BUSHFIRE PLANNING AUSTRALIA

BUSHFIRE ASSESSMENT & STRATEGIC BUSHFIRE STUDY

Proposed Industrial Development: Service Station

254 Tarean Road, Karuah

[redacted]

Bushfire Planning Australia

[redacted]

[redacted]

Version: FINAL - March 2022

Disclaimer and Limitation

This report is prepared solely for the Coastal Earth Moving Pty Ltd (the 'Client') for the specific purposes of only for which it is supplied (the 'Purpose'). This report is not for the benefit of any other person; either directly or indirectly and is strictly limited to the purpose and the facts and matters stated in it and will not be used for any other application.

This report is based on the site conditions surveyed at the time the document was prepared. The assessment of the bushfire threat made in this report is made in good faith based on the information available to Bushfire Planning Australia at the time.

The recommendations contained in this report are considered to be minimum standards and they do not guarantee that a building or assets will not be damaged in a bushfire. In the making of these comments and recommendations it should be understood that the focus of this document is to minimise the threat and impact of a bushfire.

Finally, the implementation of the adopted measures and recommendations within this report will contribute to the amelioration of the potential impact of any bushfire upon the development, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

Document Status: 2169 - Industrial Development

Version	Status	Purpose	Author	Review Date
1	Draft	Draft for Review	[redacted]	18 March 2022
2	Draft	Draft for Client Review	[redacted]	22 March 2022
3	Final	Final for Submission	[redacted]	22 March 2022

Certification

As the author of this Bushfire Assessment Report (BAR) AND Strategic Bushfire Study (SBS), I certify this BAR provides the detailed information required by the NSW Rural Fire Service under Clause 44 of the Rural Fires Regulation 2013 and Chapter 4 and Appendix 2 of Planning for Bushfire Protection 2019 in accordance with the requirements of section 4.14 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

[redacted]

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

Accredited Bushfire Practitioner

[redacted]

Date: 22 March 2022

In signing the above, I declare the report is true and accurate to the best of my knowledge at the time of issue.

Executive Summary

Bushfire Planning Australia (BPA) has been engaged by [redacted] to undertake a Bushfire Assessment Report (BAR) and to prepare a Strategic Bushfire Study (SBS) to support the proposed amendment to the Port Stephens Local Environmental Plan 2013 to permit the use of the site as a Highway Service Centre (HSC) at 254 Tarean Road, Karuah; legally known as Lot 1 DP507141.

The site has historically been used as a service station and was converted to a restaurant including onsite caretakers accommodation. The site currently remains vacant and the remaining structures are in a state of disrepair. Consequently, the site no longer benefits from any previous existing use rights. It is understood all underground services and infrastructure associated with the former use of service station remains onsite.

The landscape, vegetation and topographic studies show that this site is subject to a high bushfire threat; particularly from the ability of a fire to propagate east to south-east – in addition to a fire approaching the site from the north-west with the potential to 'jump' across Tarean Road.

Measures that are applied to create compliance with *Planning for Bush Fire Protection 2019* at the development stage would reduce the vulnerability of the buildings and occupants. Construction measures can increase the likelihood of assets to withstand most bushfires. A good access and egress strategy can also reduce the vulnerability of the development by enabling occupants to move away from a bushfire as it approaches. Achieving adequate access and safe movement is therefore a key objective prior to development proceeding.

A hazard assessment has been completed and found the site was exposed to a high bushfire hazard mainly located to the south/ south-east of the subject site. The predominant vegetation surrounding the site is consistent with a *forest* vegetation formation as described in the NSW Rural Fire Service document Planning for Bushfire Protection 2019 (PBP 2019).

The proposed land use is not considered completely incompatible with the surrounding environment and with sound bushfire management, the proposal can mitigate the bushfire risk subject to completion of the following:

1. Any future development application for a hazardous industry shall be supported by a Fire Safety Study (FSS) prepared in accordance with the NSW Department of Planning, Infrastructure and Environment (DPIE) *Hazardous Industry Planning and Assessment Papers*. The FSS must demonstrate all components and infrastructure associated with a service station will be designed and constructed with the relevant specifications and standards and are able to withstand high levels of sustained radiant heat exposure.
2. Future asset protection zones (APZs) should be based on a minimum FDI of 100. APZs will be fully contained within future lot boundaries and will not rely on adjoining land, or the existing overhead electricity transmission line easements.
3. The capacity of the site must be sufficient to deal with occupants of the site in an emergency situation; this should include a minimum of two points of access which provide two different routes of travel away from the site.
4. A traffic report should be prepared which assesses the capacity of the site in the event of an emergency, assuming that road closures of public roads surrounding the site might occur.
5. An emergency evacuation and management plan should be prepared which demonstrates the required actions to be undertaken in the event of a bushfire.
6. Details of the proposed development should be provided to the Local Emergency Management Committee to enable awareness in emergency response.

The following recommendations when implemented will reduce the impact of a bushfire to an acceptable level for the proposed industrial (non-habitable) buildings and demonstrate the proposed development is ably to comply with PBP 2019:

1. The entire site shall be managed as an Inner Protection Area (IPA) as outlined within Appendix 4 of PBP 2019 and the RFS document *Standards for asset protection zones*;
2. All land within 10m of every building is to be managed as an APZ as outlined within Appendix 4 of PBP 2019 and the RFS document *Standards for asset protection zones*;
3. Property access roads are to be constructed in accordance with Table 5.3b of PBP 2019;
4. All new buildings are to be connected to a reliable water supply network and that suitable fire hydrants are located throughout the development site that are clearly marked and provided for the purposes of bushfire protection. Fire hydrant spacing, sizing and pressure shall comply with AS2419.1 2005 and Table 5.3c of PBP 2019;
5. Consideration should be given to landscaping and fuel loads on site to decrease potential fire hazards on site; and
6. All hazardous materials to be stored on land within 100m of any designated bushfire prone land shall be stored in a secure enclosure away from the bushfire hazard.

This assessment has been made based on the bushfire hazards observed in and around the site at the time of inspection and production (March 2022).

The planning proposal meets the requirements of the Ministerial Direction in providing appropriate APZs for the development which should be required to include a climate change factor and control the siting of the high risk assets on the site, providing water supply for firefighting purposes and minimising the perimeter of the area of land interfacing the hazard. Further work is required on the access and egress to the site to ensure that appropriate access is provided for firefighting purposes and resident egress.

Should the above recommendations be implemented, the existing bushfire risk should be suitably mitigated to offer an acceptable level of protection to life and property for those persons and assets occupying the site, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

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Terms and Abbreviations

Abbreviation	Meaning
APZ	Asset Protection Zone
AS2419 -2005	Australian Standard – Fire Hydrant Installations
AS3959-2018	Australian Standard – Construction of Buildings in Bush Fire Prone Areas
BAR	Bushfire Assessment Report
BAL	Bushfire attack level
BCA	Building Code of Australia
BC Act	NSW Biodiversity Act 2016
BMP	Bush Fire Management Plan
BPA	Bush Fire Prone Area (Also Bushfire Prone Land)
BFPL	Bush Fire Prone Land
BFPLM	Bush Fire Prone Land Map
BPM	Bush Fire Protection Measures
DoE	Commonwealth Department of the Environment
DPI Water	NSW Department of Primary Industries – Water
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FDI	Fire Danger Index
FMP	Fuel Management Plan
ha	hectare
IPA	Inner Protection Area
LGA	Local Government Area
NCC	National Construction Code
OPA	Outer Protection Area
OEH	NSW Office of Environment and Heritage
PBP or PBP (2019)	Planning for Bushfire Protection 2019
PSC	Port Stephens Council
RF Act	Rural Fires Act 1997
RF Regulation	Rural Fires Regulation
RFS	NSW Rural Fire Service
SFR	Short fire run
TSC Act	NSW Threatened Species Conservation Act 1995 (as repealed)
URA	Urban release area

1. Introduction

Bushfire Planning Australia (BPA) has been engaged by Coastal Earth Moving Pty Ltd (the 'Client') to undertake a Bushfire Assessment Report (BAR) and to prepare a Strategic Bushfire Study (SBS) to support the proposed amendment to the Port Stephens Local Environmental Plan 2013 to permit the use of the site as a Highway Service Centre (HSC) at 254 Tarean Road, Karuah; legally known as Lot 1 DP507141.

1.1. Strategic Bushfire Study

The site is currently zoned RU2 Rural Landscape under the PSLEP 2013. The current land zoning prohibits a number of land uses; including a HSC. The proposed rezoning seeks to amend PSLEP 2013 to permit a HSC on the site.

The SBS aims to assess the appropriateness of the planning proposal against a more macro-scale bushfire context as it looks at the potential risk of bushfire and its impact on emergency response, infrastructure, road networks and adjoining land owners.

The BAR component of this report aims to consider and assess the bushfire hazard and associated potential bushfire threat specific to the site and relevant to the proposed development. It will outline the minimum mitigative measures required in accordance with the provisions of the New South Wales Rural Fire Service (RFS) publication *Planning for Bushfire Protection 2019* (PBP) and Clause 44 of the *Rural Fires Regulation 2013*.

Conclusions derived from this report will determine the proposal's appropriateness in it's bushfire risk context and compliance with the Aim and Objectives of PB 2019.

1.2. Other Non-Residential Development

Section 8.3 of PBP 2019 refers to any type of development that are not residential/ rural residential subdivisions, SFPPs or residential infill development as 'Other development'. The proposed industrial development seeks consent for the construction of several non-habitable buildings on the subject site.

The National Construction Code (NCC) does not provide for any bush fire specific performance requirements for other development; such as the proposed industrial development. The general fire safety construction provisions of the NCC are taken as acceptable solutions in this instance.

Nevertheless, in order to demonstrate the proposed industrial development is able to satisfy the aims and objectives of PBP 2019, the BAR component of this report has been completed to determine the bushfire hazard that has the potential to threaten the proposed development. Based on this assessment, a series of bushfire protection measures that will provide for an increased level of protection on property and life from the threat of bushfire have been recommended; thereby satisfying the aims and objectives of PBP 2019.

2. Site Description

Table 1: Site Details

Address	254 Tarean Road, Karuah
Title	Lot 1 DP507141
LGA	Port Stephens Council
Site Area	1.67 hectares
Land Use Zone	RU2 Rural Landscape
Context	The site is located south of Tarean Road, on the western edge of the township of Karuah. The site was formerly a service station and restaurant, although currently vacant and in a state of disrepair.
Topography	For the most part the site is flat.
Fire History	The site lies within a local government area with a Fire Danger Index (FDI) rating of 100.

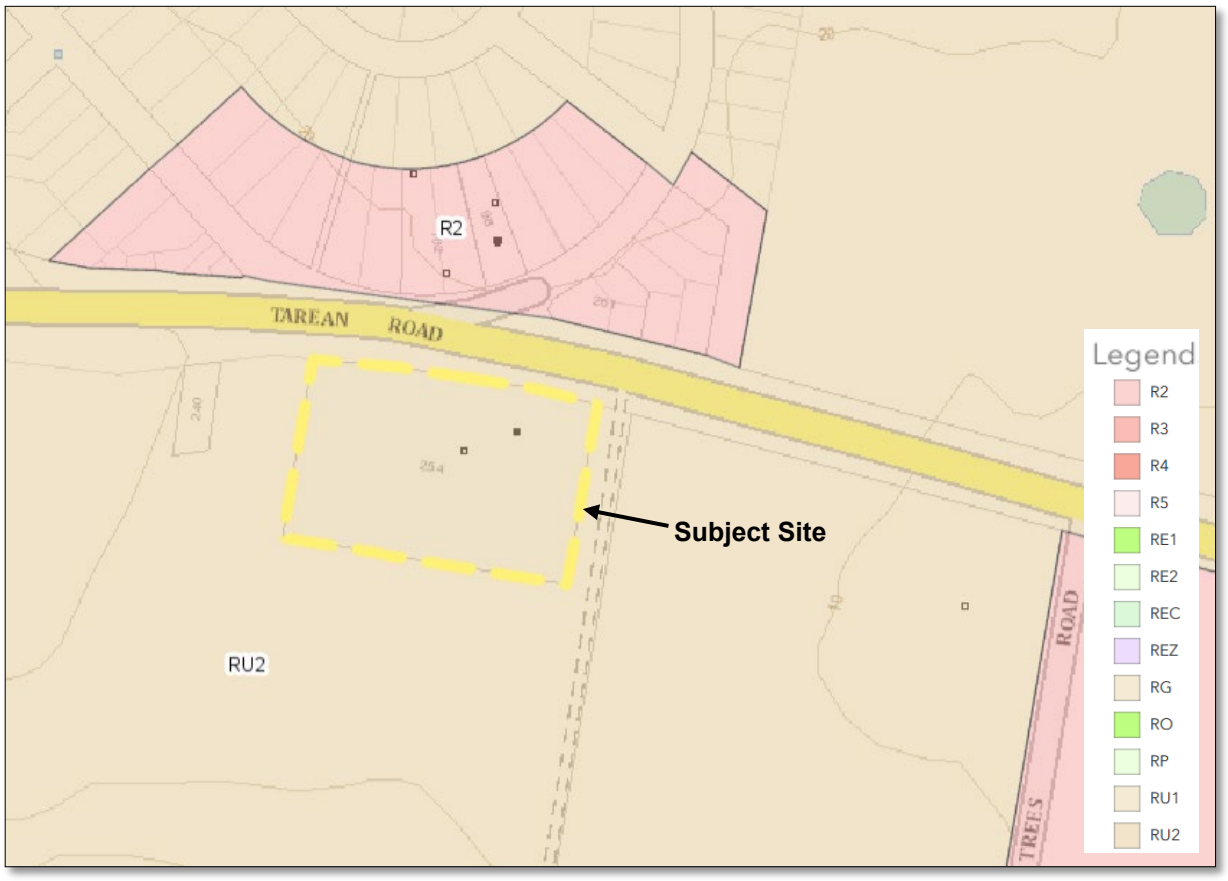

Figure 1: Land Use Zone Map (Port Stephens LEP 2013)

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Figure 2

Site Location

BUSHFIRE PLANNING AUSTRALIA

Subject site
100m Buffer
140m Buffer

N
W E
S

0 100 200
Meters

A3 Scale: 1:5,000

File:2169-TareanRdKaruah-Fig1-SiteLocation-211007 Date: 7/10/2021

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3. Bushfire Context

Bushfire activity is prevalent in landscapes that carry fuel and the two predominant bushfire types are grassland and forest fires. Factors such as topographic characteristics and quantity of fuel loads influence the intensity and spread of fire. The scale of a bushfire hazard is tailored to the characteristics of the hazard, the size and characteristics of the affected population, types of land use exposed to bushfire, predicted development growth pressures and other factors affecting bushfire risk.

Figure 3 demonstrates majority of the site, and within 140m of the site, is mapped as a bushfire Vegetation Buffer. Along the eastern boundary, there is a narrow portion of Vegetation Category 1, which continues to the neighbouring site (Lot 1 DP541568) and is the primary bushfire hazard the site is exposed to. The western portion of the site not being mapped as bushfire prone land.

Approximately 90m south of the site, a narrow portion of Vegetation Category 1 bushfire prone land exists and continues further south beyond 140m. Similarly, there is a narrow portion of vegetation located within 140m to the west of the site mapped as Vegetation Category 2.

Bushfire prone land also exists to the north of the site, separated by Tarean Road, however this will be cleared as part of a proposed residential subdivision.

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Figure 3

NSW Bush Fire Prone Land

BUSHFIRE PLANNING AUSTRALIA

Subject Site

140m Buffer

100m Buffer

Bushfire Prone Land

Vegetation Category 1

Vegetation Category 2

Buffer

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial photo: NearMap 24/03/2021
NSW Bush Fire Prone Land: NSW Rural Fire Service 2018

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0 25 50 75 100
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A3 Scale: 1:2,000

File:2169-TareanRdKaruah-Fig2-BFPL-211007 Date: 7/10/2021

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4. Proposed Planning Controls Amendment

4.1. Background

The site has historically been used as a service station and most recently a restaurant. Prior to the M1 Pacific Highway being realigned to bypass Karuah, the service station operated successfully. Since the Karuah Bypass was opened on 22 September 2004, vehicle traffic dramatically reduced and the majority of businesses; including the service station in Karuah ceased to operate.

The re-use of the site as a restaurant ceased in approximately 5 years ago and little maintenance has been undertaken on the property and remaining structures.

Figure 4: Aerial image of site following closure of service station (24 June 2010)

4.2. Proposed Development

The proposed development intends to redevelop Lot 1 DP 507141; 254 Tarean Road, Karuah (the 'site') to establish a Highway Service Centre. As the proposed land use is currently prohibited on the existing land use zone (RU2), the Proponent is submitting a Planning Proposal seeking to amended the Port Stephens Local Environmental Plan 2013 to permit the proposed use on the site.

The site is identified in Karuah Place Plan (presented to Port Stephens Council on 22 March 2022) as employment land as shown in **Figure 5**. Given the previous use/s of the site, the most appropriate use of the site is likely to be some type of non-residential land use; contrary to the existing land use zoning.

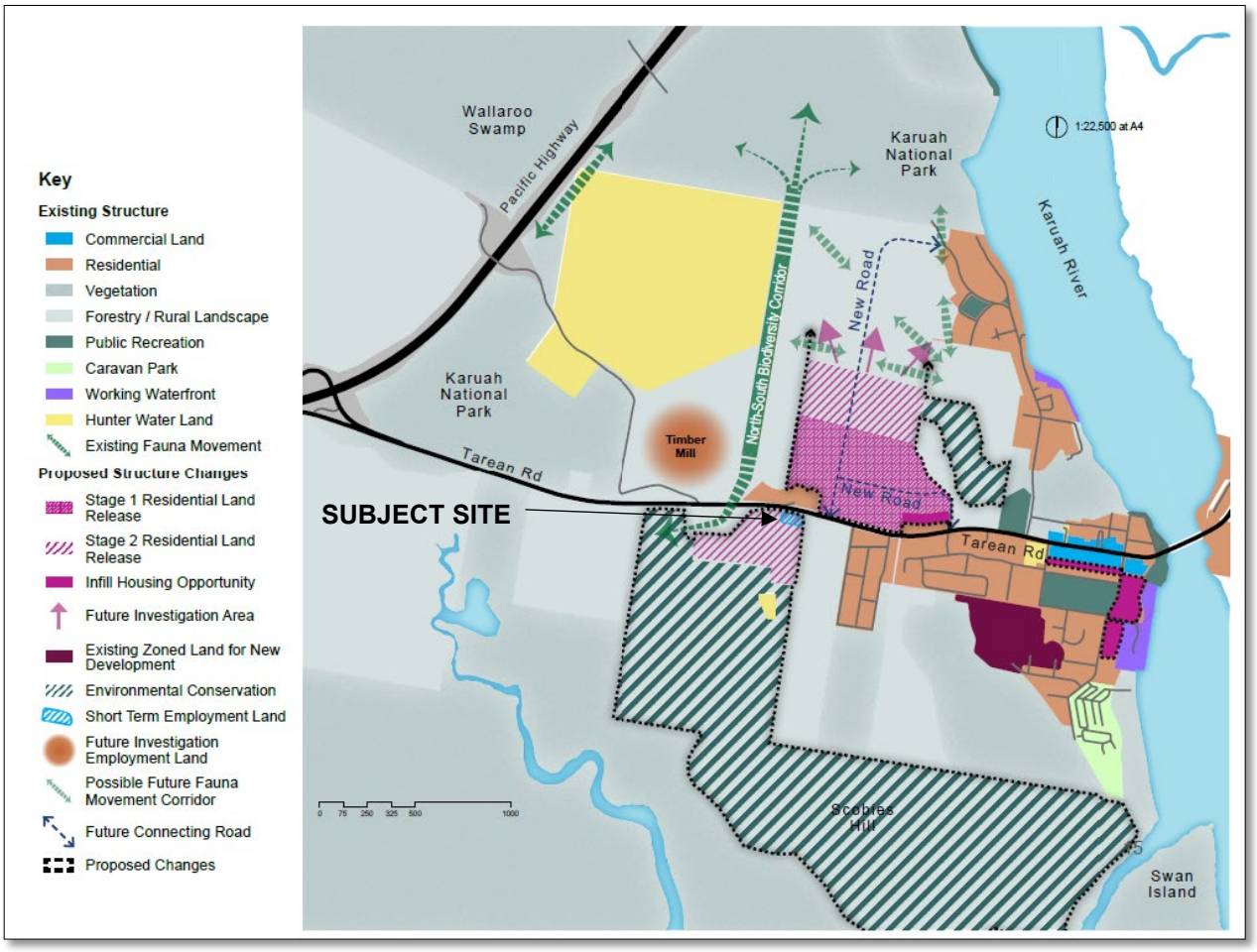

Figure 5: Karuah Place Plan (Port Stephens Council Draft 2022)

4.3. Other Non-Residential Development

Section 8.3 of PBP 2019 provides specific advice for developments that are not residential subdivision, special fire protection purposes (SFPPs) or residential infill; such as service stations.

The general aims and objectives of PBP 2019 apply in relation to matters such as access, water and services, emergency planning and landscaping/ vegetation management. However, it is prudent that a suitable package of bushfire protection measures be proposed commensurate with the assessed level of risk of the future development. Accordingly, this SBS will determine if the subject site is appropriate for the proposed land use.

4.3.1. Hazardous Industry

Chapter 8.3.9 of PBP 2019 applies to specific hazardous industries; including service stations. Service stations are by their very nature are hazardous, as much for their ability to start bushfires as their susceptibility to bushfire impacts.

As a planning proposal, the final design of the proposed development has not been determined. Accordingly, it is problematic to recommend specific mitigation measures for any particular assets or components. In this regard, and in accordance with PBP 2019, a Fire Safety Study (FSS) prepared under the DPIE *Hazardous Industry Planning and Assessment Papers* (HIPAPS) must be prepared. This study can be completed following the successful amendment to the LEP and provided to Council as part of a development application. With the benefit of a final design, the FSS can provide details of all credible fire hazards and the associated fire prevention and mitigation measures for the development. The FSS must address the appropriate protection measures to be provided commensurate with the bush fire hazards and associated risks. Care should also be taken to ensure that such facilities do not impact on existing developments.

5. Bushfire Hazard Assessment

5.1. Vegetation Assessment

Vegetation classification over the site and surrounding area has been carried out as follows:

- Aerial Photograph Interpretation to map the vegetation classification and extent;
- Reference to Greater Hunter Native Vegetation Mapping V4.0 VIS ID 3855 OEH 2009 (**Figures 6 & 7**); and
- Reference to State Vegetation Mapping (Pre-Release), NSW OHIE 2021 (**Figures 8 & 9**); and
- Site inspection on 7 October 2021 completed by Stuart Greville.

In accordance with PBP 2019, an assessment of the vegetation over a distance of 140m in all directions from the site was undertaken. Vegetation that may be considered a bushfire hazard was identified in all directions from the development footprint. The vegetation classification is based on the revised Table 2.3 in AS3959-2018 and Appendix 1 of PBP 2019. The inconsistencies between the mapping sources listed above was quantified during the site inspection and compared to the Keith Vegetation Formations. It was confirmed on site that both *Forest (Hunter Macleay Dry Sclerophyll Forest)* and *grassland* vegetation formations are present within 140m of the site.

The predominant vegetation classification presenting as a bushfire hazard was identified as a *forest* in accordance with the descriptions contained in PBP 2019 as shown in **Figure 14** and **Table 2.**

Table 2: Vegetation formations

Transect / Direction of Bushfire Attack	Vegetation or Other Infrastructure	Classification of Vegetation Formations PBP 2019
T1 West	Narrow corridor of forest vegetation running along the southern side of Tarean Road	***Forest*** *Hunter Macleay DSF*
T2 North	Northern boundary of site to the northern side of Tarean Road	***Grassland***
T3 North	Forest vegetation north of the site, separated by Tarean Road and will be cleared as part of a future residential subdivision	***Forest*** *Hunter Macleay DSF*
T4 North	Northern boundary of site to the northern side of Tarean Road	***Excluded*** *(Road)*
T5 North-east	Grassland north-east of the site, separated by Tarean Road and will be cleared as part of a future residential subdivision	***Grassland***
T6 East	A dirt driveway is located approximately 10m to the east of the site amongst forest vegetation	***Forest*** *Hunter Macleay DSF*
T7 East	Forest vegetation located to the east on adjoining lot and is the primary bushfire hazard	***Forest*** *Hunter Macleay DSF*
T8 East	An OHE easement is located on grassland which separates the forest vegetation on the eastern adjoining lot. This is the primary bushfire hazard	***Forest*** *Hunter Macleay DSF*
T9 South	An OHE easement is located on grassland south of the site	***Grassland***
T10 South-west	An OHE easement is located on grassland south-west of the site	***Grassland***
T11 West	Open grassland	***Grassland***

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Figure 6

Greater Hunter Native Vegetation

BUSHFIRE PLANNING AUSTRALIA

- Subject Site
- 140m Buffer
- 100m Buffer
- Cleared / Managed land
- Hunter-Macleay Dry Sclerophyll Forests

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial photo: NearMap 24/03/21
Vegetation: Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855 OEH 2009

N W E S

0 25 50 75 100
Meters

A3 Scale: 1:2,000

File:2169-TareanRdKaruah-Fig3a-Vegetation-VIS3855-220322 Date: 22/03/2022

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Figure 7

Greater Hunter Native Vegetation

BUSHFIRE PLANNING AUSTRALIA

- Subject Site
- 140m Buffer
- 100m Buffer
- Cleared / Managed land
- Coastal Dune Dry Sclerophyll Forests
- Coastal Floodplain Wetlands
- Coastal Freshwater Lagoons
- Coastal Swamp Forests
- Hunter-Macleay Dry Sclerophyll Forests
- Mangrove Swamps
- No equivalent
- Saltmarshes
- Sydney Coastal Dry Sclerophyll Forests

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial photo: NearMap 10/02/22
Vegetation: Greater Hunter Native Vegetation Mapping v4.0. VIS ID 3855 OEH 2009

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Meters

A3 Scale: 1:25,000

File:2169-TareanRdKaruah-Fig3b-Vegetation-VIS3855-3km220322 Date: 22/03/2022

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Figure 8

NSW State Vegetation Type (Class)

BUSHFIRE PLANNING AUSTRALIA

Subject Site

140m Buffer

100m Buffer

Vegetation Class

Hunter-Macleay Dry Sclerophyll Forests

Northern Hinterland Wet Sclerophyll Forests

Not native vegetation

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial photo: NearMap 24/03/2021
Vegetation: Pre-Release v1.1.0 Eastern NSW
Vegetation Type: NSW Department of Planning, Industry and Environment 2021

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Meters

A3 Scale: 1:2,000

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Date: 22/03/2022

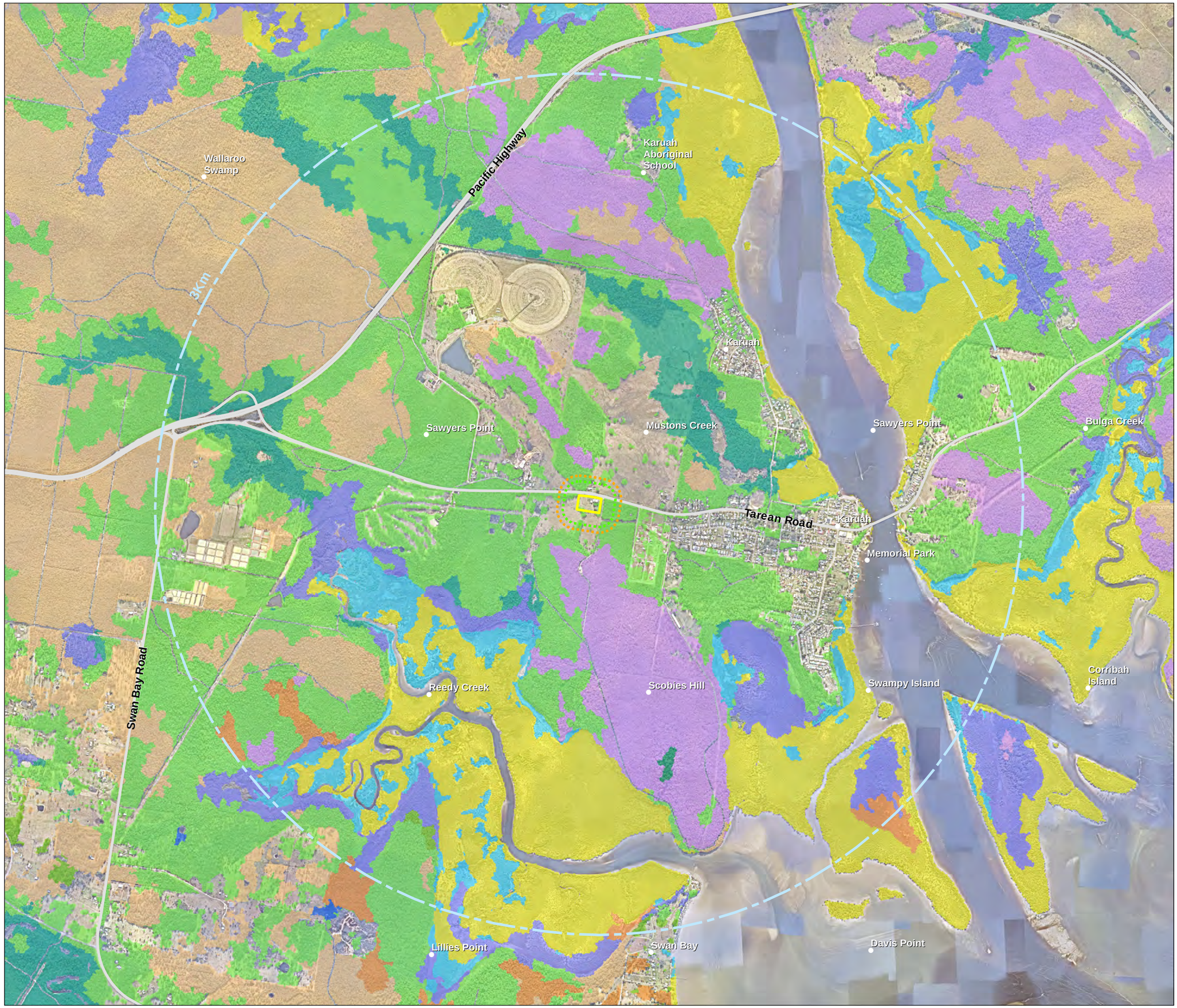

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Figure 9

NSW State Vegetation Type (Class)

BUSHFIRE PLANNING AUSTRALIA

Subject Site
140m Buffer
100m Buffer

Vegetation Class

- Coastal Dune Dry Sclerophyll Forests
- Coastal Floodplain Wetlands
- Coastal Freshwater Lagoons
- Coastal Heath Swamps
- Coastal Swamp Forests
- Dry Rainforests
- Hunter-Macleay Dry Sclerophyll Forests
- Mangrove Swamps
- Northern Hinterland Wet Sclerophyll Forests
- Not native vegetation
- Saltmarshes
- Sydney Coastal Dry Sclerophyll Forests

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial photo: NearMap 10/02/22
Vegetation: Pre-Release v1.1.0 Eastern NSW
Vegetation Type: NSW Department of Planning, Industry and Environment 2021

N W E S

0 250 500 750 1,000 1,250
Meters

A3 Scale: 1:25,000

File:2169-TareanRdKaruah-FigXb-Vegetation-SV-Class-22032 Date: 22/03/2022

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Plate 1: Looking south west towards site over Tarean Road

Plate 2: Looking south over site

Plate 3: North east over site towards Karuah River

Plate 4: From biobanking site looking north west

Plate 5: Looking east towards Karuah over subject site

Plate 6: Former service station last used as a restaurant and is currently abandoned

Plate 7: Open grassland paddock to the south of site

Plate 8: Typical vegetation mapped as Forest (Hunter Macleay DSF) (T7 or T8)

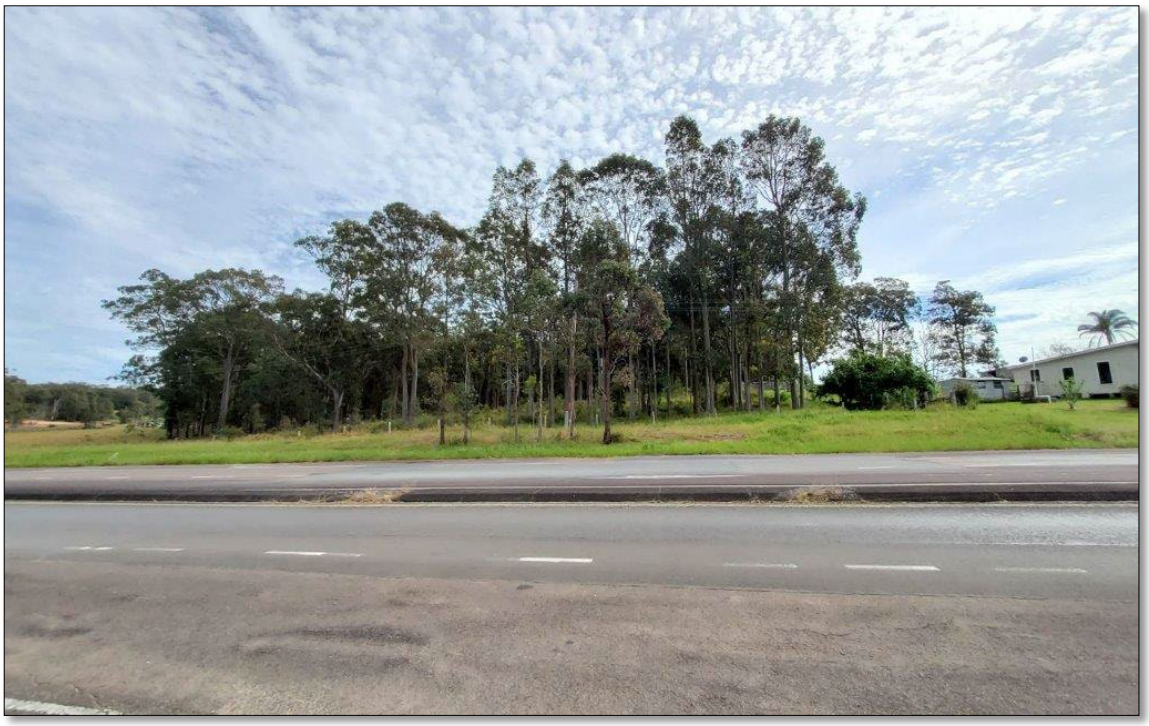

Plate 9: Unmanaged forest vegetation north of the site opposite Tarean Road (T2)

Plate 10: Open managed paddock north of site

5.2. Slope Assessment

The slope assessment was undertaken as follows:

- Review of LiDAR point cloud data – including DEM (NSW LPI) (**Figures 10 & 11**);
- Detail survey of existing contours;
- Detailed Slope Analysis (**Figures 12 & 13**); and
- Site Inspection 7 October 2021.

An assessment of the slope over a distance of 100m in the hazard direction from the site boundary was undertaken. The effective slope was then calculated under the classified vegetation where there was a fire run greater than 50m. The topography of the site has been evaluated to identify both the average slope and by identifying the maximum slope present. These values help determine the level of gradient which will most significantly influence the fire behaviour of the site.

The effective slope in all directions is shown in **Figure 14** and **Table 3.**

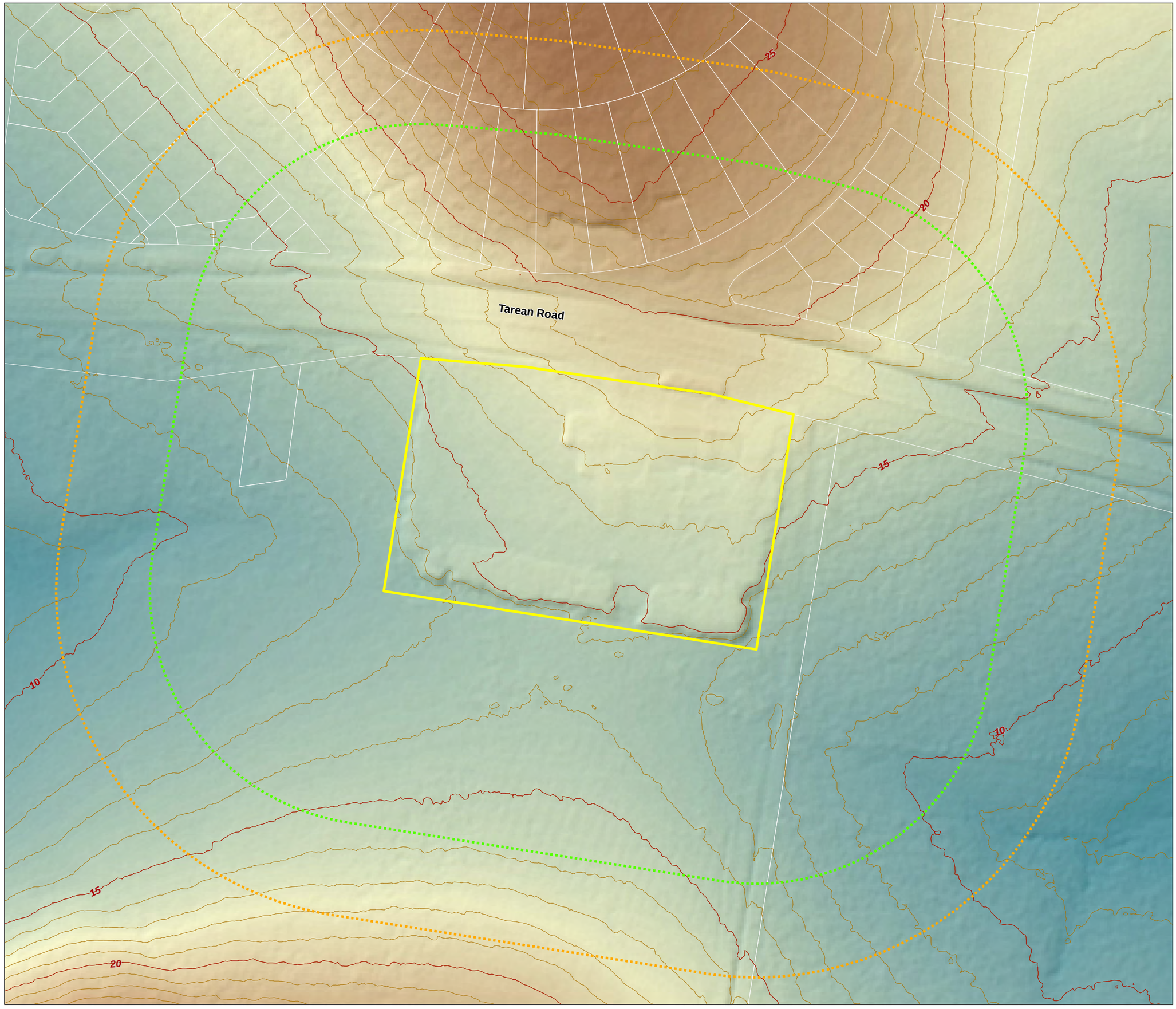

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Figure 10

Digital Elevation Model

BUSHFIRE PLANNING AUSTRALIA

Subject Site
140m Buffer
100m Buffer
Contour (10m)
Contour (5m)

Elevation (AHD)
High : 29m
Low : 7m

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2012

N
W E
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0 20 40 60 80
Meters

A3 Scale: 1:1,500

File:2169-TareanRdKaruah-Fig5a-DEM-220322 Date: 22/03/2022

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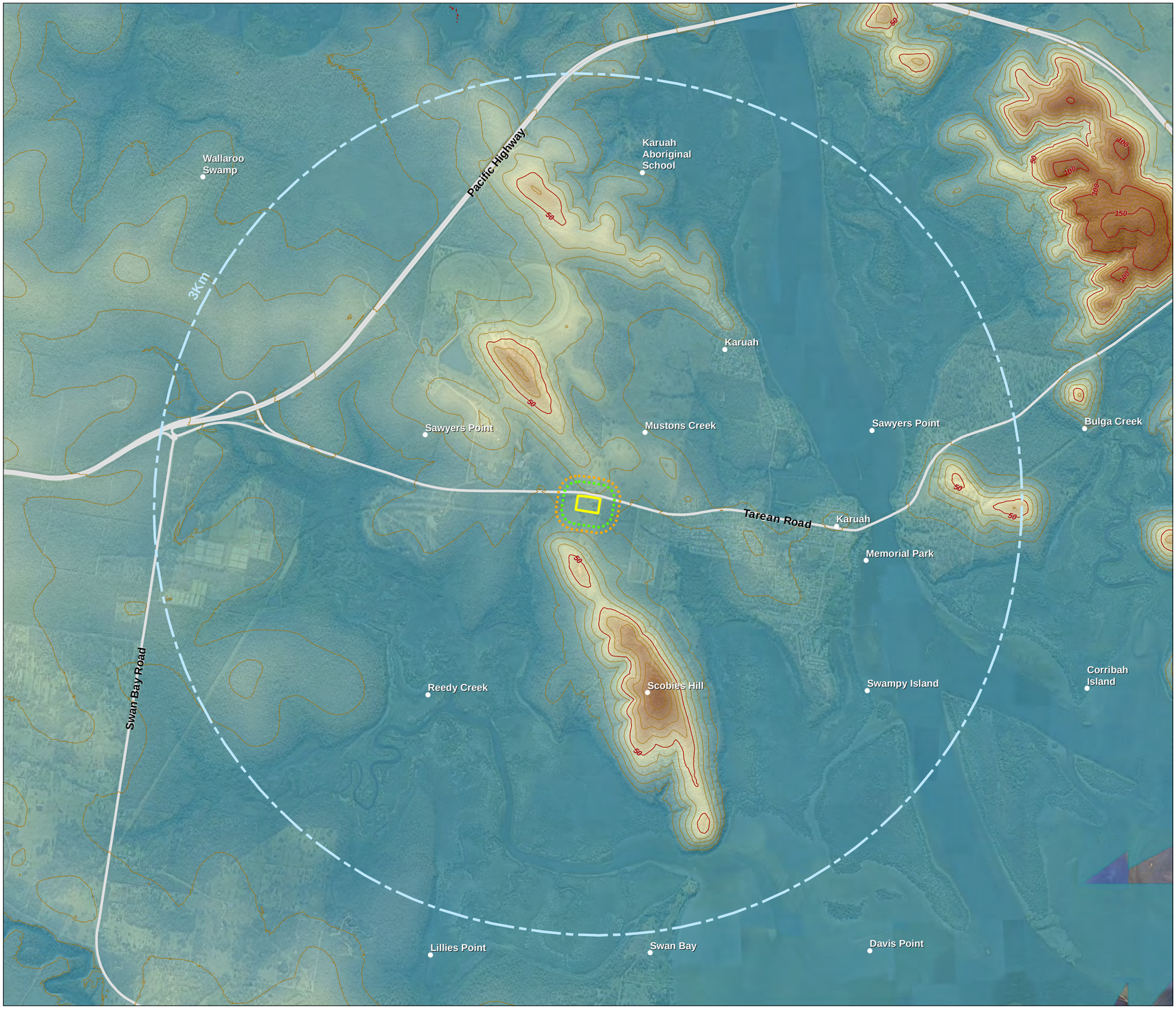

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Figure 11

Digital Elevation Model - 3Km

BUSHFIRE PLANNING AUSTRALIA

Subject Site
140m Buffer
100m Buffer
Contour (50m)
Contour (10m)

Elevation (AHD)
High : 169m
Low : 0m

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2012

N W E S

0 250 500 750 1,000 1,250
Meters

A3 Scale: 1:25,000

File:2169-TareanRdKaruah-Fig5b-DEM-3km220322 Date: 22/03/2022

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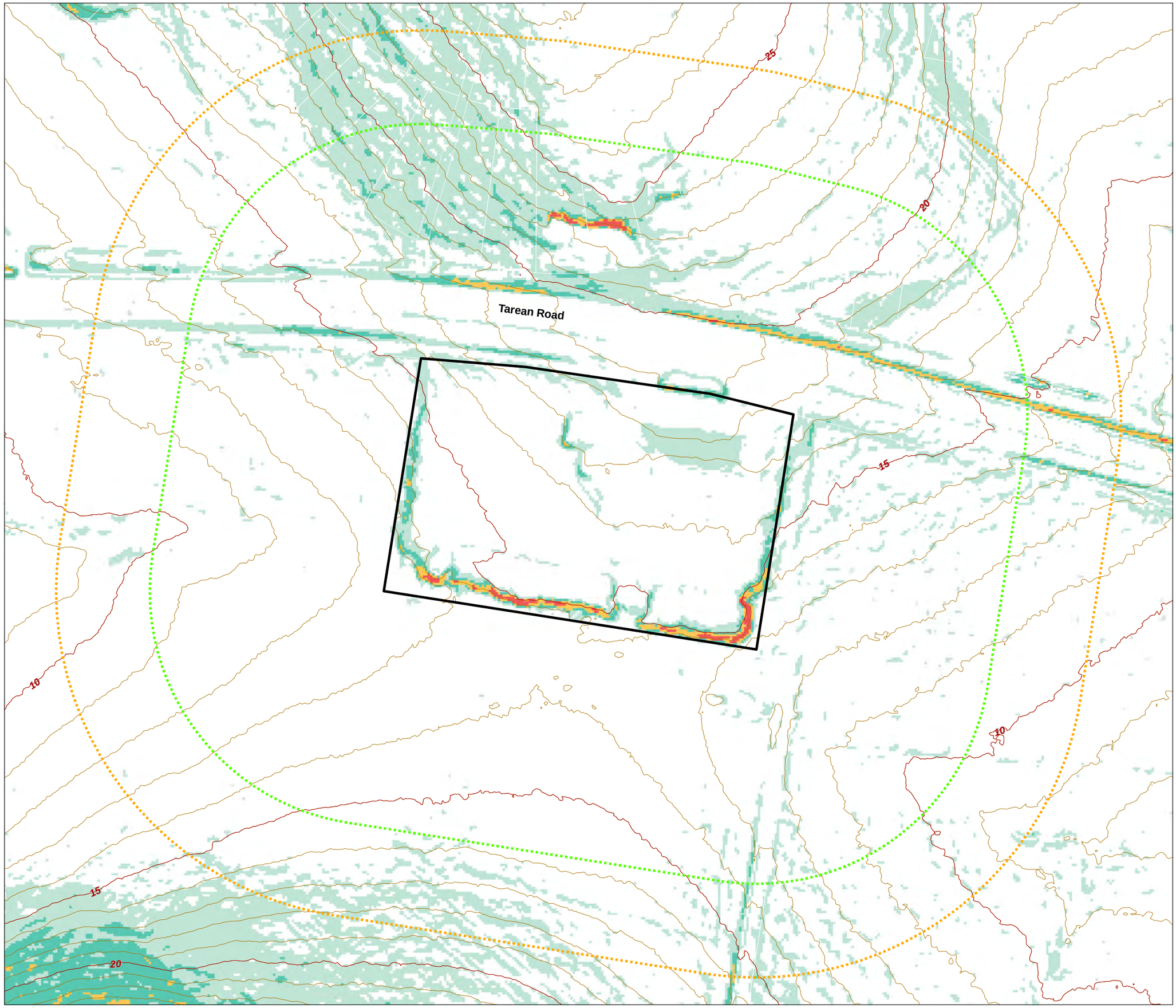

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Figure 12

Slope Analysis: LiDAR

BUSHFIRE PLANNING AUSTRALIA

- Subject Site
- 140m Buffer
- 100m Buffer
- Contour (10m)
- Contour (5m)

Slope

- 0° - 5°
- 5° - 10°
- 10° - 15°
- 15° - 20°
- >20°

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2012

N
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0 20 40 60 80
Meters

A3 Scale: 1:1,500

File:2169-TareanRdKaruah-Fig6a-SlopeLiDAR-220322 Date: 22/03/2022

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Figure 13

Slope Analysis: LiDAR - 3Km

BUSHFIRE PLANNING AUSTRALIA

Subject Site
140m Buffer
100m Buffer
Contour (50m)
Contour (10m)

Slope

0° - 5°
5° - 10°
10° - 15°
15° - 20°
>20°

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial photo: NearMap 10/02/22
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2012

N
W E
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0 250 500 750 1,000 1,250
Meters

A3 Scale: 1:25,000

File:2169-TareanRdKaruah-Fig6b-SlopeLiDAR-220322 Date: 22/03/2022

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5.4. Results

The findings of the BHA confirmed the closest vegetation providing the greater hazard was identified as the *forest* to the east and south-east. However large, continuous expanses of *forest* vegetation extend to the west, but is separated from the site by over 200m of actively grazed land. Overall the site was found to be exposed to a high bushfire hazard.

The results of the Bushfire Hazard Assessment is presented in **Table 3** and **Figure 14**.

Table 3: Slope and Vegetation Assessment results

Transect/ Direction	Classification of Vegetation Formations PBP 2019	Slope
T1 West	***Forest*** *Hunter Macleay DSF*	1.6° Downslope
T2 North	***Grassland***	-2.4° Upslope
T3 North	***Forest*** *Hunter Macleay DSF*	-4.9° Upslope
T4 North	***Excluded*** *(Road)*	-2.6° Upslope
T5 North-east	***Grassland***	1.1° Downslope
T6 East	***Forest*** *Hunter Macleay DSF*	2.1° Downslope
T7 East	***Forest*** *Hunter Macleay DSF*	2.3° Downslope
T8 East	***Forest*** *Hunter Macleay DSF*	2.6° Downslope
T9 South	***Grassland***	-1.0° Upslope
T10 South	***Grassland***	-0.5° Upslope
T11 West	***Grassland***	1.9° Downslope

Project: 254 Tarean Road, Karuah
Job No: 2169

Figure 14

Slope & Vegetation Assessment

BUSHFIRE PLANNING AUSTRALIA

- Subject Site
- 140m Buffer
- 100m Buffer
- RL
- Downslope transect
- Upslope transect
- Contour (10m)
- Contour (5m)
- Driveway (dirt)
- OHE easement
- Forest
- Grassland
- Managed land

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial Photo: Nearmap 24/03/2021
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2012

N W E S

0 20 40 60 80
Meters

A3 Scale: 1:1,500

File:2169-TareanRdKaruah-Fig7-SlopeVeg-211110 Date: 10/11/2021

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5.5. Significant Environmental Features

There are no know environmental features of significance within the development footprint or the balance of the site. The development footprint is wholly located within that part of the site that is predominantly cleared.

5.6. Threatened Species, populations or ecological communities

The area of the site to be affected by the proposed development has been identified to avoid impact on any threatened species, population or EEC. All bushfire mitigation measures; including APZs have considered the existing and potential biodiversity values to avoid impact where possible.

5.7. Aboriginal Objects

A search of the AHIMS database (results contained in **Appendix A**) revealed there is possibly 1 (one) Aboriginal sites or places recorded near the subject site, however, this is located on the northern side of Tarean Road and will not be impacted by this proposed development.

6. Strategic Bushfire Study (SBS)

As this report has been prepared to support a planning proposal to permit a service station, the strategic principles in Chapter 4 of PBP should be addressed. In a bushfire context strategic planning must ensure that future land uses are in appropriate locations to minimise the risk to life and property from bushfire attack.

This Strategic Bushfire Study (SBS) provides a landscape assessment of:

1. Likely fire runs;
2. Bushfire risk and appropriateness of land use location;
3. Adequacy of broadscale access and infrastructure;
4. Impact on the existing emergency services and adjoining land owners.

6.1. Establishing Risk and Applying Treatment

The SBS was introduced in NSW by Planning for Bush Fire Protection 2019 (PBP 2019). The SBS follows the principles of strategic planning generally in taking a long-term approach to land use planning and development expectations. The approach to a BFSS aims to minimise or avoid the impact of natural hazards by taking a risk-based approach to the assessment of strategic planning policies and proposals. The BFSS uses a macro-scale assessment, creates a risk profile for the planning proposal and seeks to respond to that risk assessment.

There are a number of national level guidance documents which provide helpful guidance in preparing strategic studies for natural hazard resilience. At a high level, the stage is set for consideration for natural hazards in strategic planning by the *Sendai Framework for Disaster Risk Reduction 2015-2030* (UNDRR, 2015), *The National Disaster Risk Reduction Framework* (Australian Government Department of Home Affairs, 2018), *Profiling Australia's Vulnerability: The interconnected causes and cascading effects of systemic disaster risk* (Australian Government Department of Home Affairs, 2018) and the *National Strategic for Disaster Resilience* (COAG, 2011).

The Land Use Planning for Disaster Resilient Communities published in 2020 by the Australian Institute for Disaster Resilience focusses on reducing disaster risk by improving strategic planning processes. The handbook aims to reduce both vulnerability and exposure of communities to natural hazard scenarios.

> *"By considering natural hazards early and through its processes, land use planning can evaluate and select land use mechanisms to treat disaster risk".*

The actions proposed by the Handbook are to understand disaster risk, make accountable decisions, establish governance, ownership and responsibility and ultimately, attract enhanced investment for reduce the risk. Ultimately, the goal is to make decisions which avoid risk. However, accepting that some level of risk is inevitable, the concept of risk tolerance and acceptable risk is highlighted. The Handbook uses a key principle introduced by the Planning Institute of Australia *National Land Use Planning Guidelines for Disaster Resilient Communities* (2015) which is the ALARP principle (As Low As Reasonably Practicable). This revolves around identifying risks that are broadly acceptable, tolerable, or generally intolerable and requires the identification of risk treatment options to move more towards the tolerable or broadly acceptable categories.

The Handbook highlights the role that land use planning can play in climate change mitigation and adaptation. Future climate change models should be identified and utilised in the process of data gathering and analysis, whilst also acknowledging the uncertainties associated with those models.

The relationship with emergency management principles is highlighted by the Land Use Planning Handbook. The integration of risk management and land use planning is recommended. The National Emergency Risk Assessment Guidelines produced by AIDR sets out the following structure for evaluating risk and applying risk treatment:

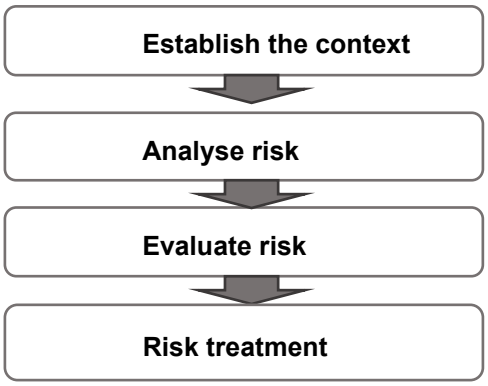


Figure 15: Risk Treatment Process (taken from NERAG)

This process is appropriate for the SBS and will be followed to establish the risk and recommended risk treatment for the planning proposal.

6.2. Ministerial Direction

Legislatively, planning proposals must follow the Ministerial Directions under Section 9.1(2) of the *Environmental Planning and Assessment Act 1979*. Direction 4.4 requires a planning proposal to have regard to PBP 2019, introduce controls that avoid placing inappropriate developments in hazardous areas and ensure that bushfire hazard reduction is not prohibited within the APZ. The planning proposal must also comply with the following provisions:

(a) provide an Asset Protection Zone (APZ) incorporating at a minimum:

1. *(i) an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and*
2. *(ii) an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,*

(b) for infill development (that is development within an already subdivided area), where an appropriate APZ cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire Protection Purposes (as defined under section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with,

(c) contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks,

(d) contain provisions for adequate water supply for firefighting purposes,

(e) minimise the perimeter of the area of land interfacing the hazard which may be developed,

(f) introduce controls on the placement of combustible materials in the Inner Protection Area.

6.3. Aim of Strategic Bushfire Study (SBS)

PBP 2019 provides high level considerations for a SBS and also provides development standards for resultant development applications. This SBS follows the considerations outlined within Table 4.2.1 of PBP 2019 to identify and analyse the risk profile and apply risk treatment measures. The aim of the SBS is to meet the following principles:

- ensure the land is suitable for the proposed additional uses in the context of bush fire risk;
- ensure any new development resulting from the planning proposal will comply with PBP 2019;
- any reliance on future performance-based solutions is minimised;
- adequate infrastructure is provided associated with emergency evacuation and firefighting operations; and
- appropriate ongoing land management practices are facilitated.

6.4. Bushfire Landscape Assessment

A bushfire landscape assessment considers the likelihood of a bushfire approaching the site, its potential severity and intensity and the resultant impact on life and property in the context of the broader surrounding landscape. The broad assessment provides the foundation for strategic decision making on appropriate land uses.

Fire behaviour has been assessed on a 3 kilometre scale. This distance is considered a reasonable scale by which to assess fire behaviour within the landscape for this particular site.

6.4.1. Vegetation

The site occurs within the Karuah Manning Subregion of the NSW North Coast Bioregion. Vegetation in the immediate vicinity of the site is dominated by dry sclerophyll forests. The majority of the site has been cleared with only scattered trees found along the rear boundary line.

Section 5.1 of this report provides a detailed assessment of the predominant vegetation communities up to 3km from the subject site. It was found the dominant vegetation across the landscape is a dry sclerophyll forest.

6.4.2. Topography

The broader landscape within a 3km radius of the site is gradually undulating in nature and ranges from peaks at 109 metres above sea level (Scobie's Hill) to floodplain troughs of 0 metres above sea level to the south (Karuah River) (**Figure 7 & 9**).

Research tells us that the speed of an advancing bushfire front will double with every 10 degree increase in slope, so that on a 20 degree slope, its speed of advancement is four times greater than on flat ground.

Section 6.2 provides a detailed landscape scale assessment of the topography surrounding the site and identifies the effective slope within close proximity of the proposed development.

6.4.3. Weather and Climate Change

The bushfire danger period in the Greater Hunter Fire Weather Area (which includes Port Stephens LGA as designated by the NSW RFS and the Bureau of Meteorology - BOM) ordinarily begins on 1 October and ends on 31 March. This is unless bushfire risk conditions are experienced earlier or later in the year, in which case the fire danger period will be extended. During this period weather is typically hotter and drier as we traverse through the seasons of spring and summer.

Studies to date conclude that "Australia will get hotter; in all regions maximum and minimum temperatures in all seasons are expected to increase 0.2 to 2.2 degrees Celsius by 2030, and 0.4 to 6.7 degrees Celsius by 2070" (Dunlop, M., & Brown, P.R. 2008).

Thunderstorms will become more prevalent "Australia is highly vulnerable to more storms of increasing intensity, especially storm surges associated with tropical cyclones" (climatecouncil.org.au). Lightning strikes will intensify and the potential for ignition of trees and

ground fuels increased. The Department of Sustainability and Environment (Victoria) estimate that 26% of bushfires on public land are caused by lighting strikes alone (CSIRO, 2009).

The east coast of NSW is also likely to experience slightly greater rainfall, mostly in the summer and autumn seasons. Increased rainfall could lead to increased plant growth and fuel load. It is difficult to say what all this may mean for vegetation communities in the future and how far into the future vegetation may change. However, on the basis of the evidence produced by Dunlop and Brown, it is possible that fuel loads will increase and there may be some drying of vegetation, such that vegetation may increase in flammability.

The Forest Fire Danger Index (FFDI) given to the Greater Hunter Region is 100, the highest FFDI which reflects a "Catastrophic" condition and risk to life and property. The index is calculated from weather station data and is based on representative values of wind speed, temperature, humidity and fuel conditions.

The index represents a 1:50 year fire weather scenario and is applied to methodologies in calculating anticipated bushfire attack levels. It is possible that due to local variations in elevation, slope, and aspect, FFDI values at any point location may reflect values which are higher or lower then 100 resulting in different rates of fire spread across a landscape.

In planning for climate change and future climatic scenarios, if the predictions are correct, we can expect to see more occasions when 'Catastrophic' fire danger is recorded. Whilst there have only been two occasions where the FFDI has exceeded 100 in the Sydney area in the past 49 years, from a future planning and risk perspective, this provides us with a precedent we can expect to see repeated more frequently in the future. We propose therefore to utilise an FFDI of 100 in the calculation of Asset Protection Zone setbacks for the resultant subdivision. The use of FFDI 100 increases required APZ setbacks by approximately 4-5 metres.

6.5. Land Use Assessment

A land use assessment identifies the appropriateness of siting different land uses in particular locations based on risk profiles.

In relation to the proposal against the bushfire landscape, as described above, the adjoining continuous vegetation and fall of the land does represents a significant risk that would rule out the siting of any commercial or residential occupancy without mitigating the potential threat. The only factors for consideration would be the ability of the future buildings to withstand bushfire attack and the capacity of the road network to cope with increased numbers should evacuation be undertaken. This however can be alleviated through the provision of a suite of PBP bushfire protection measures that includes a secondary point of egress.

Under the *Rural Fires Act 1997* (RFA) and PBP 2019 the proposed land uses fall mostly into the category of 'other development'. PBP 2019 provides performance criteria for the proposed uses (**Table 4**).

Table 4: Classification of bushfire protection requirements for proposed land uses

Land Use	Requirements of PBP 2019
Mixed Use	Offices, shops, factories, warehouses, public carparks and commercial and industrial facilities are considered as Class 5 to 8 buildings within the NCC. AS3959 and the NASH Standard are not considered as a set of deemed to satisfy provisions. Bushfire protection measures required in relation to access, water supply and services and emergency and evacuation planning.

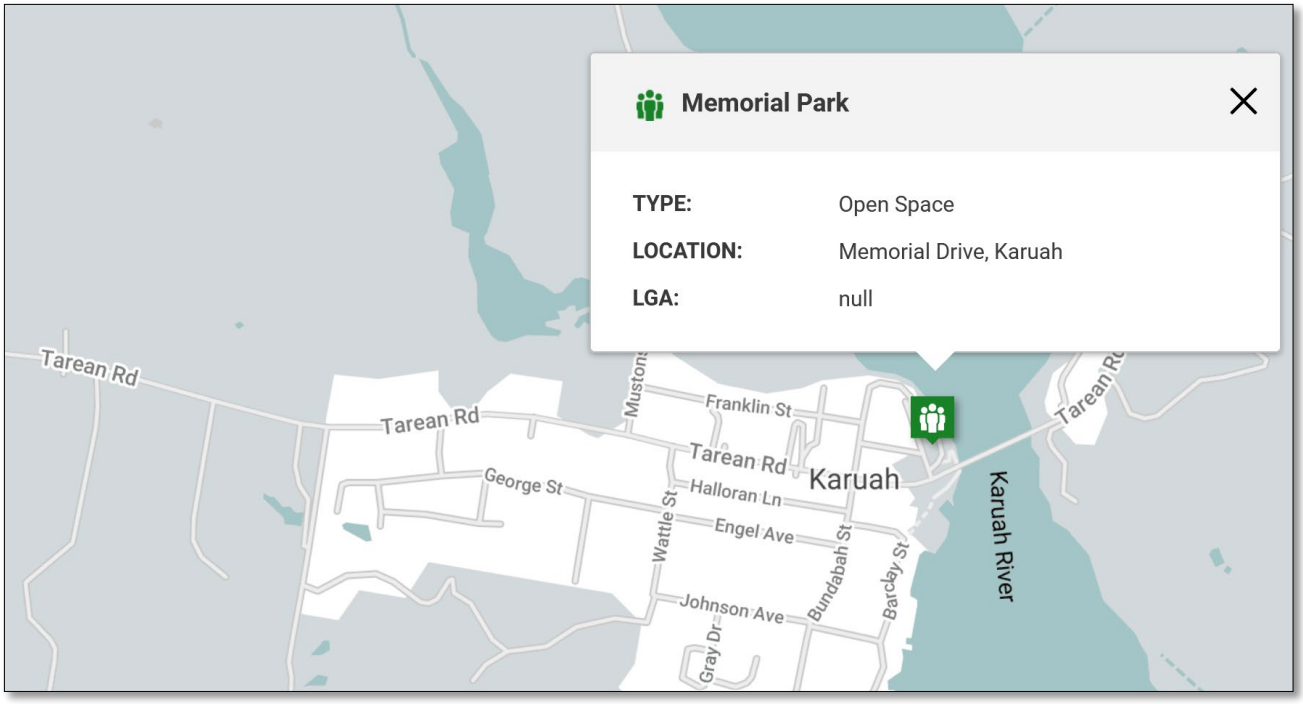
6.6. Access and Egress

Current access/egress for the site is directly from Tarean Road; which was formerly known as the Pacific Highway. Although there is little demand on the road directly accessing the site, a traffic report would be required prior to rezoning to demonstrate the capacity of the site to deal with the increase in vehicle movements and the opportunity for evacuating persons and responding emergency services based on the proposed land use profile.

In relation to the site itself and from a bushfire risk perspective, a key protection measure is to be able to provide two points of egress which give occupants of a development two different directional options away from a site. However, as a highway service centre, there will always be two main access points, both directing traffic to/ from Tarean Road, to the east and to the west. Typically the two egress points need to be in two entirely separate directions of travel such that if a bushfire blocks one egress, there is a viable alternative direction of travel. However the purpose of a highway service centre is to serve motorists for a short period of time. Further

6.7. Emergency Services

The closest (and only) Neighbourhood Safer Place (NSP) to the east of the site is located at the open space at Memorial Drive, Karuah (2km away). A NSP is a place of last resort. Their use will be highly dependent on fire activity and direction of fire run. If occupants of the site are unable to reach an NSP there are a number of other built up locations nearby which can afford occupants suitable protection away from the effects of radiant heat, smoke and embers.



There is little opportunity for an indoor NSP or refuge building onsite that meets the requirements of the *Neighbourhood Safer Places Guidelines for the Identification and Inspection of Neighbourhood Safer Places in NSW* due the limited size of the site. Accordingly the site itself would not be capable of sheltering the number of occupants anticipated to visit and work on site.

The closest Rural Fire Brigade is located at 7 Wattle Street, Karuah, approximately 1.8km or 3 minutes away from the site (**Figure 16**). In an emergency the larger NSW Fire & Rescue stations support the local rural brigades, if required. The nearest NSW Fire & Rescue station is located at 5 Leisure Way, Raymond Terrace approximately 25.2km (17 mins) drive away from the site.

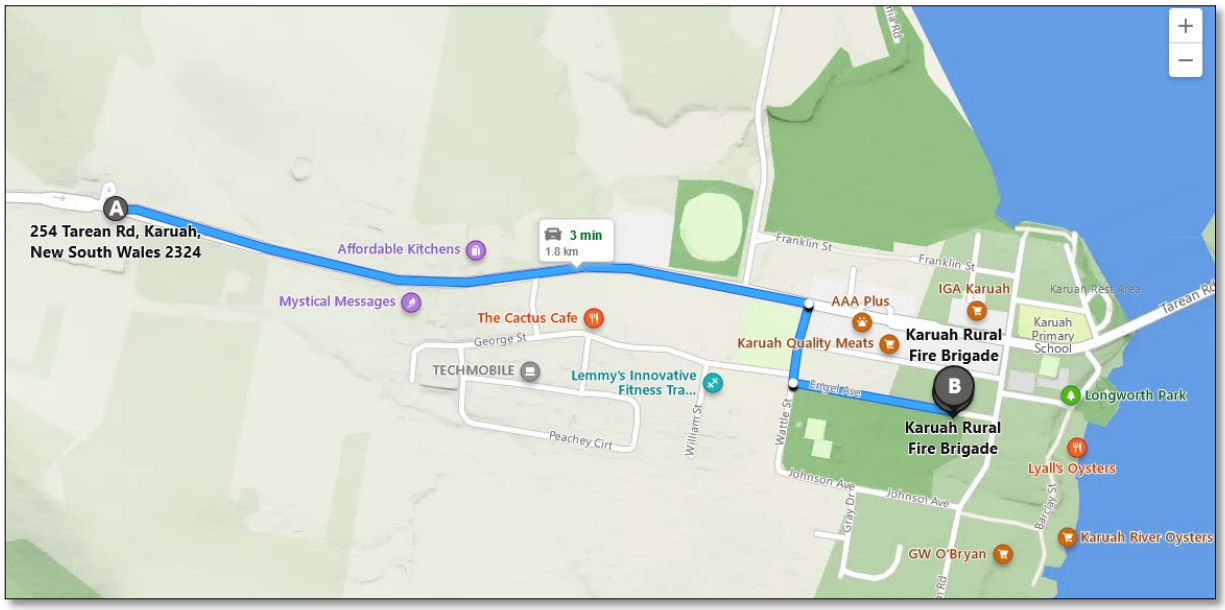


Figure 16: Karuah Rural Fire Brigade

6.8. Infrastructure

Electricity supply to the site will be underground and therefore posing no threat to life or occupants. Future development applications will be able to meet the acceptable solutions and performance criteria of PBP 2019, ensuring that the location and design of gas and electricity services does not lead to ignition of surrounding bushland or the fabric of buildings.

A water supply connection will be taken from the reticulated town supply. This supply will be required to meet the acceptable solutions and performance criteria of PBP 2019. Given the nature of the bushfire risk identified by the landscape assessment, it is recommended the site also has a static water supply available for firefighting purposes. This additional water supply should be 20,000 litres. All static water supplies should be easily accessible and include firefighting connections in accordance with PBP 2019.

6.9. Adjoining Land

The only anticipated impact the planning proposal would have on adjoining land would be an increase in traffic to the area and added dependence on town water supply, both of which have been addressed in the above sections.

There is not likely to be any negative impact on adjoining land in terms of Asset Protection Zones as they will be provided for wholly within the boundary of the site.

6.10. Strategic Bushfire Study - Conclusion and Recommendations

The landscape, vegetation and topographic studies show that this site is subject to a high bushfire threat. Measures that are applied to create compliance with Planning for Bush Fire Protection 2019 at the development stage would reduce the vulnerability of the buildings and occupants. Construction measures can increase the likelihood of assets to withstand most bushfires. A good access and egress strategy can also reduce the vulnerability of the development by enabling occupants to move away from a bushfire as it approaches. Achieving adequate access and safe movement is therefore a key objective prior to development proceeding.

Subject to the following recommendations, the proposed land use can be considered to be appropriate in its bushfire context:

1. Any future development application for a hazardous industry shall be supported by a Fire Safety Study (FSS) prepared in accordance with the NSW Department of Planning, Infrastructure and Environment (DPIE) *Hazardous Industry Planning and Assessment*

Papers. The FSS must demonstrate all components and infrastructure associated with a service station will be designed and constructed with the relevant specifications and standards and are able to withstand high levels of sustained radiant heat exposure.

2. The capacity of the site must be sufficient to deal with occupants of the site in an emergency situation; this should include a minimum of two points of access which provide two different routes of travel away from the site.
3. A traffic report should be prepared which assesses the capacity of the site in the event of an emergency, assuming that road closures of public roads surrounding the site might occur.
4. An emergency evacuation and management plan should be prepared which demonstrates the required actions to be undertaken in the event of a bushfire.
5. Details of the proposed development should be provided to the Local Emergency Management Committee to enable awareness in emergency response.

7. Bush Fire Protection Measures

PBP 2019 refers to the proposed industrial development as 'Other development'. In order to comply with PBP, the development should:

- Note the range of available Bush Fire Protection Measures (BFPMs);
- Satsify the aims and objectives of PBP 2019;
- Consider any matters listed for the specific purpose; and
- Propose an appropriate combination of BPMs.

Additional provisions relevant to 'other development' detailed in PBP 2019 state that in order to comply with PBP 2019, the following conditions must be met:

- Satisify the aims and objectives of PBP outlined in Chapter 1;
- Consider any issues listed for the specific purpose for the development; and
- Propose an appropriate combination of BFPMs.

This BAR has adopted the methodology to determine the appropriate BFPMs detailed in PBP 2019. As part of the BAR, the recommended BFPMs demonstrate the aims and objectives of PBP 2019 are able to be satisified; including the matters considered by the RFS necessary to protect persons, property and the environment from the danger that may arise from a bushfire.

7.1. Asset Protection Zones

An APZ is an area surrounding a development that is managed to reduce the bushfire hazard to an acceptable level to mitigate the risk to life and property. The required width of the APZ varies with slope and the type of hazard, however, all areas of land identified as an APZ should be managed as an IPA in accordance with Appendix 4 of PBP 2019.

7.1.1. Determining the Appropriate Setbacks

PBP 2019 does not explicitly require the proposed industrial development to provide an APZ in accordance with Appendix 1 of PBP 2019. Notwithstanding, the provision of access and defendable space is provided by the service roads. In this instance consideration has been given to the type of hazard; including the average slope and also the steepest slope.

The APZ has been calculated in accordance with Table A1.12.2 of PBP 2019.

Table 5: Required Asset Protection Zones

Transect/ Direction	Classification of Vegetation Formations PBP 2019	Slope	APZ (PBP 2019 Table A1.12.2)	Required APZ (29kW/m^2) Method 2
T1 West	***Forest*** *Hunter Macleay DSF*	1.6° Downslope	29m	17m
T2 North	***Grassland***	-2.4° Upslope	10m	10m
T3 North	***Forest*** *Hunter Macleay DSF*	-4.9° Upslope	24m	13m
T4 North	***Excluded (Road)***	-2.6° Upslope	0m	0m
T5 North-east	***Grassland***	1.1° Downslope	12m	11m
T6 East	***Forest*** *Hunter Macleay DSF*	2.1° Downslope	29m	18m
T7 East	***Forest*** *Hunter Macleay DSF*	2.3° Downslope	29m	18m
T8 East	***Forest*** *Hunter Macleay DSF*	2.6° Downslope	29m	18m
T9 South	***Grassland***	-1.0° Upslope	10m	10m
T10 South	***Grassland***	-0.5° Upslope	10m	10m
T11 West	***Grassland***	1.9° Downslope	12m	11m

7.2. Access

Under the National Construction code (NCC), Class 5 to 8 buildings include other commercial and industrial facilities such as the proposed highway service centre. Whilst bushfire is not captured in the NCC for these buildings, the following objectives will be applied in relation to access:

- To provide safe access to and from the public road system for firefighters providing property protection during a bushfire and for occupant egress for evacuation; and
- To provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development.

Any future development will be required to provide safe operational access for emergency services personnel to enable the suppression of a bushfire while occupants are evacuating the site. As no detailed information is available for the proposed future use, the assessment has considered the location of the site in relation to available egress routes.

7.3. Services - water electricity and gas

7.3.1. Water

Fire hydrant spacing, sizing and pressure should comply with AS 2419.1 – 2005. Hydrants are not to be located within any road carriageway.

All lots within the proposed development will be connected to a reticulated water supply.

7.3.2. Electricity

All electricity services are located underground.

7.3.3. Gas

Any reticulated or bottled gas should be installed and maintained according to the requirements of the relevant authorities and AS 159-2002. It is expected that the location of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.

7.4. Construction Standards - Bushfire Attack Level

The proposed land use zone permits a variety of non-habitable buildings included bulky goods premises, general industries, warehouses and distribution centres. The NCC does not provide for any bushfire specific performance requirements for these particular classes of buildings. As such, AS3959-2018 is not considered as a set of deemed-to-satisfy provisions. However, compliance with AS3959-2018 and the NASH standard may be considered when meeting the aims and objectives of PBP 2019 – for future industrial buildings.

The determinations of the appropriate bushfire attack level (BAL) is based on the maximum potential radiant heat exposure. BALs are based upon parameters such as weather modelling, fire-line intensity, flame length calculations, as well as vegetation and fuel load analysis. The determination of the BAL is derived by assessing the:

- Relevant FDI = 100;
- Flame temperature = 1090K;
- Slope = variable;
- Vegetation classification = *Forest (Hunter Macleay DSF)* and *Grassland*; and
- Building location.

Based on the unique site characteristics identified by the BAR, the intensity of a bushfire event presented as the radiant heat exposure was calculated at several locations throughout the development site using the NBC Bushfire Attack Assessor V4.1. The nominated fuel loads for the respective vegetation classifications as published by the RFS in March 2019 have been used to determine the APZs and the effective slope obtained from the Digital Elevation Model (DEM) for each transect.

Table 6: Bushfire Attack Levels (PBP 2019 & AS3959-2018)

Transect	Vegetation Formation (PBP 2019)	Slope	APZ (29kW/m²) Method 2	Distance from Hazard	Bushfire Attack Level (BAL)
T1	***Forest*** *Hunter Macleay DSF*	1.6° Downslope	**17m**	0m-<16m	BAL-FZ
				16m-<17m	BAL-40
				17m-<25m	BAL-29
				25m-<35m	BAL-19
				35m-<100m	BAL-12.5
T2	***Grassland***	-2.4° Upslope	**10m**	0m-<8m	BAL-FZ
				8m-<10m	BAL-40
				10m-<15m	BAL-29
				15m-<22m	BAL-19
				22m-<50m	BAL-12.5
T3	***Forest*** *Hunter Macleay DSF*	-4.9° Upslope	**13m**	0m-<11m	BAL-FZ
				11m-<13m	BAL-40
				13m-<18m	BAL-29
				18m-<26m	BAL-19
				26m-<100m	BAL-12.5
T4	***Excluded***	-2.6° Upslope	**0m**	BAL-LOW	
T5	***Grassland***	1.1° Downslope	**11m**	0m-<9m	BAL-FZ
				9m-<11m	BAL-40
				11m-<17m	BAL-29
				17m-<25m	BAL-19
				25m-<50m	BAL-12.5
T6	***Forest*** *Hunter Macleay DSF*	2.1° Downslope	**18m**	0m-<16m	BAL-FZ
				16m-<18m	BAL-40
				18m-<25m	BAL-29
				25m-<35m	BAL-19
				35m-<100m	BAL-12.5
T7	***Forest*** *Hunter Macleay DSF*	2.3° Downslope	**18m**	0m-<16m	BAL-FZ
				16m-<18m	BAL-40
				18m-<26m	BAL-29
				26m-<36m	BAL-19
				36m-<100m	BAL-12.5
T8	***Forest*** *Hunter Macleay DSF*	2.6° Downslope	**18m**	0m-<16m	BAL-FZ
				16m-<18m	BAL-40
				18m-<26m	BAL-29
				26m-<36m	BAL-19
				36m-<100m	BAL-12.5

Transect	Vegetation Formation (PBP 2019)	Slope	APZ (29kW/m²) Method 2	Distance from Hazard	Bushfire Attack Level (BAL)
T9	***Grassland***	-1.0° Upslope	**10m**	0m-<8m	BAL-FZ
				8m-<10m	BAL-40
				10m-<15m	BAL-29
				15m-<22m	BAL-19
				22m-<50m	BAL-12.5
T10	***Grassland***	-0.5° Upslope	**10m**	0m-<8m	BAL-FZ
				8m-<10m	BAL-40
				10m-<15m	BAL-29
				15m-<22m	BAL-19
				22m-<50m	BAL-12.5
T11	***Grassland***	1.9° Downslope	**11m**	0m-<9m	BAL-FZ
				9m-<11m	BAL-40
				11m-<17m	BAL-29
				17m-<25m	BAL-19
				25m-<50m	BAL-12.5

Project: 254 Tarean Road, Karuah
Job No: 2169

Figure 19

BAL Contour Plan

BUSHFIRE PLANNING AUSTRALIA

Tarean Road

22 m
29 m
40 m
54 m
8 m
10 m
15 m
22 m

Subject Site

Radiant Heat

10kW/m2 (Method 2)

29kW/m2 (Method 2)

Asset Protection Zone

Required Bushfire Attack Levels (PBP 2019 Table A1.12.2)

BAL - FZ

BAL - 40

BAL - 29

BAL - 19

BAL - 12.5

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2021
Aerial Photo: Nearmap 24/03/2021

N
W E
S

0 5 10 15 20 25 30
Meters

A3 Scale: 1:600

File:2169-TareanRdKaruah-Fig8-BALs-220322 Date: 22/03/2022

7.5. Landscaping and Vegetation Management

The design and management of the landscaped areas in the vicinity of buildings have the potential to improve the chances of survival of people and buildings. Generally landscaping in and around a bushfire hazard should consider the following:

- Priority given to retaining species that have a low flammability;
- Priority given to retaining species which do not drop much litter in the bushfire season and which do not drop litter that persists as ground fuel in the bush fire season;
- Priority given to retaining smooth barked species over stringy bark; and
- Create discontinuous or gaps in the vegetation to slow down or break the progress of fire towards the dwellings.

Landscaping should give due regard to fire retardant plants and ensure that fuel loads do not accumulate as a result of the selected plant varieties.

The principles of landscaping for bushfire protection aim to:

- Prevent flame impingement on buildings;
- Provide a defendable space for property protection;
- Reduce fire spread;
- Deflect and filter embers;
- Provide shelter from radiant heat; and
- Reduce wind speed.

Plants that are less flammable have the following features;

- High moisture content;
- High levels of salt;
- Low volatile oil content of leaves;
- Smooth barks without ‘ribbons’ hanging from branches or trunks; and
- Dense crown and elevated branches.

Avoiding understorey planting and regular trimming of the lower limbs of trees also assists in reducing fire penetration into the canopy. Rainforests species such as Syzygium and figs are preferred to species with high fine fuel and/or oil content.

Trees with loose, fibrous or stringy bark should be avoided. These trees can easily ignite and encourage ground fire to spread up to, and then through the crown of trees.

Careful thought must be given to the type and physical location of any proposed site landscaping. Inappropriately selected and positioned vegetation has the potential to ‘replace’ any previously removed fuel load.

Bearing in mind the desired aesthetic and environment sought by site landscaping, some basic principles have been recommended to help minimise the chance of such works contributing to the potential hazard on site.

Whilst it is recognised that fire-retardant plant species are not always the most aesthetically pleasing choice for site landscaping, the need for adequate protection of life and property requires that a suitable balance between visual and safety concerns be considered.

It is reiterated again that it is essential that any landscaped areas and surrounds are subject to ongoing fuel management and reduction to ensure that fine fuels do not build up.

8. Conclusion and Recommendations

Bushfire Planning Australia [redacted] to undertake a Bushfire Assessment Report and to prepare a Strategic Bushfire Study to support the proposed amendment to the Port Stephens Local Environmental Plan 2013 to permit the use of the site as a Highway Service Centre (HSC) at 254 Tarean Road, Karuah.

The site has historically been used as a service station and was converted to a restaurant including onsite caretakers accommodation. The site currently remains vacant and the remaining structures are in a state of disrepair. Consequently, the site no longer benefits from any previous existing use rights. It is understood all underground services and infrastructure associated with the former use of service station remains onsite.

The landscape, vegetation and topographic studies show that this site is subject to a high bushfire threat; particularly from the ability of a fire to propagate east to south-east – in addition to a fire approaching the site from the north-west with the potential to 'jump' across Tarean Road.

Measures that are applied to create compliance with *Planning for Bush Fire Protection 2019* at the development stage would reduce the vulnerability of the buildings and occupants. Construction measures can increase the likelihood of assets to withstand most bushfires. A good access and egress strategy can also reduce the vulnerability of the development by enabling occupants to move away from a bushfire as it approaches. Achieving adequate access and safe movement is therefore a key objective prior to development proceeding.

A hazard assessment has been completed and found the site was exposed to a high bushfire hazard mainly located to the south/ south-east of the subject site. The predominant vegetation surrounding the site is consistent with a *forest* vegetation formation as described in the NSW Rural Fire Service document Planning for Bushfire Protection 2019 (PBP 2019).

The proposed land use is not considered completely incompatible with the surrounding environment and with sound bushfire management, the proposal can mitigate the bushfire risk subject to completion of the following:

1. Any future development application for a hazardous industry shall be supported by a Fire Safety Study (FSS) prepared in accordance with the NSW Department of Planning, Infrastructure and Environment (DPIE) *Hazardous Industry Planning and Assessment Papers*. The FSS must demonstrate all components and infrastructure associated with a service station will be designed and constructed with the relevant specifications and standards and are able to withstand high levels of sustained radiant heat exposure.
2. Future asset protection zones (APZs) should be based on a minimum FDI of 100. APZs will be fully contained within future lot boundaries and will not rely on adjoining land, or the existing overhead electricity transmission line easements.
3. The capacity of the site must be sufficient to deal with occupants of the site in an emergency situation; this should include a minimum of two points of access which provide two different routes of travel away from the site.
4. A traffic report should be prepared which assesses the capacity of the site in the event of an emergency, assuming that road closures of public roads surrounding the site might occur.
5. An emergency evacuation and management plan should be prepared which demonstrates the required actions to be undertaken in the event of a bushfire.
6. Details of the proposed development should be provided to the Local Emergency Management Committee to enable awareness in emergency response.

The following recommendations when implemented will reduce the impact of a bushfire to an acceptable level for the proposed industrial (non-habitable) buildings and demonstrate the proposed development is ably to comply with PBP 2019:

1. The entire site shall be managed as an Inner Protection Area (IPA) as outlined within Appendix 4 of PBP 2019 and the RFS document *Standards for asset protection zones*;

2. All land within 10m of every building is to be managed as an APZ as outlined within Appendix 4 of PBP 2019 and the RFS document *Standards for asset protection zones*;
3. Property access roads are to be constructed in accordance with Table 5.3b of PBP 2019;
4. All new buildings are to be connected to a reliable water supply network and that suitable fire hydrants are located throughout the development site that are clearly marked and provided for the purposes of bushfire protection. Fire hydrant spacing, sizing and pressure shall comply with AS2419.1 2005 and Table 5.3c of PBP 2019;
5. Consideration should be given to landscaping and fuel loads on site to decrease potential fire hazards on site; and
6. All hazardous materials to be stored on land within 100m of any designated bushfire prone land shall be stored in a secure enclosure away from the bushfire hazard.

This assessment has been made based on the bushfire hazards observed in and around the site at the time of inspection and production (March 2022).

The planning proposal meets the requirements of the Ministerial Direction in providing appropriate APZs for the development which should be required to include a climate change factor and control the siting of the high risk assets on the site, providing water supply for firefighting purposes and minimising the perimeter of the area of land interfacing the hazard. Further work is required on the access and egress to the site to ensure that appropriate access is provided for firefighting purposes and resident egress.

Should the above recommendations be implemented, the existing bushfire risk should be suitably mitigated to offer an acceptable level of protection to life and property for those persons and assets occupying the site, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

9. References

- NSW Rural Fire Service (2005). *Standards for Asset Protection Zones*. NSW Rural Fire Service.
- NSW Rural Fire Service (2019). Planning for Bushfire Protection – A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners.
- Ramsay, GC and Dawkins, D (1993). *Building in Bushfire-prone Areas – Information and Advice*. CSIRO and Standards Australia.
- Rural Fires and Environmental Assessment Legislation Amendment Act 2002.
- Standards Australia (2018). AS 3959 – 2018: Construction of Buildings in Bushfire-prone Areas.

Appendix A: AHIMS Search Results

AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : 2169 Karuah Service Stat

[redacted]

[redacted]

[redacted]

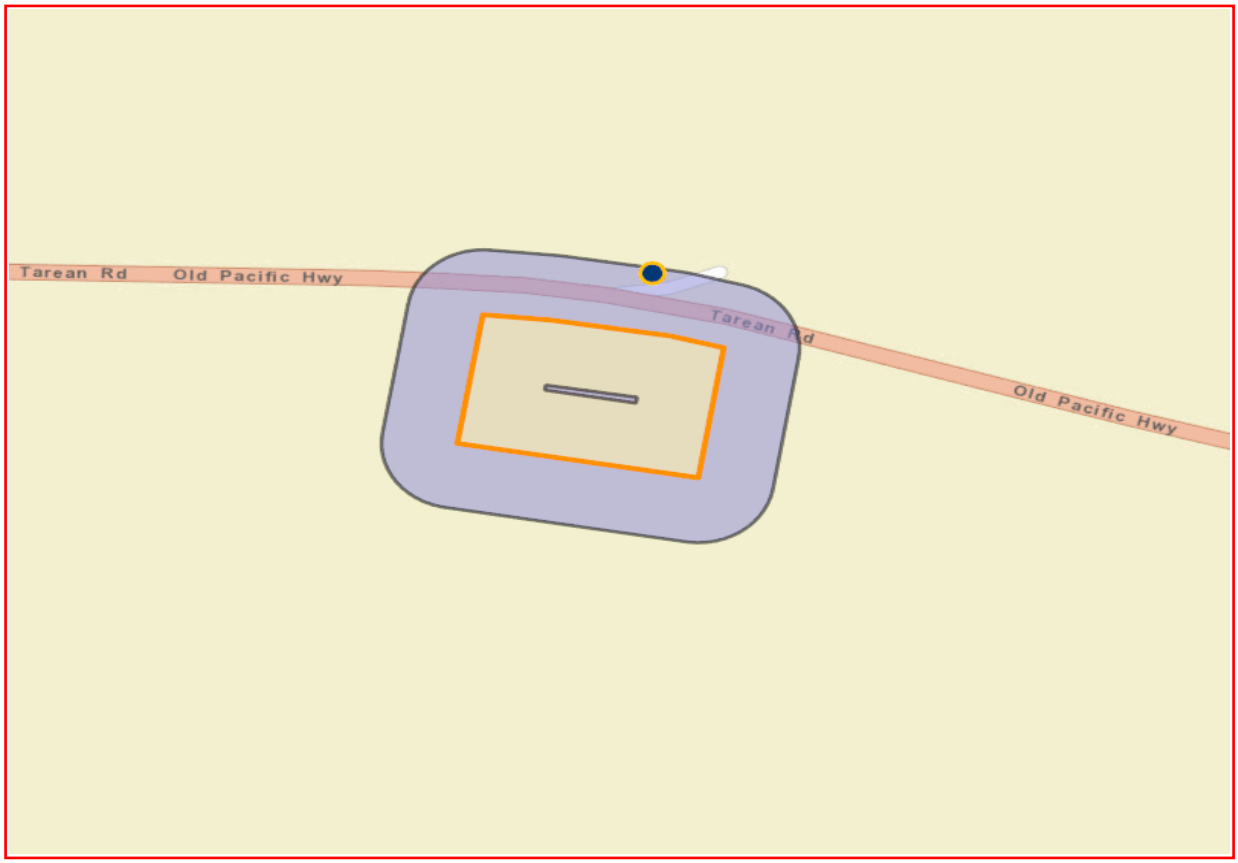
[redacted]

[redacted]

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 1, DP:DP507141, Section : - with a Buffer of 50 meters, [redacted]

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

1	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150
Locked Bag 5020 Parramatta NSW 2124
Tel: (02) 9585 6345

ABN 34 945 244 274
Email: ahims@environment.nsw.gov.au
Web: www.heritage.nsw.gov.au

Appendix B: NBC Bushfire Attack Assessor V4.1 Results Report

NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 11/11/2021 **Assessment Date:** 11/11/2021

Site Street Address: 254 Tarean Road, Karuah

Assessor: [redacted]

Local Government Area: Port Stephens **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001/Vesta/Catchpole
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: T1

Vegetation Information

Vegetation Type: Hunter Macleay DSF

Vegetation Group: Dry Sclerophyll Forests (Shrub/Grass)

Vegetation Slope: 1.6 Degrees **Vegetation Slope Type:** Downslope

Surface Fuel Load(t/ha): 14 **Overall Fuel Load(t/ha):** 24.6

Vegetation Height(m): 0.9 Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope 0 Degrees **Site Slope Type:** Downslope

Elevation of Receiver(m) Default **APZ/Separation(m):** 17

Fire Inputs

Veg./Flame Width(m): 100 **Flame Temp(K):** 1090

Calculation Parameters

Flame Emissivity: 95 **Relative Humidity(%):** 25

Heat of Combustion(kJ/kg 18600 **Ambient Temp(K):** 308

Moisture Factor: 5 **FDI:** 100

Program Outputs

Level of Construction: BAL 29 **Peak Elevation of Receiver(m):** 6.76

Radiant Heat(kW/m2): 29 **Flame Angle (degrees):** 63

Flame Length(m): 15.17 **Maximum View Factor:** 0.448

Rate Of Spread (km/h): 1.88 **Inner Protection Area(m):** 0

Transmissivity: 0.852 **Outer Protection Area(m):** 0

Fire Intensity(kW/m): 23845

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	13	17	25	35	52	6

Run Description:	T10		
Vegetation Information			
Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	0.5 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	10
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K):**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130
Program Outputs			
Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	3.81
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	64
Flame Length(m):	8.48	**Maximum View Factor:**	0.437
Rate Of Spread (km/h):	16.33	**Inner Protection Area(m):**	0
Transmissivity:	0.872	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	50613		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	0	0	0	0	0	0

Run Description:	T11		
Vegetation Information			
Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	1.9 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	11
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K):**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130
Program Outputs			
Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	4.14
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	64
Flame Length(m):	9.21	**Maximum View Factor:**	0.439
Rate Of Spread (km/h):	19.27	**Inner Protection Area(m):**	0
Transmissivity:	0.87	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	59729		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	0	0	0	0	0	0

Run Description:	T2		
Vegetation Information			
Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	2.4 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	10
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K):**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130
Program Outputs			
Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	3.57
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	64
Flame Length(m):	7.94	**Maximum View Factor:**	0.436
Rate Of Spread (km/h):	14.32	**Inner Protection Area(m):**	0
Transmissivity:	0.874	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	44395		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	0	0	0	0	0	0

Run Description: T3

Vegetation Information

Vegetation Type: Hunter Macleay DSF

Vegetation Group: Dry Sclerophyll Forests (Shrub/Grass)

Vegetation Slope: 4.9 Degrees

Vegetation Slope Type: Upslope

Surface Fuel Load(t/ha): 14

Overall Fuel Load(t/ha): 24.6

Vegetation Height(m): 0.9

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope 0 Degrees

Site Slope Type: Downslope

Elevation of Receiver(m) Default

APZ/Separation(m): 13

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 100

Program Outputs

Level of Construction: BAL 29

Peak Elevation of Receiver(m): 4.79

Radiant Heat(kW/m2): 29

Flame Angle (degrees): 63

Flame Length(m): 10.75

Maximum View Factor: 0.441

Rate Of Spread (km/h): 1.2

Inner Protection Area(m): 0

Transmissivity: 0.865

Outer Protection Area(m): 0

Fire Intensity(kW/m): 15227

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	9	12	18	26	42	6

Run Description: T4

Vegetation Information

Vegetation Type: Non-Hazard

Vegetation Group: Non-Hazard

Vegetation Slope: 2.6 Degrees

Vegetation Slope Type: Upslope

Surface Fuel Load(t/ha): 0

Overall Fuel Load(t/ha): 0

Vegetation Height(m): 0

Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope 0 Degrees

Site Slope Type: Downslope

Elevation of Receiver(m) Default

APZ/Separation(m): 1

Fire Inputs

Veg./Flame Width(m): 100

Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95

Relative Humidity(%): 25

Heat of Combustion(kJ/kg 18600

Ambient Temp(K): 308

Moisture Factor: 5

FDI: 100

Program Outputs

Level of Construction: BAL 29

Peak Elevation of Receiver(m): 0

Radiant Heat(kW/m2): 29

Flame Angle (degrees): 0

Flame Length(m): 0

Maximum View Factor: 0

Rate Of Spread (km/h): 0

Inner Protection Area(m): 0

Transmissivity: 0.905

Outer Protection Area(m): 0

Fire Intensity(kW/m): 0

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	0	0	0	0	0	6

Run Description: T5

Vegetation Information

Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	1.1 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	11

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K):**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130

Program Outputs

Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	4.03
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	64
Flame Length(m):	8.96	**Maximum View Factor:**	0.438
Rate Of Spread (km/h):	18.23	**Inner Protection Area(m):**	0
Transmissivity:	0.871	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	56521		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	0	0	0	0	0	0

Run Description:	T6		
Vegetation Information			
Vegetation Type:	Hunter Macleay DSF		
Vegetation Group:	Dry Sclerophyll Forests (Shrub/Grass)		
Vegetation Slope:	2.1 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	14	**Overall Fuel Load(t/ha):**	24.6
Vegetation Height(m):	0.9	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	18
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K):**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	6.87
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	62
Flame Length(m):	15.56	**Maximum View Factor:**	0.448
Rate Of Spread (km/h):	1.94	**Inner Protection Area(m):**	0
Transmissivity:	0.851	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	24682		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	13	18	25	35	54	6

Run Description:	T7		
Vegetation Information			
Vegetation Type:	Hunter Macleay DSF		
Vegetation Group:	Dry Sclerophyll Forests (Shrub/Grass)		
Vegetation Slope:	2.3 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	14	**Overall Fuel Load(t/ha):**	24.6
Vegetation Height(m):	0.9	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	18
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K):**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	6.96
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	62
Flame Length(m):	15.76	**Maximum View Factor:**	0.448
Rate Of Spread (km/h):	1.97	**Inner Protection Area(m):**	0
Transmissivity:	0.851	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	25025		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	13	18	26	36	55	6

Run Description:	T8		
Vegetation Information			
Vegetation Type:	Hunter Macleay DSF		
Vegetation Group:	Dry Sclerophyll Forests (Shrub/Grass)		
Vegetation Slope:	2.6 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	14	**Overall Fuel Load(t/ha):**	24.6
Vegetation Height(m):	0.9	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	18
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K):**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	7.07
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	62
Flame Length(m):	16.02	**Maximum View Factor:**	0.449
Rate Of Spread (km/h):	2.01	**Inner Protection Area(m):**	0
Transmissivity:	0.85	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	25549		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	14	18	26	36	56	6

Run Description: T9

Vegetation Information

Vegetation Type:	Grassland		
Vegetation Group:	Grassland		
Vegetation Slope:	1 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	6	**Overall Fuel Load(t/ha):**	6
Vegetation Height(m):	0	Only Applicable to Shrub/Scrub and Vesta	

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	10

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K):**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	130

Program Outputs

Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	3.75
Radiant Heat(kW/m2):	29	**Flame Angle (degrees):**	64
Flame Length(m):	8.34	**Maximum View Factor:**	0.437
Rate Of Spread (km/h):	15.77	**Inner Protection Area(m):**	0
Transmissivity:	0.873	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	48897		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	0	0	0	0	0	0