporting structures and framing systems.	Very High	Yes	No	Unknown	Yes
Assessment Comments: Any future Class 10a buildings will likely be primarily masonry, steel, aluminium and cement sheeting. *Recommendation Details:* For any future Class 10a buildings, include non-combustible structural elements where practical. In particular, avoid: polycarbonate (sheeting and skylights), softwoods (<650 kg/m3 density at 12% moisture content), and fibrous materials.						
11.4	**Construction Materials for Consequential Fire Fuels:** For constructed large consequential fire fuels, use non-combustible materials to the fullest extent possible. Potential fuels include: • Landscaping items – fences, screens, retaining walls, gazebos, plastic water tanks etc; • Attached structures - decks, verandahs, stairs, carports, garages, pergolas, patios, etc; • Adjacent structures – other houses, sheds, garages, carports, etc. Post bushfire event assessments identify structure to structure fire as a common cause of overall building loss [9].	High	Yes	No	No	Yes
Assessment Comments: The presence and design of potential large fuels is not known (other than assets assessed in Report). *Recommendation Details:* See Measure 14.4.						
11.5	**Construction Design / Materials Resistant To High Wind Damage:** Apply construction measures to prevent the type of building damage from wind that will open or create gaps (from the wind itself or carried projectiles) and allow the entry of embers, radiant heat and flames. This type of damage is typically superficial damage. Building codes relating to wind (e.g., cyclones) do not necessarily address this superficial type of impact. Additional fixings for building envelope claddings and protection of the most vulnerable elements, such as glazing, from debris impact, are key considerations. Consider applying the principles of the NASH Standard [33] design solution to construction.	Medium	Yes	No	No	No

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					
	"Potential wind effects directly associated with bushfire events have been considered in this Standard. Wind actions may affect buildings subject to a bushfire attack in various ways including: • The intensity of flame front activity may produce locally high wind pressures on parts of the building; • In the post fire phase, some weakened components on the building envelope may be vulnerable to normal design pressures; and • Wind can drive embers into the building envelope." Most applicable when the physical requirements exist for the development of an extreme bushfire event within the surrounding surrounding landscape.					
Assessment Comments: Wind is unlikely to cause sufficient damage to create a vulnerability to embers given the setback from vegetation. Increased structural requirements to account for high wind have not been applied, as Class 1-9 buildings are required to comply with the NCC and Class 10 buildings do not have practical measures available to reduce this vulnerability. *Recommendation Details:* Not Applicable						
11.6	**Construction of Gas Supply:** All gas cylinders are installed and maintained in accordance with AS 1596 (for domestic house supply) as a guide. The requirement of the standard includes: • Safety release valve shall be directed away from the building and persons access/egress routes; • Metal piping and fittings shall be used on all piping inside the building's cavities and enclosable occupied spaces and the high pressure side of any gas regulators; and • Tethers securing cylinders are to be non-combustible. The objective is to reduce the risk of consequential (secondary) fire against a building and reduce the risk of death or injury, from gas flaring or explosion. The rationale is gas cylinders which have either flared or ruptured are commonly found in post bushfire surveys [9]. The heat from the bushfire or consequential (secondary) fire has been sufficient to cause their pressure to reach critical levels beyond which their pressure release valve releases large quantities of LP gas. If these gas cylinders fall over, this pressure release valve may no longer function correctly, meaning that the gas cylinder may continue to increase in pressure with continued heating until the cylinder ruptures. The resulting explosion includes a pressure wave and large ball of flame which can threaten nearby life and buildings.	Medium	N/A	N/A	N/A	N/A

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					
	Readily available guidance is provided by CSIRO Best Practice Bushfire Guide (https://research.csiro.au/bushfire/new-builds/water-electricity-gas/) and WA Dept. Mines, Industry, Regulation and Safety 'LP Gas cylinder safety in bushfire prone areas' (https://www.commerce.wa.gov.au/publications/lp-gas-cylinder-safety-bushfire-prone-areas).					
Assessment Comments: Gas storage is not proposed on site. Any LPG will be stored in compliance with AS 1596. *Recommendation Details:* Not Applicable						
11.7	**Construction of Electricity Supply:** Cabling to be shielded (includes installing underground within subject property boundary) from applicable bushfire attack mechanisms. The objective is to assist with continuity of supply for essential site operations and/or electrically driven firefighting pumps. It also reduces the risk of electrocution to any persons onsite and reduces potentially additional sources of fire ignition. It is common in bushfires for power infrastructure to burn and collapse or be impacted by falling trees or branches while power lines are still live. Removing this risk may be appropriate for some sites.	Medium	Yes	No	No	Yes
Assessment Comments: Future Class 10a buildings may have an electricity supply. The electricity supply to buildings is not vital for emergency operations. *Recommendation Details:* See Measure 7.12.						
11.8	**Minimise Re-entrant Detail to Minimise Debris and Ember Accumulation:** Avoid or limit the accumulation of unburnt debris and embers by minimising re-entrant details and/or adopting aerodynamic forms that will self-shed windblown debris and embers. For example: • Simple building/structure footprints that avoid re-entrant corners in access ways, at wall/floor, wall/ground, roof/wall junctions and around doors, vents, windows; and • Simple roof layouts that avoid valleys and minimise the number of ridges that need protection details (e.g. skillion roofs).	Medium	Yes	No	Unknown	No
Assessment Comments: The design of any Class 10a buildings are likely to be simple rectangular structures without complex features. *Recommendation Details:* Not Applicable						
11.9	**Minimise Debris and Ember Trapping Surfaces:** Avoid or minimise the use of exposed combustible surfaces that can trap and accumulate debris and embers. These include:	Medium	Yes	No	Unknown	No

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					
	• Horizontal, or shallow angle surfaces e.g. exposed wall/roof framework, roofs, decking, verandahs, steps, windowsills; and • Vertical surfaces with rough textured cladding (e.g. sawn timber).					
Assessment Comments: The design of any Class 10a buildings are likely to be simple rectangular structures without complex features. *Recommendation Details:* Not Applicable						
11.10	**Protect Roof Plumbing to Minimise Debris and Ember Accumulation:** All roof plumbing (gutters, valleys) is protected from the accumulation of debris and embers that can result in direct fire attack mechanisms immediately adjacent to any combustible elements within the roof cavity.	Medium	N/A	N/A	N/A	N/A
Assessment Comments: Class 10a structures will not have plumbing. *Recommendation Details:* Not Applicable						
11.11	**Minimise Construction Cavities to Minimise Debris and Ember Accumulation:** Apply designs that lower the potential for accumulation of embers and debris within cavity spaces of buildings/structures. Examples include concrete floor slab on the ground and solid masonry walls.	Medium	Yes	No	Unknown	Yes
Assessment Comments: The design of any Class 10a buildings are likely to be simple rectangular structures without complex features. *Recommendation Details:* See Measure 14.11.						
11.12	**Minimise External Openings to Limit Flame/Radiant Heat/Ember/Debris Entry:** Limit potential sites for threat entry to through the external building envelope to internal spaces containing combustible materials (consequential fire fuels). Examples include reducing windows/doors on elevations facing the bushfire hazard and apply design to limit gaps and penetrations that will require screening.	Medium	Yes	No	No	Yes
Assessment Comments: None Required. *Recommendation Details:* The detailed design of any Class 10a Buildings should be reviewed to ensure it is possible for them to be fully enclosed.						
11.13	**Screen and Seal Gaps and Penetrations:** Apply fire rated sealants and/or install metal screening (corrosion resistant steel, bronze, aluminium <2mm aperture).	Medium	Yes	No	Unknown	Yes

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Buildings/Structures - NCC Classes 1-10</td></tr>
<tr><td></td><td>All external construction and penetration gaps with apertures greater than 2mm will allow ember entry (and potentially debris) to internal cavities and combustible materials within (as consequential fire fuels).
This includes gaps in roofs, walls, doors, windows and their surrounding trims – including those associated with penetrations, vents, weepholes, poor workmanship and material deterioration and movement over time (maintenance). Internal fire is difficult to see and extinguish.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="7">Assessment Comments: Class 10a buildings cannot construct to AS 3959 but ember screening is possible.
Recommendation Details: Any Class 10a buildings must have ember screening/sealants installed on any gaps, penetrations, and external glazed elements. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.</td></tr>
<tr><td>11.14</td><td>Screen External Doors and Windows: Metal screens (corrosion resistant steel, bronze, aluminium <2mm aperture) installed over non-openable and/or openable parts of windows and doors to prevent ember entry to internal spaces containing combustible materials (consequential fire fuels) and reduce radiant heat load on vulnerable surfaces.</td><td>Medium</td><td>Yes</td><td>No</td><td>Unknow n</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Any doors will likely be a solid panel or composed of the same material as walls. The site will be unstaffed and thus doors will be closed at all times. Windows are unlikely to be installed.
Recommendation Details: See Measure 11.13.</td></tr>
<tr><td>11.15</td><td>Shutter External Doors and Windows: Fire rated shutters are installed to significantly increase bushfire resistance of the vulnerable building elements.</td><td>Medium</td><td>Yes</td><td>No</td><td>Unknow n</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: Screening has been applied rather than shutters.
Recommendation Details: Not Applicable</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – AVAILABILITY OF A FIREFIGHTING RESPONSE CAPABILITY: Provide sufficient and reliable dedicated firefighting water supply and delivery capability as necessary for installed active and/or passive systems.</td></tr>
<tr><td>11.16</td><td>Firefighting Water Supply: Have a dedicated static supply of firefighting water for the protection of buildings/structures before and after the passage of a bushfire front. Adequate water supply is critical for any firefighting operation, particularly where property protection is the intent. This is necessary when:
• A water supply additional to a reticulated water supply is required to counter the loss of firefighting water as a protection measure, should the reticulated supply be interrupted; and</td><td>High</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					
	• It is the only source of firefighting water. All tanks shall be non-combustible. Aside from losing water, failure of combustible tank can provide an additional heat or load to a vulnerable building element. Metal piping and fittings shall be used for any above ground components. The limitation to the effectiveness of the measure is the requirement for persons to be present and have the minimum required operational knowledge and/or access to appropriate information.					
Assessment Comments: Hydrants are currently installed immediately outside the site boundary, at the northern entry gate and at the intersection of Delmarco Drive and Hardisty Court. *Recommendation Details:* Not Applicable						
11.17	**Firefighting Equipment Actively Operated:** In addition to a dedicated water supply, appropriate mobile firefighting appliances are available quickly and/or fixed firefighting equipment is installed (pumps, hoses, sprinklers etc). Where equipment is installed, this will be resilient to bushfire impact, to the extent necessary, through the application of appropriate equipment materials and protection (shielding or separation from the hazard). The limitation to the effectiveness of the measure is the requirement for persons to be present and have the minimum required operational knowledge and/or access to appropriate information.	High	No	No	No	No
Assessment Comments: The site is unstaffed. Actively operated firefighting equipment would not be effective. *Recommendation Details:* Not Applicable						
11.18	**Fire Fighting Equipment Passively Operated:** In addition to a dedicated water supply, appropriate water dispensing apparatus are installed (e.g. pumps, plumbing and sprinklers) that are automatically activated. These will be resilient to bushfire impact, to the extent necessary, through the application of appropriate equipment materials and protection (shielding or separation from the hazard).	High	Yes	No	No	No
Assessment Comments: Prevention of ignition and spread is effective. Passive firefighting for Class 10a buildings is not proposed, as they will be unoccupied and items stored may be damaged by sprinkler systems (and thus loss to fire is less relevant). *Recommendation Details:* Not Applicable						
11.19	**Fire Fighting Equipment Operability Maintained:** Where water pumps, shutters or other active/passive protection measures rely on the continued supply of electricity, establish barriers (shielding) or separation from potential damaging	High	N/A	N/A	N/A	N/A

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					
	factors (e.g. falling trees/branches, fire, or other impact sources). For example, bury transmission systems to the greatest extent possible.					
Assessment Comments: Not applicable to reticulated firefighting water supplies. *Recommendation Details:* Not Applicable						
11.20	**Access via Firebreaks Provided:** Installation and maintenance of firebreaks to facilitate firefighting access / backburning (and also limiting surface fire progression).	Medium	Yes	Yes	No	No
Assessment Comments: The entire site will be maintained as a trafficable hardstand, which will meet the Local Government Firebreak Notice. *Recommendation Details:* Not Applicable						
THE PROTECTION MECHANISM – MANAGE AND MAINTAIN EFFECTIVENESS OF APPLIED PROTECTION MEASURES: To ensure the retention of the level of bushfire resilience that has been established through the implementation of appropriate bushfire protection measures, formal and enforceable responsibilities are created.						
11.21	**Formal Documents Created to Guide and Enforce Management:** Through relevant site operations document(s) and/or an enforceable agreement, regulation or standard, a mechanism is put in place to ensure that: • The required management and maintenance of applied bushfire protection measures is conducted on a regular basis – with the interval dependent on the necessary frequency that will maintain full effectiveness; • The relevant protection measures are known and understood; and • Responsibilities are created.	High	Yes	Yes	Unknown	Yes
Assessment Comments: The documents have been or will be produced. *Recommendation Details:* See Measure 14.22.						
Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.2.4 for explanation and defining. **Note 2: Protection Measure Application Status:** • **Possible:** Protection measures that can potentially be applied to the proposed development/use. • **Fully or Partly Exists**: A current state assessment of protection measures already implemented by existing components of the proposed development/use. The status of current implementation can also be fully or partly. These measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).						

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Buildings/Structures - NCC Classes 1-10					

- **Currently Planned:** Protection measures that:
  - Are incorporated into the site plans;
  - Exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), alternative solutions and any additional recommended protection measures - for which a responsibility for their implementation has been created and approved; and/or
  - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), that can be met and for which a responsibility for their implementation can be created in the BMP.

  These planned measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).
- **Additionally Recommend:** Protection measures that:
  - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and comprise alternative solutions and/or additional recommended protection measures (that can and should be implemented in the opinion of the bushfire consultant), and for which a responsibility for their implementation can be created in the BMP; and/or
  - Are developed in the process of producing this risk assessment and management report and for which a responsibility for their implementation can be created in the BMP.

  These additionally recommended measures, along with existing and planned measures, are accounted for in assessing 'residual' risk levels (refer to Glossary).

5.4.2.2 PROTECTION MEASURES - EFFECTIVENESS AND NUMBER APPLIED

For the stated element at risk, the numbers of both available and potentially applied bushfire protection measures are summarised and the effectiveness of each measure at reducing vulnerability levels is stated (refer to Appendix 1 for explanatory and supporting information).

This information is applied in the following section of this report to the derivation of the potential for applied bushfire protection measures to reduce the vulnerability of the relevant element at risk to bushfire hazard threats.

VULNERABILITY REDUCING PROTECTION MEASURE ANALYSIS							
Element at Risk	Buildings / Structures - NCC Classes 1-10						
The Protection Mechanism	Effectiveness Rating [1]	Numbers of Protection Measures					
		Total Available	Application Status [2]				
			Possible	Fully Exists	Partly Exists	Currently Planned	Additionally Recommen
Construction Design and Materials	Very High	2	1				1
	High	2	1				1
	Medium	11	9				5
	Not Relevant						
Availability of a Firefighting Response Capability	Very High						
	High	4	2	1			
	Medium	1	1	1			
	Not Relevant						
Manage and Maintain Effectiveness of Applied Protection Measures	Very High						
	High	1	1	1			1
	Moderate						
	Not Relevant						
Number Analysis	Very High	2	1				1
	High	7	4	2			2
	Medium	12	10	1			5
	Not Relevant						
	Totals	21	15	3			8
Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.3.4 for explanation and defining. Note 2: Protection Measure Application Status: Refer to table footnotes in the preceding section.							

5.4.2.3 PROTECTION MEASURES - VULNERABILITY REDUCING POTENTIAL

For the stated element at risk the potential for applied bushfire protection measures to reduce vulnerability levels is assessed as a function of:

- The number of bushfire protection measures that can be applied compared to the number available; and
- The weighting applied to each protection measure that indicates how effective it can be at reducing the vulnerability of elements at risk.

ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE VULNERABILITY TO BUSHFIRE HAZARD THREATS [1]							
Element at Risk	Buildings and Structures – NCC Classes 1-10						
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF AN INHERENT VULNERABILITY LEVEL [2]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Moderate	Moderate	Minimal	Minimal	Moderate	Moderate	Minimal	Minimal
Minimal				Minimal			
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF A RESIDUAL VULNERABILITY LEVEL [3]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Moderate	Significant	Significant	Minimal	Significant	Moderate	Minimal	Moderate
Moderate				Moderate			

Note 1: Refer to Appendix A1.2 for explanatory and supporting information.

Note 2: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: Refer to Appendix 2 for explanatory and supporting information.

Assessment Comments: The protection measures concentrate on reducing the vulnerability of building(s) to ember attack, including ember screening, construction materials, enclosing subfloor cavities, and preventing leaf litter/debris accumulation.

5.4.2.4 ASSESSED VULNERABILITY LEVEL - INHERENT AND RESIDUAL

The preceding bushfire protection measure analysis has enabled the derivation of the inherent and residual vulnerability levels. These vulnerability levels are indicative as they are derived through a qualitative assessment process. In combination with the corresponding assessed threat and exposure levels, they will be applied to deriving the inherent and residual bushfire risk levels.

ASSESSED VULNERABILITY LEVELS (INDICATIVE)

POST APPLICATION OF EXPOSURE REDUCING BUSHFIRE PROTECTION MEASURES [1]

	ELEMENT AT RISK	Buildings/Structures - NCC Classes 1-10					
BUSHFIRE ATTACK MECHANISMS [2]		INHERENT VULNERABILITY LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	High
DIRECT	Radiant Heat [4]	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	
DIRECT	Embers / Burning Debris	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	
DIRECT	High/Erratic Fire Driven Wind	Very Low ☐	Low ☐	Moderate ☐	High ☐	Extreme ☒	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
INDIRECT	Surface Fire	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
INDIRECT	Tree Strike / Obstruction	Very Low ☐	Low ☐	Moderate ☐	High ☐	Extreme ☒	
INDIRECT	Consequential (Secondary) Fire	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	
BUSHFIRE ATTACK MECHANISMS [2]		RESIDUAL VULNERABILITY LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	Moderate
DIRECT	Radiant Heat [4]	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
DIRECT	Embers / Burning Debris	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
DIRECT	High/Erratic Fire Driven Wind	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Tree Strike / Obstruction	Very Low ☐	Low ☐	Moderate ☐	High ☐	Extreme ☒	
INDIRECT	Consequential (Secondary) Fire	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix 2 for explanatory and supporting information.

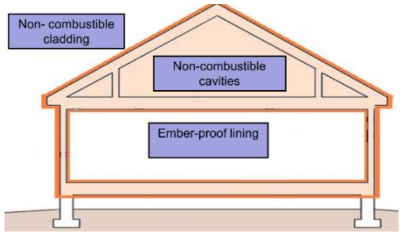
Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: The level of exposure to flames and radiant heat is derived from the assessed indicative BAL ratings (refer to the BAL contour map). The exposure levels applied are BAL-LOW/Very Low Exposure, BAL-12.5/Low Exposure, BAL-19/Moderate Exposure, BAL-29/High Exposure, BAL-40 and BAL-FZ/Extreme Exposure.

5.4.3 BUILT INFRASTRUCTURE ASSETS

5.4.3.1 PROTECTION MEASURES - IDENTIFICATION AND APPLICATION STATUS

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – CONSTRUCTION DESIGN AND MATERIALS: Increase bushfire resilience through the application of beneficial design and construction, including using non-combustible materials and minimising the use of vulnerable materials, to the greatest extent possible. Practicality and cost will be key considerations in determining the viability of applying protection measures in differing scenarios, but this should be determined with due consideration of threat levels and the importance of the elements at risk.
The constructed systems should utilise the following properties to the greatest extent possible: <u>reliability</u> (which requires their durability over time, low maintenance and being unlikely to change over time), <u>robustness</u> (which limits damage spread from minor sources, continue to protect when thermally loaded and protects vulnerable elements), <u>resilience</u> (which enables their return to a functional state following an overload) and <u>redundancy</u> (which ensures the fate of the subject building/structure is not reliant on the effective performance of a single element). Refer to the glossary for additional explanation.
The principle is also applicable to constructed consequential fire fuels.</td></tr>
<tr><td>14.1</td><td>Construct to AS 3959:2018 [4]: Use the principles and requirements established in the Standard, for buildings in general, and apply to the infrastructure assets where they have merit.
These are intended to reduce the risk of building ignition from bushfire direct attack mechanisms. Note that the indirect attack mechanisms and the threats presented by consequential fire fuels are not specifically considered. Key attributes of the Standard that may have relevance to other built assets include:
• The AS 3959 strategy that relies on the integrity of the building's exterior envelope (i.e., the cladding of roof/wall/eaves, floor supporting structures/flooring and all penetrations) to resist all bushfire exposure conditions and environmental actions thereby protecting all structural construction elements behind it, including allowable combustible materials.
• Using specified materials that provide ignition resistance (tolerance of radiant heat and flames). Higher BAL ratings impose increased construction requirements for these exterior envelope materials;
• Specifying precise gap control (applicable to all bushfire attack levels) for the exterior envelope of the building to prevent ember entry); and
• Attached and adjacent structures (within 6m) must also comply with the Standard.</td><td>High</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="7">Assessment Comments: Assets do not have a design which can comply with AS3959 or NASH.
Recommendation Details: Not Applicable.</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td>14.2</td><td>Construct to NASH Standard [33]: Use the principles and requirements established in the Standard, for residential and low-rise buildings, and apply to the infrastructure assets where they have merit.
Key attributes of the Standard that may have relevance to other built assets include:
• Materials used anywhere on the building envelope (see shaded part of diagram below), must be non-combustible (except for a small number of smaller building elements). The building envelope is comprised of a framed roof/ceiling system, an external wall system and a floor system;


• The same construction requirements apply for all BAL ratings up to BAL-40 (except for external doors and windows which apply AS 3959 requirements). An additional benefit of this is the built in resistance to the direct attack mechanisms of consequential fire when lower BAL ratings apply.
• It does not rely on eliminating ember entry to the roof space, wall cavities and floor system as these are non-combustible construction. Embers only need to be kept from entering the internal living/operating spaces.
• It is ember tolerant without unrealistic workmanship, supervision and maintenance requirements;
• The combination of a non-combustible cladding and cavities is a robust solution that enables the building to be configured so that failure or damage to one element does not lead to the inevitable failure of the building or a breach of the habitable envelope; and
• Attached and adjacent structures (within 6m) must also comply with the Standard.</td><td>Very High</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="7">Assessment Comments: Assets do not have a design which can comply with AS3959 or NASH.
Recommendation Details: Not Applicable.</td></tr>
<tr><td>14.3</td><td>Construction Materials for External and Internal Cavity Building Elements: Except for internal living or operation spaces, to the degree necessary, utilise materials resistant to fire attack mechanisms of flame and radiant heat (preferably non-combustible) for all relevant building elements, including wall, roof, floor, supporting structures and framing systems.</td><td>Very High</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td colspan="7">Assessment Comments: Battery modules will be self-contained through highly insulated steel casing used to encapsulate modules.
Cabinets and fencing will be non-combustible (metal or mineral).
Installation of thermally insulated steel vents within the thermal roof protecting the units from flame impingements and hot gas intrusion
Recommendation Details: Not Applicable</td></tr>
<tr><td>14.4</td><td>Construction Materials for Consequential Fire Fuels: For constructed large consequential fire fuels, use non-combustible materials to the fullest extent possible. Potential fuels include attached structures, adjacent structures and surrounding landscaping items (fences, screens, retaining walls etc.).</td><td>High</td><td>Yes</td><td>No</td><td>Unknown</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: No combustible structural elements have been identified. They will likely be primarily masonry, steel, aluminium and cement sheeting.
Recommendation Details: It is recommended non-combustible elements are used for structural and supporting/associated constructions wherever practical. This includes sheds, lean-tos, verandas, shade screening, lattice, garden edging, fencing etc.</td></tr>
<tr><td>14.5</td><td>Construction Design / Materials Resistant To High Wind Damage: Apply construction measures to prevent the type of building damage from wind that will open or create gaps (from the wind itself or carried projectiles) and allow the entry of embers, radiant heat and flames.
This type of damage is typically superficial damage. Building codes relating to wind (e.g., cyclones) do not necessarily address this superficial type of impact.
Additional fixings for building envelope claddings and protection of the most vulnerable elements, such as glazing, from debris impact, are key considerations.
Consider applying the principles of the NASH Standard [33] design solution to construction.
“Potential wind effects directly associated with bushfire events have been considered in this Standard. Wind actions may affect buildings subject to a bushfire attack in various ways including:
• The intensity of flame front activity may produce locally high wind pressures on parts of the building;
• In the post fire phase, some weakened components on the building envelope may be vulnerable to normal design pressures; and
• Wind can drive embers into the building envelope.”
Most applicable when the physical requirements exist for the development of an extreme bushfire event within the surrounding surrounding landscape.</td><td>Medium</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td></tr>
</table>

<table>
<tr><th colspan="3" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td colspan="2">Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td colspan="8">Assessment Comments: Assets will be installed underground, fixed to the ground (concrete or buried support pillars), and else will be metal and heavily weighted. Wind is unlikely to cause sufficient damage to create a vulnerability to embers.

Recommendation Details: Not Applicable</td></tr>
<tr><td>14.6</td><td colspan="2">Construction of Gas Supply: All gas cylinders are installed and maintained in accordance with AS 1596 (for domestic house supply) as a guide. The requirement of the standard includes:
• Safety release valve shall be directed away from the building and persons access/egress routes;
• Metal piping and fittings shall be used on all piping inside the building's cavities and enclosable occupied spaces and the high pressure side of any gas regulators; and
• Tethers securing cylinders are to be non-combustible.
The objective is to reduce the risk of consequential (secondary) fire against a building and reduce the risk of death or injury, from gas flaring or explosion. The rationale is gas cylinders which have either flared or ruptured are commonly found in post bushfire surveys [9]. The heat from the bushfire or consequential (secondary) fire has been sufficient to cause their pressure to reach critical levels beyond which their pressure release valve releases large quantities of LP gas. If these gas cylinders fall over, this pressure release valve may no longer function correctly, meaning that the gas cylinder may continue to increase in pressure with continued heating until the cylinder ruptures. The resulting explosion includes a pressure wave and large ball of flame which can threaten nearby life and buildings.
Readily available guidance is provided by CSIRO Best Practice Bushfire Guide (https://research.csiro.au/bushfire/new-builds/water-electricity-gas/) and WA Dept. Mines, Industry, Regulation and Safety 'LP Gas cylinder safety in bushfire prone areas' (https://www.commerce.wa.gov.au/publications/lp-gas-cylinder-safety-bushfire-prone-areas).</td><td>Medium</td><td>N/A</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="8">Assessment Comments: Gas storage is not proposed on site. Any LPG will be stored in compliance with AS 1596.

Recommendation Details: Not Applicable</td></tr>
<tr><td>14.7</td><td colspan="2">Construction of Electricity Supply: Cabling to be shielded (includes installing underground within subject property boundary) from applicable bushfire attack mechanisms.
The objective is to assist with continuity of supply for essential site operations and/or electrically driven firefighting pumps. It also reduces the risk of electrocution to any persons onsite and reduces potentially additional sources of fire ignition.</td><td>Medium</td><td>Yes</td><td>Unknown</td><td>Unknown</td><td>Yes</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					
	It is common in bushfires for power infrastructure to burn and collapse or be impacted by falling trees or branches while power lines are still live. Removing this risk may be appropriate for some sites.					
Assessment Comments: All high-risk components will be positioned such that they are subject to a maximum 10kW/m2 radiant heat flux. The critical threshold for electrical cabling applied in Measure 7.3 is 12kW/m2, with the APZ being 10kW/2 to ensure this threshold is not exceeded. Electric line easements are under the management of Western Power. Vegetation clearances will follow *Vegetation Clearances for the Construction of Overhead Powerlines* (Western Power Standard - Internal Document - DM#9288088). *Recommendation Details:* See Measure 7.12.						
14.8	**Minimise Re-entrant Detail to Minimise Debris and Ember Accumulation:** Avoid or limit the accumulation of unburnt debris and embers by minimising re-entrant details and/or adopting aerodynamic forms that will self-shed windblown debris and embers. For example: • Simple building/structure footprints that avoid re-entrant corners in access ways, at wall/floor, wall/ground, roof/wall junctions and around doors, vents, windows; and • Simple roof layouts that avoid valleys and minimise the number of ridges that need protection details (e.g. skillion roofs).	Medium	Yes	Yes	Unknown	Yes
Assessment Comments: The structure design and construction allow for little debris accumulation. No trees are proposed to be planted or retained within the 10kW/m2 APZ and thus accumulation of debris will be unlikely and, where any occurs, will occur slowly. Any visual buffer landscaping will increase the potential for debris accumulation and is addressed in Measure 7.11. Recommendation Details: Where electrical cabling, or gas or liquid piping, contacts the ground or any arrangement of associated structures creates a 'pocket' for accumulation of debris, this should be rectified by design or filling with non-combustible material such as mineral earth. Consideration should be given to making the arrangement self-cleaning through wind action to the greatest extent possible. These measures will reduce accumulation and/or make the management (clearing) of accumulated debris easier. E.g. cable raking to be 100mm above ground.						
14.9	**Minimise Debris/Ember Trapping Surfaces:** Avoid or minimise the use of exposed combustible surfaces that can trap and accumulate debris and embers. These include: • Horizontal, or shallow angle surfaces e.g. exposed wall/roof framework, roofs, decking, verandahs, steps, windowsills; and • Vertical surfaces with rough textured cladding (e.g. sawn timber).	Medium	Yes	Yes	Unknown	No

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					
Assets are not expected to include the above features. Horizontal surfaces may exist but will be open-air and will be self-clearing through wind. No rough textured vertical surfaces will exist as assets will be metal, concrete, or tilt-up panels. No trees are proposed to be planted or retained within the 10kW/m2 APZ and thus accumulation of debris will be unlikely and, where any occurs, will occur slowly. Any visual buffer landscaping will increase the potential for debris accumulation and is addressed in Measure 7.11. *Recommendation Details:* Not Applicable						
14.10	**Protect Roof Plumbing to Minimise Debris and Ember Accumulation:** All roof plumbing (gutters, valleys) is protected from the accumulation of debris and embers that can result in direct fire attack mechanisms immediately adjacent to any combustible elements within the roof cavity.	Medium	N/A	N/A	N/A	N/A
Assessment Comments: Built assets will not have roof plumbing. *Recommendation Details:* Not Applicable						
14.11	**Minimise Construction Cavities to Minimise Debris and Ember Accumulation:** Apply designs that lower the potential for accumulation of embers and debris within cavity spaces of buildings/structures. Examples include concrete floor slab on the ground and solid masonry walls.	Medium	Yes	Yes	No	Yes
Assessment Comments: The internal spaces of assets will be entirely enclosed. BESS cabinets may have exposed subfloors (as containers placed on the ground). *Recommendation Details:* Any subfloor cavities must have exposed subfloor spaces enclosed, sealed with non-combustible material, or be ember screened. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.						
14.12	**Minimise External Openings to Limit Flame/Radiant Heat/Ember/Debris Entry:** Limit potential sites for threat entry to through the external building envelope to internal spaces containing combustible materials (consequential fire fuels). Examples include reducing windows/doors on elevations facing the bushfire hazard and apply design to limit gaps and penetrations that will require screening.	Medium	Yes	Yes	No	Yes
Assessment Comments: BESS cabinets likely include intake/extraction/air conditioning vents. Assets will otherwise be sealed against weather impacts. *Recommendation Details:* The manufacturer or appropriate engineers should be contacted to enquire if it is possible to apply ember screening to intake/exhaust/air conditioning vents and other paths of entry to the interior cavity or accessing any combustible elements of BESS cabinets. This ember screening would be applicable to the exterior of the battery cabinet, not internal components. The intention is to prevent both ember ingress and debris accumulation. Ember screening mesh is to be maximum 2mm aperture and composed of corrosion-resistant steel, bronze, or aluminium.						

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td>14.13</td><td>Screen and Seal Gaps and Penetrations: Apply fire rated sealants and/or install metal screening (corrosion resistant steel, bronze, aluminium <2mm aperture).
All external construction and penetration gaps with apertures greater than 2mm will allow ember entry (and potentially debris) to internal cavities and combustible materials within (as consequential fire fuels).
This includes gaps in roofs, walls, doors, windows and their surrounding trims – including those associated with penetrations, vents, weepholes, poor workmanship and material deterioration and movement over time (maintenance). Internal fire is difficult to see and extinguish.</td><td>Medium</td><td>Yes</td><td>Unknown</td><td>No</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Not Required
Recommendation Details: See Measures 14.11 and 14.12.</td></tr>
<tr><td>14.14</td><td>Screen External Doors and Windows: Metal screens (corrosion resistant steel, bronze, aluminium <2mm aperture) installed over non-openable and/or openable parts of windows and doors to prevent ember entry to internal spaces containing combustible materials (consequential fire fuels) and reduce radiant heat load on vulnerable surfaces.</td><td>Medium</td><td>Yes</td><td>Unknown</td><td>No</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Assets will not have windows or doors.
Recommendation Details: See Measure 14.15.</td></tr>
<tr><td>14.15</td><td>Shutter External Doors and Windows: Fire rated shutters are installed to significantly increase bushfire resistance of the vulnerable building elements.</td><td>Medium</td><td>Yes</td><td>Unknown</td><td>No</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: Assets will not have windows or doors.
Recommendation Details: External doors (if present) should be self-closing.</td></tr>
<tr><td>14.16</td><td>Construction Materials for Critical Non-Structural Elements: Utilise fire/radiant heat rated products (rated to the level determined necessary), for the construction of non-structural elements that are essential to the continued operation of the built asset, and which are potentially exposed to the attack mechanisms of both bushfire and consequential fire.
These vulnerable elements include cabling and plumbing associated with power (delivery) inputs and outputs, data transmission, liquid/gas transport (fuel/water) etc.</td><td>High</td><td>Yes</td><td>Yes</td><td>Yes</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: No constructed assets or infrastructure are expected to include combustible or otherwise vulnerable materials. The battery (CATL EnerC+ Packs) product is designed in compliance with relevant standards:</td></tr>
</table>

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td colspan="7">• NFPA 855: Standard for the Installation of Stationary Energy Storage Systems
• UL 9540: Energy Storage System Requirements
• UL 9540A: Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems
• IEC 62619:2022 - Secondary cells and batteries containing alkaline or other non-acid electrolytes which has been adopted by Standards Australia as AS IEC 62619:2023.
Recommendation Details: Review FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems for additional measures applicable to the development.</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – AVAILABILITY OF A FIREFIGHTING RESPONSE CAPABILITY: Provide sufficient and reliable dedicated firefighting water supply and delivery capability as necessary for installed active and/or passive systems.</td></tr>
<tr><td>14.17</td><td>Firefighting Water Supply: Have a dedicated static supply of firefighting water for the protection of buildings/structures before and after the passage of a bushfire front. Adequate water supply is critical for any firefighting operation, particularly where property protection is the intent. This is necessary when:
• A water supply additional to a reticulated water supply is required to counter the loss of firefighting water as a protection measure, should the reticulated supply be interrupted; and
• It is the only source of firefighting water.
All tanks shall be non-combustible. Aside from losing water, failure of combustible tank can provide an additional heat load to a vulnerable building element. Metal piping and fittings shall be used for any above ground components.
The limitation to the effectiveness of the measure is the requirement for persons to be present and have the minimum required operational knowledge and/or access to appropriate information.</td><td>High</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: The Guidelines for Planning in Bushfire Prone Areas does not establish a firefighting water supply for non-habitable structures, including high-risk uses. Battery Energy Storage Systems do not have an applicable firefighting water supply under state or national requirements.
The State of Victoria Country Fire Authority has produced an applicable document, which is being used as a source to determine the appropriate firefighting water requirements.
Per the Design Guidelines and Model Requirements – Renewable Energy Facilities v4 (CFA August 2023), s4.2.2:
Where reticulated water is available, a fire hydrant system that meets the requirements of AS 2419.1-2021: Fire hydrant installations, Section 3.9: Open Yard Protection, and Table 2.2.5(d): Number of Fire Hydrants Required to Flow Simultaneously - Open Yards. Except, that fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a 60m length of hose connected to a fire hydrant outlet.</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					
Hydrants are currently installed immediately outside the site boundary, at the northern entry gate and at the intersection of Delmarco Drive and Hardisty Court. The requirements of AS 2419.1-2021 are met. Flow rate and pressure are under the control of Water Corporation, however these installations are expected to meet the relevant Australian Standards. *Recommendation Details:* Not Applicable						
14.18	**Firefighting Equipment Actively Operated:** In addition to a dedicated water supply, appropriate mobile firefighting appliances are available quickly and/or fixed firefighting equipment is installed (pumps, hoses, sprinklers etc). Where equipment is installed, this will be resilient to bushfire impact, to the extent necessary, through the application of appropriate equipment materials and protection (shielding or separation from the hazard). The limitation to the effectiveness of the measure is the requirement for persons to be present and have the minimum required operational knowledge and/or access to appropriate information.	High	No	No	No	No
Assessment Comments: The site is unstaffed. Actively operated firefighting equipment would not be effective. *Recommendation Details:* Not Applicable						
14.19	**Fire Fighting Equipment Passively Operated:** In addition to a dedicated water supply, appropriate water dispensing apparatus are installed (e.g. pumps, plumbing and sprinklers) that are automatically activated. These will be resilient to bushfire impact, to the extent necessary, through the application of appropriate equipment materials and protection (shielding or separation from the hazard).	High	Yes	No	Yes	Yes
Assessment Comments: The BESS units have active monitoring and electrical fault safety devices which ensure the units only remain operational within their intended operating environment, with an automated shut-down system. *Recommendation Details:* Automatic fire detection and suppression systems should be installed and maintained, as appropriate to the BESS details and recommended by the manufacturer. This measure is not applied to reduce the vulnerability or risk posed, as the methodology for this Risk Assessment **assumes** that fire occurs.						
14.20	**Fire Fighting Equipment Operability Maintained:** Where water pumps, shutters or other active/passive protection measures rely on the continued supply of electricity, establish barriers (shielding) or separation from potential damaging factors (e.g. falling trees/branches, fire, or other impact sources). For example, bury transmission systems to the greatest extent possible.	High	N/A	N/A	N/A	N/A
Assessment Comments: Not applicable to reticulated firefighting water supplies. *Recommendation Details:* Not Applicable						

<table>
<tr><th colspan="2" rowspan="2">PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS</th><th rowspan="2">Effectiveness Rating [1]</th><th colspan="4">Application Status [2]</th></tr>
<tr><th>Possible</th><th>Exists</th><th>Planned</th><th>Additionally Recommend</th></tr>
<tr><td>Element at Risk</td><td colspan="6">Built Infrastructure Assets</td></tr>
<tr><td>14.21</td><td>Access via Firebreaks Provided: Installation and maintenance of firebreaks to facilitate firefighting access / backburning (and also limiting surface fire progression).</td><td>Medium</td><td>Yes</td><td>Yes</td><td>No</td><td>No</td></tr>
<tr><td colspan="7">Assessment Comments: The entire site will be maintained as a trafficable hardstand, which will meet the Local Government Firebreak Notice.
Recommendation Details: Not Applicable</td></tr>
<tr><td colspan="7">THE PROTECTION MECHANISM – MANAGE AND MAINTAIN EFFECTIVENESS OF APPLIED PROTECTION MEASURES: To ensure the retention of the level of bushfire resilience that has been established through the implementation of appropriate bushfire protection measures, formal and enforceable responsibilities are created.</td></tr>
<tr><td>14.22</td><td>Formal Documents Created to Guide and Enforce Management: Through relevant site operations document(s) and/or an enforceable agreement, regulation or standard, a mechanism is put in place to ensure that:
• The required management and maintenance of applied bushfire protection measures is conducted on a regular basis – with the interval dependent on the necessary frequency that will maintain full effectiveness;
• The relevant protection measures are known and understood; and
• Responsibilities are created.</td><td>High</td><td>Yes</td><td>Yes</td><td>Unknown</td><td>Yes</td></tr>
<tr><td colspan="7">Assessment Comments: The documents have been or will be produced.
Recommendation Details: Ongoing requirements established in this Risk Assessment and Section 5.7 of the associated Bushfire Management Plan, must be included in operational documents.</td></tr>
<tr><td colspan="7">Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.2.4 for explanation and defining.
Note 2: Protection Measure Application Status:
• Possible: Protection measures that can potentially be applied to the proposed development/use.
• Fully or Partly Exists: A current state assessment of protection measures already implemented by existing components of the proposed development/use. The status of current implementation can also be fully or partly. These measures are accounted for in assessing ‘inherent’ risk levels (refer to Glossary).
• Currently Planned: Protection measures that:
    • Are incorporated into the site plans;</td></tr>
</table>

PROTECTION MEASURES AVAILABLE TO REDUCE VULNERABILITY LEVELS		Effectiveness Rating [1]	Application Status [2]			
			Possible	Exists	Planned	Additionally Recommend
Element at Risk	Built Infrastructure Assets					

- Exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), alternative solutions and any additional recommended protection measures - for which a responsibility for their implementation has been created and approved; and/or
- Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and are comprised of the applicable acceptable solutions (established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), that can be met and for which a responsibility for their implementation can be created in the BMP.

These planned measures are accounted for in assessing 'inherent' risk levels (refer to Glossary).

- **Additionally Recommend:** Protection measures that:
  - Exist in a yet to be submitted Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and comprise alternative solutions and/or additional recommended protection measures (that can and should be implemented in the opinion of the bushfire consultant), and for which a responsibility for their implementation can be created in the BMP; and/or
  - Are developed in the process of producing this risk assessment and management report and for which a responsibility for their implementation can be created in the BMP.

These additionally recommended measures, along with existing and planned measures, are accounted for in assessing 'residual' risk levels (refer to Glossary).

5.4.3.2 PROTECTION MEASURES - EFFECTIVENESS AND NUMBER APPLIED

For the stated element at risk, the numbers of both available and potentially applied bushfire protection measures are summarised and the effectiveness of each measure at reducing vulnerability levels is stated (refer to Appendix 1 for explanatory and supporting information).

This information is applied in the following section of this report to the derivation of the potential for applied bushfire protection measures to reduce the vulnerability of the relevant element at risk to bushfire hazard threats.

VULNERABILITY REDUCING PROTECTION MEASURE ANALYSIS							
Element at Risk	Built Infrastructure Assets						
The Protection Mechanism	Effectiveness Rating [1]	Numbers of Protection Measures					
		Total Available	Application Status [2]				
			Possible	Fully Exists	Partly Exists	Currently Planned	Additionally Recommen
Construction Design and Materials	Very High	2	1	1			
	High	3	2	1		1	2
	Medium	11	9	5			7
	Not Relevant						
Availability of a Firefighting Response Capability	Very High						
	High	4	2	1		1	1
	Medium	1					
	Not Relevant						
Manage and Maintain Effectiveness of Applied Protection Measures	Very High						
	High	1	1	1			1
	Medium						
	Not Relevant						
Number Analysis	Very High	2	1	1			
	High	8	5	3		2	4
	Moderate	12	9	5			7
	Not Relevant						
	Totals	22	15	9		2	11

Note 1: Protection Measure Effectiveness Rating: Refer to Appendix A1.3.4 for explanation and defining.

Note 2: Protection Measure Application Status: Refer to table footnotes in the preceding section.

5.4.3.3 PROTECTION MEASURES - VULNERABILITY REDUCING POTENTIAL

For the stated element at risk the potential for applied bushfire protection measures to reduce vulnerability levels is assessed as a function of:

- The number of bushfire protection measures that can be applied compared to the number available; and
- The weighting applied to each protection measure that indicates how effective it can be at reducing the vulnerability of elements at risk.

ASSESSED POTENTIAL OF APPLIED PROTECTION MEASURES TO REDUCE VULNERABILITY TO BUSHFIRE HAZARD THREATS [1]							
Element at Risk	Built Infrastructure Assets						
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF AN <u>INHERENT</u> VULNERABILITY LEVEL [2]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Significant	Significant	Moderate	Significant	Significant	Significant	Moderate	Moderate
Significant				Moderate			
ASSESSMENT OF PROTECTION MEASURES APPLIED TO THE DERIVATION OF A <u>RESIDUAL</u> VULNERABILITY LEVEL [3]							
Direct Attack Mechanisms [4]				Indirect Attack Mechanisms [4]			
Flame Contact	Radiant Heat	Embers / Burning Debris	High / Erratic Fire Driven Wind	Debris Production / Accumulation	Surface Fire	Tree Strike / Obstruction	Consequential (Secondary) Fire
Very Significant	Very Significant	Significant	Significant	Significant	Very Significant	Moderate	Very Significant
Very Significant				Significant			

Note 1: Refer to Appendix A1.2 for explanatory and supporting information.

Note 2: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: Refer to Appendix 2 for explanatory and supporting information.

Assessment Comments: The protection measures concentrate on reducing the vulnerability of BESS cabinets to ember attack, including ember screening, construction materials, enclosing subfloor cavities, and preventing leaf litter/debris accumulation. The existing reticulated water supply is sufficient for the scale of the proposed development.

5.4.3.4 ASSESSED VULNERABILITY LEVEL - INHERENT AND RESIDUAL

The preceding bushfire protection measure analysis has enabled the derivation of the inherent and residual vulnerability levels. These vulnerability levels are indicative as they are derived through a qualitative assessment process. In combination with the corresponding assessed threat and exposure levels, they will be applied to deriving the inherent and residual bushfire risk levels.

ASSESSED VULNERABILITY LEVELS (INDICATIVE)

POST APPLICATION OF EXPOSURE REDUCING BUSHFIRE PROTECTION MEASURES [1]

	ELEMENT AT RISK	Built Infrastructure Assets					
	BUSHFIRE ATTACK MECHANISMS [2]	INHERENT VULNERABILITY LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	Moderate
DIRECT	Radiant Heat [4]	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
DIRECT	Embers / Burning Debris	Very Low ☐	Low ☐	Moderate ☐	High ☒	Extreme ☐	
DIRECT	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
INDIRECT	Surface Fire	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
INDIRECT	Tree Strike / Obstruction	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
INDIRECT	Consequential (Secondary) Fire	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
	BUSHFIRE ATTACK MECHANISMS [2]	RESIDUAL VULNERABILITY LEVEL [3]					OVERALL
DIRECT	Flame Contact [4]	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	Low
DIRECT	Radiant Heat [4]	Very Low ☒	Low ☐	Moderate ☐	High ☐	Extreme ☐	
DIRECT	Embers / Burning Debris	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
DIRECT	High/Erratic Fire Driven Wind	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Debris Production / Accumulation	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Surface Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	
INDIRECT	Tree Strike / Obstruction	Very Low ☐	Low ☐	Moderate ☒	High ☐	Extreme ☐	
INDIRECT	Consequential (Secondary) Fire	Very Low ☐	Low ☒	Moderate ☐	High ☐	Extreme ☐	

Note 1: Refer to Appendix 1 for explanatory and supporting information.

Note 2: Refer to Appendix 2 for explanatory and supporting information.

Note 3: Refer to Appendix A1.3.3 for explanatory and supporting information. 'Inherent' accounts for all currently implemented bushfire protection measures and those planned to be implemented. 'Residual' additionally accounts for bushfire protection measures recommended to be implemented by the bushfire consultant.

Note 4: The level of exposure to flames and radiant heat is derived from the assessed indicative BAL ratings (refer to the BAL contour map). The exposure levels applied are BAL-LOW/Very Low Exposure, BAL-12.5/Low Exposure, BAL-19/Moderate Exposure, BAL-29/High Exposure, BAL-40 and BAL-FZ/Extreme Exposure.

6 BUSHFIRE RISK MANAGEMENT – PROTECTION MEASURE IMPLEMENTATION ASSESSMENTS

BUSHFIRE RISK MANAGEMENT MECHANISMS

Effective bushfire risk management mechanisms are needed to direct the implementation of required and recommended bushfire protection measures and ensure they continue to be maintained as effective measures.

To assist planners and managers to navigate this space, Bushfire Prone Planning divides the risk management mechanisms into 'mandatory' mechanisms and 'informative' mechanisms – although there will be some crossover.

Mandatory Mechanisms: Can be considered as those developed by relevant government authorities to establish required minimum protection measures and will require compliance. Some apply to both existing and future operations (use of sites), while others are primarily directed at future development. They include:

- Operating Regulations and Standards where part of the content will have direct relevance to a fire event;
- Construction Standards for buildings in bushfire prone areas; and
- Planning guidelines/overlays and any requirements for production of formal planning documents (e.g., a 'Planning' Bushfire Management Plan) for planning applications;

Informative Mechanisms: Can be considered as those documents that detail the operational responsibilities and associated actions as bushfire protection measures applicable to specific sites and their use. These protection measures can originate from various sources and include:

- Assessments, recommendations, and advice from appropriately experienced and qualified persons. This mechanism can be employed at the various life stages of a development and its use. The intent is to assist with initial planning and design, construction, extension, change of use, or just improving on existing resilience to bushfire and establishing relevant operational information to ensure bushfire resilience is retained;
- Site Operations Documents, possibly co-ordinated by an overarching 'Operational' Bushfire Management Plan (as distinct from a 'Planning' BMP), that establish detailed operations procedures. These can include (and will vary according to site use and management requirements):
  - Site Operations Procedures
  - Annual Site Works Program
  - Prescribed Burning Guide
  - Site Emergency Plan / Guide / Evacuation Plan / Bushfire Emergency Plan

SECTION SIX CONTENT OUTLINE

The following components can be included within the assessment, but the actual inclusions will be established by the objectives set for the Bushfire Risk Report in Section 2.3.

1. **Compliance Assessments:** For each relevant 'mandatory' risk management mechanism, a compliance assessment is conducted that establishes the site's current compliance and/or its ability to comply in the future and identifies any issues for management to consider.
2. **Protection Measure Recommendations and Implementation Guidance:** As an extension of the bushfire risk assessment process conducted in Section 5 of this Report:
   (a) All additionally recommended bushfire protection measures that apply to a specific site and its use are identified; and
   (b) Guidance is provided to management regarding the instruments through which these measures are best applied and those with higher priority are identified.
3. **Advice:** Note that where additional advice is to be provided it will be presented within the relevant summary section of this report (Section 4.5) and can consist of either:
   (c) Specific advice to inform planning for design and construction; or
   (d) General advice that identifies issues for management to consider.

6.1 INFORMATIVE MECHANISMS – GUIDANCE FOR THE APPLICATION OF ALL BUSHFIRE PROTECTION MEASURES

6.1.1 BUSHFIRE HAZARD THREAT REDUCING MEASURES

BUSHFIRE HAZARD THREAT REDUCING PROTECTION MEASURES [1]			IDENTIFICATION OF 'ADDITIONALLY RECOMMENDED' (EXTRA) MEASURES AND THEIR IMPLEMENTATION PRIORITY		APPLICATION GUIDANCE Identification of the Document(s) Recommended to Contain the Applicable Protection Measures							
			EXTRA MEASURE	PRIORITY RATING [2]	DOCUMENTS REQUIRED FOR PLANNING FUTURE DEVELOPMENT AND/OR RETROFIT		OPERATIONAL DOCUMENTS RELEVANT TO SITE USE					
The Protection Mechanism	Ref No	Brief Description [1]			Bushfire Manage. Plan (Planning)	Inform Design & Construct	External Agreement	Site Operations Procedures	Emergency Services Manifest	Prescribed Burning Guide	Site Emergency Plan/Guide	Staff Inductions and Training
Prevent bushfire ignition by managing heat energy sources	1.9	Robust and effective site operational procedures	✓	High				✓	✓		✓	✓

[1] The full description of each bushfire protection measure, the detail of the assessment and any recommendation, is presented in Section 5.1.4
[2] Refer to Appendix A1.2.5 for implementation priority rating explanation.

6.1.2 EXPOSURE REDUCING MEASURES –STRUCTURES/ASSETS

STRUCTURES/ASSETS EXPOSURE REDUCING PROTECTION MEASURES [1]			IDENTIFICATION OF 'ADDITIONALLY RECOMMENDED' MEASURES AND THEIR IMPLEMENTATION PRIORITY		APPLICATION GUIDANCE Identification of the Document(s) Recommended to Contain the Applicable Protection Measures							
			EXTRA MEASURE	PRIORITY RATING [2]	PLANNING FUTURE DEVELOPMENT		OPERATIONAL – AS RELEVANT TO SITE USE					
The Protection Mechanism	Ref No	Brief Description [1]			Bushfire Manage. Plan (Planning)	Inform Design & Construct	External Agreement	Site Operations Procedures	Emergency Services Manifest	Prescribed Burning Guide	Site Emergency Plan/Guide	Staff Inductions and Training
Establish sufficient separation from relevant bushfire hazard threats	4.3 7.3	Landscaping - asset protection zone (APZ)	✓	Highest	✓	✓						✓
	4.7 7.7	Separation from stored and constructed combustible items	✓	High		✓		✓				✓
Establish shielding from relevant bushfire hazard threats	4.11 7.11	Planted vegetation barrier	✓	Medium		✓		✓				
	4.12 7.12	Shield operation critical non-structural elements	✓	Lowest		✓						

[1] The full description of each bushfire protection measure, the detail of the assessment and any recommendation, is presented in Section 5.3.2. and Section 5.3.3
[2] Refer to Appendix A1.2.5 for implementation priority rating explanation.

6.1.3 VULNERABILITY REDUCING MEASURES – STRUCTURES/ASSETS

STRUCTURES/ASSETS VULNERABILITY REDUCING PROTECTION MEASURES [1]			IDENTIFICATION OF 'ADDITIONALLY RECOMMENDED' MEASURES AND THEIR IMPLEMENTATION PRIORITY		APPLICATION GUIDANCE Identification of the Document(s) Recommended to Contain the Applicable Protection Measures								
			EXTRA MEASURE	PRIORITY RATING [2]	PLANNING FUTURE DEVELOPMENT		OPERATIONAL – AS RELEVANT TO SITE USE						
The Protection Mechanism	Ref No	Brief Description [1]			Bushfire Manage. Plan (Planning)	Inform Design & Construct	External Agreement	Site Operations Procedures	Emergency Services Manifest	Prescribed Burning Guide	Site Emergency Plan/Guide	Staff Inductions and Training
Construction design and materials	11.3	Construction materials for external and internal cavity building elements	✓	Lowest		✓						
	11.4 14.4	Construction materials for consequential fire fuels	✓	Medium		✓						
	14.8	Minimise re-entrant detail to minimise debris and ember accumulation	✓	Medium		✓						
	11.11 14.11	Minimise construction cavities to minimise debris and ember accumulation	✓	High		✓						
	11.12 14.12	Minimise external openings to limit flame / radiant heat / ember / debris entry	✓	High		✓						
	11.13	Screen and seal gaps and penetrations	✓	Medium		✓						
	14.15	Shutter external doors and windows	✓	Lowest		✓						
	14.16	Construction materials for critical non-structural elements	✓	Medium		✓						

STRUCTURES/ASSETS VULNERABILITY REDUCING PROTECTION MEASURES [1]			IDENTIFICATION OF 'ADDITIONALLY RECOMMENDED' MEASURES AND THEIR IMPLEMENTATION PRIORITY		APPLICATION GUIDANCE Identification of the Document(s) Recommended to Contain the Applicable Protection Measures							
					PLANNING FUTURE DEVELOPMENT		OPERATIONAL – AS RELEVANT TO SITE USE					
The Protection Mechanism	Ref No	Brief Description [1]	EXTRA MEASURE	PRIORITY RATING [2]	Bushfire Manage. Plan (Planning)	Inform Design & Construct	External Agreement	Site Operations Procedures	Emergency Services Manifest	Prescribed Burning Guide	Site Emergency Plan/Guide	Staff Inductions and Training
Availability of a firefighting response capability	14.19	Firefighting equipment passively operated	✓	Highest		✓			✓			
Manage and maintain effectiveness of applied protection measures	11.21 14.22	Formal documents created to guide and enforce management	✓	Medium	✓			✓			✓	

[1] The full description of each bushfire protection measure, the detail of the assessment and any recommendation, is presented in Sections 5.4.2 & 5.4.3
[2] Refer to Appendix A1.2.5 for implementation priority rating explanation.

APPENDIX 1: THE APPLIED RISK ASSESSMENT PROCESS

A1.1 THE RELEVANT RISK

For this Bushfire Risk Report, the relevant risk is the potential for loss of life, injury, or destroyed or damaged assets which results in personal loss and economic loss due to disruption of services and/or repair or replacement of buildings and infrastructure. The source of the risk is a potential bushfire event as a natural hazard.

A1.2 THE RISK ASSESSMENT FRAMEWORK

To conduct the risk assessment, Bushfire Prone Planning (BPP) has adapted the concept for 'Understanding Disaster Risk' as recognised by the United Nations Office for Disaster Risk Reduction [46] and presented in Figure A1.1. This concept is also applied by CSIRO within their Bushfire Best Practice Guide [48].

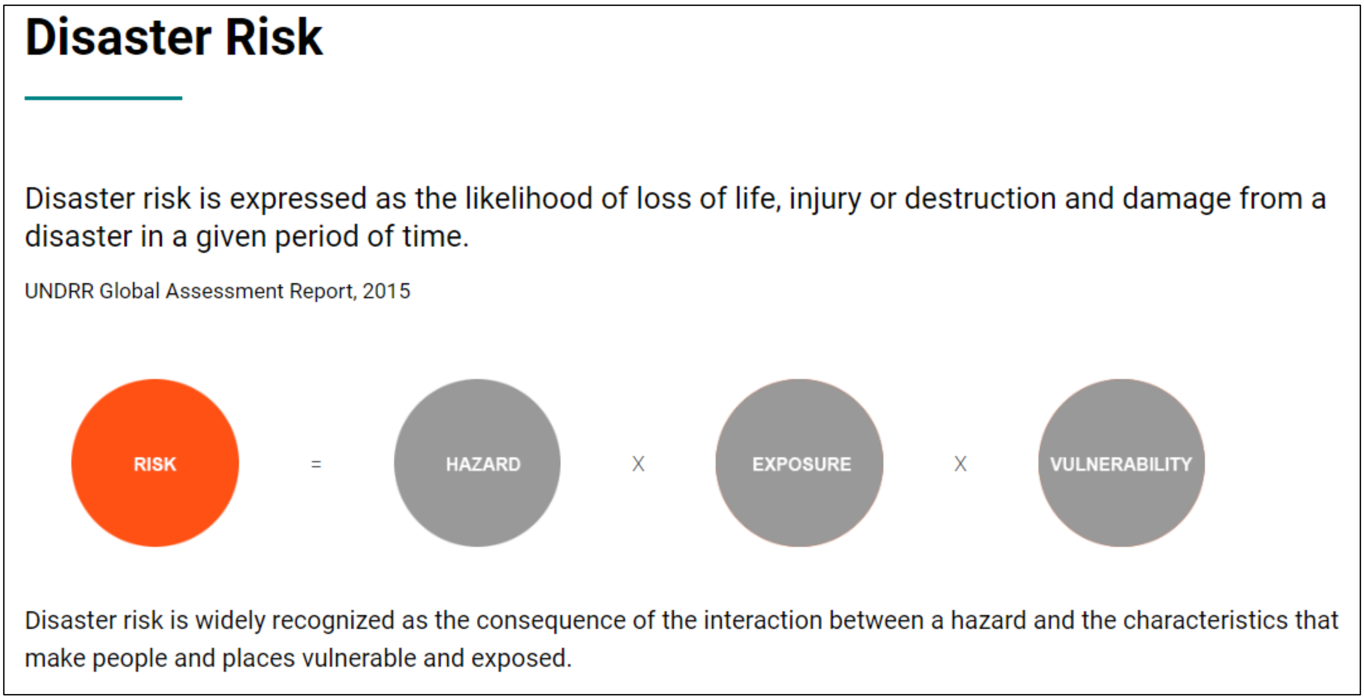


Figure A1.1: Concept for 'Understanding Disaster Risk' as recognised by the UN Office for Disaster Risk Reduction.

In applying this concept, bushfire risk can be considered a consequence of the interaction of bushfire hazard threats and the exposure and vulnerability of the elements at risk from those threats (i.e., the 'exposed elements' which can include various classes of persons and/or property).

The application of available bushfire protection measures will lower the level of risk associated with a bushfire by either:

1. Reducing the number and/or level of hazard threats; and/or
2. Reducing the level of exposure and/or vulnerability of the identified elements at risk.

Additional detail of the application of the risk assessment framework is presented in Figure A1.2 and Figure A1.3 on the following pages. Refer to the glossary for terminology information.

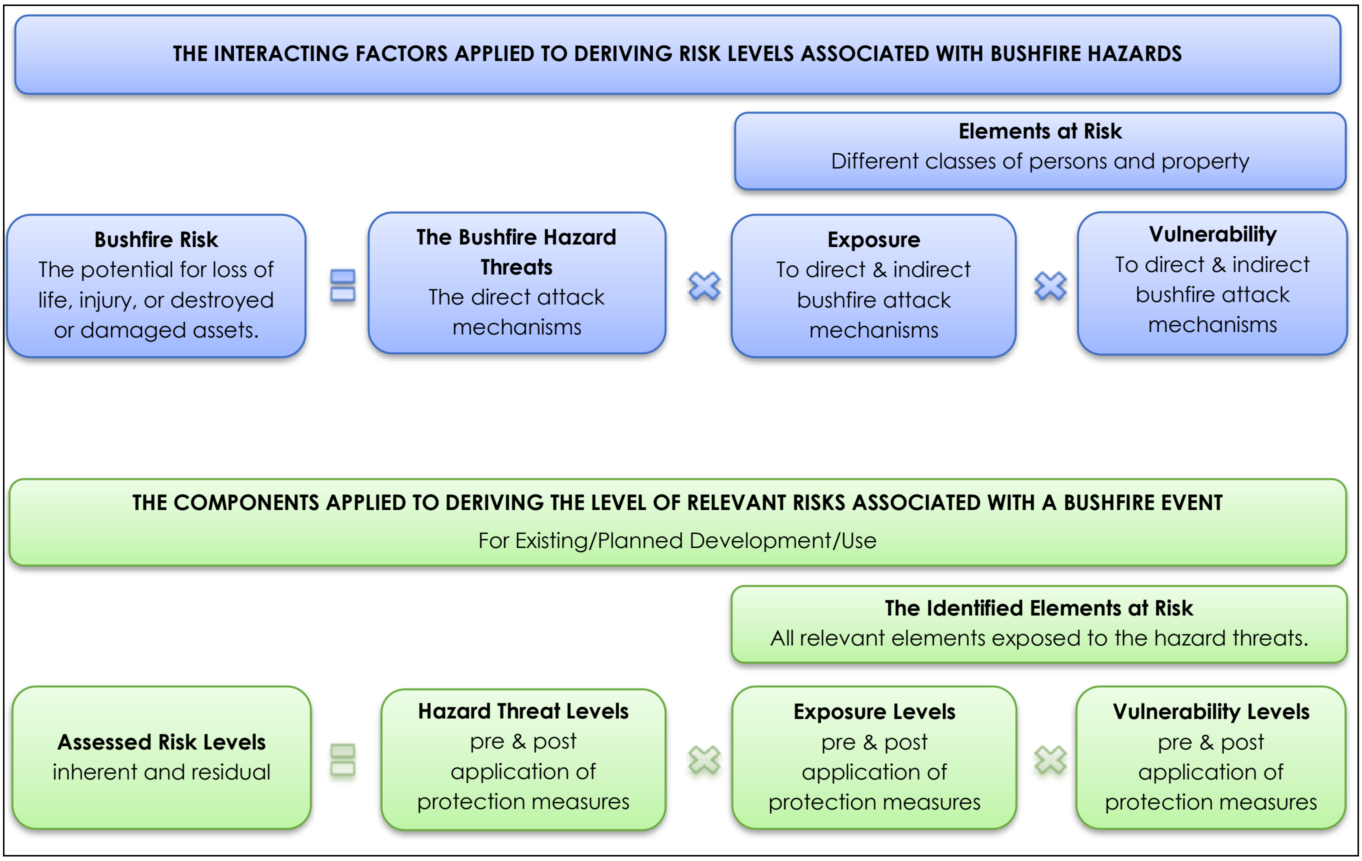


Figure A1.2: The framework of the applied bushfire risk assessment process.

Identify the Bushfire Hazard	Bushfire is a natural hazard and the common term for forest, scrub, shrub, and grass fire. It can exist in any vegetation (identified as the 'hazard') that establishes an ongoing source of readily combustible materials within and surrounding subject land, The bushfire hazard presents threats. These are the direct attack mechanisms (flame contact, radiant heat transfer, ember/burning debris attack, high/erratic fire driven wind) and indirect attack mechanisms (debris production/accumulation, surface fire, tree strike/obstruction, consequential fire). Identify and categorise surrounding vegetation based on a defined set of physical criteria. Each category has an associated 'Potential Threat Level' range.
Assess Hazard Threat Levels	Assess the existence of relevant physical factors in the surrounding landscape that can significantly change bushfire behaviour, intensity and the levels of each bushfire hazard threat and consequently the threat level for each identified category of vegetation. This assessment identifies how the threat level should be 'modified' (i.e., increased or decreased) within its potential range and derives a threat level that is to apply as the 'base' threat level, prior to application of any bushfire protection measures. Conduct a qualitative protection measure analysis that considers how many of all available bushfire protection measures - that can reduce threat levels - are and can be applied. The effectiveness of each measure at reducing threat levels is considered as part of the analysis. Apply the outcome to the derivation of 'Inherent' and 'Residual' threat levels.
Identify the Elements at Risk	Identify all relevant site specific elements 'exposed' to the bushfire hazard. These can include persons in different settings, buildings, structures, temporary accommodation, infrastructure and other physical assets.
Assess Exposure Levels	Conduct a qualitative protection measure analysis that considers how many of all bushfire protection measures available to reduce exposure levels (of an element at risk to bushfire threats), are and can be applied. Consideration of the effectiveness of each measure at reducing exposure levels is part of the analysis. Apply the outcome to the derivation of 'Inherent' and 'Residual" exposure levels.
Assess Vulnerability Levels	Conduct a qualitative protection measure analysis that considers how many of all bushfire protection measures available to reduce vulnerability levels (of an element at risk to bushfire threats), are and can be applied. Consideration of the effectiveness of each measure at reducing vulnerability levels is part of the analysis. Apply the outcome to the derivation of 'Inherent' and 'Residual' vulnerability levels.
Derive the Bushfire Risk Levels	There are potential risks associated with a bushfire hazard and a bushfire event. These include the loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Derive 'Inherent' and 'Residual' risk levels (for each element at risk) from the derived threat, exposure and vulnerability levels by reference to the risk matrix.
State the Risk Tolerability	Derive the tolerability rating by applying the risk tolerance scale. The tolerability scale is based on the 'As Low As Reasonably Practical' (ALARP) principle.

Figure A1.3: Detail of applied bushfire risk assessment process.

A1.3 RISK ANALYSIS EXPLANATORY GUIDANCE

The risk analysis will derive risk levels as the outcome of the assessment. The risk level analysis can be conducted for either each element at risk separately and/or the proposed or existing development/use overall.

Different labels are applied to reported risk levels to indicate how they have been derived and what they refer to. These labels are:

1. The labels **'Indicative Risk Level'** and **'Determined Risk Level'** are used to identify what methodology has been applied in conducting the risk analysis. (Note: This Bushfire Risk Report **does not** derive 'determined' risk levels (but information is included to explain why this is not possible); and
2. The labels **'Inherent Risk'** and **'Residual Risk'** are used to identify the point in time for which the risk level is being reported i.e., the existing state or a future state.

Additional detail is provided in the following sections and in the Glossary.

A1.3.1 INDICATIVE RISK – APPLICATION JUSTIFICATION AND DERIVATION

Deriving 'Indicative Risk Levels' requires conducting a qualitative assessment. This establishes a subjective understanding of the level of risk that potentially exists and is intended to inform and assist with making planning and operational decisions.

The indicative risk level is derived from a mostly qualitative assessment of the site (some components of the assessment are quantitative in nature), the existing or planned development/use, the assessment of observable physical facts and the knowledge and relevant experience of the bushfire practitioner. The outcome is the provision of an informed and justifiable opinion regarding the levels of risk associated with a bushfire event.

This is an applicable and valuable process when the quantitative information required to derive a 'determined' risk level is either not available or is not possible to generate for practical or economic reasons. Refer to Appendix A1.3.2 for explanatory information.

JUSTIFICATION OF QUALITATIVE ANALYSIS APPROACH

Justification for deriving 'indicative' risk levels is based on the following assumptions:

1. There is a limited number of 'bushfire protection mechanisms' that can be applied to reducing hazard threats and the exposure and vulnerability of at risk elements.
2. There will be a range of individual bushfire protection measures associated with each 'protection mechanism'. The number of available protection measures for each 'protection mechanism' will vary dependent on the specifics of the site and its use, including scale, but effectively these will also have a practical limit.
3. Individual bushfire protection measures will vary in their standalone effectiveness at reducing hazard threat levels and reducing the exposure and vulnerability levels of elements at risk (refer to A1.2.4).
4. The greater the number of effective bushfire protection mechanisms and associated measures that can be applied, the lower the indicative risk level will be.

DERIVATION OF THE INDICATIVE RISK LEVEL

For a given site/development/use, an indication of the level of risk associated with a bushfire event and its tolerability is derived by:

1. Assessing the 'indicative' hazard threat levels and the 'indicative' exposure and vulnerability levels of elements at risk by:
   a) Assessing the potential levels of threat presented by the direct and indirect bushfire attack mechanisms of the identified bushfire hazard;
   b) Assessing how many bushfire protection mechanisms and their associated protection measures are applicable and can be applied, compared to the total available; and
   c) Applying an effectiveness weighting to each protection measure.
2. Derive the indicative risk level by applying the risk matrix presented in Table A1.1;

3. Establish the tolerability of the risk by applying the 'As Low as Reasonably Practicable' (ALARP) principle and associated risk tolerance scale (refer to Appendix A1.2.5).

Table A1.1: Risk matrix for deriving indicative risk levels from the assessed relative levels of hazard threats, and the exposure and vulnerability of elements at risk.

INDICATIVE RISK LEVEL MATRIX						
Indicative Threat Level (a)	Indicative Exposure Level (b)	Indicative Vulnerability Level (c)				
		Very Low (1)	Low (2)	Moderate (3)	High (4)	Extreme (5)
Very Low (1)	Very Low (1)	VL1	VL2	VL3	L4	L5
	Low (2)	VL2	VL3	L4	L5	L6
	Moderate (3)	VL3	L4	L5	L6	M7
	High (4)	L4	L5	L6	M7	M8
	Extreme (5)	L5	L6	M7	M8	H9
Low (2)	Very Low (1)	VL2	VL3	L4	L5	6
	Low (2)	VL3	L4	L5	L6	M7
	Moderate (3)	L4	L5	L6	M7	M8
	High (4)	L5	L6	M7	M8	H9
	Extreme (5)	L6	M7	M8	H9	H10
Moderate (3)	Very Low (1)	VL3	L4	L5	L6	M7
	Low (2)	L4	L5	L6	M7	M8
	Moderate (3)	L5	L6	M7	M8	H9
	High (4)	L6	M7	M8	H9	H10
	Extreme (5)	M7	M8	H9	H10	H11
High (4)	Very Low (1)	L4	L5	L6	M7	M8
	Low (2)	L5	L6	M7	M8	H9
	Moderate (3)	L6	M7	M8	H9	H10
	High (4)	M7	M8	H9	H10	H11
	Extreme (5)	M8	H9	H10	H11	E12
Extreme (5)	Very Low (1)	L5	L6	M7	M8	H9
	Low (2)	L6	M7	8M	H9	H10
	Moderate (3)	M7	M8	H9	H10	H11
	High (4)	M8	H9	H10	H11	E12
	Extreme (5)	H9	H10	H11	E12	E13

Risk level key: VL = very low, L = low, M = moderate, H = high, E = extreme.
The qualitative relative levels are assigned a numerical value.
The risk value is calculated as = (a + b + c) – 2 and range from 1 (lowest) to 13 (greatest).
The irisk levels are derived from an assigned a numerical range: very low = 1-3, low = 4-6, moderate = 7-8, high = 9-11, extreme = 12-13.

A1.3.2 DETERMINED RISK – APPLICATION LIMITATIONS

IMPORTANT: THIS BUSHFIRE RISK REPORT DOES NOT DERIVE DETERMINED BUSHFIRE RISK LEVELS.

Deriving 'determined' risk levels requires conducting a quantitative assessment. This establishes an objective understanding of the level of risk that potentially exists and is intended to inform and assist with making planning and operational decisions.

The key difference from an 'indicative' risk level assessment is the requirement to apply a quantitative set of risk factor criteria against which hazard threat levels and the exposure and vulnerability levels of identified elements at risk to these threats can be objectively assessed.

These risk factor criteria would be developed and supported by a relevant government authority (exercising their responsibility), accepted by persons relying on the assessment and be available for the assessor to use. In addition, the corresponding risk level matrix and the risk tolerability scale are required.

It is necessary that:

1. The risk factor criteria reflect society's and/or community's expectations and preparedness/capacity to tolerate risk;
2. The information is standardised to the greatest extent possible so that it provides an accepted basis from which the determined risk level can be derived and be relied upon in making decisions;
3. The corresponding risk level matrix and the risk tolerability scale are developed to derive a risk level and tolerance level from the derived threat, exposure, and vulnerability levels; and
4. Responsibility for development of the reference information is not left to individual assessors who have varied expertise, qualification, and no approved responsibility to provide such information. Such an approach would not result in consistent and reliable assessment outcomes.

Limitations: Where the required reference information (that is researched, effective, functional and acceptable) has not been established and provided by the responsible authorities, determined risk levels cannot be derived.

RISK FACTOR CRITERIA

The required risk factor criteria would need to establish:

- What factors are to define the different 'determined' levels of hazard threats;
- What factors are to define the different 'determined' levels of exposure of elements at risk; and
- What factors are to define the different 'determined' levels of vulnerability of elements at risk.

RISK LEVEL MATRIX

The matrix would need to establish how the 'determined' levels of threat, exposure and vulnerability are to be applied in deriving the 'determined' risk level. Different sets of matrices to account for different development types, uses and scales would likely be required.

Different development types, uses and scales are potentially capable of tolerating different levels of risk and still be considered by the relevant authority (who are reflecting the understood society/community position), to remain acceptable or at least tolerable.

RISK TOLERANCE SCALE

After the 'determined' risk level has been derived after an assessment applying the risk factor criteria and the risk level matrix, a methodology is required to classify the risk level as either unacceptable, tolerable or acceptable.

A1.3.3 INHERENT AND RESIDUAL RISK

In this Bushfire Risk Report, inherent risk is current situation risk after accounting for bushfire protection measures that are either already in place (for existing development/use) and/or are currently planned to be incorporated into the proposed development/use.

Inherent risk levels are derived before the application of any additional protection measures that have been identified and recommended by the bushfire consultant, and which subsequently determines the residual risk. If there are none, the residual risk is the same as the inherent risk. Refer to the Glossary for additional supporting information.

A1.3.4 PROTECTION MEASURE EFFECTIVENESS RATINGS

DERIVING AN EFFECTIVENESS RATING

As part of the qualitative risk assessment process, an effectiveness rating, established by the application of this table, is applied to each bushfire protection measure. The rating weights each bushfire protection measure's ability to reduce a hazard's threat levels or reduce the exposure and/or vulnerability levels of the elements at risk.

The greater the effectiveness the greater the contribution of a protection measure to the reduction in levels of risks associated with a bushfire event. It is also an important factor applied to the determination of the bushfire protection measure's implementation priority.

The effectiveness ratings incorporate the qualities of:

1. **Independent/Dependent:** A qualitative assessment of the extent to which a protection measure can reduce threat, exposure and vulnerability levels as a standalone measure as opposed to only providing an additive reduction by being a part of a package of protection measures; and
2. **Risk Reduction Potential:** A qualitative assessment of a protection measure's capacity to reduce the levels of risks associated with a bushfire event as a standalone risk measure.

The rating methodology assumes the greater the independence and risk reduction potential of a bushfire protection measure, the greater its effectiveness.

DERIVING EFFECTIVENESS RATINGS FOR BUSHFIRE PROTECTION MEASURES	
Rating	Protection Measure Characteristics and Capability
Very High	Very significant risk reduction as an independent (standalone) measure. Impact on risk reduction is immediate and persistent in all scenarios. A priority measure to be implemented wherever possible.
High	Material risk reduction as an independent (standalone) measure;
Medium	Alone the measure will have limited impact on risk reduction. It is dependent on providing additive value when combined with other protection measures to create a 'package' of bushfire protection measures.
Not Relevant	The measure is not relevant to the type of development/use. This is different to not being able to be applied – it is just not relevant to any configuration of the subject development/use.

A1.3.5 PROTECTION MEASURE IMPLEMENTATION PRIORITY RATINGS

The effectiveness of a bushfire protection measure at reducing 'relative' threat, exposure and vulnerability levels, is the primary determinant of the implementation priority rating (refer to Section A1.2.3 for effectiveness rating explanation).

However, the implementation priority rating, corresponding to each effectiveness rating, can be modified with appropriate consideration of factors that may constrain the implementation and ongoing management of the measure. A justifiable weighting for each of the factors may be incorporated into the assessment for differing scenarios, either by the consultant or applied later by the landowner/operator with their greater knowledge of specific factors.

The matrix is applied qualitatively to the determination of the implementation priority rating that will apply to a recommended bushfire protection measure in this Bushfire Risk Report.

DERIVING THE IMPLEMENTATION PRIORITY FOR BUSHFIRE PROTECTION MEASURES									
Derived Implementation Priority Rating	Primary Determinant Effectiveness Rating	Secondary Determinants - Constraints to Implementation and Management [less constraints = potentially higher implementation priority and vice versa]							
		Restrictions from Government / Regulations	Owner / Operator Acceptance	Community Acceptance	Control of Land Restrictions	Financial Cost / Affordability	Knowledge and Ability to Apply Protection Measure	Practicality and Ease of Implementation	Requirement for Ongoing Implementation and Management
Highest	Very High	No Constraints	Likely Alignment with Management Intent & Values	Likely Majority Accept	No Constraints	Likely Within Current Resource Capacity	Past / Current Application Experience	Well Within Existing Capabilities	None - Passive
High	High								
Medium	Medium								
Lowest		Significant Constraints	Likely Strong Conflict with Management Intent & Values	Likely Majority Do Not Accept	Significant Constraints	Unlikely to be Affordable	None – Extensive Education / Training Required	Not Practical	Necessary - Active

A1.3.6 DETERMINATION OF BUSHFIRE RISK LEVEL TOLERANCE

The application of a risk tolerance scale is necessary to:

1. Identify which exposed elements must be given priority for the development and application of bushfire protection measures; and
2. When planning approval is being sought, to identify if the residual risk levels can be considered as tolerable or acceptable and therefore potentially be approved for this factor.

THE APPLIED TOLERANCE SCALE

The risk tolerance scale applied in this Bushfire Risk Report is presented in Table A1.2. It incorporates the application of the 'As Low as Reasonably Practicable' (ALARP) Principle. An overview of this principle and justification for its application is presented on the following pages.

Table A1.2: The applied risk tolerance scale

<table>
<tr><th colspan="4">THE APPLIED RISK TOLERANCE SCALE - INCORPORATING THE ALARP PRINCIPLE</th></tr>
<tr><th>Risk Level</th><th colspan="2">Tolerability Description and Action Required</th><th>Risk Tolerance Level[1]</th></tr>
<tr><td>Extreme</td><td colspan="2">The risks are unacceptable and require immediate implementation of risk management measures to eliminate or reduce risk to tolerable or acceptable levels.

Proposed development giving rise to risks in this region would not be approved unless there are exceptional reasons for the development to proceed.</td><td>Unacceptable</td></tr>
<tr><td rowspan="2">High</td><td rowspan="2">The risks are the most severe that can be tolerated but not unduly high. They require monitoring in the short term as risk management measures are likely to be needed in the short term given the intent should be to drive residual risk lower down the tolerable range where possible.</td><td rowspan="4">Tolerance Regions Subject to ALARP Principle</td><td>Intolerable
- if <u>not</u> ALARP-</td></tr>
<tr><td>Tolerable
- if ALARP -</td></tr>
<tr><td rowspan="2">Moderate</td><td rowspan="2">The risk is approaching an acceptable level. It can be tolerated and requires monitoring in the short to medium term. Need to consider potential changes over time in the risk and/or techniques for reducing/eliminating risk.

Risk management measures may be needed to reduce risk to more acceptable levels where possible – or accept the risk.</td><td>Tolerable
- if <u>not</u> ALARP -</td></tr>
<tr><td>Acceptable
- if ALARP -</td></tr>
<tr><td>Low</td><td colspan="2" rowspan="2">The risk is accepted as it is generally regarded as insignificant or adequately controlled by existing measures. No additional risk management measures will be required in the short to medium term other than monitoring.</td><td rowspan="2">Acceptable</td></tr>
<tr><td>Very Low</td></tr>
<tr><td colspan="4">[1] Refer to the glossary for definitions of the tolerance levels.</td></tr>
</table>

THE ADJUSTMENT OF RESIDUAL BUSHFIRE RISK LEVEL TOLERABILITY

Development/use scenarios can exist where a higher level of residual risk might be considered as tolerable or acceptable. Such a situation may exist when the exposed element is not persons and the economic cost due to the loss or damage of assets and/or disruption of services, is a risk that is retained by the owners as an informed decision.

Consideration of the knock-on risk implications to persons who might be associated with these elements, or other nearby elements at risk, will be part of the tolerability adjustment assessment.

There may also be isolated scenarios where the limits for tolerability of risk need to be established at lower residual risk levels i.e. an additional margin of safety is required. The rationale for any residual risk tolerance adjustment is presented below.

RATIONALE FOR THE ADJUSTMENT OF RISK TOLERANCE FOR PRPOSED DEVELOPMENT	
Relevant Element at Risk [Section 5.2]	Adjustment Rationale
Not applied.	Not applied.

THE ALARP PRINCIPLE

The 'As Low as Reasonably Practicable' (ALARP) Principle is based on the belief it is not possible to completely eliminate all risk involved, there will always be a certain level of risk remaining known as residual risk. The term is used to express the expected level of residual risk within a system, activity or, relevant to this document, within a proposed development/use, when good practice, judgement and duty of care are applied to decisions and operations.

The origins of the ALARP (As Low as Reasonably Practicable) principle are from United Kingdom case law and their regulatory framework. It is applied by their Health and Safety Executive (HSE) and is used by regulators and companies around the world as it provides a logical basis for managing risks.

The ALARP principle has been defined by the United Kingdom Health and Safety Executive (HSE-UK, 2001) to depict the concept that efforts to reduce risk should be continued until the incremental cost in doing so is grossly disproportionate to the value of the incremental risk reduction achieved (see figure). Incremental cost is defined in terms of time, effort, finance or other expenditure of resources – including loss of natural resources. Usually, each incremental reduction in risk will require a greater expenditure of resources.

This concept is depicted in Figure A3.1 where the triangle represents the decreasing risk and the diminishing proportional benefit as risk is reduced. There are also three regions shown in the figure into which general levels of residual risk can fall. The residual risk should fall either in the broadly acceptable region, or near the bottom of the tolerable region. This approach allows higher levels of safety to be provided where it is feasible.

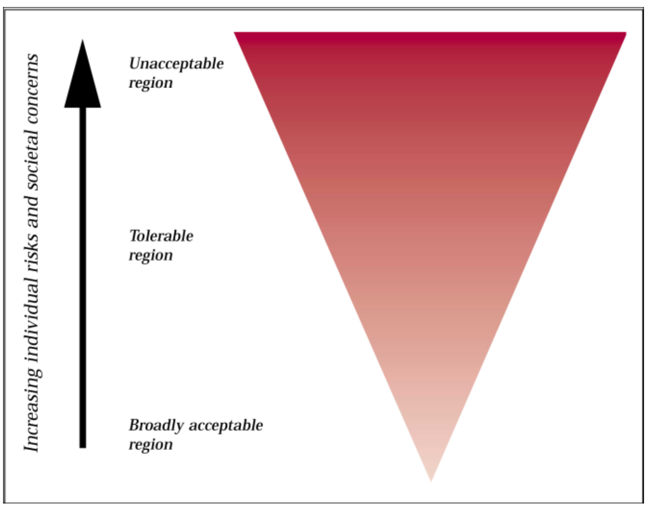


Figure A1.2: HSE framework for the tolerability of risk (source: HSE-UK, 2001)

Moving up the triangle from the region considered broadly acceptable, through a tolerable region (for which a greater range of risk can be considered), to an unacceptable region, represents increasing levels of 'risk' for a particular hazard or hazardous activity (determined through relevant risk analysis). Table A3.1 describes the risks that define each region.

Table A1.3: The risks associated with the risk tolerance regions (adapted from HSE-UK, 2001)

THE ALARP PRINCIPLE – DEFINING THE REGIONS OF RISK TOLERANCE	
Unacceptable Region	For practical purposes, a particular risk falling into this region is regarded as unacceptable whatever the level of benefits associated with the activity. Any activity, practice or use of land giving rise to risks falling in this region would, as a matter of principle, be not approved unless the activity or practice can be modified to reduce the degree of risk so that it falls in one of the regions below, or there are exceptional reasons for the activity, practice or use to be retained.
Tolerable Region	Risks in this region are typical of the risks from activities that people are prepared to tolerate in order to secure benefits, in the expectation that: • The nature and level of the risks are properly assessed, and the results used properly to determine control measures. The assessment of the risks needs to be based on the best available scientific evidence and, where evidence is lacking, on the best available scientific advice; • The residual risks are not unduly high and kept as low as reasonably practicable. This is the region to which the ALARP principle applies; and • The risks are periodically reviewed to ensure that they still meet the ALARP criteria, for example, by ascertaining whether further or new control measures need to be introduced to take into account changes over time, such as new knowledge about the risk or the availability of new techniques for reducing or eliminating risks. • In practice and where possible, the intent should be that residual risk continues to be driven down the tolerable range so that it falls either in the broadly acceptable region or is near the bottom of the tolerable region, in keeping with the duty to ensure health, safety and welfare so far as is reasonably practicable as per the ALARP principal.
Broadly Acceptable Region	Risks falling into this region are generally regarded as insignificant and adequately controlled. Regulators would not usually require further action to reduce risks unless reasonably practicable measures are available. The levels of risk characterising this region are comparable to those that people regard as insignificant or trivial in their daily lives. They are typical of the risk from activities that are inherently not very hazardous or from hazardous activities that can be, and are, readily controlled to produce very low risks.
Note: The risk tolerability framework is a conceptual model. The factors and processes that ultimately decide whether a risk is unacceptable, tolerable or broadly acceptable are dynamic in nature and are sometimes governed by the circumstances, time and environment in which the activity, practice or use occurs or is proposed. Standards change and public expectations vary between societies and change with time.	

APPLICATION OF THE ALARP PRINCIPLE IN AUSTRALIA

To contribute to justification for the use of the principle in this bushfire risk report, it is noted that the following Australian guidelines also apply adaptations of the principle:

- Australian Institute for Disaster Resilience, 2020; Land use Planning for Disaster Resilient Communities;
- WA Department of Mines, Industry Regulation and Safety, 2020; Petroleum safety and major hazard facility – guide. ALARP demonstration;
- NOPSEMA (Australia's offshore energy regulator), 2020; ALARP and risk assessment guidance notes;
- Department of Planning Lands and Heritage (DPLH), 2019; Coastal hazard risk management and adaptation planning guidelines;

- Planning Institute of Australia, 2015; National Land Use Planning Guidelines for Disaster Resilient Communities; and

- NERAG 2010, an earlier version of NERAG 2020, applied the ALARP Principle.

The following is taken from the 'National Land Use Planning Guidelines for Disaster Resilient Communities' (Planning Institute of Australia, 2015) and is also referred to in the document 'Land use Planning for Disaster Resilient Communities' (Australian Institute for Disaster Resilience, 2020).

> *Of relevance to planners in the NERAG is the ALARP principle and how it is used in evaluating risks. According to NERAG, the ALARP principle is applied to define boundaries between risks that are generally intolerable, tolerable or broadly acceptable. The ALARP principle will help to prioritise a risk hierarchy and determine which risks require action and which do not. Those that are broadly acceptable naturally require little, if any, action while risks that are at an intolerable level require attention to bring them to a tolerable level.*
>
> *According to NERAG, it is entirely appropriate and accepted practice that risks may be tolerated, provided that the risks are known and managed.*
>
> *The ALARP principle is particularly relevant to planners and other built environment professionals as it provides the means to categorise risks according to their severity, and to assign risk treatment options accordingly.*
>
> *It is important to note that the effect each hazard has on a community and its settlement is different, and therefore land use planning and building responses may not always be appropriate to treat the risk borne by a particular hazard. Equally, the effectiveness or strength of response provided by land use planning or building may not be sufficient to fully address the risk.*
>
> *In addition, it is likely that through a normal natural hazard management process a range of treatment measures will be proposed, tested and implemented to provide a comprehensive approach to risk treatment that may involve other measures working in concert with land use planning or building responses.*
>
> *The manner in which land use planning and building responses are deployed to treat specific instances of natural hazard risk will vary depending on location, information availability, community views, broader development intent for the settlement under analysis and the effect of complementary risk treatment measures.*
>
> *However, the ALARP principle provides a good reference for demonstrating the land use responses for the various ALARP risk categories. Generally speaking, in areas of intolerable risk the strongest land use planning and building responses should apply. Conversely, in areas of acceptable risk only minimal controls should apply, if at all.*
>
> *The most complex risk category for which to prescribe treatment from a land use and building perspective is those areas of tolerable risk. Such risks in existing settlements may not be sufficiently concerning to warrant severe use restrictions or relocation, however they will need treatment over time to ensure the risk does not increase. Treatment options in this instance may include limiting vulnerable uses in this area, restricting significant intensification of development, and promoting resilient urban design. Such areas of tolerable risk are also best avoided from a greenfield perspective to limit increases in future risk and costs associated with infrastructure failure in these locations that could otherwise been avoided.*

***

A1.3.7 ADDRESSING THE LIKELIHOOD OF A BUSHFIRE EVENT OCCURRING

USING THE QUALITATIVE RISK ASSESSMENT APPROACH (NOTE: APPLIED IN THIS BUSHFIRE RISK REPORT)

In using a subjective approach, the pragmatic assumption that a bushfire will occur is made. It is assumed a bushfire can occur within any timeframe and could result in loss or life or injury, or unacceptable damage to property and or unacceptable disruption to services.

This approach acknowledges that the requirements for fire of fuel, ignition source and oxygen will always exist. That is:

- The fire fuels being considered will always be there unless physically removed permanently;
- A potential ignition source will always exist through lightning and/or human activities; and
- The potential for adverse fire weather conditions to exist at some point within each year will always be present.

Additionally, the subjective assessment of the site specific indicative threat levels of the direct and indirect bushfire attack mechanisms associated with the bushfire hazard, by default and indirectly, effectively incorporate a likelihood component.

Also, where the costs of implementing the required bushfire protection measures to lower indicative risk levels is not excessive, it makes sense not to try to avoid these costs by considering that risk is reduced because likelihood is lower.

USING THE QUANTITATIVE RISK ASSESSMENT APPROACH (NOTE: NOT APPLIED IN THIS BUSHFIRE RISK REPORT)

A quantitative approach will necessarily be based on the historical record of past bushfire events and determining the mathematical probability of a future event. This approach is problematic to achieving increased bushfire resilience at all stages of existing or proposed development/use for these reasons:

- Historical data may not be available or have enough data sets to be accurate;
- Historical data does not account for future changes in climate that may result in a different occurrence period. Consequently, further assumptions need to be made;
- Siting, design and construction of development to resist bushfire threats is easier, more practical (and likely economical), to incorporate at initial planning stages rather than the retro-establishment of protection measures when the considered likelihood of events increases over time for various reasons or tolerance of risk decreases;
- Time spent conducting historical research, performing statistical calculations and modifying risk levels, apart from being costly, is likely better spent assessing potential threat, exposure and vulnerability levels and developing appropriate protection measures; and
- The likelihood of occurrence cannot modify the levels of hazard threats, exposure or vulnerability. It can only be applied to reduce the overall risk level. That is, it would be applied as a modifying factor via the established risk level matrix and not the established risk factor criteria. The validity of incorporating such a factor may be indicated when, despite the existence of vegetation that can burn, there are other mitigating physical conditions that exist at the specific site that make the likelihood of ignition and severity of bushfire behaviour very low. How this is applied would need to be established by the authority establishing the relevant risk level matrix.

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APPENDIX 2: ASSESSING BUSHFIRE HAZARD THREATS

DEFINING THE BUSHFIRE HAZARD AND ITS THREATS

THE BUSHFIRE

For this assessment, a bushfire is the unplanned burning of a fire in vegetation of any type and structure. It is applied as a generic term to refer to forest fires, scrub/shrub fires and grass fires, which have differences of behaviour within and between the fire types, dependant on a range of variables. Key fire behaviours include rate of spread, flame height, intensity and spotting (i.e., ignition ahead of the fire front by embers/burning debris).

Grassfire: Note that grass fires are significantly different, and this is recognised in the assessment. Grass fire behaviour results in a much shorter duration fire, the embers produced being mostly consumed within the flame front and radiant heat flux dropping more quickly with distance from the fuel load - as indicated in the application of AS 3959:2018 methodology where 'Grassland' achieves a BAL-LOW rating at half the separation distance of all other classified vegetation. These differences are acknowledged in other jurisdictions:

> *The risk posed by grass fires is different to that of fires in other vegetation types. Grass fires burn at a higher intensity and spread more rapidly with a shorter residence time. Embers produced by grass fires are smaller and fewer in number than those produced from forest fires. In recognition of the characteristics of grassland fire behaviour, the NSW RFS has developed a simplified set of Deeming Provisions for residential infill development (Planning for Bushfire Protection, RFS NSW, 2019).*
>
> *While pastures, crops and native grasslands often experience fast moving fires, their intensity is usually insufficient to justify a land use planning response (Justin Leonard et al (2014): A new methodology for State-wide mapping of bushfire prone areas in Queensland, CSIRO, Australia)*

THE BUSHFIRE HAZARD

A bushfire hazard is the natural process/phenomenon of a bushfire event that gives rise to the associated risks of loss of life or injury or destroyed or damaged assets, which results in personal loss and economic loss.

The term bushfire hazard is necessarily applied to both the relevant vegetation as the source of the hazard and the bushfire event itself. This approach is aligned with the definition applied by the United Nations Office for Disaster Risk Reduction.

LAND USE PLANNING AND THE BUSHFIRE HAZARD THREATS TO BE ASSESSED

The bushfire hazard is a potential source of direct and indirect bushfire attack mechanisms (refer to A2.3 for additional information), that present threats to persons and property and give rise to the associated risks of loss of life or injury or destroyed or damaged assets.

Direct Attack Mechanisms: Of most relevance to land use planning are the bushfire threat levels generated by the direct attack mechanisms of:

- Flame contact;
- Radiant heat transfer; and
- Ember/burning debris attack.

Consequently, these are the bushfire hazard threats that are to be considered when assessing the potential bushfire hazard threat levels. Due consideration of winds generated by fire/terrain interactions, is applied when the physical requirements exist for development of landscape scale fire and extreme bushfire events.

Indirect Attack Mechanisms: The indirect attack mechanisms are considered within a risk assessment section of a Bushfire Risk Report when this is required, as the threat levels from these mechanisms is determined by the degree to which available bushfire protection measures are or will be implemented in mitigating risk.

FACTORS INFLUENCING BUSHFIRE BEHAVIOUR
There are three primary factors that influence the intensity, speed and spread of a bushfire. Any increase in these behaviours will result in greater threat levels, to exposed elements, from the bushfire attack mechanisms.

1. **VEGETATION AND OTHER FUELS**

Key characteristics that will influence fire behaviour include:

- **Fuel size and shape** – anything less than 6mm diameter/thickness is considered a fine fuel and will ignite and burn quickly. Larger/heavier fuels take longer to ignite but burn for longer, so the threat exists for longer;
- **Fuel load** – the quantity of available fuel (t/ha) will influence the size of the fire. In particular it is the fine fuel load that determines the intensity of the bushfire and the flame sizes. Vegetation type and period over which it can accumulate will determine fuel loads;
- **Vegetation type** – this influences the size, shape and quantity of available fuels. For bushfire purposes vegetation types include the classifications of forest, woodland, scrub, shrubland and grassland (with total fuel loads typically decreasing in that order);
- **Fuel arrangement** – will influence two factors of fire behaviour (1) the speed and intensity of burning and (2) how much of the total fuels are likely to be involved in the fire simultaneously. The first factor is a function of how densely packed or aerated the fuels are with the more available arrangement burning with greater intensity. The second factor is a function of the availability of 'ladder' fuels (i.e. near surface, elevated and bark fuels) to carry fire up the vegetation profile, and the continuity of fuels to carry the fuel across the land; and
- **Fuel moisture content** – drier fuels will ignite easily and burn quickly. The inherent moisture content of the vegetative fuels is a function of the vegetation type and arrangement and/or the positioning of the vegetation complex near readily available sources of moisture.

Greater quantities of finer, dryer, aerated and connected fuels will result in more severe behaviours and elevated bushfire threat levels. Large extents of vegetation (surrounding landscape scale) can have additional implications for the development of extreme bushfire events and the consequent increase in bushfire threat levels (refer to Appendix 3 for additional information).

2. **WEATHER**

Adverse fire weather that results in more severe behaviours and elevated threat levels includes strong winds, high temperatures, low relative humidity and extended periods of these factors.

Weather events at the surrounding landscape scale can have implications for the development of extreme bushfire events and consequent increase in bushfire threat levels (refer to Appendix 3 for additional information).

3. **TOPOGRAPHY**

The physical terrain can influence the severity of fire behaviour. At a local scale, it is the influence of ground slope on the rate a fire spreads, that is most relevant. Fire travels faster up slopes (rule of thumb is a doubling of speed for every 10 degrees increase in slope). Greater rates of spread increase fire intensity and the resultant threat levels.

At the surrounding landscape scale, the impact of topography can be significant and includes establishing the potential for development of certain dynamic fire behaviours that can lead to extreme bushfire events and elevated threat levels (refer to Appendix 3 for additional information).

BUSHFIRE THREATS - DIRECT ATTACK MECHANISMS
ORIGINATING FROM THE BUSHFIRE PRONE VEGETATION

FLAME CONTACT

When flames contact buildings/structures they can flow over, under and around – impacting surfaces not directly facing the bushfire. Flames can enter small gaps and crevices. This results in a significant risk that combustible parts of buildings/structures.

Flames will be longer when fine fuel loads are higher and will move faster up slopes and generally, slower down slopes.

Flame temperatures are highest in the lower parts of the flame and decrease towards the tip. The flame has two distinct regions - the lower solid body flame and the upper part that is a transitory flame (intermittently present). Both flame regions can damage structures.

Note: AS 3959:2018 *Construction of buildings in bushfire prone areas*, establishes both the construction requirements corresponding to each Bushfire Attack Level (BAL) and the methodology for determining a BAL. For a bushfire modelled using this methodology, the derived flame length only provides an estimate of the solid body flame length.

RADIANT HEAT TRANSFER

This heat is produced from combustion of a fuel source, radiates in all directions from the fire and can potentially be felt from hundreds of meters away.

The amount of heat that a fire can transfer to other objects, through radiation, is influenced by its flame size and flame temperature. These are a function of the characteristics of the fuels being burnt including fuel size, dryness, structure, arrangement and quantity. The bushfire is additionally influenced by weather and topography factors that can intensify fire behaviour (described at start of this section with additional detail provided in Appendix 3).

The radiant heat:

- Can ignite combustible materials such as timber (doors, cladding, external framework), some plastics (which if not ignited will melt and distort (cladding, pipes, gutters, tanks). This breaches the building's envelope allowing flames and embers to enter, increasing the likelihood of damage or destruction;
- Can dry and heat vegetation and other fuels (combustible materials such as timber) to a temperature at which they ignite or are more easily ignited by existing flames or embers; and
- Is an extremely significant threat to persons (occupants, firefighters) when they are not physically shielded. Protective clothing can provide only limited protection.

EMBER / BURNING DEBRIS ATTACK

Note: The importance of establishing protection measures to mitigate the potential impact of consequential fire ignited by the ember attack mechanism, cannot be overstated.

An ember is a small particle of burning material that is transported in the winds that that accompany a bushfire (larger particles can exist as firebrands from certain vegetation types). Typically these consist of plant materials such as bark, leaves and twigs that exist as part of the standing vegetation or have accumulated on the ground. Experimental scientific work has shown that that embers greater than 2mm are effective at igniting combustible materials.

Ember attack is the most common way for buildings/structures to ignite in a bushfire:

Scientific research indicates that at least 80% of building losses from past Australian bushfires can be attributed to ember/firebrand attack (mostly in isolation but also in combination with radiant heat), and the resultant consequential fires. (Leonard J.E. et.al; 2004 – Blanchi R. et.al. 2005 - Blanchi R. et.al. 2006).

Embers are the primary ignition source for consequential fire:

- They accumulate around and on vulnerable parts of structures such as low angle surfaces windows and wherever re-entrant corners exist (e.g., roofs, gutters, doors, windows etc);
- They enter gaps in structure envelopes to vulnerable materials within internal cavities and spaces (e.g., roof, sub-floor, living areas); and

- They ignite surface materials such as walls and decks and any accumulated vegetative debris.

Embers can attack structures for a significant length of time before and after the passage of the fire front, as well as during. This potential length of exposure is an important factor in the consideration of the level of threat embers present.

The importance of bark as an ember source:

(Sources: CSIRO Climate and Disaster Resilience Report 2020 and Overall Fuel Hazard Assessment Guide 4th edition July 2010, Victoria DSE and Cruz, MG (2021) The Vesta Mk 2 rate of fire spread model: a user's guide. CSIRO).

Bark is the primary source of embers and spotting in Australian eucalypt forests due to the key attributes of ease of ignition, extended burnout time and the favourable size to weight ratio and aerodynamic properties. Differences in these attributes strongly influence the spotting potential from different forest types – and therefore the potential hazard rating of the bark.

The type of tree bark will determine the size, shape and number of embers/firebrands which, along with the prevailing fire behaviour and weather conditions will dictate the spotting distances and density of ignitions.

Fine fibrous barks - including stringybarks (e.g. jarrah), have loosely attached fibrous flakes and can produce massive quantities of embers (prolific spotting) for shorter (up to 0.75 km) and medium distances (up to 5 km).

Short distance spotting (including ember showers) are generally the result of embers and firebrands blown directly ahead of the fire with little or no lofting. Density tends to decrease with distance from the fire front.

Medium distance spotting results from embers and firebrands that are lofted briefly in a convection column or blown from an elevated position (e.g., from treetops on ridges). With sufficient density and coalescing spot fires, this can rapidly increase the size of a fire (deep flaming) leading to dynamic fire behaviours and extreme fire events.

Ribbon/candle type barks - have longer burnout time, extended flight paths and are more likely to be responsible for longer distance spotting > 5 km (with up to 30 km having been authenticated). This results from significant lofting of large firebrands (e.g. curled hollow tubes of bark that can burn for 40 minutes) in well-developed convection columns. These develop as separate, independent fires. Very long distance spotting requires Intense fire, maintenance of a strong convection column (to lift firebrands aloft) and strong winds aloft (to transport the firebrands).

Other bark types - that include coarsely fibrous (e.g. marri) / slab or smooth / platy and papery barks - produce lower quantities of embers and shorter distance spotting. Their highest bark hazard ratings that are lower than fine fibrous or ribbon barks.

HIGH / ERRATIC FIRE DRIVEN WIND ATTACK

High winds resulting from bushfire / vegetation / terrain / fire weather interactions, can directly damage the external envelope of a building or structure by:

- Positive and negative pressure dislodging building parts; and/or;
- Causing solid materials (e.g., branches or parts of other structures) to break loose and be transported to impact and damage the building's envelope. This provides openings for other bushfire attack mechanisms to enter and ignite internal cavities.

Strong winds are common during serious bushfire events as they are a necessary requirement for bushfires to develop higher intensities and greater severity levels.

Increased wind speeds can be the result of:

1. General weather patterns that will present as strong prevailing winds; and
2. The more complex interactions of prevailing winds along with vegetation types and structures, terrain factors and fire weather factors - that can lead to the development of dynamic fire behaviours resulting in intensification of fire behaviour and generation of local and erratic high winds.

   For highest risk scenarios, the bushfire can couple with the atmosphere as a pyro-convective event resulting in extreme bushfire events and gusty, severe windspeeds (refer to Appendix 3 for more detail).

It is the potential for the interactions and outcomes of the latter that will be considered as a direct bushfire attack mechanism for the relevant bushfire hazard threat level assessment in this report.

BUSHFIRE THREATS - INDIRECT ATTACK MECHANISMS PRIMARILY ORIGINATING FROM WITHIN AN ASSET PROTECTION ZONE (APZ)
For the following indirect bushfire attack mechanisms to impact relevant exposed elements, certain requirements need to exist within an APZ (i.e., the area immediately surrounding a subject building/structure). Where these requirements exist, they increase the exposure of the subject building/structure to the indirect bushfire attack mechanisms. In this Report, it is the exposure component of the risk assessment that will assess the potential impact from the bushfire threat indirect attack mechanisms.

DEBRIS PRODUCTION AND ACCUMULATION

The relevant debris are combustible fine fuels that can accumulate, by falling and/or being windblown to be close to or against buildings, surrounding structures and other heavy fuels.

This makes the ignition of these structures/heavy fuels more likely through flame contact and radiant heat generated by the accumulated debris that has been ignited by embers and/or surface fire attack (i.e. a consequential fire).

This debris can accumulate over long time periods (years) in locations such as:

- On horizontal or close to horizontal surfaces and rough timber surfaces;
- Within re-entrant corners and roof gutters/valleys;
- Against vertical surfaces; and
- Within internal spaces /cavities and under sub-floors when gaps are present.

The threat level of this attack mechanism will be determined by:

- The presence of vegetation types that produce significant quantities of combustible debris and produce this in the driest and hottest part of the year; and
- The extent of the vegetation producing this threat.

The level of exposure of the telecommunications infrastructure is dependent on the proximity of this threat generating vegetation.

SURFACE FIRE

These are low intensity fires with short flames that burn along the ground and are not considered to be part of the 'bushfire' in identified bushfire prone vegetation. They are typically patchy and erratic in their direction, consuming low-lying vegetation, ground litter, mulch and other debris and are short lived (<40 seconds) when burning in the absence of heavier fuels.

Surface fires occur on the land immediately surrounding buildings, associated structures and other heavy consequential fire fuels. Surface fires bring the threats of direct flame contact, higher radiant heat and embers closer to the relevant elements at risk than the bushfire itself can.

To reduce the exposure of relevant elements at risk to this indirect bushfire threat, the area of land typically recognised as an APZ, should be maintained in a minimal fuel / low threat state.

TREE STRIKE/OBSTRUCTION

Branches or trees, subject to strong winds and/or tree burnout, can:

- Damage the envelope of a structure creating openings for direct attack mechanisms of bushfire (or consequential fire) to ignite internal cavities or living space; and/or
- Fall and obstruct access to or egress from, a structure or site being impacted by bushfire.

To reduce the exposure of relevant elements at risk to this indirect bushfire threat, consideration of the locations and susceptibility of trees needs to form part of the assessment of exposure and site management.

CONSEQUENTIAL (SECONDARY) FIRE

Note: The importance of establishing protection measures to mitigate the potential impact of consequential fire cannot be overstated.

Consequential fire Is the burning of vulnerable (combustible/flammable) materials, items and structures that exist within the area surrounding the subject building or structure – the surrounding vulnerable elements. These vulnerable surrounding elements can also include other buildings in proximity.

The burning of these surrounding vulnerable elements can result in the subject building/ structure being exposed to the direct fire attack mechanisms (threats) of flame, radiant heat, embers and surface fire from a close distance.

These consequential fire threats are separate from and additional to the threats generated by the bushfire front itself - which can be and often is, a considerable distance away.

Consequential Fire Fine fuels:

- Dead plant material such as leaves grass, bark and twigs thinner than 6mm (or live material less than 3mm thick that can be consumed in a fire involving dead material); and
- Originate from the indirect bushfire attack mechanism of 'debris accumulation' and potentially from other areas of landscaped vegetation.

Consequential Fire Heavy and Large Heavy Fuels:

- Stored combustible / flammable items:
  - Building materials, packaging materials, firewood, sporting/playground equipment, outdoor furniture, matting, rubbish bins etc;
  - Large quantities of dead vegetation materials stored as part of site use;
  - Liquids and gases; and
  - Vehicles, caravans and boats, etc.
- Constructed combustible items:
  - Surrounding landscaping items - fences/screens, retaining walls, gazebos, plastic water tanks etc;
  - Attached structures - decks, verandahs, stairs, carports, garages, pergolas, patios, etc; and
  - Adjacent structures - houses, sheds, garages, carports, etc. Structure to structure fire is a common cause of overall building loss in post bushfire event assessments [9].

The assessment of the potential risk impact of the existence, types and proximity of consequential fire fuels to subject buildings/structures, is conducted by assessing the exposure level of

The level of risk associated with the potential contribution of consequential fire to overall risk levels, is derived by assessing the exposure of relevant elements at risk to consequential fire fuels – which considers the existence, type and proximity of these fuels.

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APPENDIX 3: DYNAMIC FIRE BEHAVIOURS AND EXTREME BUSHFIRE EVENTS

The content of this appendix is an overview of information that supports the assessment approach of section 5.2 of this report. It considers the risk implications arising from what is being learnt from the latest research work within the bushfire science of dynamic fire propagation and extreme fire development.

Any potential for extreme fire events to develop in the surrounding landscape surrounding the subject site, will result in increased in bushfire hazard threat levels to exposed elements and must be accounted for in the risk assessment.

The selected compilation of information is taken from various sources including peer reviewed research papers [references 1-3, 12, 15, 21, 27, 28, 41, 42].

RECENT BUSHFIRE RESEARCH

Traditionally, bushfire modelling conducted to determine rates of spread, intensity, flame lengths, radiant heat etc and provide measurements of threat levels, has been based on the quasi-steady fire state (i.e. a fire propagating under constant and uniform fuel, weather and topography – after it has finished its growth phase).

More recent research has provided important insights into the dynamic nature of fire spread in the landscape and identified local drivers of bushfire risk and highlighted the role of environmental factors that are significant for large and extreme fire development.

These environmental factors include aspects of the vertical structure of the atmosphere, meso-scale fire weather processes (e.g., sea breezes, cold fronts, squall lines, convective complexes), interactions between the fire and the atmosphere, and the modification of fire weather and fire behaviour due to the local topography.

From this work, several processes that can contribute significantly to the level of risk posed by a bushfire have been identified. These include:

- Extreme fire weather processes;
- Dynamic fire propagation; and
- Violent pyroconvection and pyrogenic winds.

Of relevance to this risk assessment are the topographic aspects of the surrounding landscape surrounding the subject site and the potential it might present for dynamic fire propagation, development of extreme fire events and therefore increased bushfire hazard threat levels and consequent risk.

DYNAMIC FIRE BEHAVIOURS

Dynamic fire behaviours (DFBs) result from interactions between the physical factors of fuel, terrain, fire weather conditions, atmosphere and different parts of the bushfire itself. They are physical phenomenon that involve rapid changes of fire behaviour and occur under specific conditions.

Certain DFBs occur at various scales and time frames (e.g. spotting), others only at large scales (e.g., conflagrations and pyroconvective events) and others at small scales and short time spans (e.g. junction fires, fire whirls). The following fire behaviours are considered DFBs:

Spotting

The production of embers/firebrands, carried by the wind/convective currents that ignite spot fires ahead of the bushfire front. Under extreme conditions, with the necessary fuels, mass spotting events can occur. Dependent on fuel types, winds and convective currents, embers can be consumed by the fire front itself or travel tens of kilometres. Spot fire occurrence can be so prevalent that spotting becomes the dominant propagation mechanism – with the fire spreading as a cascade of spot fires forming a ‘pseudo’ front.

Fire Whirl / Tornado

Various sized (<1m - >150m) spinning vortices of ascending hot air and gases that carry smoke, debris, and flame. The intensity of larger whirls compares to tornados. Can induce fire spread contrary to prevailing wind and ignite spot fires away from the fire front.

Junction Fire

Is associated with merging fire fronts that produces very high rates of spread and have the potential to generate fire whirls / tornadoes.

Crown Fire

Types of tree crown fires have been categorised according to their degree of dependence on the surface fire phase - passive, active, independent - with the last two being considered dynamic fire behaviour.

Active crown fire is "a fire in which a solid flame develops in the crowns of trees, but the surface and crown phases advance as a linked unit dependent on each other."

Independent crown fires "advance in the tree crowns alone, not requiring any energy from the surface fire to sustain combustion or movement."

For a crown fire to start, a surface fire of sufficient intensity is first necessary. The distance between the heat source at the ground surface and the canopy-fuel layer will determine how much of the surface fire's energy is dissipated before reaching the fuels at the base of the canopy. The higher the canopy base, the lower the chance of crowning.

The existence of trees themselves, separated from surface fuels, can offer a degree of protection by absorbing radiant heat, trapping embers and shielding from winds. Necessary considerations include:

- Eliminating understorey fuels;
- Species Issue: Understanding the extent to which the trees will contribute to fuels (leaves/bark/twigs etc) that accumulate on the ground and when moved (wind) become involved in consequential fire away from the tree during the fire season. This needs to be considered against the maintenance capability (regular removal of material) of the responsible entity; and
- Species / Positioning Issue: Requirements include not being highly flammable, no loose stringy bark, less able to trap embers, not being prone to branches breaking in high winds potentially causing structural damage to buildings (allowing ember entry) and keeping crowns separated as an additional measure of safety and allow wind to permeate rather than be totally blocked.

Eruptive Fire

Behaviour where the head fire accelerates rapidly on sufficiently steep terrain with sufficiently strong wind – as a result of fire plume attachment to the surface, bathing it in flames ahead of the front (pre-heating).

Fire Channelling / VLS (vorticity-driven lateral spread)

Behaviour where rapid lateral fire spread, in generated vortices, occurs across a sufficiently steep leeward slope in a direction approximately transverse to the prevailing winds. This results in the rapid increase in width of the fire front. VLS are highly effective at producing mass spotting events.

Conflagrations

These are large, intense, destructive fires. They have a moving front as distinguished from a fire storm (blow up / pyroconvective fire). With sufficient vegetation extent, fuel loads and the development of dynamic fire behaviours, the large amounts of heat and moisture released can cause its plume to rise into the atmosphere and develop large cumulus or cumulonimbus flammagenitus cloud (pyrocumulus or pyrocumulonimbus). Where the extent of vertical development is limited (e.g. a stable atmosphere, or insufficient flaming zone), the fire is likely to remain a surface-based event.

Downbursts

These are strong wind downdrafts associated with convective columns of heated air (and associated cloud forms). The consequent falling columns of cooled air induce an outburst of strong winds on or near the ground that radially spread causing fire spread in directions contrary to the prevailing wind.

Pyroconvective Event

A pyro-convective event is an extreme manifestation of a conflagration that develops in an unstable atmosphere and can transition into a towering pyrocumulus or a pyrocumulonimbus (pyroCb's) that can extend to the upper troposphere or lower stratosphere. With the fire/atmosphere coupling, it has evolved beyond a purely surface based fire into dynamic fire propagation rather than quasi-steady propagation. In the violent pyroconvective system:

- As a fire's plume reaches higher into the atmosphere, larger scale mixing can cause drier and higher-momentum upper air to be transferred back to the surface, thereby further exacerbating the potential for more intense fire behaviour, including fire spread contrary to the prevailing wind direction;
- Pyrogenic winds can cause considerable damage to structures, directly or indirectly, increasing their vulnerability to bushfire attack mechanisms; and

- The pyroCb's carry dense ember loads, fire and other burning debris and generate lightning, all with very little rain or hail that would typically occur with an ordinary thunderstorm.

DRIVERS OF DEEP FLAMING

Deep flaming is the fire condition when the active flaming zone is unusually large and flame-front intensity is simultaneously great, resulting in large quasi-instantaneous energy release.

Deep flaming can be produced by numbers of mechanisms on varying terrain (flat, undulating of rugged) when a large enough area of sufficiently heavy fuels is present. These mechanisms include:

- Very strong winds – so the head fire advances more rapidly than the back of the flaming zone;
- Change in wind direction – so the long flank of a fire is transformed into a fast running head fire;
- Eruptive fire behaviour – where steep slopes can cause a fire to accelerate rapidly;
- Vorticity-driven lateral spread (wind channelling) – where strong winds and steep terrain interact to rapidly drive a fire laterally, accompanied by downwind mass spotting and consequent coalescing of spot fires forming large areas of flame (can include the DFB of 'junction fire').

Research has identified strong links between:

- Eruptive fire behaviour, VLS and the occurrence of deep flaming; and
- The development of deep flaming and extreme bushfire events.

EXTREME BUSHFIRE EVENTS

Extreme bushfire events create disproportionate risks to human and environmental. Their development is affected by dynamic feedback processes that result in unpredictable behaviour, and the worsening of rates of spread and intensities - even when environmental conditions are consistent.

The term 'extreme bushfire' is applied in the recent bushfire science literature in two ways:

1. Where it refers to large, intense bushfires in which one or more DFBs are simultaneously involved; and
2. Where it more specifically refers to a fire that exhibits deep or widespread flaming in an atmospheric environment conducive to the development of violent pyroconvection, often manifesting as towering pyrocumulus (pyroCu) or pyrocumulonimbus (pyroCb) storm(s) – also referred to as blow-up fire event(s).

   A distinguishing feature of these types of fires is that they involve a coupling of the fire with an unstable atmosphere to a much greater vertical extent, well above the mixed layer, which modifies or maintains the fire's propagation (e.g. through mass spotting, blustering winds and lightning);

Relevance to Risk Assessment: Given that this risk assessment is concerned with identifying the potential for the landscape surrounding the subject site to increase bushfire risk, the following common aspects of the two above descriptions are relevant:

- An extreme fire is a large intense fire, so it requires a sufficient area and sufficient fuels in which to develop; and
- An extreme fire of scale requires the formation of deep flaming to develop.

Consequently, the risk assessment is primarily focused on the extent and fuel types/loads of bushfire prone vegetation and the existence of terrain (topography) properties necessary for the relevant dynamic fire behaviours - rather than the potential for adverse fire weather / atmospheric conditions - whose likely occurrence can be assumed as possible.

Note also that the second description requires an unstable atmosphere - to enable deep/violent pyroconvection and subsequent significant cloud formation and latent heat release. This is not essential for the first. Consequently, this identifies a potential difference between the two defined extreme bushfire events to be considered when assessing risk:

- Large, intense bushfires can occur without deep convective column development. These fires remain as surface fires (essentially wind-driven fires), with a greater predictability of behaviour; and
- Large, intense bushfire that couple with an unstable atmosphere are no longer surface based. They are associated with a higher level of energy, chaos, and nonlinearity due to the enhanced (fire-induced)

interaction between the boundary layer and the free troposphere, which may introduce factors that act to maintain or enhance widespread flaming. The fire behaviour is much more unpredictable.

PHYSICAL REQUIREMENTS OF TERRAIN, FUEL LOAD (AND WINDSPEED) FOR DEEP FLAMING

The dynamic fire behaviours of eruptive fire and VLS with associated mass spotting, along with potential for topographically modified winds to develop, are strongly linked with the development of deep flaming, which is a prerequisite for extreme bushfire events.

There are certain environmental thresholds that are required to be met for these dynamic fire behaviours to occur. These are described below and form part of the assessment of the bushfire hazard in Section 5.3.

Eruptive Fire Behaviour

Eruptive fires are characterised by a rapid acceleration of the head fire rate of spread (exponential increases in rate of spread have been observed). It results in a rapid deepening of the flaming zone (larger area of active flame), from which heat is released into the atmosphere.

Eruptive fire results from the interaction between the slope of the terrain and the fire's plume. In the absence of wind, plume attachment can be expected on terrain that is inclined at roughly 24° or more and the effects of wind could cause plume attachment on slopes inclined at angles of 24° or lower. Consequently, the primary topographic requirement for eruptive fire is sufficiently steep terrain and sufficiently strong wind.

"This mode of fire propagation is completely contrary to that expected under the quasi- steady fire spread paradigm … eruptive fire behaviour poses a serious threat to the successful containment of a bushfire and provides a mechanism that can substantially elevate the risk posed by a bushfire in areas that are prone to its occurrence".

Rugged terrain (areas with local topographic relief >300m), is particularly prone to eruptive fire (and dynamic fire behaviours in general).

Fire Channelling (Vorticity-Driven Lateral Spread)

Fire channelling (VLS) exists when a fire exhibits rapid spread in a direction transverse to the synoptic winds as well as in the usual downwind direction. It is characterised by intense lateral and downwind spotting and production of extensive flaming zones.

VLS is highly effective at producing mass spotting events. A link between deep flaming events caused by VLS and the formation of pyroCb has been demonstrated. Under extreme conditions, spot fire occurrence can be so prevalent that spotting becomes the dominant propagation mechanism.

VLS can only be expected to occur on parts of the landscape, and under certain fire weather conditions. VLS occurrence depends critically on the following:

- Leeward slopes greater than 20-25° are required;
- Wind direction must be within 30-40° of the topographic aspect;
- Wind speed in excess of about 20 km h-1 are required;
- Generally, VLS is only observed in heavy forest fuel types with load in excess of 15-20 t ha; and
- Fuel moisture content – dense spotting and downwind extension of the flaming zone are far more likely when fuel moisture contents are around 5% or less.

Topographically Modified Surface Winds - Downslope Winds

In WA the scarp winds are the well-known local occurrence of downslope winds. Similar meteorological phenomena (typically as foehn winds) occur in the lee of mountain ranges in many parts of the world, particularly on ranges with gentle windward and steep leeward slopes.

Scarp winds are nocturnal, strong and gusty winds that develop near the base of the scarp through summer months. The local mechanism is for a synoptic easterly flow, causing air to rise to the top of the scarp from further inland, at which point it is cooler and denser than the surrounding airmass. This produces an unstable situation and consequently the air flows down the scarp as a turbulent density current.

There are implications for enhanced fire activity for a fire located in a region of downslope winds, as they provide a clear mechanism for rapid, irregular direction of fire spread as well as turbulent transport of firebrands and plume development. If a 'hydraulic jump' is also present, the strong vertical motion in the jump region is a mechanism for lofting and dispersal of firebrands further ahead of the bushfire front.

APPENDIX 4: EXPLAINING BUSHFIRE ATTACK LEVEL (BAL)

Bushfire attack levels are determined using the methodology established by AS 3959:2018 Construction of buildings in bushfire prone areas. The Standard defines a bushfire attack level (BAL) as a "means of measuring the severity of a building's exposure to ember attack, radiant heat and direct flame contact, using increments of radiant heat expressed in kW/m^2."

Each BAL rating represents a set range of radiant heat flux (see table below). The amount of radiant heat and flame lengths generated by a bushfire is dependent on many factors that are modelled using the Standard's fire behaviour and flame length models. Key factors include vegetation type, terrain and a range of fire weather factors. The variation that can exist in these factors will result in varying separation distances, away from bushfire prone vegetation, corresponding to a given BAL rating. These distances can be presented as data in a table or illustrated by mapping – the 'BAL Contour Map'

The different BAL ratings effectively incorporate the threat levels of flame contact, radiant heat transfer and ember/firebrand attack:

- The highest ratings of BAL-FZ and BAL-40 indicate direct or likely exposure to the flame contact threat;
- Each BAL rating represents a defined range (in kW/m^2), of the radiant heat transfer threat, with the threat level increasing from BAL-LOW to BAL-FZ; and
- Each higher BAL rating assumes an increased exposure to the ember/burning debris attack threat. This is based on the practical acknowledgement that the closer the element at risk is to the source of ember production the greater the likely exposure level. In practice, this strong correlation does not exist for all bushfire event scenarios. However, AS 3959 is only intending to apply the same construction response to ember/firebrand attack for each BAL rating above BAL-LOW as consequential fire from any source other than from within the subject structure itself is not being considered by the Standard.

Bushfire Attack Level	**Explanation** [Source AS3959:2018]
BAL – LOW	There is insufficient risk to warrant specific construction requirements but there is still some risk. *Important Note: For AS3959:2018 purposes, BAL-LOW will exist at 100m from classified vegetation (50m for Grassland).* *However, embers/firebrands from certain vegetation types can ignite spot fires ahead of the fire front for significant distances – short range spotting up to 740m, medium range spotting up to 5km and long range spotting has been authenticated up to 30km.*
BAL – 12.5	There is a risk of ember attack. Construction elements are expected to be exposed to heat flux not greater than 12.5 kW/m^2
BAL – 19	There is a risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to radiant heat. The construction elements are expected to be exposed to a heat flux not greater than 19 kW/m^2.
BAL – 29	There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat. The construction elements are expected to be exposed to a heat flux not greater than 29 kW/m^2.
BAL – 40	There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front. The construction elements are expected to be exposed to a heat flux not greater than 40kW/m^2.
BAL – FZ (Flame Zone)	There is an extremely high risk of ember attack and burning debris ignited by windborne embers, and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front. The construction elements are expected to be exposed to a heat flux greater than 40 kW/m^2.

APPENDIX 5: THE SURROUNDING LANDSCAPE - VEGETATION CATEGORY AND HAZARD DETERMINATION CRITERIA

DETERMINATION OF VEGETATION CATEGORIES AND THE BASE BUSHFIRE HAZARD SCENARIO

The following criteria are applied to the categorisation of vegetation on the surrounding landscape and the establishment of the base bushfire hazard scenario, for the purpose of deriving indicative bushfire threat levels. These threat levels are subsequently applied in the determination of risk levels associated with a bushfire event.

Vegetation Categories

These are established to enable a comprehensive assessment of the type and severity of the bushfire attack mechanisms (i.e., the bushfire threats), potentially generated by bushfire prone vegetation on surrounding land. This enables variations in vegetation composition and structure to be more appropriately accounted for in the determination of the levels of risk associated with a local bushfire event.

The variations in the potential threat level ranges assigned to each vegetation category in the table below are the result of these differences.

The 'Categories' are necessarily different to the vegetation 'Classifications' applied in the BAL determination methodology of AS 3959:2018. The building Standard primarily considers the flame contact and radiant heat attack mechanisms and does not fully address ember/firebrand attack or other threats.

The Range of Potential Threat Levels the Base Bushfire Hazard Scenario

The assumptions that make up the base bushfire hazard scenario are applied to deriving the midpoint of each potential threat level range for each category of vegetation. Variations from the base scenario will potentially modify the assessed threat level (i.e., increase or decrease it within the relevant range). The assessment of the subject site for the existence of threat modifying physical factors, is presented in Section 5.1.4 of this report.

The primary components of the Base Bushfire Hazard Scenario are:

- The extent of bushfire prone vegetation is sufficiently large such that a fully developed fire can be supported. Parameters applied to the design fire of AS 3959:2018 BAL determination methodology are applied. Specifically, a head fire width of at least 100 metres is physically possible and sufficient fire run length exists to allow a quasi-steady rate of spread (after the initial growth phase) to be attained and a head fire width of 100 metres to develop from a single point of ignition. Typically, but not in every scenario, this will equate to areas of vegetation greater than 3ha and within which fire runs directly at an element at risk will be greater than 50 -100 metres in length;
- The fire fuels are continuous, and the terrain is flat to undulating with no vegetated slopes greater than ten degrees; and
- It is assumed to be possible for the most adverse fire weather to occur at the subject locality.

<table>
<tr><th colspan="6">SURROUNDING LANDSCAPE VEGETATION MAPPING - CATEGORY DETERMINATION CRITERIA</th></tr>
<tr><th rowspan="2">Category Code</th><th colspan="5">Category Description</th></tr>
<tr><th>Total Fuel Loads</th><th>Most Relevant Fuel [1]</th><th>Spotting Range [2]</th><th>Spotting Density [2]</th><th>Potential Threat Level Range (Property) [3]</th></tr>
<tr><td rowspan="2">Tree-1</td><td>Moderate to High</td><td>Fine, fibrous, long strand bark</td><td>Short to Medium</td><td>Very High</td><td>Moderate to Extreme</td></tr>
<tr><td colspan="5">Trees and Bark Hazard: Tree dominated vegetation including tall species. At least 10% of the trees present have fine, longer strand fibrous barks (stringybarks). "These barks are easily dislodged from the trunk, allowing simultaneously for vertical fire propagation into the overstorey and profuse short to medium range spot fire ignitions."

Spotting Threat: The fine, longer strand fibrous barks (stringybarks) have the potential to produce the highest short range (up to 500-750 metres) spotting density (quantity) and can spot out to medium ranges (up to 5 km) under conducive fuel, terrain and fire weather conditions.

Potential spotting (ember / firebrand attack) threat levels range from moderate to extreme.

Fuel Loads: Surface and near surface fuel loads (t/ha) range from moderate to very high (note: the worst potential fuel load for the location is applied, regardless of time since last burnt).

Example Eucalyptus Species: Includes jarrah, messmate stringybark and brown/red stringybark. Marri can be included in this category due to the potential high-density spotting but will be limited to the shorter spotting range.</td></tr>
<tr><td rowspan="2">Tree-2</td><td>Moderate to Very High</td><td>Ribbon, candle bark</td><td>Short to Long</td><td>Moderate</td><td>Moderate to Extreme</td></tr>
<tr><td colspan="5">Trees and Bark Hazard: Tree dominated vegetation including tall species. Less than 10% of trees present will have fine, longer strand fibrous barks (stringybarks). The predominant trees are smooth bark species where the bark sheds in long ribbons (ribbon/candle barks), and often hangs on the branches. "These bark types provide aerodynamically efficient, firebrand material that can remain alight for long periods and be transported over considerable distances."

Spotting Threat: These bark types have the longest distance spotting potential (greater than 5 km) due to the long burnout time of the firebrands. However, the potential ember/firebrand density (quantity) will be lower than for fine, longer strand fibrous barks.

Potential spotting (ember / firebrand attack) threat levels range from moderate to very high.

Fuel Loads: Surface and near surface fuel loads (t/ha) range from moderate to very high (note: the worst potential fuel load for the location is applied, regardless of time since last burnt).

Example Eucalyptus Species: Includes manna gum, blue gum, alpine ash and woollybutt, mallee species. Karri can be included in this category on the basis that while spotting distance is unlikely to be long range (as the bark is shed in short ribbons/small polygonal flakes), the potential for extreme fuel loads is relevant to the categorisation.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="2">Tree/Shrub</td><td>Moderate to High</td><td>Smooth, platy, papery, coarsely fibrous bark and/or Shrub fuels</td><td>Short</td><td>Low to Moderate</td><td>Moderate to High</td></tr>
<tr><td colspan="5">This category can have the most variation in vegetation types that are present. It can consist of predominantly trees with the stated bark types or be predominately shrub type vegetation or any combination. Can include areas of grass.

Trees and Bark Hazard: Trees can be of any height. Bark types are more varied and have the characteristics of being tightly held onto the trunk, producing short strands, or producing chunks or</td></tr>
</table>

	small flakes which fall to the ground. These bark types are described as smooth, platy, papery and coarsely fibrous. **Shrub Fuels:** Scrub, shrub, heath type fuels of vertically oriented, well aerated, with live and dead vegetation extending from the surface to the top of the vegetation complex and up to 6 metres high. **Spotting Threat:** Trees with the stated bark types can produce limited quantities of embers and shorter spotting distances (up to 500-750 metres). Shrub fuels can produce moderate to high quantities of smaller and shorter burn duration embers, resulting in mostly short distance spotting. **Fuel Loads:** Surface, near surface and elevated fuel loads (t/ha) range from moderate to high (note: the worst potential fuel load for the location is applied, regardless of time since last burnt).				
Shrub	Low to High	Shrub fuels	Short	Low	Low to Moderate
	Shrub Fuels: Scrub, shrub, heath type fuels of smaller sized, vertically oriented, well aerated fuels, with continuous live and dead vegetation extending from the surface to the top of the vegetation complex and up to 2 metres high. Can include areas of grass. **Spotting Threat:** Shrub fuels can produce limited quantities of small and short burn duration embers resulting in low density short distance spotting (up to 500-750 metres). **Fuel Loads:** Surface, near surface and elevated fuel loads (t/ha) range from moderate to high (note: the worst potential fuel load for the location is applied, regardless of time since last burnt).				
Grass	Low to Moderate	Fine grass fuels	Very Short	Low	Low to Moderate
	Fuel Types: Will be varied and includes the following groups that each have similar structural characteristics - tropical grasslands, tussock grasslands, hummock grasslands, and improved pastures / crop lands comprised of species that cure. These fuels are typically much finer than other vegetation types with a low bulk density. Where trees are present, they make up no more than 10% of canopy cover and will have no influence on fire behaviour. **Fuel Loads:** Are much lower than other types of vegetation complexes. For example, default total fuel loads applied in AS 3959:2018 BAL determination methodology for Grassland range from 43% to 85% less than other vegetation classifications. **Fire Behaviour:** Combustion rates are faster in grasslands than forest fuels due to the finer materials and more aerated structure. This gives rise to the main cause of differences in fire behaviour between grassfires and fires in other fuel types - the residence time is much shorter. This is the period during which flames remain burning over one spot on the ground. Using pastures as an example, the residence time is in the order of 5 seconds in fine light pastures and 10-15 seconds in heavy pastures. This results in grassfires spreading more quickly, reacting very quickly to changes in wind direction and speed and being a shorter duration threat to a specific exposed element. **Spotting Threat:** Embers produced by grass fires are smaller and fewer in number than those produced from forest fires and burn for shorter durations. Typically, spotting in grassfires occurs over very short distances and are generally not noticed as they are quickly overrun by the main fire. Potential spotting (ember / firebrand attack) threat levels are low.				
No/Low Threat					No Threat to Low
	Areas of land will satisfy this category when the following factors apply: • Low threat vegetation characteristics including low flammability, high moisture content (including non-curing crops) and minimal fuel load. Low threat examples established in AS 3959:2018 include: managed grassland, mangroves/saline wetlands, maintained lawns, golf courses, public reserves/parklands, sporting fields, vineyards, orchards, banana plantations, market gardens, commercial nurseries, nature strips and windbreaks; and • Areas permanently cleared of vegetation, including natural features such as rocky outcrops and manmade infrastructure.				

Note 1: The fuel type/s that are most relevant for the categorisation of area of vegetation are stated. This has particular relevance where certain bark types and quantity are a significant component of total fuel loads, resulting in higher threat levels for the ember/firebrand direct attack mechanism. Bark fuels are the primary source of fuel for the ember/firebrand attack threat (refer to Appendix 2 for additional information).

Note 2: Understanding and assessing the threat level generated by the ember/firebrand direct attack mechanism (spotting) is important to the management of risks associated with any bushfire hazard. With respect to categorising surrounding landscape vegetation, based on threat levels, the following points identify why the assessment of the spotting threat is important:

- At distances beyond 100 metres from a subject land the direct attack mechanisms of flame contact and radiant heat transfer cannot significantly and directly impact the building elements at risk within that site;
- However, embers/firebrands can impact subject land through the ignition of consequential fire (as an indirect attack mechanism of bushfire), in fuels and structures surrounding, upon and within the relevant elements at risk (e.g., habitable buildings). Consequential fires bring the direct attack mechanisms of flame and radiant heat much closer than the bushfire itself can. Assessments of past bushfire events indicate that ember attack and consequential fire be the cause of 80% or greater of property losses; and
- Spotting can significantly influence the increase scale of the bushfire event and its consequent intensity, both within the surrounding landscape and within the 100 metres surrounding a subject land. From *Cruz M.G. et al (2015): A Guide to Rate of Fire Spread Models for Australian Vegetation. CSIRO, AFAC*). “Spotting is an important, at times dominant, fire propagation process in high intensity fires in eucalypt forests. The type of tree bark will determine the size, shape, and number of firebrands, which the prevailing weather conditions will dictate the spotting distances and density of ignitions.” Refer to Appendix 2 for additional information.

Note 3: The stated potential threat levels identify the threat level range that is associated with the stated vegetation category as it applies to constructed property, as opposed to persons in the open or travelling access routes in vehicles, which will be separately assessed.

Subsequent assessment of vegetation, terrain and fire weather factors associated with the surrounding landscape that can increase or decrease the bushfire hazard threat levels, will complete the surrounding landscape assessment for the subject land.

APPENDIX 6: THE IDENTIFIED BUSHFIRE HAZARDS

A6.1 LOCATION OF SUBJECT LAND RELATIVE TO DESIGNATED AREAS OF BUSHFIRE PRONE LAND

Relevant State/Territory authorities have determined what is to be considered bushfire prone vegetation and how areas of land will be identified as presenting bushfire risk, by their designation on maps.

The mapping then functions as a trigger, for development and uses within the designated areas of land, to apply one or more of the following, as applicable to the jurisdiction:

- Legislated bushfire planning provisions/controls;
- Legislated bushfire building provisions/controls; and/or
- Legislated fire controls.

The location of the subject site relative to the relevant mapping is presented in Figure A5.1.

Figure A6.1: Subject site is within a Bushfire Prone Area

A6.2 SURROUNDING LANDSCAPE - VEGETATION CATEGORISATION – PHOTO EVIDENCE

PHOTO EVIDENCE - CATEGORISED VEGETATION	
Categorisation in accordance with the criteria established in Appendix 5	Tree-1
Additional Justification:	Jarrah and Marri

PHOTO EVIDENCE - CATEGORISED VEGETATION	
Categorisation in accordance with the criteria established in Appendix 5	Tree-2
Additional Justification:	Eucalypt and Peppermint

PHOTO EVIDENCE - CATEGORISED VEGETATION	
Categorisation in accordance with the criteria established in Appendix 5	Tree/Shrub
Additional Justification:	Melaleuca and Banksia

PHOTO EVIDENCE - CATEGORISED VEGETATION	
Categorisation in accordance with the criteria established in Appendix 5	Shrub
Additional Justification:	Not Required.

PHOTO EVIDENCE - CATEGORISED VEGETATION	
Categorisation in accordance with the criteria established in Appendix 5	Grass
Additional Justification:	Not Required.

A6.4 SUBJECT LAND + 150M EXTENT – VEGETATION CLASSIFICATION (SUPPORTING DATA)

INFORMATION TO ASSIST INTERPRETATION

Vegetation Types and Classification

In accordance with AS 3959:2018 clauses 2.2.3 and C2.2.3.1, all vegetation types within 100 metres of the 'site' (defined as "the part of the allotment of land on which a building stands or is to be erected"), are identified and classified. Any vegetation more than 100 metres from the site that has influenced the classification of vegetation within 100 metres of the site, is identified and noted. The maximum excess distance is established by AS 3959: 2018 cl 2.2.3.2 and is an additional 100 metres.

Modified Vegetation

The vegetation types have been assessed as they will be in their natural mature states, rather than what might be observed on the day. Vegetation destroyed or damaged by a bushfire or other natural disaster has been assessed on its expected re-generated mature state. Modified areas of vegetation can be excluded from classification if they consist of low threat vegetation or vegetation managed in a minimal fuel condition, satisfying AS 3959:2018 s2.2.3.2(f), and there is sufficient justification to reasonable expect that this modified state will exist in perpetuity.

The Influence of Ground Slope

Where significant variation in effective slope exists under a consistent vegetation type, these will be delineated as separate vegetation areas to account for the difference in potential bushfire behaviour, in accordance with AS 3959:2018 clauses 2.2.5 and C2.2.5.

THE INFLUENCE OF VEGETATION GREATER THAN 100 METRES FROM THE SUBJECT SITE	
Vegetation area(s) within 100m of the site whose classification has been influenced by the existence of bushfire prone vegetation from 100m – 200m from the site:	N/A
Assessment Statement:	No vegetation types exist close enough, or to a sufficient extent, within the relevant area to influence classification of vegetation within 100 metres of the subject site.

A6.4.1 VEGETATION CLASSIFICATION PHOTOS AND JUSTIFICATION

VEGETATION AREA 1					
Classification	**A. FOREST**				
Types Identified	Low open forest A-04				
Exclusion Clause	N/A				
Effective Slope	Determined	flat 0 degrees	Applied Range (Method 1)	Upslope or flat 0 degrees	
Foliage Cover of Tallest Plant Layer	30-70%	Shrub/Heath Height	1-2m	Tree Height	Up to 30m
Justification Comments	Low open forest with a mix of species composition creating a ground layer, a mid-storey and a taller trees. Tree species are dominated by Peppermint Trees, Melaleuca, Eucalyptus, and some Sheoak. Higher levels of ground fuel from leaf litter and dry grasses.				
Post Development Assumptions:	N/A				

PHOTO ID: 1

PHOTO ID: 2

PHOTO ID: 3

PHOTO ID: 4

<table>
<tr><th colspan="8">VEGETATION AREA 2</th></tr>
<tr><td>Classification</td><td colspan="7">D. SCRUB</td></tr>
<tr><td>Types Identified</td><td colspan="7">Open scrub D-14</td></tr>
<tr><td>Exclusion Clause</td><td colspan="7">N/A</td></tr>
<tr><td>Effective Slope</td><td>Determined</td><td colspan="2">flat 0 degrees</td><td colspan="2">Applied Range (Method 1)</td><td colspan="2">Upslope or flat 0 degrees</td></tr>
<tr><td>Foliage Cover of Tallest Plant Layer</td><td colspan="2">10-30%</td><td>Shrub/Heath Height</td><td>>2m</td><td>Tree Height</td><td colspan="2">-</td></tr>
<tr><td>Justification Comments</td><td colspan="7">A small area of melaleucas within an isolated patch of vegetation. Tall grasses underneath.</td></tr>
<tr><td colspan="2">Post Development Assumptions:</td><td colspan="6">N/A</td></tr>
<tr><td colspan="8">
</td></tr>
<tr><td colspan="8">PHOTO ID: 5</td></tr>
</table>

<table>
<tr><th colspan="7">VEGETATION AREA 3</th></tr>
<tr><td>Classification</td><td colspan="6">G. GRASSLAND</td></tr>
<tr><td>Types Identified</td><td colspan="6">Tussock grassland G-22   Sown pasture G-26</td></tr>
<tr><td>Exclusion Clause</td><td colspan="6">N/A</td></tr>
<tr><td>Effective Slope</td><td>Determined</td><td>flat 0 degrees</td><td colspan="2">Applied Range (Method 1)</td><td colspan="2">Upslope or flat 0 degrees</td></tr>
<tr><td>Foliage Cover of Tallest Plant Layer</td><td colspan="2">-</td><td>Shrub/Heath Height</td><td><2m</td><td>Tree Height</td><td>-</td></tr>
<tr><td>Justification Comments</td><td colspan="6">Areas of unmanaged grassland with large areas of grassland used for grazing livestock.</td></tr>
<tr><td colspan="2">Post Development Assumptions:</td><td colspan="5">N/A</td></tr>
</table>

PHOTO ID: 6

PHOTO ID: 7

VEGETATION AREA 4	
Exclusion Clause	2.2.3.2 (e) non-vegetated areas and (f) vegetation managed in a minimal fuel condition.
Justification Comments	Excluded areas include those that are permanently non-vegetated such as roads, footpaths, driveways, car parks and buildings. As well as areas of low bushfire threat such as maintained lawns and road verges, patches of gravel or dirt that are to be developed.
Post Development Assumptions:	N/A

PHOTO ID: 8

PHOTO ID: 9

PHOTO ID: 10

PHOTO ID: 11

PHOTO ID: 12

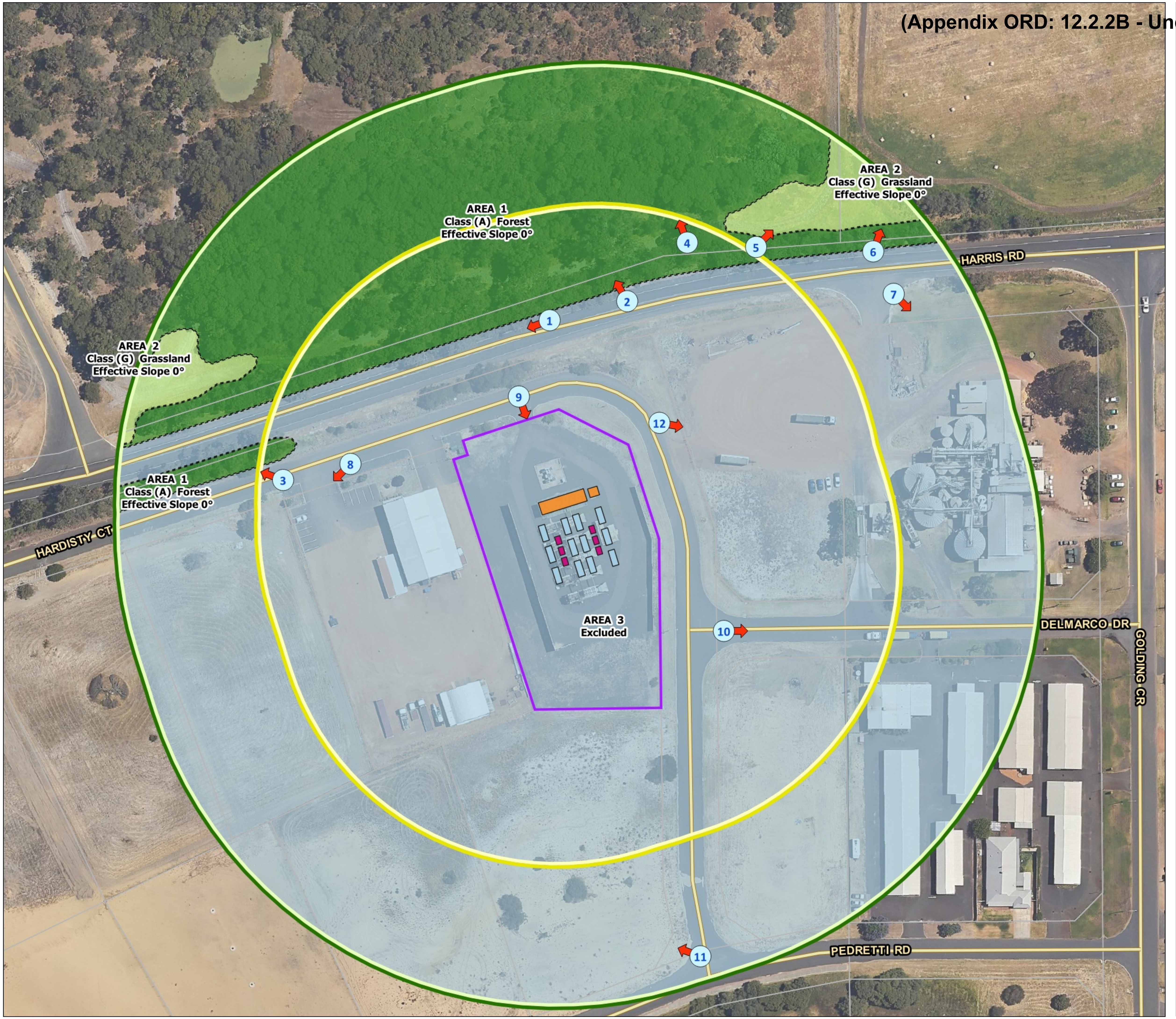
PHOTO ID: 13

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Figure A6.2

Classified Vegetation & Topography (Existing)

Lot 504 on Plan 059719, Area :5740m sq
5 Hardisty Court
PICTON EAST
SHIRE OF DARDANUP



------ LEGEND ------

- Subject Site
- Cadastral
- Legend Entry Photo
- 150m Assessment Area
- 100m Assessment Area

Buildings

- BESS Enclosure
- Control room
- Inverter

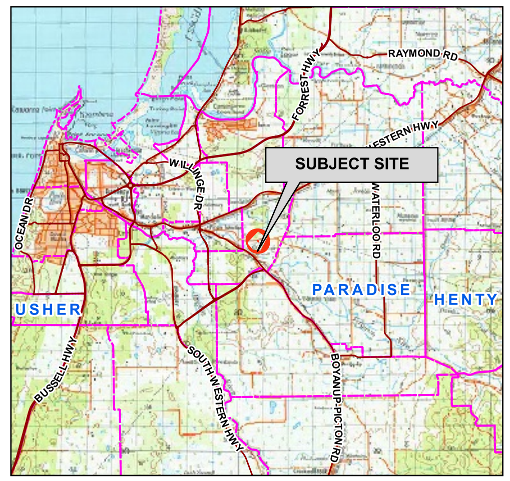
Classified Vegetation

- Class A - Forest
- Class G - Grassland
- Exclusion 2.2.3.2

0 20 40 60 80

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: 29-11-2023
SCALE (A3): 1 : 1250

BUSHFIRE PRONE PLANNING

230997_Fig3_VEG_5 Hardisty Court Picton East.qgz

A6.6 RADIANT HEAT MODELLING – CALCULATION INPUT / OUTPUT DATA

Table A6.6.1: Applied calculation input variables.

SUMMARY OF CALCULATION INPUT VARIABLES APPLIED TO THE DETERMINATION OF SEPARATION DISTANCES CORRESPONDING TO RADIANT HEAT LEVELS [1]												
Applied BAL Determination Method		METHOD 1 - SIMPLIFIED PROCEDURE (AS 3959:2018 CLAUSE 2.2) AND METHOD 2 - DETAILED PROCEDURE (AS 3959:2018 APPENDIX B)										
The Calculation Variables Corresponding to the BAL Determination Method Applied												
Methods 1 and 2		Method 1		Method 2								
Vegetation Classification		FDI	Effective Slope		Site Slope	FFDI or GFDI	Flame Temp.	Elevation of Receiver	Flame Width	Fireline Intensity	Flame Length	Modified View Factor
			Applied Range	Determined								
Area	Class		degree range	degrees	degrees		K	metres	metres	kW/m	metres	% Reduction
1	(A) Forest	80	Upslope or flat 0	flat 0	flat 0	80	1090	Default	Default	Default	Default	Default
2	(D) Scrub	80	Upslope or flat 0	flat 0	Select.	80	1090	Default	Default	Default	Default	Default
3	(G) Grassland	80	Upslope or flat 0	flat 0	Select.	110	1090	Default	Default	Default	Default	Default
4	Excluded cl 2.2.3.2(e & f)	N/A	N/A	-	-	-	-	-	-	-	-	-

Note 1: Where the values are stated as 'default' these are either the values stated in AS 3959:2018, Table B1 or the values calculated as intermediate or final outputs through application of the equations of the AS 3959:2018 BAL determination methodology. They are not values derived by the assessor.

The summary 'printouts' of calculation input and output values for each area of classified vegetation are presented following the tables.

Note 2: Classified in accordance with AS 3959:2018 BAL determination methodology, or an accepted State specific classification and associated fuel loads.

Table A6.6.2: Vegetation separation distances corresponding to the radiant heat levels illustrated as BAL contours in Figure 5.1 (Section 5.1.2)

THE CALCULATED VEGETATION SEPARATION DISTANCES CORRESPONDING TO THE STATED LEVEL OF RADIANT HEAT TRANSFER [1]									
The Bushfire Hazards Vegetation Classification [2]		Separation Distances Corresponding to Stated Level of Radiant Heat (metres)							
		Bushfire Attack Level						Maximum Radiant Heat Flux	
Area	Class	BAL-FZ	BAL-40	BAL-29	BAL-19	BAL12.5	BAL-LOW	10 kW/m^2	2 kW/m^2
1	(A) Forest	<16	16-<21	21-<31	31-<42	42-<100	>100	>48.9	-
2	(D) Scrub	<10	10-<13	13-<19	19-<27	27-<100	>100	>32.9	-
3	(G) Grassland	<6	6-<8	8-<12	12-<17	17-<50	>50	>21.2	-
4	Excluded cl 2.2.3.2(e & f)	-	-	-	-	-	-	-	-

Note 1: All calculation input variables are presented in Table A6.6.1.

Note 2: Classified in accordance with AS 3959:2018 BAL determination methodology, or an accepted State specific classification and associated fuel loads.

SUMMARY CALCULATOR INPUT AND OUTPUT VALUES FOR EACH AREA OF CLASSIFIED VEGETATION

FLAMESOL
FPA AUSTRALIA

Calculated November 30, 2023, 2:06 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	2.4 km/h
Vegetation classification	Forest	Flame length	19.8 m
Understorey fuel load	25 t/ha	Flame angle	52 °, 61 °, 69 °, 73 °, 74 ° & 81 °
Total fuel load	35 t/ha	Elevation of receiver	7.8 m, 8.65 m, 9.24 m, 9.460000000000001 m, 9.51 m & 9.77 m
Vegetation height	n/a	Fire intensity	43,400 kW/m
Effective slope	0 °	Transmissivity	0.863, 0.841, 0.8110000000000001, 0.786, 0.773 & 0.716
Site slope	0 °	Viewfactor	0.6085, 0.4531, 0.3066, 0.2086, 0.1696 & 0.0458
Flame width	100 m	Minimum distance to < 40 kW/m²	16.1 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	21.5 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	30.6 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	41.9 m
		Minimum distance to < 10 kW/m²	48.9 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980
Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

FLAMESOL
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Calculated November 30, 2023, 2:07 pm (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	80	Rate of spread	4.16 km/h
Vegetation classification	Scrub	Flame length	11.62 m
Understorey fuel load	25 t/ha	Flame angle	53 °, 63 °, 72 °, 76 °, 78 ° & 83 °
Total fuel load	25 t/ha	Elevation of receiver	4.64 m, 5.18 m, 5.52 m, 5.64 m, 5.68 m & 5.77 m
Vegetation height	m	Fire intensity	53,815 kW/m
Effective slope	0 °	Transmissivity	0.878, 0.862, 0.838, 0.8139999999999999, 0.8 & 0.735
Site slope	0 °	Viewfactor	0.5988, 0.4419, 0.2962, 0.2016, 0.1638 & 0.0446
Flame width	100 m	Minimum distance to < 40 kW/m²	9.6 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	13 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	19.3 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	27.5 m
		Minimum distance to < 10 kW/m²	32.9 m

Rate of Spread - Catchpole et al. 1998
Flame length - Byram, 1959
Elevation of receiver - Douglas & Tan, 2005
Flame angle - Douglas & Tan, 2005
Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Calculated January 24, 2024, 11:48 am (MDc v.4.9)

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Understorey fuel load	4.5 t/ha	Flame angle	54 °, 64 °, 73 °, 78 °, 80 ° & 85 °
Total fuel load	4.5 t/ha	Elevation of receiver	2.78 m, 3.08 m, 3.28 m, 3.36 m, 3.38 m & 3.42 m
Vegetation height	n/a	Fire intensity	33,247 kW/m
Effective slope	0 °	Transmissivity	0.887, 0.877, 0.861, 0.841, 0.829 & 0.755
Site slope	0 °	Viewfactor	0.5823, 0.4291, 0.29, 0.1946, 0.158 & 0.0434
Flame width	100 m	Minimum distance to < 40 kW/m²	5.8 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	7.9 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	11.7 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	17.3 m
		Minimum distance to < 10 kW/m²	21.2 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

GLOSSARY

APPLIED TERMINOLOGY	
Consequence	The outcome of an event or situation expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. In the emergency risk management context, consequences are generally described as the effects on persons, society, the environment and the economy. *(Source: DPLH 2019)* An impact on the natural, economic, built or social environments as a result of the hazard. The consequences are influenced by the vulnerability of elements at risk, by the exposure of elements at risk to the hazard, and by the characteristics of the hazard. *(Source: PIA, 2015)*. The outcome of an event that affects objectives. Can be a range of consequences; can be certain or uncertain; can have positive or negative effects; can be expressed qualitatively or quantitatively; can escalate through knock-on effects. *(Source: ISO Guide 73:2009)*
Controls	A measure that maintains and/or modifies risk. Controls include, but are not limited to, any process, policy, device, practice, or other conditions and/or actions which maintain and/or modify risk. *(Source: AIDR Knowledge Hub; Glossary)* A control is any measure or action that modifies or regulates risk. Controls include any policy, procedure, practice, process, technology, technique, method, or device that modifies or regulates risk. Risk treatments become controls, or modify existing controls, once they are implemented. *(Source: Praxiom)* *Note: 'Protection Measures' and 'Risk Treatments' will be alternative terms used in this risk assessment report.*
Decision Maker	The Minister for Planning, State Administrative Tribunal, Western Australian Planning Commission, Development Assessment Panel, any other State decision-making authorities, and/or the relevant local government and their delegates that make decisions regarding the application of this Policy. *(Source: SPP 3.7)* For proposed development or use that is not subject to planning approval, the relevant decision makers are those tasked with the development and management of a development or use. Typically this might be an existing development/use for which an improved bushfire performance is being sought.
Elements At Risk	The population, buildings and civil engineering works economic activities, public services and infrastructure, etc. exposed to hazards. (Australian Institute for Disaster Resilience, 2019)
Exposure	Refers to the people and things in the path of potential hazards. *(Source: AIDR* LUPDRC, *2020)* The elements within a given area that have been, or could be, subject to the impact of a particular hazard. Bushfire exposure can refer to property that may be endangered by a fire burning in another structure or by a bushfire. *(Source: AIDR Knowledge Hub; Glossary)* The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard prone areas. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest. *(Source: UNDRR, 2017)*

Hazard	A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption or environmental degradation. Hazards may be natural, anthropogenic or socionatural in origin. • **Natural hazards** are predominantly associated with natural processes and phenomena (note: disasters often follow natural hazards, but there is no such thing a natural disaster); • **Anthropogenic hazards** are human-induced – being induced entirely or predominantly by human activities and choices; • **Socionatural hazards** are associated with a combination of natural and anthropogenic factors, including environmental degradation and climate change. Hazards may be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity or magnitude, frequency and probability. *(Source: UNDRR Terminology 2017)* A source of potential harm or a situation with a potential to cause loss. A potential or existing condition that may cause harm to people, or damage to property or the environment. A source of risk. *(Source: AIDR Knowledge Hub; Glossary)*
Hazardous Event	The manifestation of a hazard in a particular place during a particular period of time. [Severe hazardous events can lead to a disaster as a result of the combination of hazard occurrence and other risk factors.] (Source: *United Nations Office for Disaster Risk Reduction, 2017)*
Hazard Identification	The process of recognising that a hazard exists and defining its characteristics. *(Australian Institute for Disaster Resilience, 2019)*
Hazard - Bushfire	A fuel complex, defined by amount, type condition, arrangement, and location, that determines the degree of hazard. *(Source: AIDR Knowledge Hub; Glossary)* The term 'bushfire hazard' in this assessment report is intended to refer to both bushfire prone vegetation and the associated potential bushfire event itself. The term 'bushfire' is being applied as the common term for forest, scrub, shrub, and grass fire events.
Hazard - Urban Fire	1. Susceptibility of a material to burn. 2. The presence of combustible materials. 3. A process or activity posing a fire risk if not adequately controlled. *(Source: AIDR Knowledge Hub; Glossary)*
Hazardous Material	A substance or material which has been determined by an appropriate authority to be capable of posing an unreasonable risk to health, safety and property. *(Source: AIDR Knowledge Hub; Glossary)*
Impact	Describes as a quantitative or qualitative measure, the relative potential ability of a threat to adversely affect an exposed element or of a protection measure to reduce threat, exposure or vulnerability levels and consequently, risk levels.
Likelihood	Chance of something happening. The likelihood level reflects the probability of **both the emergency event and the estimated consequences** occurring as a result of the event. *(Source: AIDR NERAG, 2020)* In risk management terminology, the word 'likelihood' is used to refer to the chance of something happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically - such as a probability or a frequency over a given time period. *(Source: ISO Guide 73:2009)*

	The chance of an event occurring. Likelihood may be represented as a statistical probability (such as Annual Exceedance Probability), or where this is not possible, it can be represented qualitatively using such measures as 'likely', 'possible', and 'rare'. *(Source: PIA, 2015)*.
Mitigation	The lessening or minimizing of the adverse impacts of a hazardous event. The adverse impacts of hazards, in particular natural hazards, often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures include engineering techniques and hazard-resistant construction as well as improved environmental and social policies and public awareness. *(Source: UNDRR, 2017)*
Reliability	Refers to the expected reliability of a designed solution (protection measure). Over time it will be a function of: • Its Initial likely reliability; • Its durability which may or may not be a function of maintenance; • The level of maintenance required; • The likelihood of solution being modified over time; and • The influence of other adjoining/adjacent structures or stored materials that may be installed after the initial construction. (Adapted from Kelly M. et al; *Structural Design Options for Residential Buildings in Bushfire Areas,* Australasian Structural Engineering Conference November 2016)
Resilience	The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management. (*United Nations Office for Disaster Risk Reduction, 2017)* Is that property of a building, system, or community that facilitates its return to a functional state following an overload. In the context of bushfire damage, resilience will be maximised when: • There is a high probability of an attacked building remaining fit for purpose; and • There is a low time and cost to make badly damaged buildings fit for purpose. (Adapted from Kelly M. et al; *Structural Design Options for Residential Buildings in Bushfire Areas,* Australasian Structural Engineering Conference November 2016)
Robustness	Refers to that property of structural systems that seeks to achieve proportionality of damage to the severity of an overloading event. It will be maximised when bushfire design solutions: • Have few 'weak links' that allow progressive spread of damage from minor sources; • Consist of materials and assemblies that retain physical properties when thermally loaded beyond their design capacity; and • Include protection of inherently vulnerable and brittle elements. Such as openings to internal parts of structures (including doors and windows) and essential services that maintain required functioning (e.g. cabling and plumbing). (Adapted from Kelly M. et al; *Structural Design Options for Residential Buildings in Bushfire Areas,* Australasian Structural Engineering Conference November 2016) As a design principle it means that the design and materials are not easily damaged or compromised, and do not require manual operation or intervention to work (Source: State Government of Queensland, CSIRO, 2020)

Redundancy	Refers to design that ensures the fate of the subject building/structure is not reliant on the effective performance of a single element. (State Government of Queensland, CSIRO, 2020) An example is a roof system that does not rely solely on the roof cladding to resist bushfire threats. It has additional layers of resistance including non-combustible roof/ceiling framing, insulation and ceiling lining, and the sealing/screening of gaps into internal operating spaces.
Risk	Disaster risk is the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity. *(Source: UNDRR, 2017)* Disaster risk is a product of a hazard (a sudden event or shock), exposure (the people and things in the path of potential hazards), vulnerability (the potential for those people and things to be adversely impacted by a hazard) and the capacity (the ability for those people and assets and systems to survive and adapt). *(Source: AIDR LUPDRC, 2020)* Risk is the chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood. In emergency management it is a concept used to describe the likelihood of harmful consequences arising from the interaction of hazards, communities and the environment. *(Source: PIA, 2015)*
Risk Management	Disaster risk management is the application of disaster risk reduction policies and strategies to prevent new disaster risk, reduce existing disaster risk and manage residual risk, contributing to the strengthening of resilience and reduction of disaster losses. *(Source: UNDRR, 2017)* Coordinated activities of an organisation or a government to direct and control risk. The risk management process includes the activities of: • Communication and consultation; • Establishing the context; • Risk Assessment (risk identification, risk analysis, risk evaluation); • Risk Treatment; and • Monitoring and Review. *(Source: AIDR NERAG, 2020)* **Risk management vs. risk mitigation:** Though risk management and risk mitigation are often used interchangeably, the two terms refer to slightly different things. Risk mitigation involves limiting the effect that risks can have (i.e. making less severe). It is a single component of the larger risk management process. Risk management refers to the overall practice of assessing and addressing the relevant risk. (*an explanation of the use of these terms as applied by Bushfire Prone Planning*)
Risk Identification	Process of finding, recognising and describing sources of risks, their causes and their potential consequences. *(Source: ISO Guide 73:2009)* It is a process used to find, recognise, and describe the risks that could affect the achievement of objectives. *(Source: Praxiom)*
Risk Source	An element which, alone or in combination, has the intrinsic potential to give rise to risk. *(Source: ISO Guide 73:2009)*
Risk Assessment	Disaster risk assessment is a qualitative or quantitative approach to determine the nature and extent of disaster risk by analysing potential hazards and evaluating existing conditions of exposure and vulnerability that together could harm people property, services and livelihoods and the environment on which they depend. Assessments include the identification of hazards; a review of the technical characteristics of hazards such as their location, intensity, frequency, and probability; the analysis of exposure and

	vulnerability, including the physical, social, health, environmental and economic dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities with respect to likely risk scenarios. *(Source: UNDRR, 2017)* The overall process of risk identification, risk analysis and risk evaluation. *(Source: ISO Guide 73:2009)*
Risk Analysis	The process to comprehend the nature of risk and determine the level of risk. Provides the basis for risk evaluation and decisions about risk treatment. *(Source: ISO Guide 73:2009)* Is a process that is used to understand the nature, sources, and causes of the risks that you have identified and to estimate the level of risk. It is also used to study impacts and consequences and to examine the controls that currently exist. How detailed your risk analysis ought to be will depend upon the risk, the purpose of the analysis, the information you have, and the resources available. *(Source: Praxiom)* In this risk assessment report, risk analysis is the part of the risk assessment process that assesses the hazard threat levels, identifies the protection measures (and their effectiveness) that can be applied and derives the levels of exposure and vulnerability of the identified elements at risk, based on the ability to apply protection measures. From this information indicative risk levels can be derived. Where relevant sets of risk factor criteria and a risk level matrix have been established by the relevant authorities, a determined risk level can be derived. The required risk level analysis can be conducted for either each exposed element separately and/or the proposed or existing development/use overall.
Risk Evaluation	The process used to determine risk management priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels or other criteria. *(Source: PIA, 2015)* In this risk assessment report, it is the process of classifying the acceptability of the levels of risk, derived from the risk analysis, by reference to an established risk tolerance scale. The relevant tolerance scale will be that derived from the application of the 'as low as reasonably practicable' principle – 'ALARP' (refer to Appendix 1 for further information). This process can only be conducted when <u>determined</u> risk levels have been derived.
Risk Factor Criteria	In this risk assessment report, the risk factor criteria establish the parameters that will define the different hazard threat levels, the different levels of exposure of elements at risk and the different levels of vulnerability of elements at risk. Different sets of risk factor criteria can exist corresponding to different development types, uses and scale. They are applied as part of the risk analysis. These criteria are established by the relevant authorities as they must reflect societies preparedness to tolerate risk and be determined by those authorities exercising their responsibilities.
Risk Level Matrix	In this risk assessment report, the risk level matrix establishes how the assessed levels of hazard threats, exposure and vulnerability are to be analysed in deriving a determined risk level. It is applied as part of the risk analysis. The matrix is established by the relevant authorities as they must reflect societies preparedness to tolerate risk and be determined by those authorities exercising their responsibilities.
Risk Tolerance Scale	In this risk assessment report the applied risk tolerance scale defines the acceptability of determined risk levels based on the 'as low as reasonably practical' principle (ALARP). The risk tolerance scale can be applied within the risk assessment report when the required risk factor criteria and risk level matrix are available.

Risk - Inherent	In this risk assessment report, inherent risk is considered to be current risk after accounting for existing and any 'planned' protection measures (controls / risk treatments) but before the application of any additional protection measures that have been identified and recommended by the bushfire consultant – and which subsequently determines the residual risk (this approach is supported by the relevant information sourced from the two references below). 'Planned' protection measures are those that are incorporated into the site development plans and those that exist in an approved Bushfire Management Plan (BMP) and/or Bushfire Emergency Plan (BEP) and for which a responsibility for their implementation has been created. If a BMP or BEP is yet to be developed or is being developed concurrently, the additional protection measures it contains (including any that are part of relevant 'acceptable solutions' established by the 'Guidelines for planning in bushfire prone areas', DPLH as amended), are considered to be additionally recommended protection measures. ***1. Source: www.fairinstitute.org*** *"Confusion exists between Inherent Risk and Residual Risk … Here are the standard definitions of the two concepts:* • *Inherent risk represents the amount of risk that exists in the absence of controls.* • *Residual risk is the amount of risk that remains after controls are accounted for.* *Sounds straightforward. But these two terms seem to fall apart when put into practice. Applying the above definitions to the clients' scenario uncovered the fact that the 'inherent' risk being described was not a 'no controls' environment, but rather, one that only excluded some controls.* *The flaw with inherent risk is that in most cases, when used in practice, it does not explicitly consider which controls are being included or excluded. A truly inherent risk state, in our example, would assume no employee background checks or interviews are conducted and that no locks exist on any doors. This could lead to almost any risk scenario being evaluated as inherently high. Treating inherent risk therefore can be quite arbitrary. According to Jack Jones, author of Measuring and Managing Information Risk: A FAIR Approach and creator of the FAIR model, much more realistic and useful definitions would be:* • *Inherent risk is current risk level given the existing set of controls rather than the hypothetical notion of an absence of any controls; and* • *Residual risk would then be whatever risk level remain after additional controls are applied."* ***2. Source: Wikipedia:*** *Inherent risk, in risk management is:* • *an assessed level of raw or untreated risk; that is, the natural level of risk inherent in a process or activity without doing anything to reduce the likelihood or mitigate the severity of a mishap, or the amount of risk before the application of the risk reduction effects of controls; or* • *Another definition is that inherent risk is the current risk level given the existing set of controls, which may be incomplete or less than ideal, rather than an absence of any controls.*
Risk - Residual	In this risk assessment report, residual risk is that which remains after the application of protection measures that are additional to those that already exist or are 'planned' and that establish the inherent risk (see Risk – Inherent in glossary) It is the disaster risk that remains in unmanaged form, even when effective disaster risk reduction measures are in place, and for which emergency response and recovery

	capacities must be maintained. The presence of residual risk implies a continuing need to develop and support effective capacities for emergency services, preparedness, response and recovery, together with socioeconomic policies such as safety nets and risk transfer mechanisms, as part of a holistic approach. *(Source: UNDRR, 2017)* It is the risk left over after you've implemented a risk treatment option. It's the risk remaining after you've reduced the risk, removed the source of the risk, modified the consequences, changed the probabilities, transferred the risk, or retained the risk. *(Source: Praxiom)* It is the risk remaining after any risk treatment has been applied to reduce its potential likelihood and/or its potential consequences. Residual risk can also be any risk that is chosen to be retained rather than treated *(Source: AIDR* LUPDRC*, 2020)* Residual risk can contain unidentified risk. Residual risk can also be known as retained risk. *(Source: ISO Guide 73:2009)*
Risk Level - Determined	Magnitude of a risk or a combination of risks. In this risk assessment report, as an outcome of the risk analysis, a determined risk level is derived from: 1. The determination of threat, exposure and vulnerability levels by reference to an established set of risk factor criteria that corresponds to each risk level (for each factor); and 2. The determination of the risk level by reference to an established risk level matrix that incorporates threat, exposure and vulnerability levels.
Risk Level - Indicative	Magnitude of a risk or a combination of risks. In this risk assessment report, as an outcome of the risk analysis, an indicative risk level is derived from analysis of the number of bushfire protection measures able to be implemented compared to the number of measures available, and the relative effectiveness of each at reducing threat, exposure and/or vulnerability levels. Overall, more applicable and applied measures is better and the measures with a higher effectiveness rating have greater weighting in the analysis.
Risk - Acceptable	Risks that do not need further treatment. The expression acceptable level of risk refers to the level at which it is decided that further restricting or otherwise altering the activity is not worthwhile e.g. additional effort will not result in significant reductions in risk levels. *(Source: DPLH, 2019)* That level of risk that is sufficiently low that society is comfortable with it. Society does not generally consider expenditure in further reducing such risks justifiable. *(Source: AIDR Knowledge Hub)* An acceptable risk is a risk that is sufficiently low to require no new treatments or actions to reduce the risk as communities can live with this level of risk without further action. *(Source: Queensland Government 2019: Natural hazards, risk and resilience – Bushfire: State Planning Policy – state interest guidance material)* Acceptable risk or tolerable risk is an important sub-term (of disaster risk). The extent to which a disaster risk is deemed acceptable or tolerable depends on existing social, economic, political, cultural, technical and environmental conditions. *(Source: UNDRR, 2017)* ***Note:*** *It is generally accepted that nothing can be absolutely free of risk, everything under some circumstance can cause harm. There are differing levels of risk and consequently levels of safety. In practice, attaining zero risk is not possible. Nevertheless, after risk avoidance, reduction/mitigation, transfer or acceptance - the residual risk may be determined as acceptable, as judged by the participants in an activity and decision makers (who apply societies expectations). For certain land uses, the residual risk may exist at higher levels but still be judged by to be acceptable (or tolerable) on this basis.*

Risk - Tolerable	The willingness to live with a risk to secure benefits and achieve objectives, on the understanding that it is being properly controlled. 'Tolerability' does not mean 'acceptability'. Tolerating a risk does not mean that it is regarded as negligible, or something we may ignore, but rather as something that needs to be kept under review and reduced further. *(Source: DPLH, Guidelines v1.4)* Certain levels of risk may be tolerated, provided that the risks are known and managed. *(Source: AIDR LUPDRC, 2020)* A tolerable risk is a risk that is low enough to allow the exposure to a natural hazard to continue while at the same time high enough to require new treatments or actions to reduce risk. Communities can live with level of risk but as much as is reasonably practical should be done to further reduce the risk. *(Source: Queensland Government 2019: Natural hazards, risk and resilience – Bushfire: State Planning Policy – state interest guidance material)* Risk tolerance is defined as the organisations or stakeholder's readiness to bear the risk, after risk treatment, in order to achieve its objectives. Risk tolerance can be influenced by legal or regulatory requirements. *(Source: ISO Guide 73:2009)* A level of risk that defines the ALARP region, as risks that should be driven to the broadly acceptable region. *(Source: PIA, 2015)*
Risk - Intolerable	A level of risk that is so high that require risk treatment measures whatever their cost, or the elimination of the risk. *(Source: PIA, 2015)* Risk that is unacceptable in any circumstances or at any level. *(Source: DPLH, 2019)*
Risk Treatment	Risk treatment options available as part of the risk management process are generally categorised as follows: • Risk Avoidance: Measures taken to avoid risks from natural hazards. Can include avoiding development in hazardous areas, relocating people or assets away from hazardous areas, or developing buffer zones to the hazard; • Risk reduction/mitigation: Measures undertaken to reduce the risks from natural hazards. Includes building control and development controls; • Risk Transfer: Measures taken to transfer the risk from natural hazards from one party to another; and • Risk Acceptance: The acceptance of risk from a natural hazard. Any realised losses will be borne by those parties exposed to the hazard. This is not specifically a treatment option as no action is taken, but it is an option for addressing risk. *(Source: AIDR LUPDRC, 2020)*
Retrofitting	Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards. Retrofitting requires consideration of the design and function of the structure, the stresses that the structure may be subject to from particular hazards or hazard scenarios and the practicality and costs of different retrofitting options. *(Source: UNDRR, 2017)*
Structural and Non-Structural Measures	Structural measures are any physical construction to reduce or avoid possible impacts of hazards, or the application of engineering techniques or technology to achieve hazard resistance and resilience in structures or systems. Non-structural measures are measures not involving physical construction which use knowledge, practice or agreement to reduce disaster risks and impacts, in particular through policies and laws, public awareness raising, training and education.

	Common non-structural measures include building codes, land-use planning laws and their enforcement, research and assessment, information resources and public awareness programmes. *(Source: UNDRR, 2017)*
Threats	The mechanisms by which hazards can impact exposed elements.
Vulnerability	The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards. (*United Nations Office for Disaster Risk Reduction, 2017)* The characteristic or property of a community, system or object that makes it susceptible to the damaging effects of a specific hazard. Can be defined according to the responses of people, houses and assets in mitigating the impacts of a hazard. Specifically, it refers to the extent to which a community, building, services or location is likely to be damaged or disrupted by the impacts of a hazard, such as a bushfire. Building vulnerability refers to weak points in a building caused by its design, construction, use of materials and management (including maintenance). These weak points are identified in the context that they are not able to withstand the level of hazard they are exposed to. Climate and weather may directly influence the buildings vulnerability through several processes including (i) moisture content of combustible elements around and within buildings (ii) gaps between materials that may shrink and expand due to changes in moisture content and temperature (iii) wind action causing damage or dislocation of elements. *(Source: State Government of Queensland, CSIRO, 2020; Bushfire Resilient Building Guidance for Queensland Homes)*
'Vulnerable' Persons	These are persons who are considered to be at-risk members of the community and may be more susceptible to the impacts of bushfire. These persons are likely to present relocation (including evacuation) challenges in the event of a bushfire. Attributes of this group of persons includes: • Less physically or mentally able to relocate themselves; and/or • Are unfamiliar with their surroundings; and/or • Large numbers of persons in a building(s) or in the open, on a single site, such that the numbers present practical challenges.

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(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Appendix E

Acoustics Assessment

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Environmental Noise Assessment - Solar Peaking Power Station

Lot 504 (#5) Hardisty Court, Picton East

Reference: 23108451-01

Prepared for:
Tesla Corporation

Reference: 23108451-01

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Date	Rev	Description	Author	Verified
19-Dec-23	0	Issued to Client	Matt Nolan	Terry George

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1. INTRODUCTION

Lloyd George Acoustics was engaged by Tesla Corporation to undertake an environmental noise assessment for a proposed solar peaking power station (proposed facility) that will replace an existing peaking power station (existing facility). The proposed facility will be located at Lot 504 (#5) Hardisty Court, Picton East - refer *Figure 1-1*. The proposed facility will consist of 12 Battery Energy Storage System (BESS) Enclosures, 4 Inverters and 2 Transformers, and will operate as required, on any day between 7.00am and 9.00pm.

GHD has previously completed an Acoustic Assessment (*GHD Report Number 12599664*) of a site with similar operations to the proposed facility. As detailed within the GHD Report, the proposed BESS fans will operate at a normal operating speed for the majority of the time, with speeds up to 80% of the maximum speed expected occasionally to allow for additional cooling during very hot days in summer. Fan speeds of 100% are considered highly unlikely and therefore have not been included within this assessment. A site plan is attached in *Appendix A*.

Figure 1-1: Subject Site Location (Source: DPLH PlanWA)

With regard to noise emissions, consideration is given to noise from the proposed BESS fans, inverter fans and transformers at neighbouring properties, against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

Appendix D contains a description of some of the terminology used throughout this report.

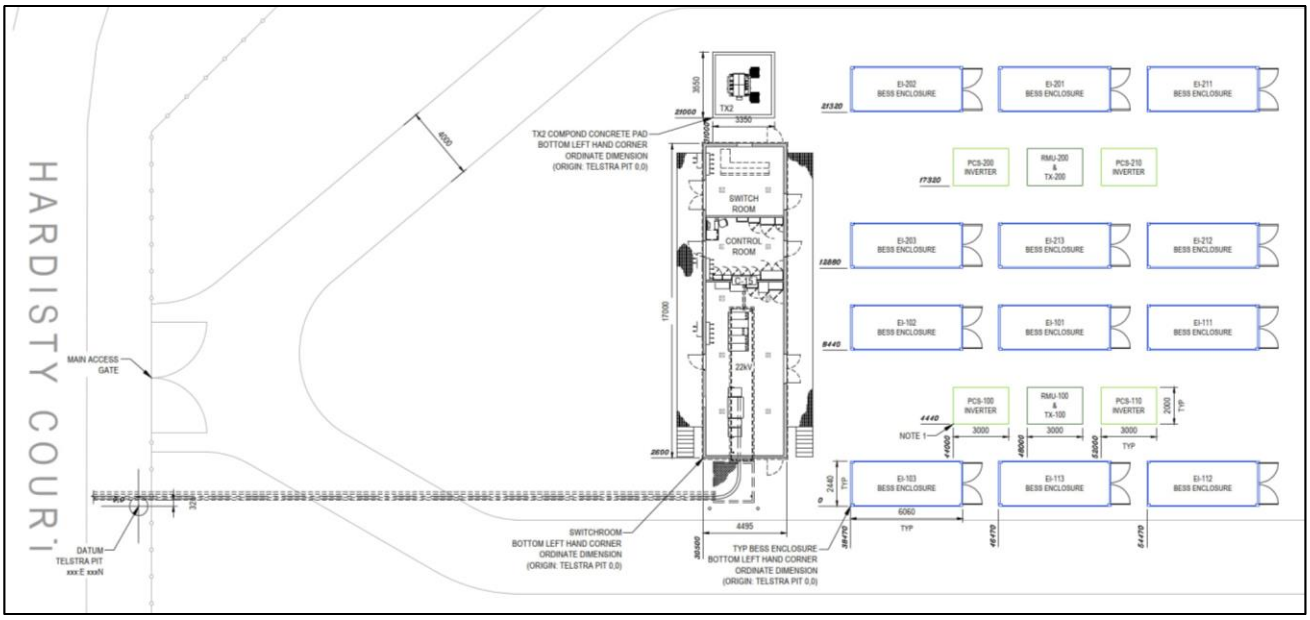

Figure 1-2: Subject Site Plan

2. CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations) as follows:

"7. Prescribed standard for noise emissions

(1) Noise emitted from any premises or public place when received at other premises –

(a) must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and

(b) must be free of –

(i) tonality; and

(ii) impulsiveness; and

(iii) modulation,

when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix C*). Under regulation 9(3), *"Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation if -*

(a) the characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and

(b) the noise emission complies with the standard prescribed under regulation 7(1)(a) after the adjustments in the table [Table 2-1] … are made to the noise emission as measured at the point of reception."

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music*			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2 Baseline Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

1. ***highly sensitive area*** means that area (if any) of noise sensitive premises comprising —
   (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
   (b) any other part of the premises within 15 metres of that building or that part of the building.

The influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as between 0-5 dB, as determined in *Appendix B*. *Table 2-3* shows the assigned levels including the influencing factor and transport factor at the receiving locations.

Table 2-3 Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
0 dB IF 96 Martin-Pelusey Rd Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45	55	65
	0900 to 1900 hours Sunday and public holidays (Sunday)	40	50	65
	1900 to 2200 hours all days (Evening)	40	50	55
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35	45	55
+1 dB IF 334 Harris Rd Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	46	56	66
	0900 to 1900 hours Sunday and public holidays (Sunday)	41	51	66
	1900 to 2200 hours all days (Evening)	41	51	56
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	36	46	56
+4 dB IF 275 Martin-Pelusey Rd Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	49	59	69
	0900 to 1900 hours Sunday and public holidays (Sunday)	44	54	69
	1900 to 2200 hours all days (Evening)	44	54	59
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	39	49	59

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
+5 dB IF 158 Harris Rd Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	50	60	70
	0900 to 1900 hours Sunday and public holidays (Sunday)	45	55	70
	1900 to 2200 hours all days (Evening)	45	55	60
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	40	50	60
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

The assigned levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as *"a period of time of not less than 15 minutes, and not exceeding 4 hours, determined by* an *inspector* or *authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission"*. An inspector or authorised person is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Water Environmental Regulation. Acoustic consultants or other environmental consultants are not appointed as an inspector or authorised person. Therefore, whilst this assessment is based on a 4-hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

3. NOISE MODELLING METHODOLOGY

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 8.2* with the CONCAWE (ISO 17534-3 improved method) selected, as they include the influence of meteorological conditions. Input data required in the model are listed below and discussed in *Section 3.1* to *Section 3.4*:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1. Meteorological Conditions

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1: Modelling Meteorological Conditions

Parameter	Day (7.00am to 7.00pm)[2]	Night (7.00pm to 7.00am)[2]
Temperature (°C)	20	15
Humidity (%)	50	50
Wind Speed (m/s)	4	3
Wind Direction[1]	All	All
Pasquil Stability Factor	E	F

Notes:
1. The modelling package allows for all wind directions to be modelled simultaneously.
2. The conditions above are as defined in *Guideline: Assessment of Environmental Noise Emissions*; May 2021

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.2. Topographical Data

Topographical data was adapted from publicly available information (e.g. *Google*) in the form of spot heights. Flat ground has been assumed for the site itself. The site buildings have been included in the model, including the BESS enclosures themselves, as these can provide barrier attenuation when located between a source and receiver, much the same as a hill. Receivers are modelled 1.5m above ground level.

There is an existing noise wall on the east and west side of the existing facility that is assumed to be 3 metres high. This noise wall has also been included when modelling the proposed facility.

Figure 3-1 shows a 2D overview of the noise model, with *Figure 3-2* showing the nearest residential receivers included in the model.

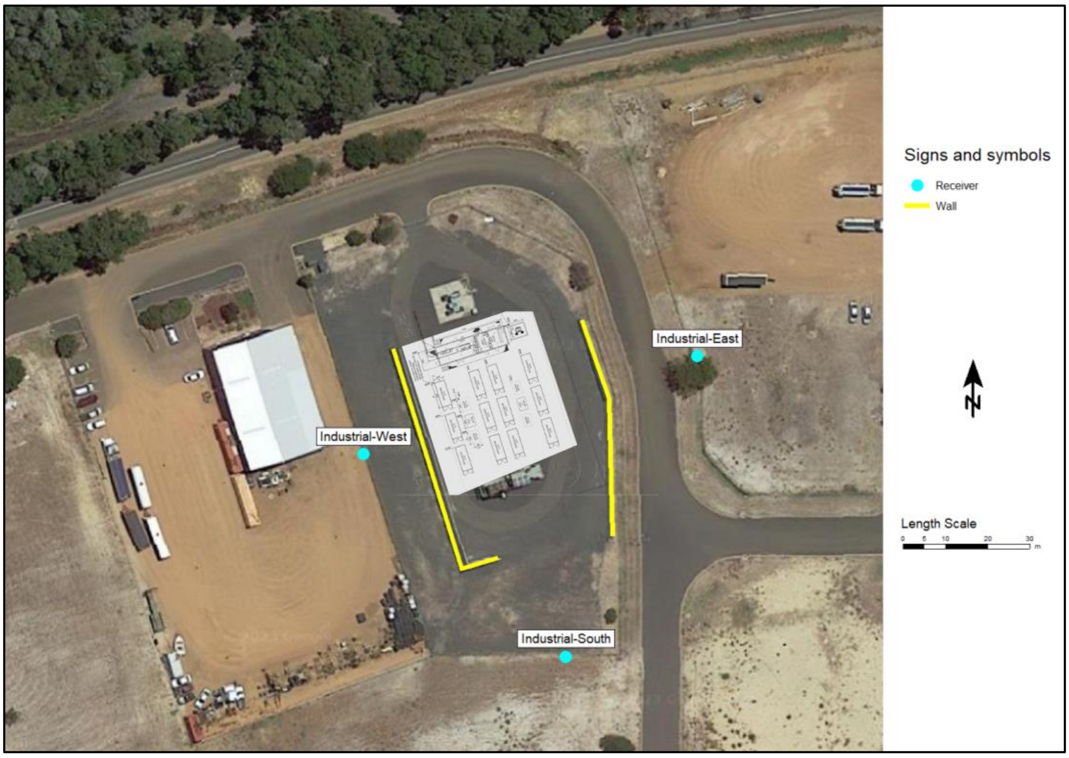

Figure 3-1: Overview of Nearfield Noise Model

Figure 3-2: Overview of Nearest Residences

3.3. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the site and surrounding industrial areas, and 1 (100%) elsewhere as it is predominantly paddocks and forest, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

3.4. Source Sound Levels

The source sound power levels from each side of the BESS, inverter and transformer were derived from the GHD Report and are provided in *Table 3-2*. The source levels from the GHD Report are provided in *Appendix C.*

Table 3-2: Source Sound Power Levels, dB(A)

Description	A-Weighted Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
BESS at normal operating fan speed, each side	83	80	82	84	83	78	73	66	**86**
BESS at 80% fan speed, each side	89	87	89	92	90	86	81	74	**94**
Inverter at 80% fan speed, each side	88	87	88	89	83	80	77	74	**90**
Auxiliary Transformer, each side	67	69	64	64	58	53	48	41	**64**

The following is noted in relation to *Table 3-2*:

- A height of 2.5 metres has been assumed for the equipment at the proposed facility.
- During normal operations, an L_{10} parameter has been used as these operations are predicted to occur for more than 24-minutes in a 4-hour period. An L_1 parameter has been used for the worst case noise levels as the Tesla Corporation have indicated that this speed will occur for less than 24-minutes in any 4-hour period.
- A constant 80% fan speed for the inverters has been assumed for both normal and worst case operations as limited details were provided within the GHD report.

4. RESULTS & ASSESSMENT

The noise levels were predicted for the following scenarios:

- Normal Operations (L_{A10}) – BESS fans operating at normal operating speeds, inverter fans operating at 80% of maximum fan speed.
- Worst Case Operations (L_{A1}) – BESS and inverter fans operating at 80% of maximum fan speed during the day period only.

4.1. Normal Operations

The results of the normal operations are shown in *Table 4-1*, with the noise contours provided in *Figure 4-1* for the near-field area. The critical assigned level is during the night period for the residences, as the normal operations of the proposed facility may occur between 7.00am and 9.00am on a Sunday. The assessment is undertaken as an L_{10} parameter as these operations will occur for more than 24-minutes in a 4-hour period, being the maximum representative assessment period of the *Regulations*. An adjustment of + 5 dB is included for tonality, since this may be present.

Table 4-1: Normal Operations - Predicted Noise Levels and Assessment, dB L_{A10}

Receiver	Total	Total Adjusted	Assigned Level	Assessment
Industrial Boundary East*	60	65	**65**	*Complies*
Industrial Boundary South	63	68	**65**	*+3 dB*
Industrial Boundary West*	59	64	**65**	*Complies*
96 Martin-Pelusey Rd	24	29	**35**	*Complies*
158 Harris Rd	31	36	**36**	*Complies*
275 Martin-Pelusey Rd	37	42	**39**	*+3 dB*
334 Harris Rd	39	44	**40**	*+4 dB*

*The highest noise level from predictions at multiple receivers were used in the assessment

The predicted noise levels show that the neighbouring industrial boundary to the south is 3 dB above the assigned level during normal operations of the proposed facility. The predicted noise levels at two of the nearest residences are also shown to exceed the criteria during normal operations of the proposed facility between 7.00am and 9.00am on a Sunday. Compliance is achieved at all nearby residences during all other periods as the assigned level is 5 to 10 dB higher.

If the noise levels from the proposed facility were contributing to an exceedance at a nearby residence (within 5 dB of the assigned level), it is likely that the tonality would not be audible. Therefore, achieving a noise level 5 dB below the assigned level (while the +5 dB tonal penalty is also included) is not considered applicable.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Figure 4-1 Normal Operations Noise Contour Plot (1.5m AGL), dB L_{A10}

Predicted Noise level

= 50
= 55
= 60
= 65
= 70

Legend

Wall

N

Scale 1:700

0 4.5 9 18 27 m

Project No: 23108451
Consultant: MN
Date: 19/12/2023
Algorithm: ISO 9613
SoundPLAN Version: 8.2

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4.2. Worst Case Operations

The results of the worst case operations (when the BESS and inverter fans speeds are operating at 80% of the maximum speed) are shown in *Table 4-2*, with the noise contours provided in *Figure 4-2* for the near-field area. The critical assigned level is during the day period on a Sunday, as these worst case operations are predicted to only occur during very hot days in summer. The assessment is undertaken as an L_1 parameter as the Tesla Corporation have indicated that these operations will occur for less than 24-minutes in any 4-hour period, being the maximum representative assessment period of the *Regulations*. An adjustment of + 5 dB is included for tonality, since this may be present.

Table 4-2: Worst Case Operations - Predicted Noise Levels and Assessment, dB L_{A1}

Receiver	Total	Total Adjusted	Assigned Level	Assessment
Industrial Boundary East*	66	71	**80**	*Complies*
Industrial Boundary South	69	74	**80**	*Complies*
Industrial Boundary West*	65	70	**80**	*Complies*
96 Martin-Pelusey Rd	31	36	**50**	*Complies*
158 Harris Rd	37	42	**51**	*Complies*
275 Martin-Pelusey Rd	43	48	**54**	*Complies*
334 Harris Rd	45	50	**55**	*Complies*

*The highest noise level from predictions at multiple receivers were used in the assessment

The predicted noise levels show that the neighbouring industrial boundaries and nearby residences are compliant with the assigned levels.

(Appendix ORD: 12.2.2B - Under Separate E-Cover)

Figure 4-2 Worst Case Operations Noise Contour Plot (1.5m AGL), dB L_{A1}

Project No: 23108451
Consultant: MN
Date: 19/12/2023
Algorithm: ISO 9613
SoundPLAN Version: 8.2

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5. CONCLUSION & RECOMMENDATIONS

Calculations based on measurements and the data provided show that the noise levels from the proposed facility will exceed the prescribed standards of the *Environmental Protection (Noise) Regulations 1997* at the neighbouring southern industrial boundary and two nearby residences during normal operations.

Given the southern industrial lot is currently vacant, this exceedance is not considered to be an issue. If another industry was constructed on the lot boundary to the south, extending the existing wall as shown in *Figure 5-1* would provide a noise level of 65 dB(A) or below. Prior to constructing the additional wall, it is recommended measurements be undertaken once the facility is operational to confirm if any mitigation is required.

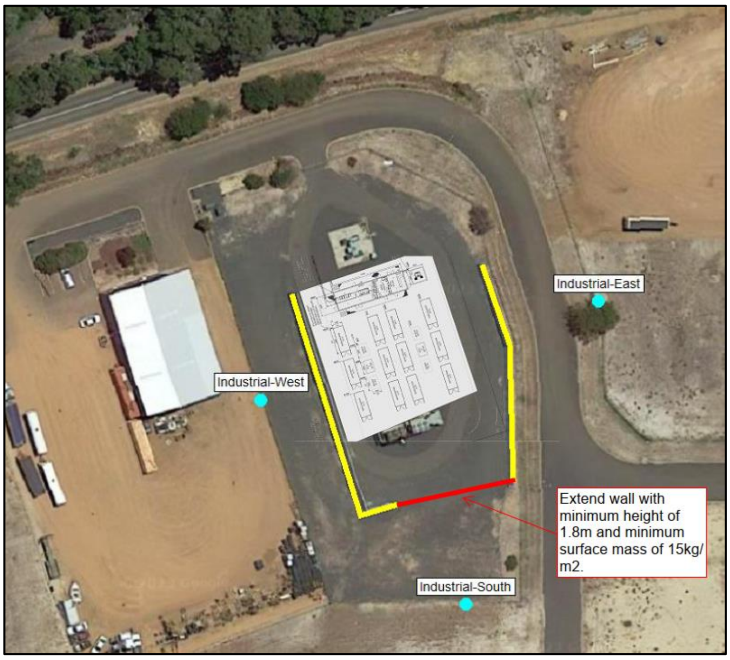


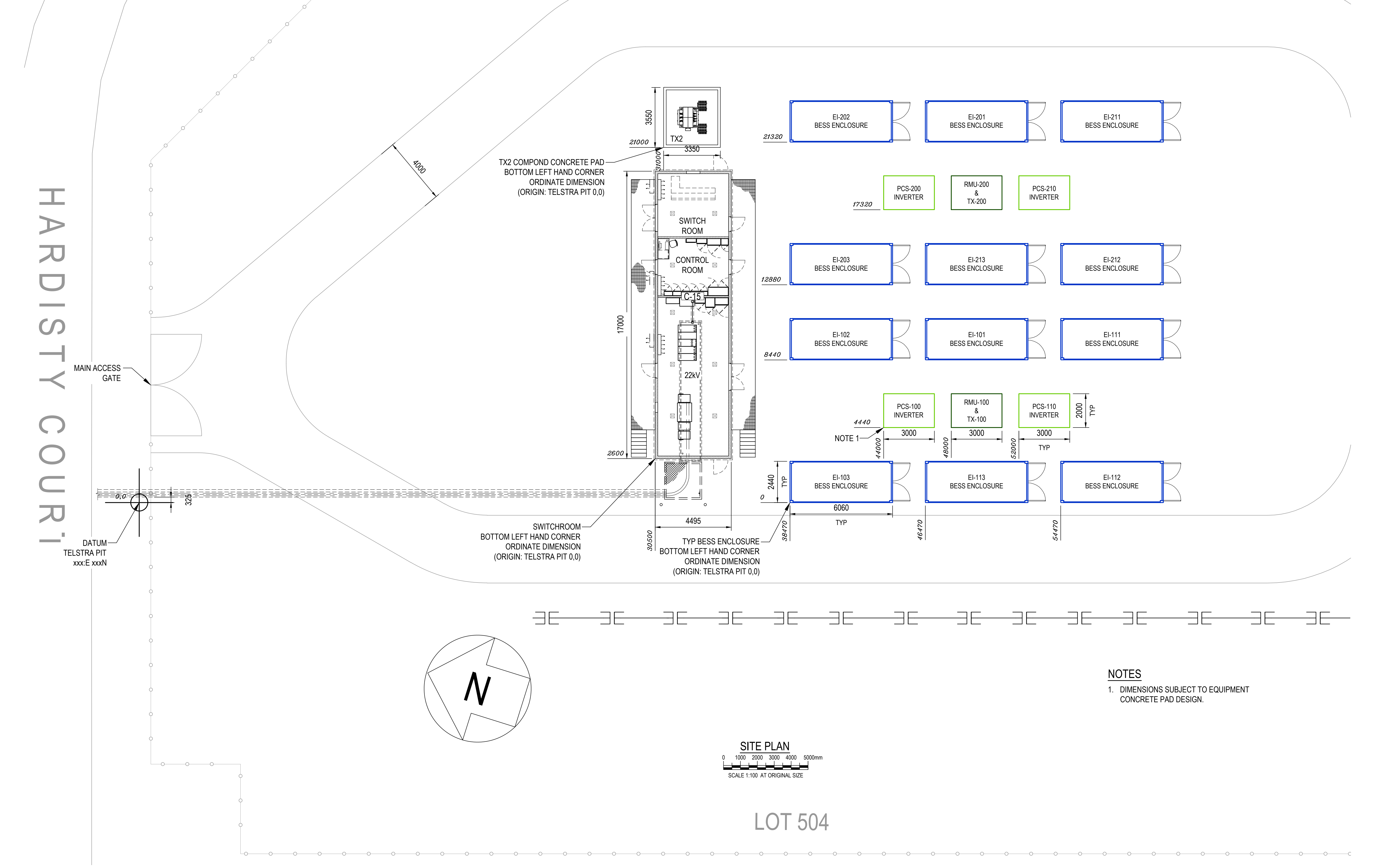
Figure 5-1: Noise Wall Design

According to the GHD Report, the fan speeds are typically reduced to 20% slower than normal operation during the night period, which equates to a reduction of 4 dB in the sound power level of the BESS fans. Assuming a similar level of noise reduction for the inverters, implementing this 20% reduction in fan speed between 7.00am and 9.00am on a Sunday would achieve compliance at all nearby residences during normal operations. Another option to achieve compliance during this period would be to delay the start of operations for the proposed facility until 9.00am on Sundays.

Compliance is predicted at the nearest industrial boundaries and residences when the BESS and inverter fans are operating at a fan speed of 80%, given that this will only occur for less than 24-minutes in any 4-hour period.

Appendix A – Development Plans

(Appendix ORD: 12.2.2B - Under Separate E-Cover)



NOTES

1. DIMENSIONS SUBJECT TO EQUIPMENT CONCRETE PAD DESIGN.

DRAWING No.	REFERENCE DRAWING	No.	DATE	REVISION	DRN	CHK	APP	No.	DATE	REVISION	DRN	CHK	APP
x								A	23.08.23	ISSUED FOR REVIEW	JFC	DG	GM

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DRAWN JFC DATE AUG 2023
CHECKED DG DATE AUG 2023
DESIGNED PME DATE AUG 2023
JOB 8582
CAD FILE: 8582-E-800_A.DWG

CLIENT TESLA CORPORATION Pty Ltd
PROJECT PICTON - HARRIS ROAD, DARDANUP
TITLE BESS UPGRADE SITE GENERAL ARRANGEMENT
SHEET A1 SCALE N/A REV A
DRG No. 8582-E-800

FILE NAME: 8582-E-800_A.dwg PLOT DATE: 23/08/2023 4:07:46 PM BY: John Clare

Appendix B – Influencing Factor Calculation

The assigned levels combine a baseline assigned level with an influencing factor, with the latter increasing the assigned level on the basis of the existence of significant roads and commercial or industrial zoned land within an inner circle (100 metre radius) and an outer circle (450 metre radius) of the noise sensitive premises. The calculation for the influencing factor is:

$$= \frac{1}{10}\left(\%\,\text{Type A}_{100} + \%\,\text{Type A}_{450}\right) + \frac{1}{20}\left(\%\,\text{Type B}_{100} + \%\,\text{Type B}_{450}\right)$$

$where:$

$\%\,\text{Type A}_{100}$ = the percentage of industrial land within a 100m radius of the premises receiving the noise

$\%\text{TypeA}_{450}$ = the percentage of industrial land within a 450m radius of the premises receiving the noise

$\%\,\text{Type B}_{100}$ = the percentage of commercial land within a 100m radius of the premises receiving the noise

$\%\text{TypeB}_{450}$ = the percentage of commercial land within a 450m radius of the premises receiving the noise

+ Transport Factor (maximum of 6 dB)

= 2 for each secondary road (6,000 to 15,000 vpd) within 100m

= 2 for a major road (>15,000 vpd) within 450m

= 6 for a major road within 100m

The nearest noise sensitive premises are identified as:

- 96 Martin-Pelusey Rd
- 334 Harris Rd
- 275 Martin-Pelusey Rd
- 158 Harris Rd

Table B-1 shows the percentage of industrial and commercial land within the inner (100 metre radius) and outer (450 metre radius) circles of the noise sensitive premises.

Table B-1: Percentage of Land Types within 100m and 450m Radii

Receiver	Land Type	Within 100m	Within 450m
96 Martin-Pelusey Rd	Type A - Industrial and Utility	0	0
	Type B – Commercial	0	0
334 Harris Rd	Type A - Industrial and Utility	0	9
	Type B – Commercial	0	0
275 Martin-Pelusey Rd	Type A - Industrial and Utility	7	30
	Type B – Commercial	0	0
158 Harris Rd	Type A - Industrial and Utility	0	45
	Type B – Commercial	0	0

Table B-2: Influencing Factor Calculation, dB

Receiver	Industrial Land	Commercial Land	Transport Factor	Total
96 Martin-Pelusey Rd	0	0	0	**0**
334 Harris Rd	0.9	0	0	**1**
275 Martin-Pelusey Rd	3.7	0	0	**4**
158 Harris Rd	4.6	0	0	**5**

The influencing factor calculated in *Table B-2 is* combined with those baseline assigned levels of *Table 2-2,* resulting in the project assigned levels provided in *Table 2-3*.

Appendix C – GHD Report Sound Power Level

Table 5.3 Battery pack sound power level data, dB

Fan speed	Third octave centre frequency band, Hz																											dB(A) sum
	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	
100%[1]	98	99	99	98	96	94	95	93	95	95	95	97	97	99	101	98	97	97	94	92	91	90	87	85	84	79	75	**106**
80%[1]	93	95	94	93	91	89	90	88	90	90	90	92	92	94	96	94	92	92	89	87	87	85	82	80	79	74	70	**101**
Normal Operation[1]	87	89	89	87	85	82	83	81	83	84	83	85	85	86	88	86	84	84	81	80	79	77	74	72	72	66	63	**93**
20% slower than normal operation[1]	82	84	84	82	80	77	78	76	78	79	78	80	80	81	83	81	79	79	76	75	74	72	69	67	67	62	58	**89**

Note 1: Sound power level noise data for 100 percent fan speed was derived from similar equipment on similar projects

Table 5.4 Inverter sound power level data, dB

Fan speed	Third octave centre frequency band, Hz																											dB(A) sum
	25 Hz	31.5 Hz	40 Hz	50 Hz	63 Hz	80 Hz	100 Hz	125 Hz	160 Hz	200 Hz	250 Hz	315 Hz	400 Hz	500 Hz	630 Hz	800 Hz	1 kHz	1.25 kHz	1.6 kHz	2 kHz	2.5 kHz	3.15 kHz	4 kHz	5 kHz	6.3 kHz	8 kHz	10 kHz	
100%[1]	88	89	91	93	97	96	94	94	94	94	95	96	100	92	91	90	90	89	89	87	85	84	84	82	82	81	80	**100**
80%[1]	83	85	86	88	92	91	89	89	90	90	90	91	95	87	87	85	85	85	84	82	80	80	79	77	77	76	75	**97**

Note 1: Sound power level noise data was derived using ISO 3744 methodology based on sound pressure levels measurements summarised in manufacturer's datasheet titled 'Inverter acoustic characterisation report PCSM GEN3 (ISO 3744) -Rev2.pdf'

Table 5.5 Other equipment sound power levels, dB

Equipment	Octave band centre frequency, Hz								dB(A) sum
	63	125	250	500	1k	2k	4k	8k	
Auxiliary transformer (2.5 MVA)[1]	74	76	71	71	65	60	55	48	72
Low noise HV transformer (290 MVA)[2]	94	96	91	91	85	80	75	68	92

Note 1: Sound power level noise data for transformers is based on total apparent power and derived from the Strutt software database which uses AS 2374.6 Power transformers Part 6: Determination of transformer and reactor sound levels

Note 2: Overall Sound Power for HV transformer was taken from Siemens Energy Test report No.STCL/TC-22.812535, the overall value was used to scale a generic transformer spectrum taken from AS2374.6

Appendix D – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **Sound Power Level (L_w)**

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure level at known distances. Noise modelling incorporates source sound power levels as part of the input data.

- **Sound Pressure Level (L_p)**

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc. and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

- **L_{ASlow}**

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

- **L_{AFast}**

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

- **L_{A1}**

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

The L_{A10} level is the A-weighted noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

- **L_{A90}**

The L_{A90} level is the A-weighted noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

- **L_{Aeq}**

The equivalent steady state A-weighted sound level ("equal energy") in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the "average" noise level.

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **Representative Assessment Period**

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

- **L_{Amax} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded at any time.

- **L_{A1} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 1 percent of the representative assessment period.

- **L_{A10} assigned level**

Means an assigned level, which, measured as a L_{ASlow} value, is not to be exceeded for more than 10 percent of the representative assessment period.

- **Tonal Noise**

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

– the presence in the noise emission of tonal characteristics where the difference between -

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

- **Modulating Noise**

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

– a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band; and

(b) is present for at least 10% of the representative assessment period; and

(c) is regular, cyclic and audible.

- **Impulsive Noise**

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness means:

– a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

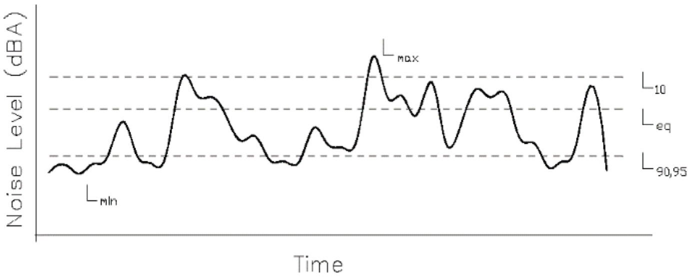
- **Major Road**

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

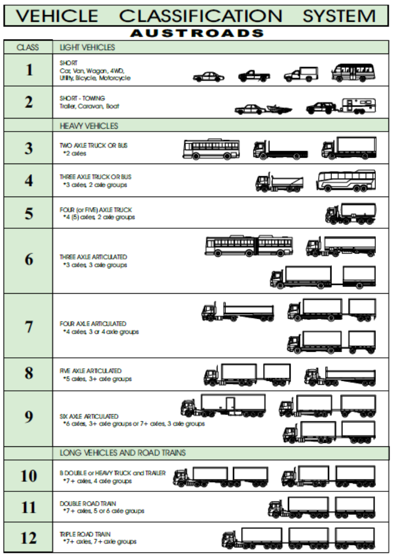
- **Secondary / Minor Road**

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



- **Typical Noise Levels**