Kiama West Planning Proposal Strategic Bushfire Study

Ocean Farm Property Trust

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DOCUMENT TRACKING

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Template 2.8.1

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Abbreviations

Abbreviation	Term
AS	Australian Standard
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BC Act	*Biodiversity Conservation Act 2016*
BFPL	Bush Fire Prone Land
BFRMP	Bush Fire Risk Management Plan
BFRMC	Bush Fire Risk Management Committee
CDC	Complying Development Certificate
DA	Development Application
DPE	Department of Planning and Environment
EP&A Act	*Environmental Planning and Assessment Act 1979*
EP&A Regulation	*Environmental Planning and Assessment Regulation 2000*
FDR	Fire Danger Rating
FFDI	Forest Fire Danger Index
GEV	Generalised Extreme Value
GSC	Greater Sydney Commission
LEP	Local Environmental Plan
LGA	Local Government Area
NSP	Neighbourhood Safer Place
NSW	New South Wales
PBP	Planning for Bushfire Protection
RFS	Rural Fire Service

Executive Summary

This strategic study presents an evaluation of the suitability for rezoning of rural land (the Study Area), situated in Kiama West, for urban development as contemplated by Ocean Farm Property Trust. This study considers bushfire risk and bushfire protection for various typologies that would be enabled by rezoning, as contemplated by the indicative layout plan (ILP).

The proposal has been considered against the bushfire strategic planning requirements of *Planning for Bushfire Protection* (PBP). In undertaking this assessment, a Strategic Bushfire Study was prepared to comply with the requirements set out in Chapter 4 (*Strategic Planning*) of PBP. This Strategic Bushfire Study examines whether the rezoning proposal for is appropriate given its bushfire risk exposure context or whether it represents 'inappropriate development' as described by PBP.

The technical assessment compiled for this study considered the broader bushfire landscape and risk profile for the assessment area, along with the feasibility for the provision of bushfire protection measures. In consideration of the subject site for residential land uses. with regard to the strategic planning principles of PBP, the landscape risk assessment included an assessment of the broader bushfire landscape, bushfire weather and potential fire behaviour, while the land use evaluation considered the appropriateness of future land uses and the ability for future development to comply with the bushfire protection requirements set out in PBP.

The outcomes of this assessment determine that for the proposal, bushfire protection measures can be achieved by future residential development, including the provision of asset protection zones and access for evacuation and egress.

1. Introduction

This Strategic Bushfire Study (SBS) has been prepared to evaluate future residential development options being considered by Ocean Farm Property Trust for land situated in Kiama West (the Study Area). This study provides an assessment of the site for future residential growth in regard to the strategic planning principles outlined in *Planning for Bushfire Protection* (PBP) (RFS 2019). Specific development outcomes would then be facilitated via the development application (DA) process, and if occurring on bush fire prone land (BFPL), would be subject to the relevant requirements set out in PBP and supported with detailed bushfire assessment.

1.1 Study Area

The Municipality of Kiama is located approximately 120 km south of Sydney. Residential land use dominates the eastern landscape, with the western portion of the LGA primarily agricultural / rural grassland. Budderoo National Park is located to the south-west, supporting remnant vegetation.

The area contemplated for future urban settlement primarily occupies land currently zoned as rural landscape (RU2), environmental conservation (C2) and environmental management (C3). The following properties are included in the Study Area:

103 Jamberoo Road, Kiama:

- Lot 187 DP751279
- Lot 102 DP1176643

33 Greyleigh Drive Kiama:

- Lots 156, 183, 185, 186, 188 and 189 DP 751279
- Lot 1 DP 995058
- Lot 1 DP 1003719
- Lot 1320 DP 1060995
- Lot 2 DP 1135218
- Lot 1 DP 1178500

177 Long Brush Road, Jerrara:

- Lot 201 DP 1148007.

1.2 Aims and Objectives

The aim of this study is to review the proposal in relation to the strategic planning requirements of PBP. The key objective is to undertake a Strategic Bushfire Study as per the strategic planning principles, 'inappropriate development' exclusion requirements and assessment considerations outlined in PBP.

1.3 Bush Fire Prone Land Status

The study area is partially mapped as bush fire prone land (BFPL) on the Bushfire Prone Land layer within the ePlanning Spatial Viewer[1]. As shown in Figure 2 (DPE 2022).

[1] https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address

Figure 1: Study area map

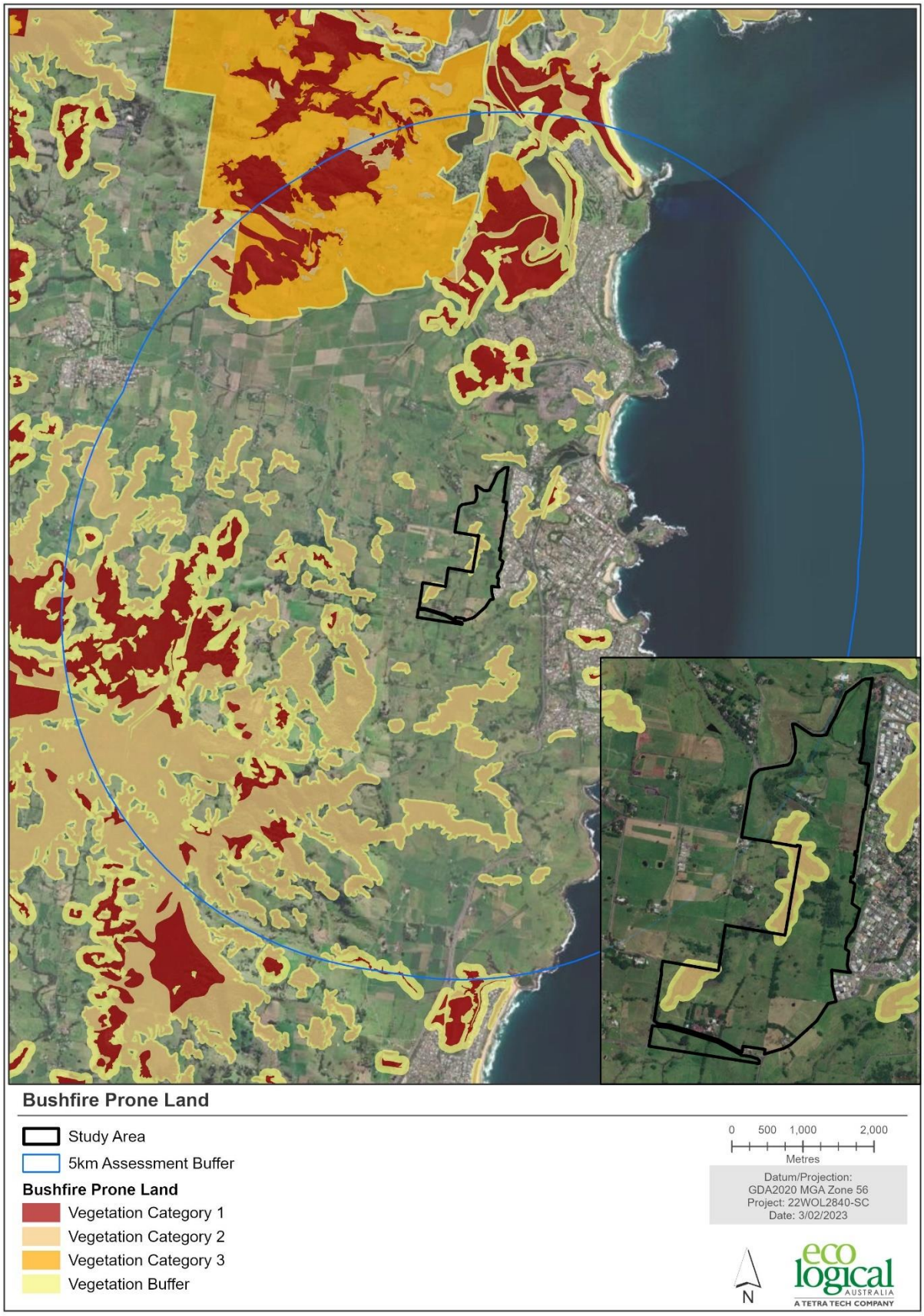

Figure 2: Bush Fire Prone Land Mapping (DPE 2022)

2. Legislative Framework

2.1 Legislation

Under the Ministerial Direction 4.3 (Planning for Bushfire Protection) issued under Section 9.1 (2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), where a proposal includes or is in close proximity to BFPL, the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service (RFS). Therefore, the assessment detailed in this study seeks to evaluate whether the proposal adheres to the requirements of PBP. The legislative framework guiding the assessment of bushfire risk and the application of bushfire protection measures at the strategic level, includes the NSW *EP&A Act* and the *Rural Fires Act 1997* (RF Act). Key aspects of these instruments are outlined below.

The objectives of Direction 4.3 are:

- To protect life, property and the environment from bushfire hazards, by discouraging the establishment of incompatible land uses in bushfire prone areas; and
- To encourage sound management of bushfire prone areas.

Direction 4.3 instructs the consent authority on the bushfire matters which need to be addressed with respect to Master Planning. This includes:

- Consultation with the Commissioner of the NSW RFS and consideration to any comments made;
- Regard to requirements of PBP*;* and
- Compliance with numerous bushfire protection provisions where development is proposed.

The *RF Act* is integrated into the *EP&A Act* and triggered by Section 4.46. The key objectives of the RF Act are to provide for the:

- Prevention, mitigation and suppression of bush and other fires;
- Co-ordination of bushfire fighting and bush fire prevention;
- Protection of persons from injury or death, and property from damage, arising from fires;
- Protection of infrastructure and environmental, economic, cultural, agricultural and community assets from damage arising from fires; and
- Protection of the environment by requiring certain activities to be carried out having regard to the principles of ecologically sustainable development.

2.2 Assessment Approach

Section 9.1 (2) of the *EP&A Act* triggers consideration of PBP for strategic planning. Chapter 4 of PBP contains strategic planning principles, 'inappropriate development' exclusions and assessment considerations required for any LEP amendment that may arise as planning for future residential settlement in the Shire is progressed. Chapter 4 of PBP prescribes the completion of a Strategic Bushfire Study, which provides the opportunity to assess whether proposed land uses are appropriate in the bushfire risk context. It also provides the ability to assess the strategic implications of future development for bushfire mitigation and management.

2.2.1 Strategic Planning Principles

The strategic planning principles of PBP are:

- *Ensuring land is suitable for development in the context of bushfire risk;*
- *Ensuring new development on BFPL will comply with PBP;*
- *Minimising reliance on performance-based solutions;*
- *Providing adequate infrastructure associated with emergency evacuation and firefighting operations; and*
- *Facilitating appropriate ongoing land management practices.*

These principles trigger the consideration of bushfire protection measures at the strategic planning stage, to provide an opportunity to consider the suitability of future land uses within the broader bushfire risk setting and that future land uses can meet the aim and objectives of PBP outlined below:

In addition, Chapter 4 of PBP prescribes that strategic planning should exclude 'inappropriate development' in bushfire prone areas, where:

- *the development area is exposed to a high bushfire risk and should be avoided;*
- *the development is likely to be difficult to evacuate during a bushfire due to its siting in the landscape, access limitations, fire history and/or size and scale;*
- *the development will adversely affect other bushfire protection strategies or place existing development at increased risk;*
- *the development is within an area of high bushfire risk where density of existing development may cause evacuation issues for both existing and new occupants; and*
- *the development has environmental constraints to the area which cannot be overcome.*

This study therefore assesses the contemplated residential development in the context of the PBP strategic planning principles, 'inappropriate development' exclusions as well as the assessment considerations identified in Table 4.2.1 of PBP, summarised in Table 1 below.

Table 1: Summary of PBP assessment considerations for a Strategic Bushfire Study (RFS 2019)

Issue	Summary of Assessment Considerations
Bushfire landscape assessment	A bushfire landscape assessment considers the likelihood of a bushfire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape.
Land use assessment	The land use assessment will identify the most appropriate locations within the Master Plan area or site layout for the proposed uses.
Access and egress	A study of the existing and proposed road networks both within and external to the Katoomba/Master Plan area and site layout.
Emergency services	An assessment of the future impact of the new development on emergency services provision.
Infrastructure	An assessment of the issues associated with infrastructure provision.
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bushfire management.

Planning pursuits enabled by rezoning would be subject to various aspects of PBP, when occurring on BFPL. Investigation of the suitability of future development permissible following rezoning, involves evaluation of a complex and large array of bushfire-related issues and concepts. Therefore, prioritisation of first principal bushfire risk considerations is critical. As such, the bushfire assessment framework detailed in Table 22 will guide this study.

Any development on BFPL always has a residual bushfire risk e.g., from burning debris or for offsite evacuation, regardless of the initial risk level and risk treatments. This study acknowledges that the outcome of any development on BFPL includes a level of residual risk and explores the acceptability of that level of residual risk.

Table 2: Risk Assessment Framework

Risk Consideration	Context	Required Outcome
Residual Risk	Complete removal of bushfire risk is not appropriate or possible in many instances, nor is it a policy setting under PBP. Determining whether the level of residual risk (i.e., the level of risk after application of bushfire protection measures) is a key factor in the strategic assessment of whether a development proposal is appropriate	Assessed risk exposure is appropriately reduced, development can occur with an appropriate level of safety on BFPL
Risk to life versus risk to property	A lower residual risk is required for the protection of life than that required for the protection of built assets, due to the vulnerability of people exposed to bushfire attack and the pre-eminent value assigned to human life	Assessment of the residual risk has therefore considered life and property risks separately
Life Protection and Evacuation	An appropriately low residual risk to human life is fundamentally important in bushfire protection. Early offsite evacuation is the nationally accepted safest means for protection of life. However, logistical challenges of offsite evacuation can be high, and need to be overcome without any additional demand on emergency services. Therefore, multiple life protection options provide the lowest residual risk.	Effective early offsite evacuation that is not reliant on the assistance of emergency services should be provided. Additional refuge options such access to a safer place or refuge should be considered for increased resilience
Emergency Service Response	The acceptability of proposed development should not be reliant on emergency service response / intervention. However, an emergency service response is a legitimate risk lowering consideration, that can be viewed as a bushfire protection 'redundancy' in a strategic planning context.	Future development should contribute to the emergency management response rather than provide additional demand on resources.
Adjoining Lands	Whilst fuel management (e.g., hazard reduction burning) lowers bushfire risk under most circumstances, during extreme bushfire attack and with increasing time after a burn, the life and property protection benefit is likely to be minimal and therefore should not be relied on for the protection of life and property in a strategic planning context.	There should be no reliance on fuel management of adjoining lands. Capacity for perimeter roads and asset protection zones should be provisioned during strategic planning.

3. Bushfire Landscape Risk Assessment

An evaluation of the bushfire risk within a 5-kilometre assessment area has been undertaken, as detailed below. This includes evaluation of the vegetation, slope and bushfire weather pertaining to the broader landscape, and the combined influence on potential fire behaviour, along with the fire history within the assessment area.

3.1 Bushfire Hazard

The bushfire hazard has been classified using the methodology prescribed by PBP, through assessment of vegetation, slope and bushfire weather.

3.1.1 Vegetation

Vegetation formations within and surrounding the study and assessment areas are shown in Figure 3 and based on the State Vegetation Type Mapping (DPE 2022) with areas of rural (agricultural) grassland included from high level desktop assessment. The landscape immediately adjoining the study area is primarily dominated by rural (agricultural) grassland vegetation under various forms of management, with remnant forest vegetation also present. Larger extents of rainforests and sclerophyll forests are present in the south-west, however are separated from the study area by stretches of rural (agricultural) grassland.

A summary of the relationship between PBP hazard class, vegetation formation and fuel load within the study area and surrounds is shown in Table 3. I

It is important to note, that rural grassland for agricultural purists have conservatively been included as “grassland’. However, given that much of these areas are undergoing various levels of mixed-management practices and grazing, actual fuel loads for these areas would be lower than the PBP prescribed value (6t/ha). Therefore, a lower fuel load of 4.5t/ha has been applied, representative of grazed grasslands as per Appendix B of AS-3959.

3.1.2 Slope

Slope across the broader study area has been generated from a Digital Elevation Model (DEM), established using 2 m contours.

Figure 3 shows the slope across the broader study area. Elevated slopes are predominantly present in the south-western portion of the assessment area however occur throughout.

Table 3: Vegetation formation and fuel loads for vegetation types in the study area

Vegetation Formation	Fuel Load (t/ha)[1]	Keith Class[2]
Forest	36.1	Coastal Dune Dry Sclerophyll Forests North Coast Wet Sclerophyll Forests South Coast Sands Dry Sclerophyll Forests Southern Escarpment Wet Sclerophyll Forests Southern Lowland Wet Sclerophyll Forests Sydney Coastal Dry Sclerophyll Forests
Forested Wetlands	15.1	Coastal Floodplain Wetlands Coastal Swamp Forests Eastern Riverine Forests
Saline Wetlands	0	Mangrove Swamps Saltmarshes
Grasslands	4.5*	Agricultural/rural Grasslands
Grassy and Semi-arid Woodland	20.2	Coastal Valley Grassy Woodlands
Heathlands	36.9	Coastal Headland Heaths Southern Montane Heaths
Rainforests	13.2	Dry Rainforests Littoral Rainforests Northern Warm Temperate Rainforests Subtropical Rainforests

[1]FROM TABLE A1.12.8 OF PBP;
[2]BASED ON SVTM (DPE 2022)
*GRASSLAND INCLUSION FROM DESKTOP ASSESSMENT AND FUEL LOAD BASED ON GRAZED STATUS

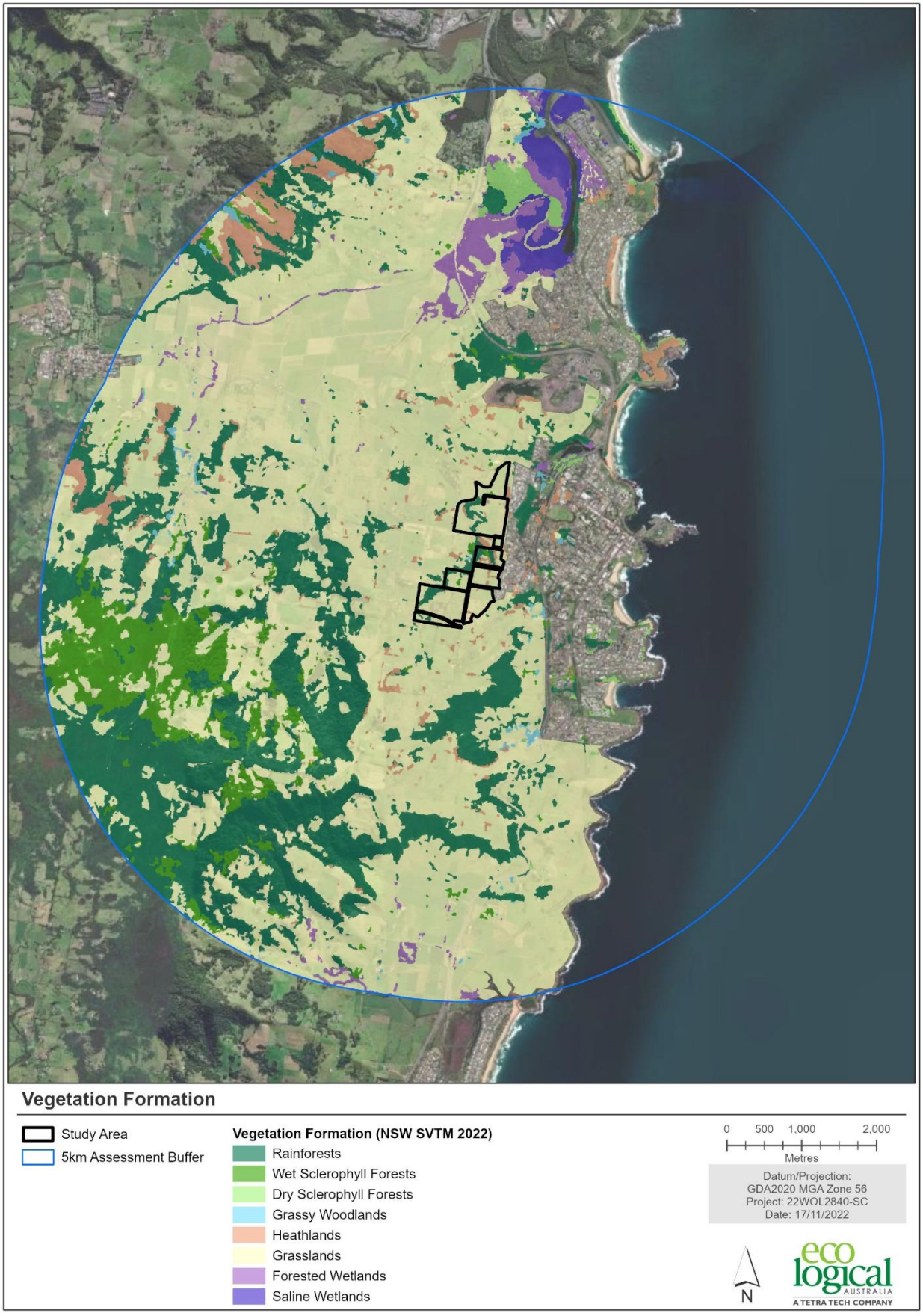

Figure 3: Vegetation formations in study area

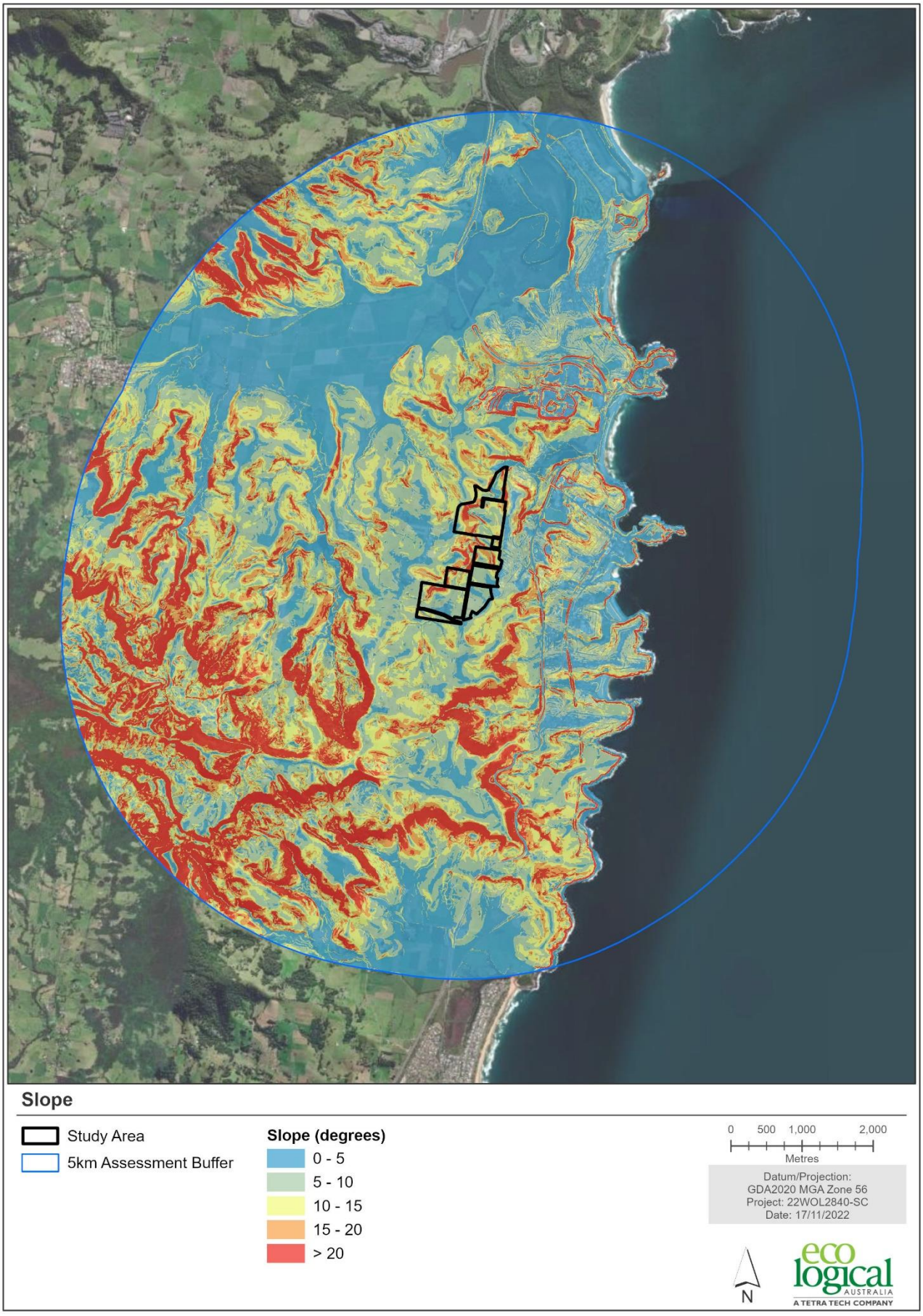

Figure 4: Slope across the study area

3.2 Bushfire Risk Considerations

The following sections outline considerations informing the bushfire risk exposure of the precinct. This includes analysis of bushfire weather and potential fire behaviour, consideration of fire catchments and potential fire pathways, and fire history.

3.2.1 Bushfire Weather

The study area is located within the Illawarra Bush Fire Management Committee (IBFMC) area. Within the BFMC area, the climate is humid temperate, characterised by cool winters and warm to hot summers. As per the Illawarra Bush Fire Risk Management Plan (Illawarra BFRMC, 2008) Adverse fire weather conditions associated with the bush fire danger period in the Illawarra region is related to strong South-westerly to North-westerly winds accompanied by high daytime temperatures before the onset of summer rains. The fire season generally extends from Summer through to Autumn when low rainfall is experienced. Lightning activity is common but generally focussed on the escarpment area, west of the study area.

Days where an FFDI of 50 or higher has been recorded, has occurred on average, about 7.5 days per year based on data analysed from the National Bushfire Weather Data set for Nowra (the closest weather station within the National Historical Fire Weather Dataset) weather station (station number 068072) (Lucas 2010). Weather data developed by Lucas (2010) under the National Historical Fire Weather Dataset (1972-2019) incorporates the daily Forest Fire Danger Index (FFDI), where suitable inputs are available from over 70 weather stations across Australia

PBP identifies that the applicable FFDI for the study area is 100, which influences certain bushfire protection measures including Asset Protection Zones (APZ) and construction standards via the assessment of the Bushfire Attack Level (BAL). However, utilising historical data from the Nowra weather station from the National Historical Fire Weather Dataset, and applying the maximum FFDI for a 1 in 50-year event (being the accepted recurrence period for land use planning) provides a better understanding of bushfire weather relevant to the Study Area.

To analyse the FFDI for a 1 in 50-year event a Generalised Extreme Value (GEV) analysis was undertaken using the process documented by Douglas (2017) and Douglas et al (2014; 2016). The dataset was split into subsets based on identified directions of potential bushfire attack relevant to the site, being north-east to south-east (clockwise); south-east to south-west (clockwise); and south-west to north-east (clockwise).

The following directional FFDIs were identified through the GEV analysis of the historic weather records for Nowra:

- Maximum FFDI for wind directions from the north-east to south-east (N-SE) was 47;
- Maximum FFDI for wind directions from the south-east to south-west (SE-SW) was 64 and
- Maximum FFDI for wind directions from the south-west to north-east (SW-N) was 117.

This analysis indicates that there is variation in the potential likelihood and consequence of bushfire attack from different directions toward the study area**.** Areas exposed to bushfire attack at higher FFDI are more likely to be impacted by fire as adverse fire weather will occur more often from those directions and a higher fire intensity is more likely as the weather conditions reach higher FFDI values. Areas exposed to bushfire attack at lower FFDI have a lower (but still significant) risk profile.

3.2.2 Potential Bushfire Behaviour

Whilst each bushfire event is different, fire spreads by responding to changes in fuel, terrain, and weather conditions. Therefore, based on weather analysis, landscape conditions and fire history, potential fire behaviour can be determined. It is generally anticipated that a potential fire within the study area and surrounds would spread more quickly and have the potential for higher intensities when:

- Burning under the influence of south-westerly to northerly winds
- Moving upslope on steeper vegetated areas, particularly to the west of the site
- Burning within forest vegetation exhibiting higher fuel loads, most notable in the western portion of the study area.

Bushfire intensity prediction has been used to review potential bushfire with the potential head fire intensity modelled using the outputs from the directional fire danger index analysis in section 3.2.1 and the forest fire intensity formulae of McArthur (1967) and Cheney *et. al.* 2012.

As it is also important to understand fire behaviour in a landscape that is dominated by rural (agriculture) grasslands, fire intensity analysis was also undertaken for grassland, using the grassland rate of spread formula of AS-3959, and grazed grassland fuel loads as discussed in section 3.1.1.

Both the FFDI and GFDI inputs for fire intensity modelling are tabulated below (Table 4)

Table 4:Forest and Grassland Danger Index

Direction	FFDI	GFDI
SW-N	117	160
SE-SW	64	90
N-SE	47	60

The fire intensity model is predicting potential fire intensities, and it is important to note that the probability of these occurring is not considered, nor are other factors like fire development, the effects of fuel management, change in weather, or the impact fire suppression activities. While bushfire intensity can be used as a determinant of risk to life and property and the controllability of bushfires, these models also do not consider extreme fire behaviour / weather including phenomena such as spotting/fire storm, fire tornado/whirls, lateral vortices, junction zones (jump fires), eruptive fires, conflagrations, downbursts; or pyro-convective events.

3.2.2.1 Fire Intensity Modelling Outcomes

Based on the outcomes of the GEV analysis of the historic weather records (see Section 3.2.1) elevated fire intensities are most likely to occur under prevailing south-westerly to northerly winds, accompanied by elevated FFDI, with an FFDI of 117 the analysed maximum in the available record. Based on this, directional fire intensity modelling was undertaken for SW-N scenario and FFDI 117 (Figure 5). Under this scenario, where there are steeper forested areas on steep slopes, they are more likely to experience higher fire intensities, as evident in Figure 5, with potential for fire transfer in an easterly direction under these conditions to occur via rural grasslands under varying levels of management. As such rural

grasslands has not been incorporated into fire intensity models as it would likely overestimate the fuel load these lands pertain.

While higher fire intensities are also evident on steeper slopes that correspond to forest areas based on direction modelling outcomes for FFDI of 64 and 47, the accompanying conditions (i.e. wind direction and aspect) means the general direction of the fire pathway would be away from the site. Figures 6 and 7 also demonstrate these outcomes.

Outcomes from directional grassland intensity modelling (Figures 8 to 10) also indicate that there is potential for higher fire intensities under GFDI of 160. However modelling does not take into account the agricultural grass species mix across the landscape that supports grazing of dairy cattle. This is important to note, as species used for this purpose such as Kikuyu, often contain a high moisture content and does not cure as quickly as many other grasses. Additionally, modelling has assumed that all (non-woody) rural land is agricultural (grazed) grassland, when it is likely that some of this land could be considered managed land as per PBP. Therefore, it is likely that fire intensity outcomes are elevated, and the low fire history of the area, is reflective of this.

3.2.3 Fire History

The available mapped fire history record (from 1968 onwards) (Figure 11) and corresponding analysis of fire frequency (Figure 12) demonstrates there has been very little fire activity, with only one mapped fire. Although the mapped record may not contain all smaller fires, it does demonstrate that the study area has generally been subject to minimal recorded landscape scale fire activity, including areas situated to the west of the study area where conditions are more favourable for bushfire. Indeed, this areas has been exposed to a low fire frequency based on the mapped fire history.

3.2.4 Bushfire Catchment, Spread and Ignition

The broader area outside the study area is situated within a small fire catchment, with potential fire pathways extending from the south-west, however these pathways are fragmented by rural lands with minimal canopy cover and rural grasslands under various levels of management. Fire spreading from the west, would generally be through grassland environments under mixed management and varying levels of rural condition. To the east, adjoining the study area there is minimal vegetation with existing development, and the township of Kiama.

Potential sources for fire ignition as documented by the Illawarra BFMC Risk Management Plan include both human and natural sources including:

- Arson and incendiarism in high visitation areas;
- Car dumping in urban and bushland interfaces;
- Lightning strikes during storms, particularly during the bush fire season;
- Electrical power lines arcing during high winds;
- Escapes from legal burns in rural areas; and
- Escapes from illegal burns mainly in rural areas.

3.3 Bushfire Risk Evaluation

In evaluating the bushfire risk with consideration to land uses contemplated by the ILP the bushfire hazard, bushfire weather, fire behaviour and fire history were analysed and reviewed.

The assessment identified there is potential for bushfire attack to occur, primarily from the west, however, there are fire advantages that assist in lowering the risk to a level more favourable for fire management and response, as well as the land uses contemplated. This is due to several factors including:

- Mixed management of surrounding rural /agricultural grasslands, will likely result in a lower fuel load than the PBP standard and reduced curing, which moderate default fire behaviour; therefore, opportunity for the transfer of higher fire intensity fires to the site is reduced.
- Lack of wooded canopy vegetation to carry higher intensity fires along to the site; and
- Demonstrated minimal intrusion of past landscape scale fires within and surrounding the study area.

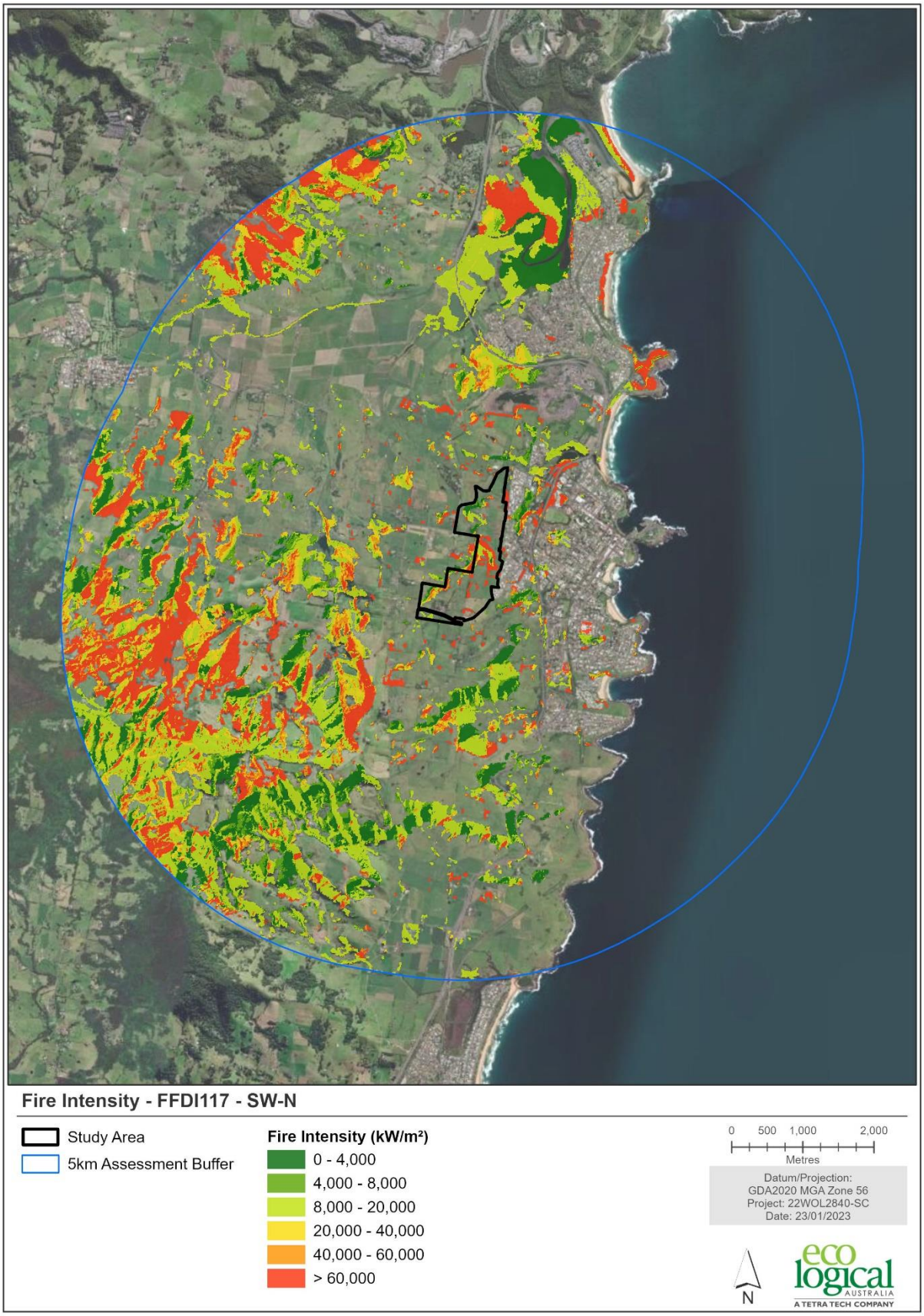

Figure 5: Directional Fire intensity modelling for wooded vegetation based on FFDI 117, South-west to north winds

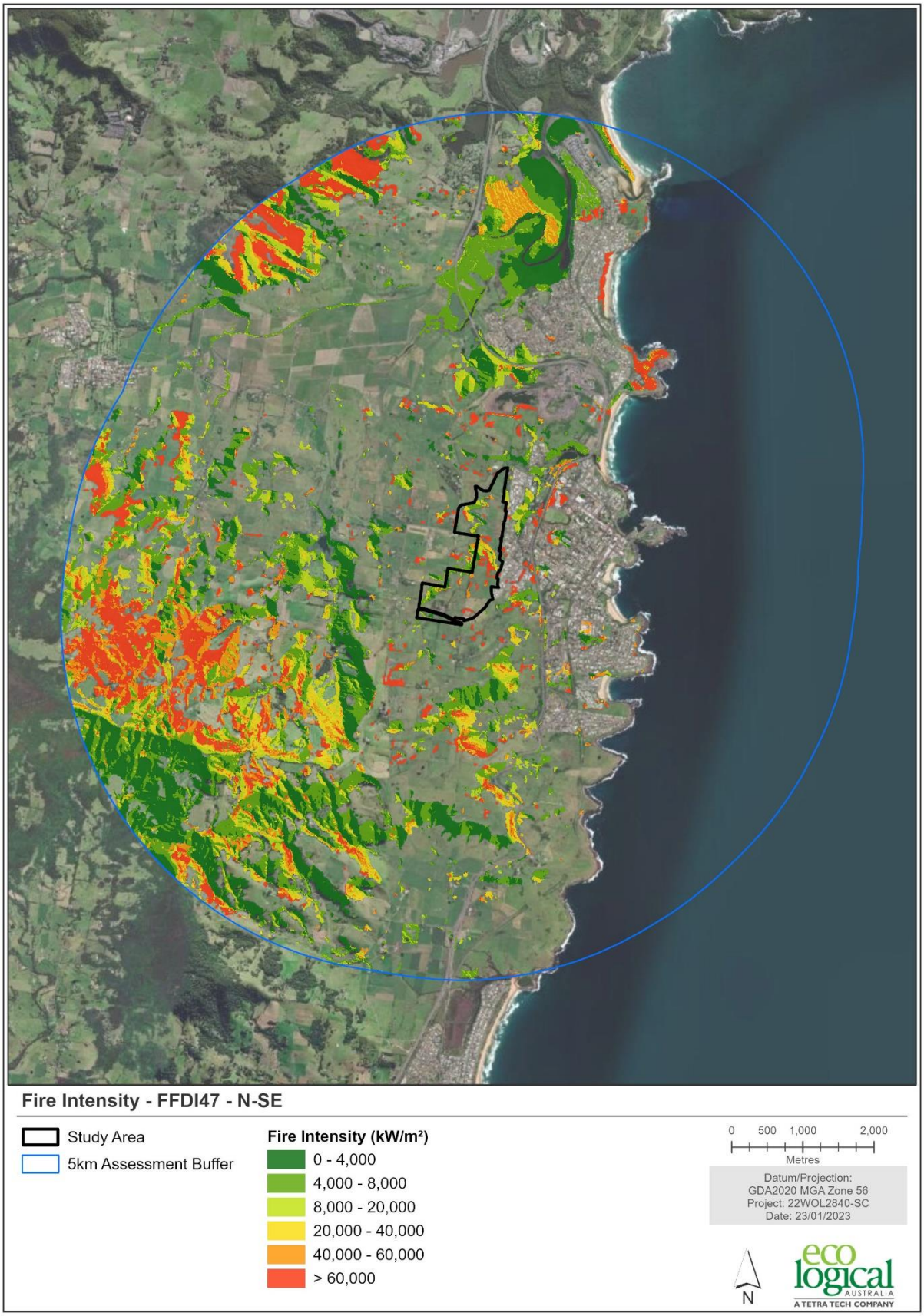

Figure 6: Directional Fire intensity modelling for wooded vegetation based on FFDI 47, North to South-east winds

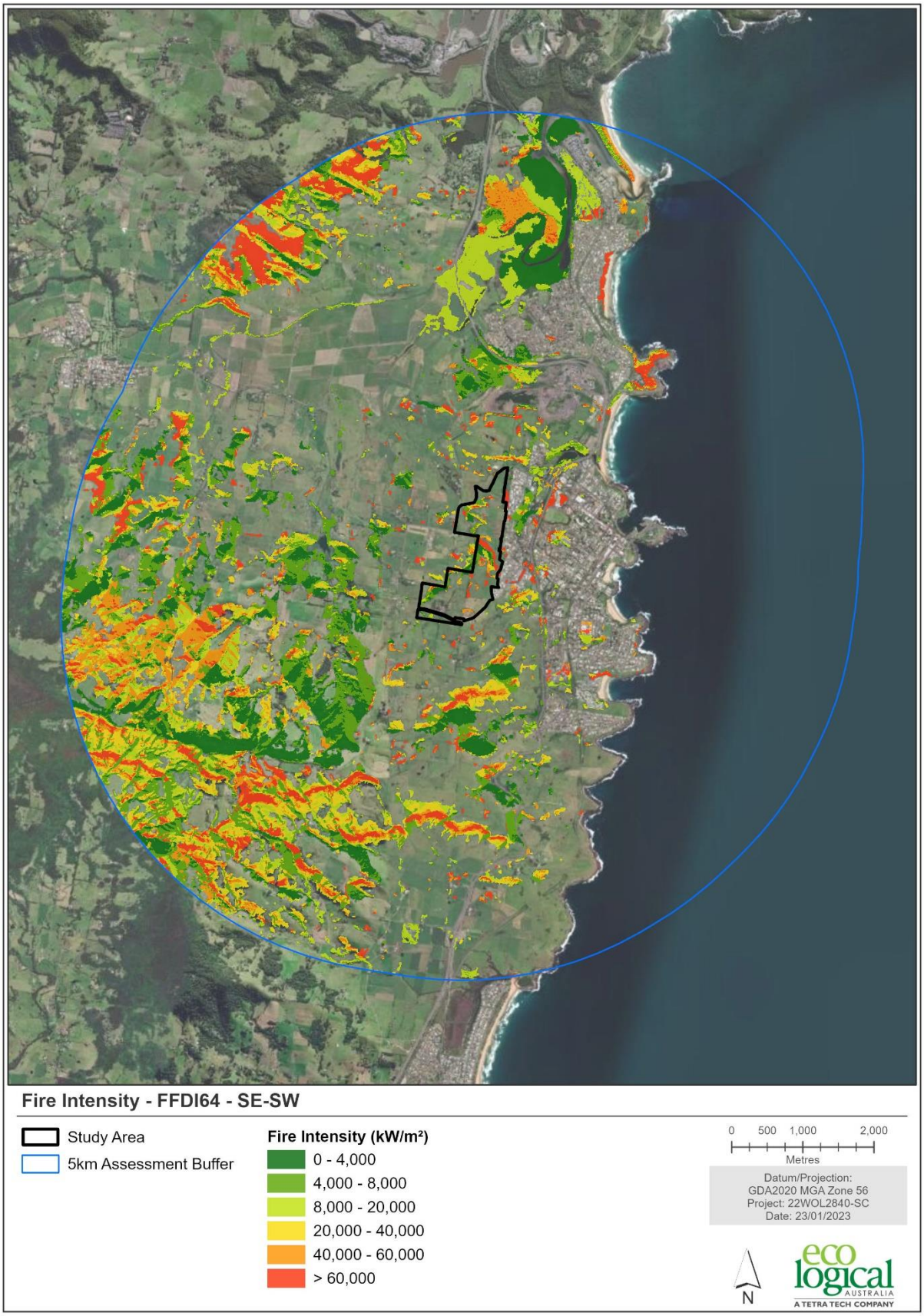

Figure 7: Directional Fire intensity modelling for wooded vegetation based on FFDI 64, South-east to South-west winds

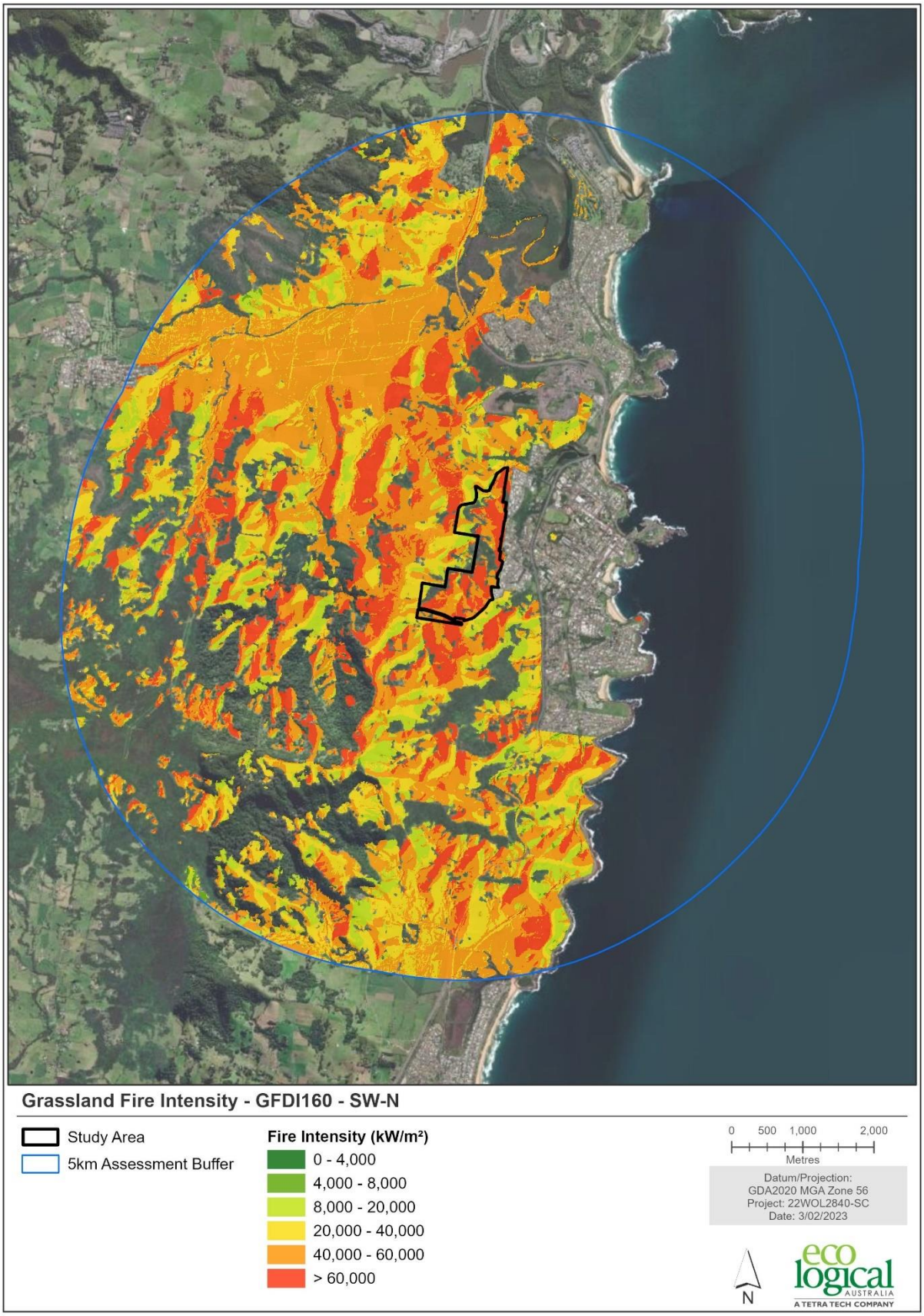

Figure 8: Directional Fire intensity modelling for grassland vegetation based on FFDI 117, South-west to north winds

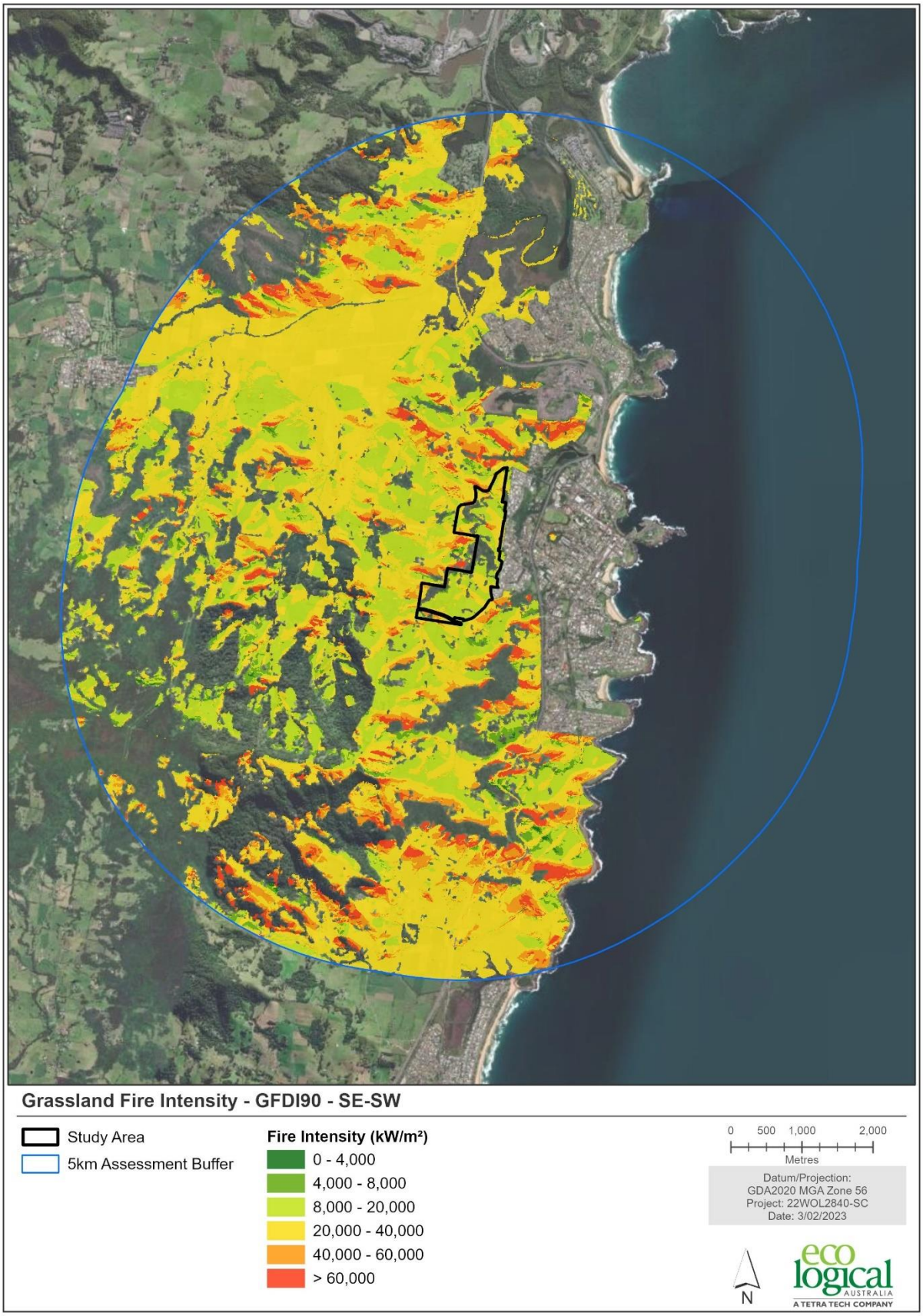

Figure 9: Directional Fire intensity modelling for grassland vegetation based on FFDI 47, North to South-east winds

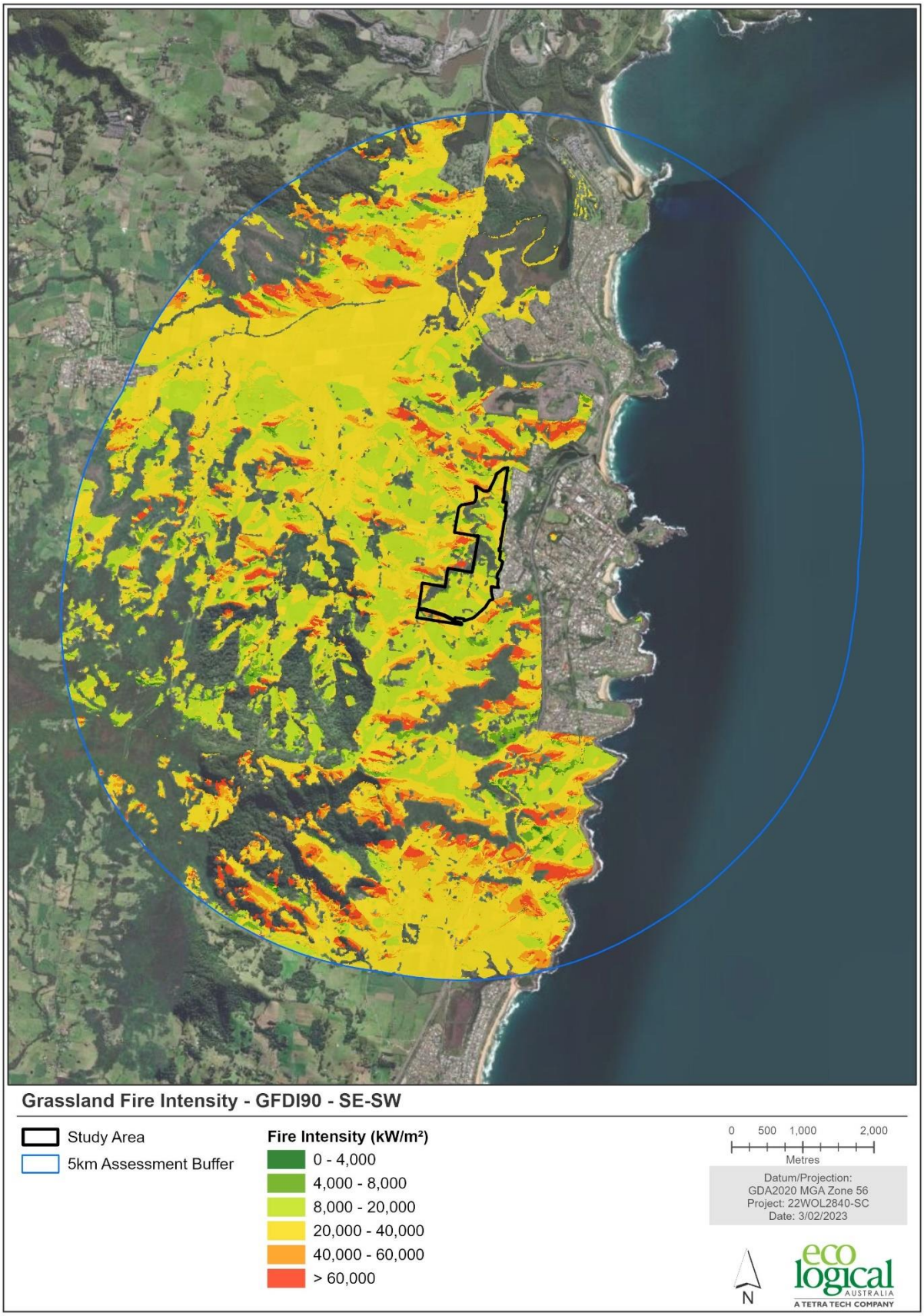

Figure 10: Directional Fire intensity modelling for wooded vegetation based on FFDI 64, South-east to South-west winds

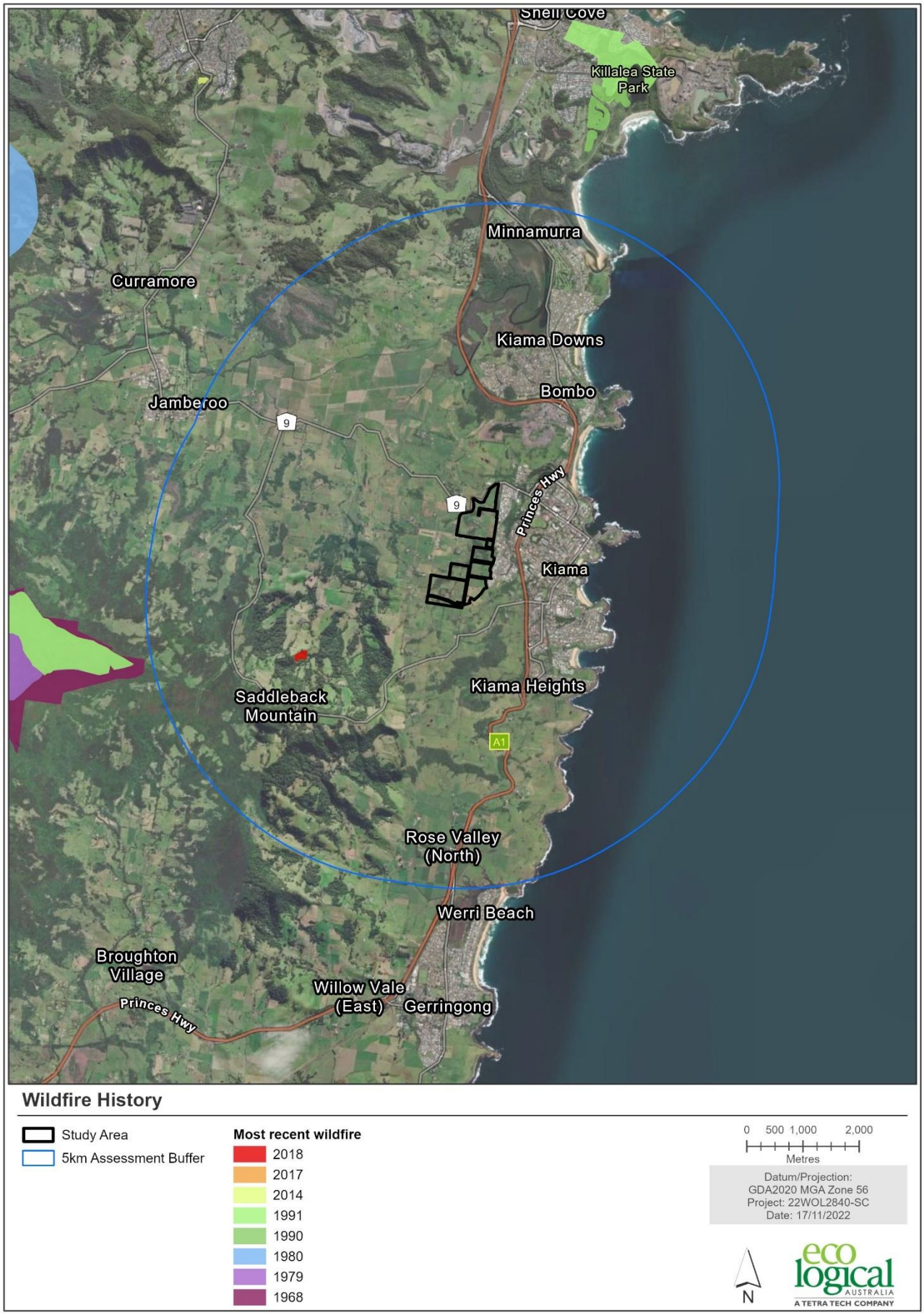

Figure 11: Mapped wildfire history within the study area (Source: NPWS and RFS)

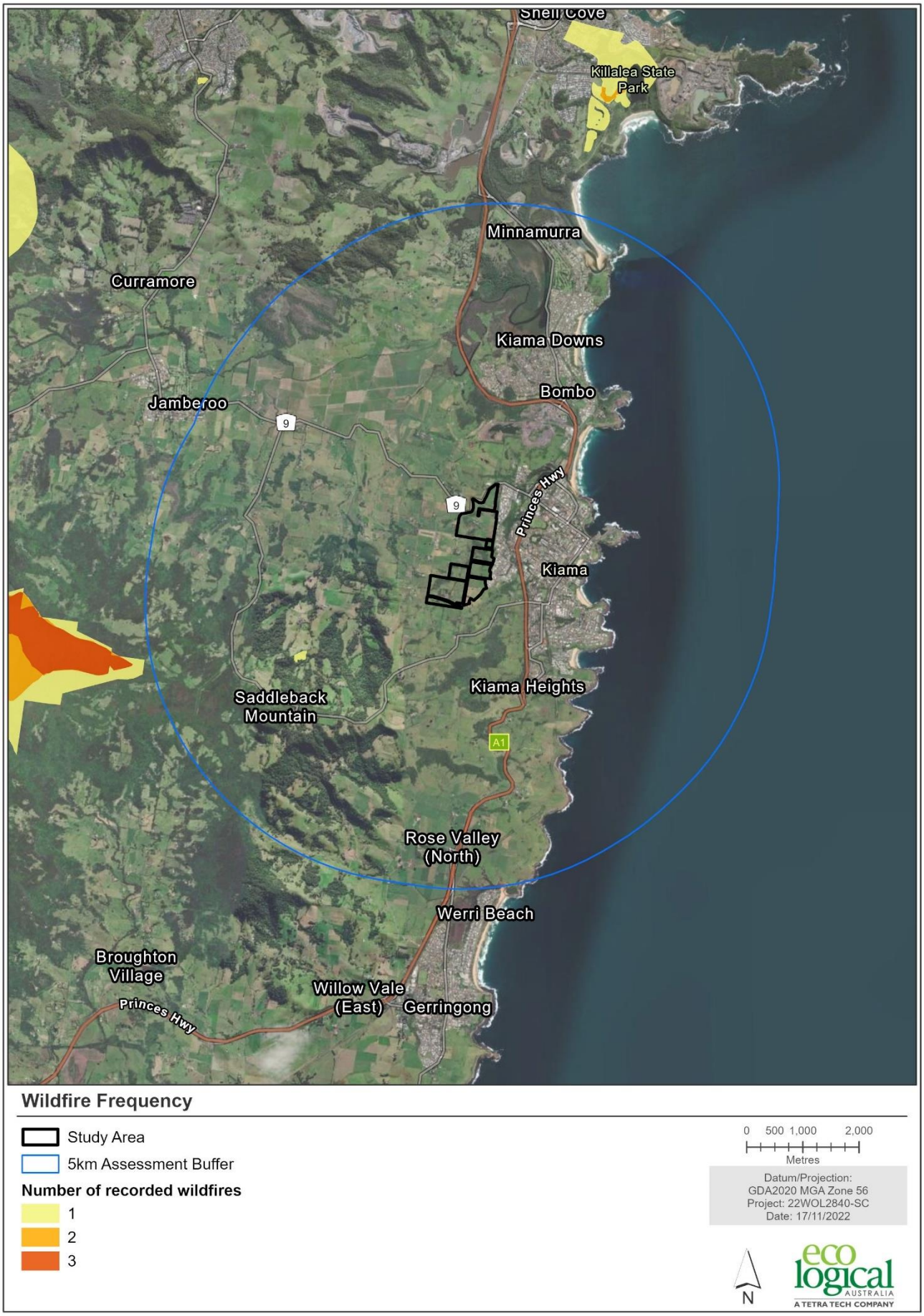

Figure 12: Fire frequency within the study area – 1951/1952 fire season to 2019/2020 season

4. Land Use Assessment

PBP outlines broad principles and assessment considerations for strategic planning proposals. It also specifies that bushfire protection measures (BPMs) need to be considered at the strategic planning stage, to ensure that the future development can comply with PBP, as per the specified BPMs in Chapters 5-8 of PBP. This land use assessment therefore considers the risk profile for the study area and the suitability for residential land uses, along with the feasibility to meet APZ requirements.

4.1 Land Use Evaluation

Future development contemplated by the Indicative Layout Plan (Figure 13) on BFPL will need to satisfy the performance criteria identified in PBP. It is expected that future land uses enabled through LEP/DCP amendments to enable residential settlement, Special fire Protection Purpose Development (SFPP) and commercial development will need to accommodate the acceptable solutions identified in PBP to minimise reliance on performance solutions at the DA stage. A summary of these requirements is outlined below.

It is also important to note, that the eastern boundary of the site is situated largely alongside and existing urban hazard interface. Therefore, future urban development in this area would provide a level of bushfire protection and resilience to existing development that is underpinned by current guidelines.

4.1.1 Chapter 5 of PBP – Residential and Rural Residential Subdivision

Within the study area, it is anticipated that future land uses will be subject to the requirements outlined in Chapter 5 of PBP. Following rezoning and as part of the DA process, future development will need to demonstrate the suitability of the proposed subdivision, the following provisions will need to be considered:

- Provision of compliant APZs;
- Access and egress within the developable land and along the adjoining public road system shall include safety provisions for attending emergency service vehicles and evacuating residents;
- Subdivision design shall include perimeter roads separating developable lots from hazardous bushland areas;
- Access is to be ensured for maintenance of APZ and other fire mitigation activities;
- Firefighting water supply and associated firefighting equipment (i.e., pump and hose) for each dwelling in addition to any reticulated water supplies; and
- Provision of access and infrastructure requirements according to Table 5.3b of PBP.

4.1.2 Special Fire Protection Purpose Development

It is also understood that rezoning will enable the provision of land uses pertaining to education. In general, where future development incorporates buildings that accommodate students, special fire protection purpose APZ's will apply. Specific guidelines for this type of development are detailed in *Chapter 6 - Special Fire Protection Purpose Developments in PBP.* Table A1.12.1 of PBP contains the minimum APZ distances for SFPP developments such as education facilities, and other development as required (e.g. child care, nursing homes etc.).

4.1.3 Multi-storey Development

Where multi-storey development greater than three (3) storeys is proposed, section 8.2.2 - Multi-storey residential development of PBP specific additional consideration in relation to:

- Population - higher resident densities can pose issues for emergency management;
- Location – bush fire impacts can be increased where high rise buildings are located in higher elevations or on ridge tops;
- Egress - is more challenging and places an increased demand on road infrastructure during evacuation;
- Construction - there is a higher external façade surface area that may be exposed to bush fire attack and:
- car and storage facilities on the ground level can provide an additional fuel loading;
- balconies and external features can easily trap embers which can ignite combustible materials.
- Height -the height can result in increased exposure to convective heat.

4.1.3.1 Section 8.3.1 of PBP - Buildings of Class 5 to 8 under the NCC /Section 8.3.10 Commercial and Industrial Development

As per the NCC building classification system, buildings such as offices, shops, factories, warehouses, and other commercial or industrial facilities on BFPL have no specific bushfire requirements, and as such Australian Standard AS 3959-2018 and the National Association of Steel-framed Housing (NASH) Standard '*Steel Framed Construction in Bushfire Areas 2014*' are not deemed to satisfy (DTS) provisions. However, such developments still need to meet the aims and objectives of PBP and consider the following:

- Provision of appropriate APZ / defendable space;
- Provision of safe access to/from the public road system for egress and evacuation;
- Provision of suitable emergency and evacuation arrangements for occupants;
- Provision of adequate water supply to protect the building, and the location of gas and electricity supplies so as they do not contribute to the bushfire risk; and
- Provision for the storage of hazardous materials away from any hazards.

In meeting the objectives of PBP, best practice is for such developments to meet the requirements of residential subdivision in regard to APZ dimensions. General access and infrastructure requirements listed in Table 7.4a of PBP should also be considered. Where future mixed-use development includes residential development, bushfire protection measures residential requirements outlined in chapter 5 of PBP (for subdivision) or Chapter 7 of PBP (for infill development) will apply. Where future mixed-use development includes SFPP uses, bushfire protection measures should be consistent with the provisions outlined in Chapter 6 of PBP.

4.2 Risk Profile

The feasibility for future development within the study area to comply the bushfire protection measures identified within PBP is a fundamental consideration in determining the residual risk profile. Whilst bushfire protection measures and their performance criteria are a benchmark for approval of a development, a strategic level study needs also to evaluate these measures within the landscape risk context. This Study has therefore considered the following:

- The bushfire landscape risk context in consideration of the protection measures for future development and their potential adequacy;
- The type and suitability of development proposed given the bushfire risk context;
- The pattern and potential bushfire resilience of the bushland interface; and
- Potential cumulative risk associated with proposed development in the locality and provision of bushfire protection measures.

The feasibility for APZs is a key bushfire protection measure and based on the landscape assessment of vegetation and slope, APZ dimensions that may apply to future development in the study area listed in Table 5.

4.2.1 Feasibility of Asset Protection Zones

Future residential development contemplated for the planning proposal will need to meet the applicable APZ dimensions for vegetation type and slope combinations, as compiled in Table 5 5. APZ dimensions for any future development on bushfire prone land will be determined based on the proposed land use, vegetation configuration and topography.

Whilst BPM and their performance criteria are a benchmark for approval of a development, at a strategic level, the minimum requirements under the PBP Acceptable Solutions for residential development (i.e. to meet a maximum Radiant Heat Flux (RHF) of no greater than 29 kW/m^2) are detailed in Table 5 and indicatively shown in Figures 14 to 16. Based on the indicative layout plan (ILP) and early lot designs, compliant APZs are generally achievable on site, with capacity to facilitate a lot layout where APZs are compliant as design iterations are made.

The following considerations will apply for any future development:

- For any revegetation, *Planning for Bushfire Protection* (PBP) allows for vegetation to be classified as 'Low Hazard' and excluded from assessment based on patch size (i.e. <1 ha), width (i.e. <20 m) and proximity. Importantly, the separation distance between these patches needs to meet or exceed the distances detailed in A1.10 of PBP (see below). If assessed as a low threat exclusion the provision of bushfire protection measures such as an Asset Protection Zone (APZ) setback is not required. Areas where this approach has been applied are identified in Figures 10 to 12 and include areas where road corridors (including carriage way and verge) are required to be a minimum distance of 20 m to ensure separation is maintained.
- Vegetation within required Asset Protection Zones should be managed as an inner protection area (see A4.1.1 of PBP).
- Vegetation removal has been assumed as shown in Figure 14 to 16
- All APZs are assumed to be on land less than 18 degrees. Some slope constraints are identified in Figures 14 to 16 which will need to be resolved as planning progresses.
- Some hazard interfaces assume that riparian averaging would be accepted by the regulatory body and confirmation of riparian corridors and the final hazard extent would be required before progressing.
- Future SFPP development will be designed to accommodate the required SFPP APZ dimensions

Table 5: APZ dimensions for residential development

Vegetation Formation	PBP Slope Class	Residential APZ[1]	SFPP APZ[2]
Low Hazard (Rainforest)	Upslope/Flat	11 m	38 m
	>0-5° downslope	14 m	47 m
	>5-10° downslope	18 m	57 m
	>10-15° downslope	23 m	69 m
	>15-20° downslope	30 m	81 m
Grassland	Upslope/Flat	10 m	36 m
	>0-5° downslope	12 m	40 m
	>5-10° downslope	13 m	45 m
	>10-15° downslope	15 m	50 m
	>15-20° downslope	17 m	55 m

[1] TABLE A1.12.2 FROM PBP
[2] TABLE A1.12.1 FROM PBP

4.3 Summary of land use evaluation

The location and type of land uses proposed is generally considered consistent with the strategic planning principles, with regard to the ability for bushfire protection measures to be provided. The land use evaluation has considered potential for residential land with consideration to the risk profile of the site and the potential for compliant bushfire protection measures. As such, the proposed land uses and indicative sitting are not considered inappropriate for the site given capacity for bushfire protection measures and opportunity for increased bushfire protection for existing urban development. Therefore, the proposed land uses are not considered incompatible with the residual risk profile, subject to minor amendments to preliminary designs to ensure compliant APZs are achievable on all future lots.

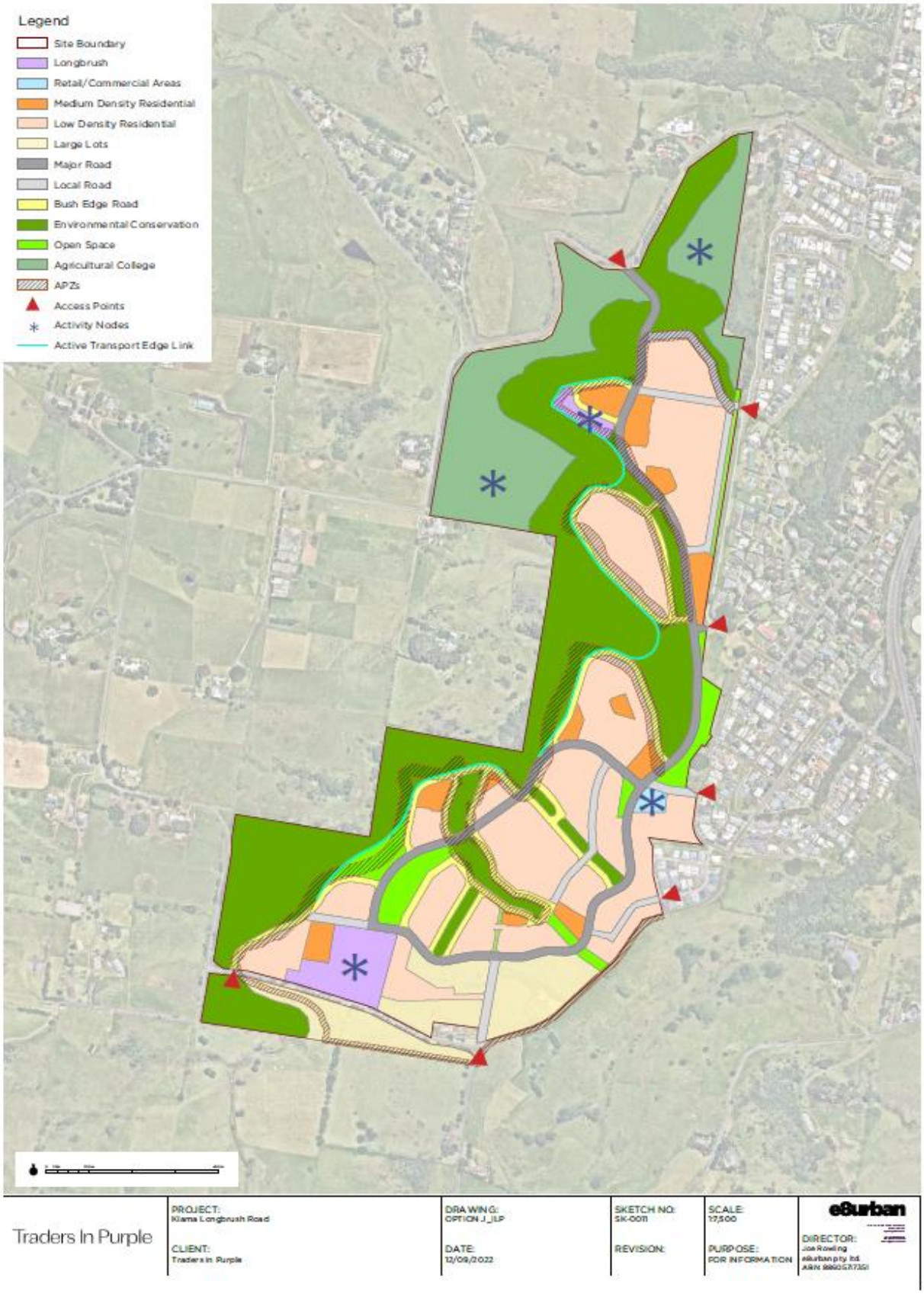

Figure 13: Indicative Layout Plan and Land Use Typology

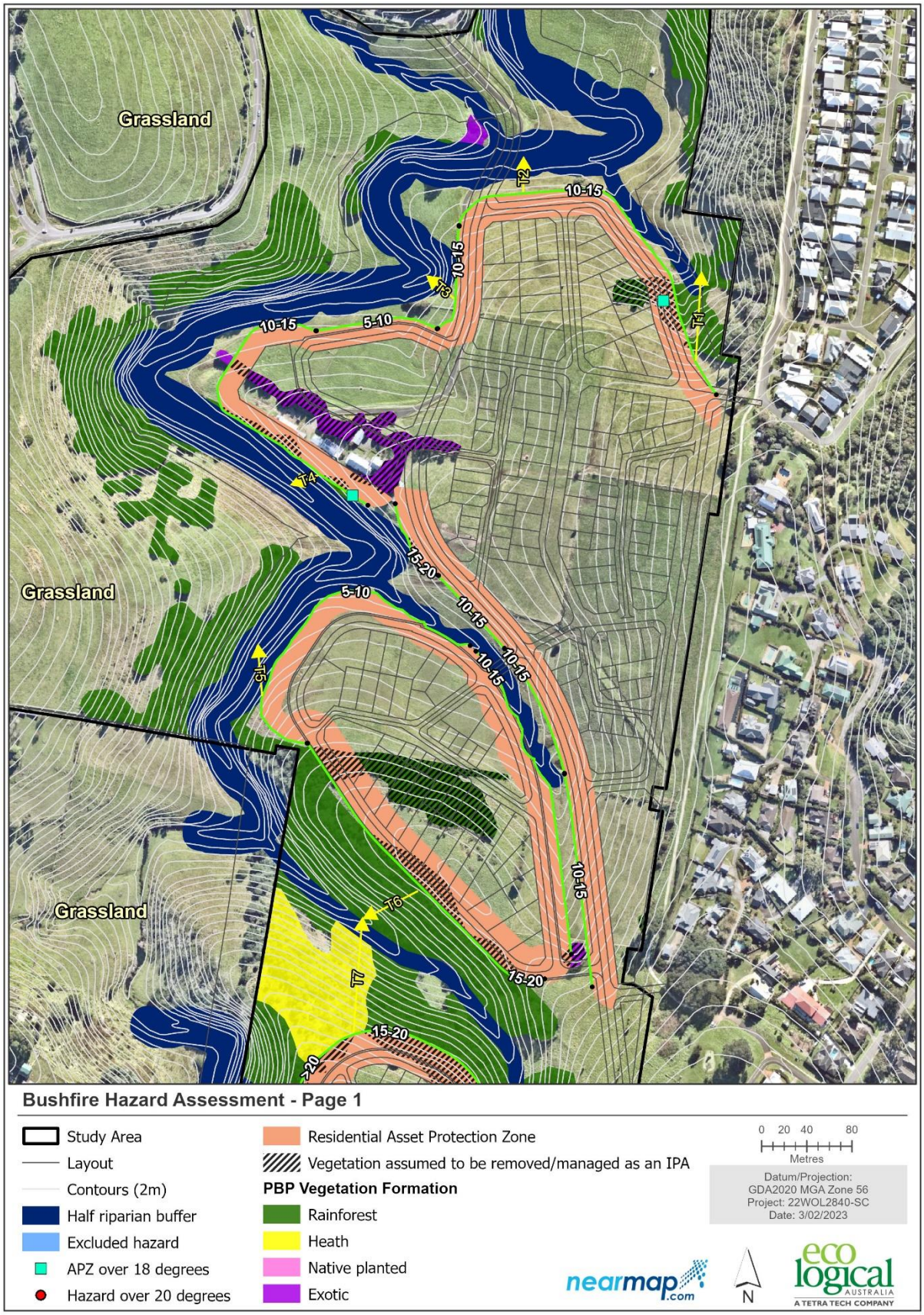

Figure 14: Preliminary Hazard Assessment and Indicative APZ – page 1

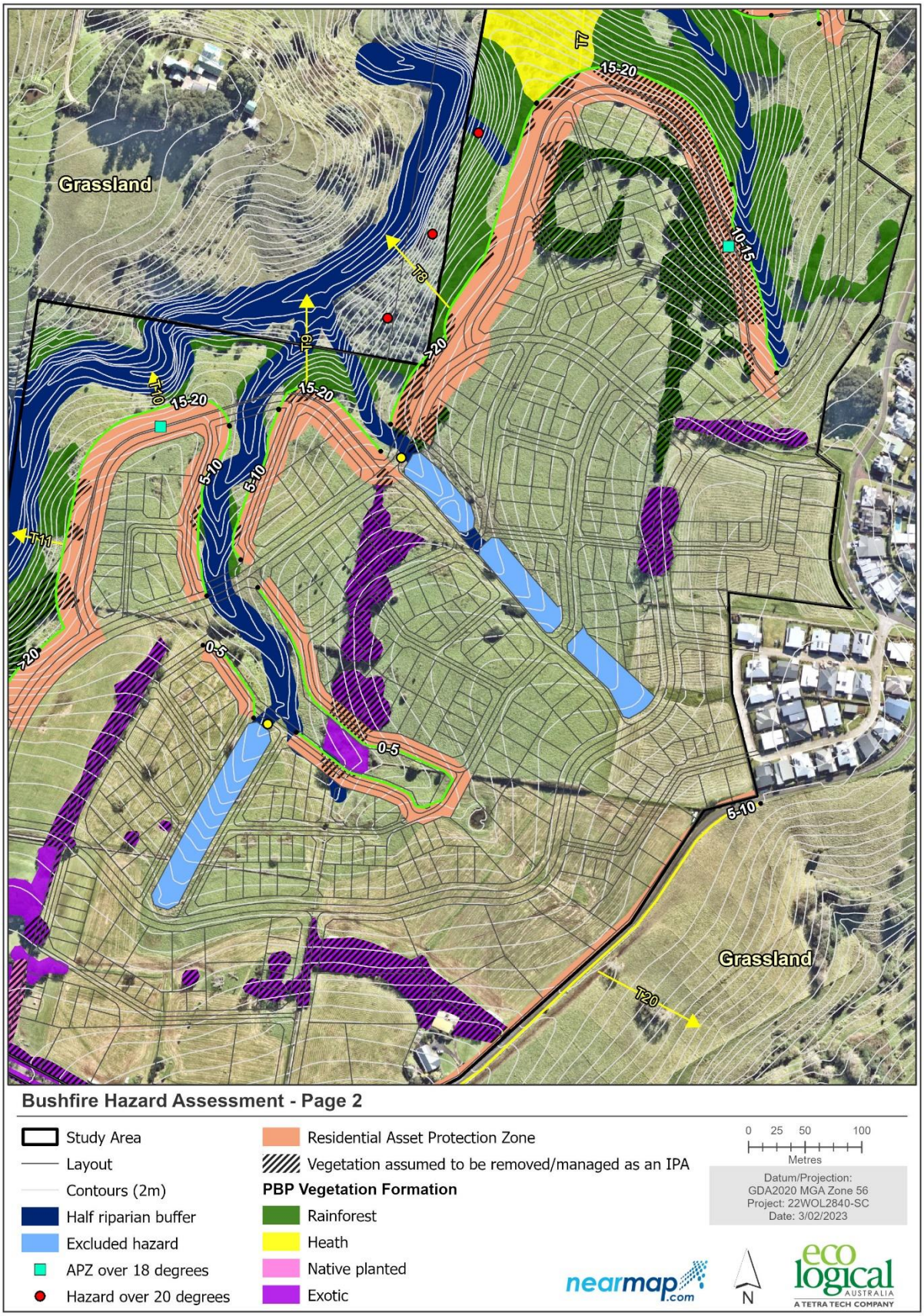

Figure 15: Preliminary Hazard Assessment and Indicative APZ – page 2

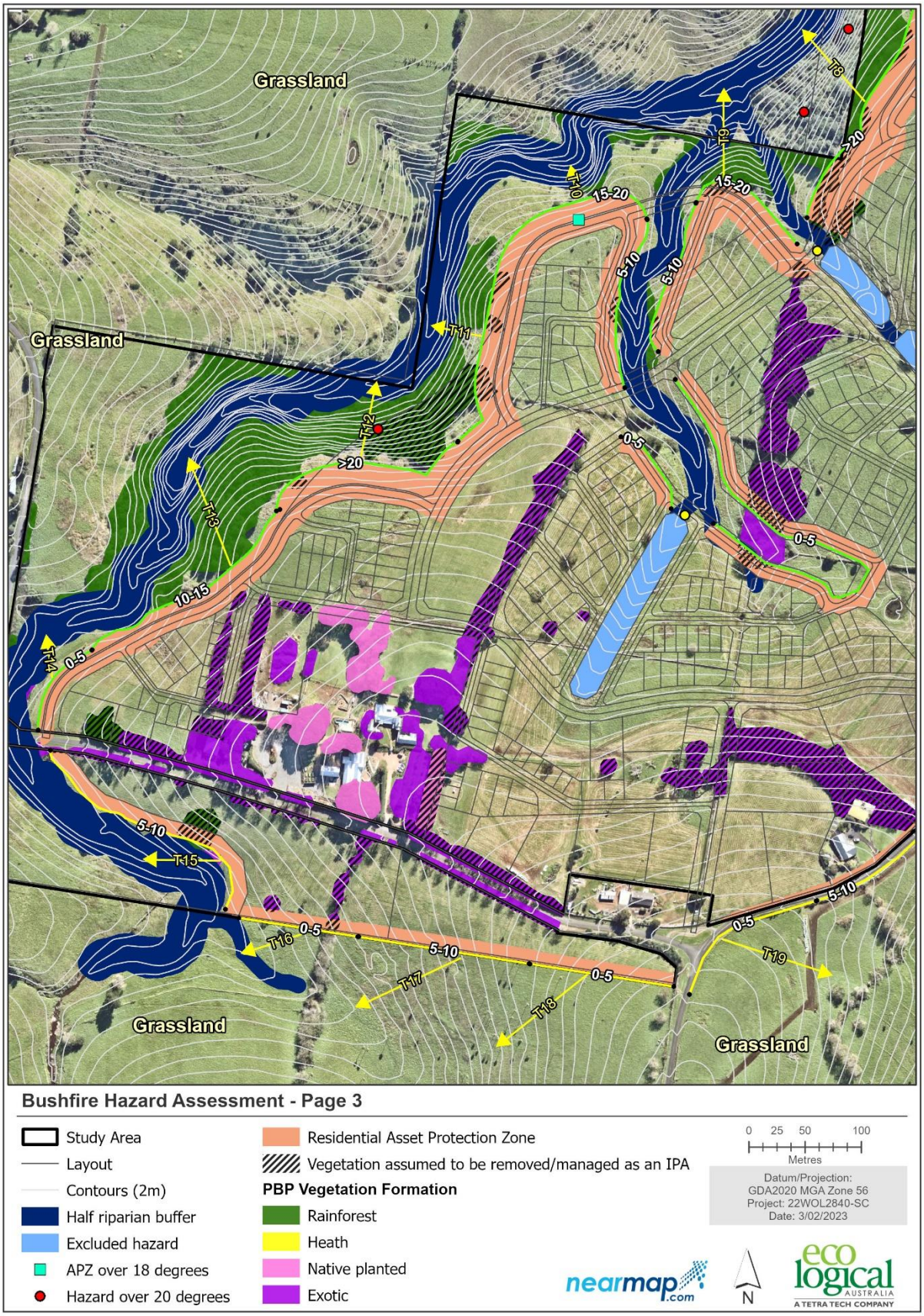

Figure 16: Preliminary Hazard Assessment and Indicative APZ – page 3

5. Access, Egress and Evacuation

In evaluating opportunity for residential settlement, consideration to the provision of adequate infrastructure associated with access, emergency evacuation and firefighting is required as per the strategic planning principles outlined in PBP. This includes determination if the exclusion requirements for "inappropriate development" apply with consideration to access. Future development may be considered inappropriate where:

- the development is likely to be difficult to evacuate during a bushfire due to its siting in the landscape, access limitations, fire history and/or size and scale;
- the development is within an area of high bushfire risk where density of existing development may cause evacuation issues for both existing and new occupants.

The above aspects were considered for the study area, along with specific considerations for access, evacuation and emergency service as outlined below in sections 5.1 to 5.3, and outcome of evaluation is presented in section 5.4.

5.1 Access

The strategic planning requirements of PBP prescribe the following assessment considerations for access:

- capacity of the proposed road network to deal with evacuating residents and responding emergency services, based on the existing and proposed community profile;
- the location of key access routes and direction of travel and;
- the potential for development to be isolated in the event of a bushfire.

The ILP proposes the connection of future development to the existing road network by a number of access points as shown in Figure 17. Access points will primarily transfer residents in an easterly direction, away from potential bushfire hazards from the west. As such, it is considered unlikely that access to and from the site would be cut off by fire.

In addition, future subdivision will require the provision of perimeter roads, and other access requirements as set out in Table 5.3b of PBP. However, with the provision of perimeter roads in the ILP and early lot design, this is not considered a constraint to future development.

5.2 Evacuation

While the risk of a significant bushfire necessitating the need for complete evacuation is low for the site it is an important consideration for strategic planning. Therefore, key considerations in relation to evacuation have been considered, including:

- Early offsite evacuation with multiple options;
- Safe on-site refuge capacity;
- Low risk development outcomes.

5.2.1 Early Offsite Evacuation

Evacuation is a necessary component of bushfire planning for the protection of life. Strategic planning should include adequate provision to support offsite evacuation. Table 6 below evaluates key considerations for safer offsite evacuation.

Table 6: Evacuation considerations

Consideration	Evaluation
Early offsite evacuation is critical, with late evacuation considered unsafe	Multiple access points provisioned in ILP to connect proposed new roads to existing road network. The capacity of these connections should be confirmed by further traffic analysis as design progresses.
Evacuation should occur away from (or across) the path of a fire, but not towards it	Evacuation would primarily be to the east, and is therefore considered appropriate.
Roads that could be cut by fire during the evacuation period are not suitable	There is minimal or no hazard adjacent to existing access roads, therefore it is unlikely they would be cut by fire
The road must be suitable to use in an emergency situation	Compliance with Table 5.3b of PBP is to be met.
Intervention by emergency services should not be relied on for road control or other activities.	As design progresses, traffic studies should determine road capacity, and any necessary intersection upgrades on the surrounding road network.

5.2.2 Access to Safer Places

Whilst early evacuation will always be the safest option, research into past bushfire incidents reveals that multiple and varying evacuation and refuge options should be provided to the community. Provision of access to safer place options is particularly important to support community resilience under rapid onset bushfire attack scenarios where evacuation is not achievable or not able to be undertaken due to safety concerns.

Consideration of NSPs provides one mechanism for increasing accessibility to safer places. Typically, NSPs provide a temporary refuge and include a building or an open space that may provide for improved protection of human life during the onset and passage of a bushfire (RFS 2017).

NSPs are approved by the NSW RFS and inspected by the regional Bush Fire Management Committee (BFMC). To ensure ongoing suitability and management, NSPs are included on the asset list in the regional Bush Fire Risk Management Plan (BFRMP). The criteria and principles for NSPs are documented in RFS (2017). There are existing NSPs outside of the study area, as detailed in Table 7 and shown in Figure 18. It is also expected that Kiama Town Centre would be utilised by evacuating residents.

Table 7: Existing NSPs in close Proximity

Neighbourhood Safer Place	Suburb	Type
Foxground RFS Station	Foxground	Built
Gerroa Fishermans Club Carpark	Gerroa	Open Space

^ Accessed from https://www.rfs.nsw.gov.au/plan-and-prepare/neighbourhood-safer-places

5.2.3 Low risk development outcomes

In combination with early off-site evacuation and capacity for safe on-site refuge, the risk level of the potential development outcomes across the sites warrants consideration with respect to evacuation demand. With consideration to the scale of the planning proposal, as demonstrated in Figure 19, there are many residential allotments that would no longer be bush fire prone (i.e., greater than 100 m from remaining hazards) and therefore future development in these areas would have a low bushfire risk.

5.2.4 Emergency services

The following is recommended for strategic land use planning to achieve the objectives and strategic planning principles of PBP 2019 relating to emergency management. Strategic emergency management planning is undertaken in collaboration with emergency service organisations within the strategic land use planning process, to establish preferred future outcomes (i.e., emergency evacuation) that have implications for land use planning, including:

a. Consideration of the increase in demand for emergency services;
b. Emergency evacuation planning; and
c. Evacuation adequacy assessment.

In regard to the demand for emergency services, ELA reviewed existing services in proximity to the site and note that there are existing RFS brigades close by as shown in Figure 20 and compiled in Table 8. Additional Fire and Rescue NSW (FRNSW) resources are also stationed at Kiama and Shellharbour. Further resources may be required to support the proposed development, and this should be further discussed with emergency services.

Table 8: Fire stations within proximity to the Study Area

Station
Rural Fire Service
Albion Park RFS
Dunmore RFS
Jamberoo RFS
Foxground RFS
Gerringong RFS
Fire and Rescue NSW
Albion Park FRNSW
Shellharbour FRNSW
Kiama FRNSW

5.3 Evaluation of Access, Egress and Evacuation

The evaluation of current access, egress and evacuation conditions is not considered inappropriate for the site given the following:

- Multiple access points to the sit, with primary access routes unlikely to be impacted by fire.
- Capacity for perimeter roads adjoining hazards

- Achievable low risk development outcomes
- Potential for additional NSP's on site within the retail precinct or open space
- Evacuation potential to Kiama CBD and nearby existing NSP's

Further progression of the proposal should consider traffic studies to confirm road capacities are complimentary to the level of development proposed, and consideration to any external road or intersection upgrades.

Figure 17: Access to the Study Area

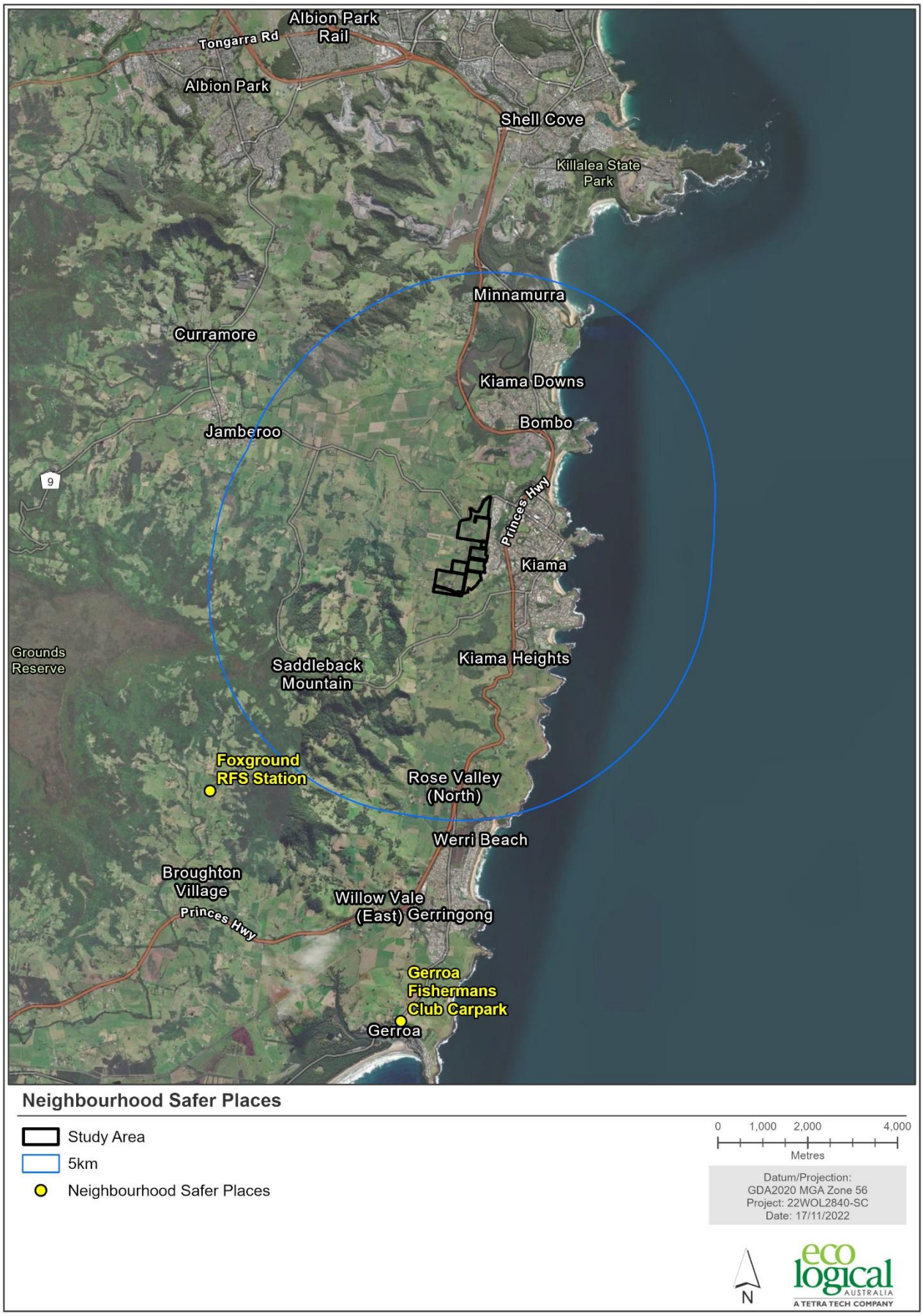

Figure 18: Existing Neighbourhood Safer Places

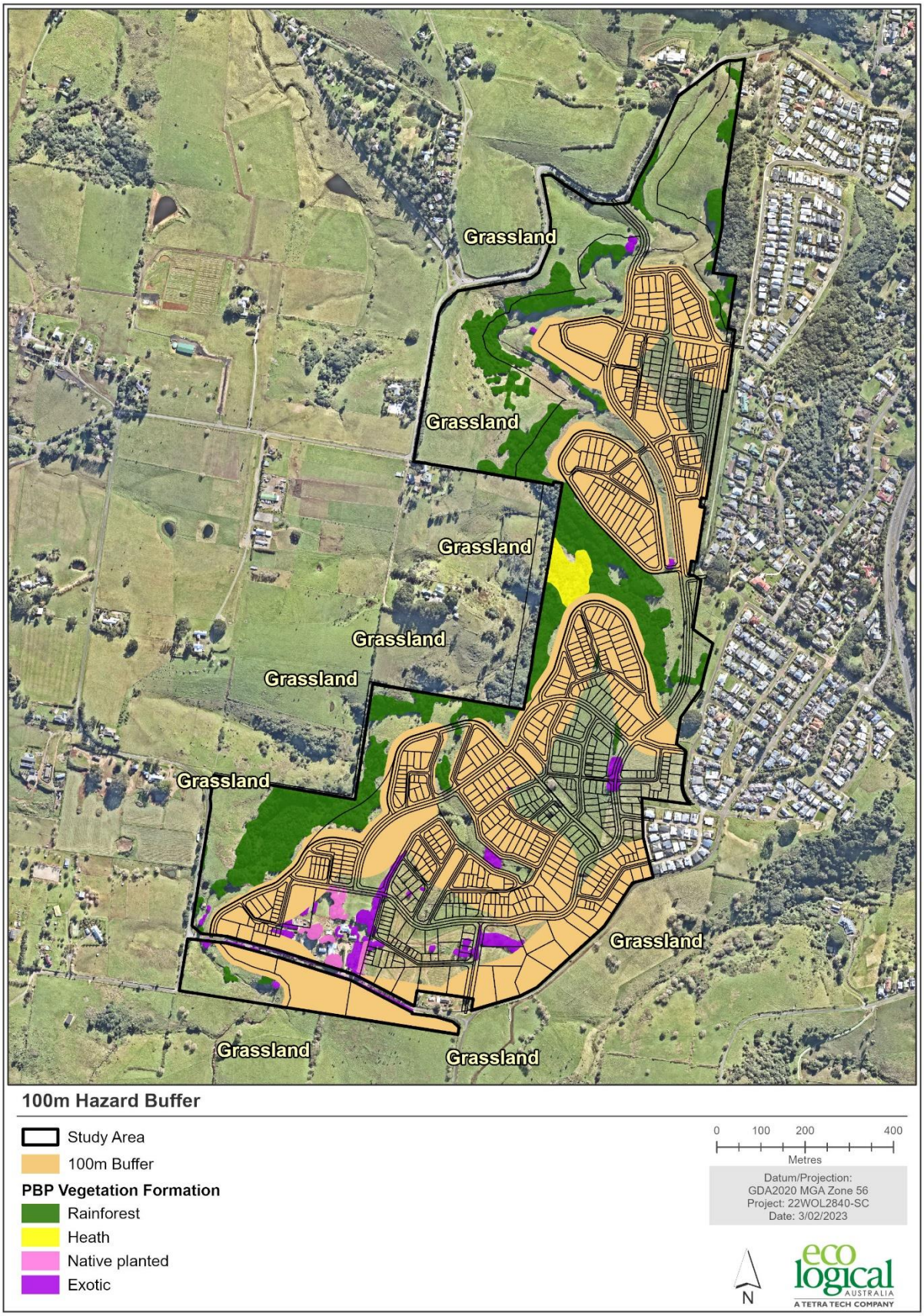

Figure 19: Low Risk Development Outcomes

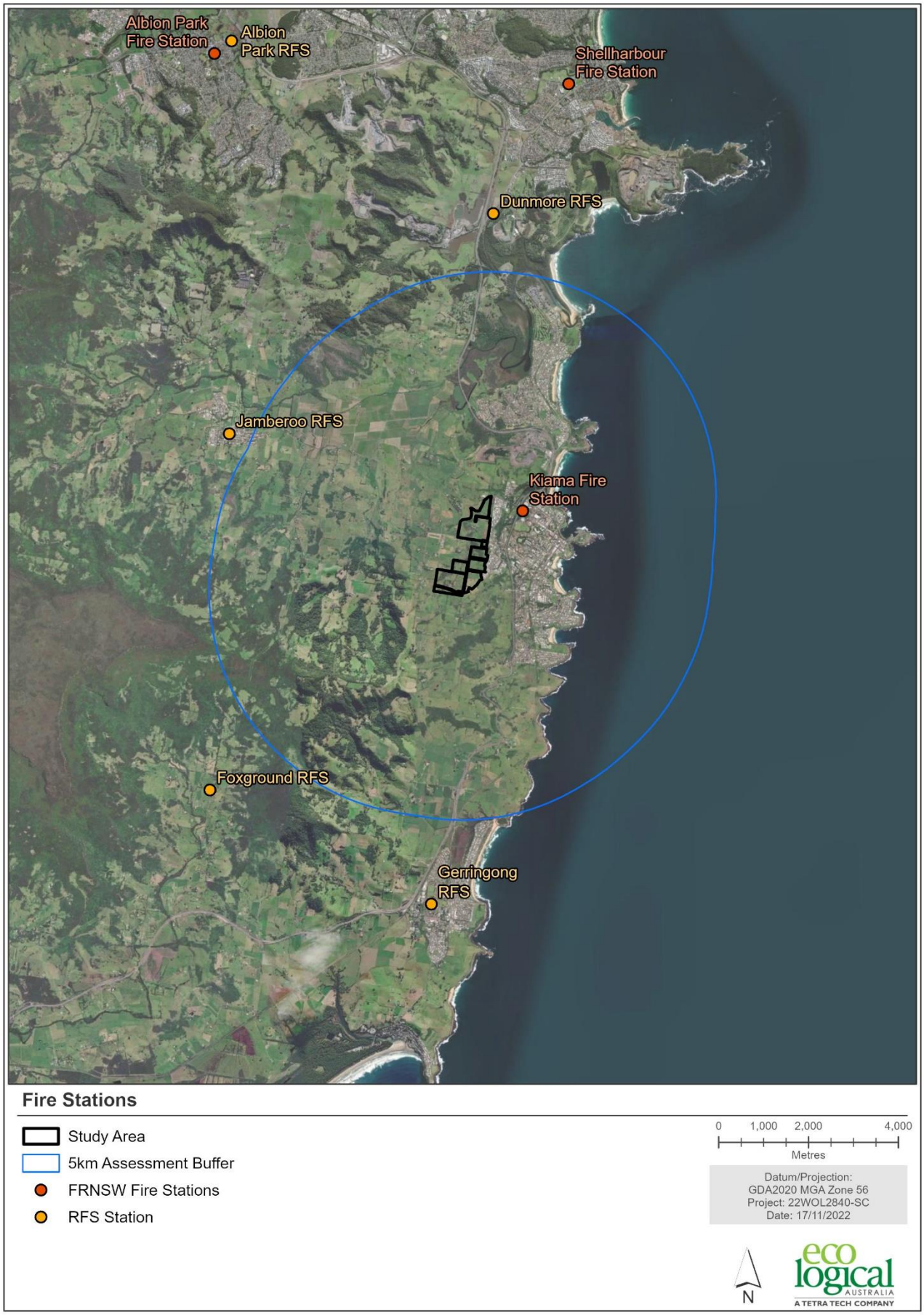

Figure 20: Fire stations in close proximity to the study area

6. Infrastructure and Adjoining Land

Strategic planning requirements seek to identify any potential issues associated with infrastructure and utilities. Key considerations on suitability of infrastructure to meet the requirements of PBP include the ability of the reticulated water system to deal with a major bushfire event in terms of pressures, flows, and spacing of hydrants and life safety issues associated with fire and proximity to high voltage power lines, natural gas supply lines, etc. Table 5.3 (residential subdivision) and Table 6.8 (SFPP) of PBP detail the acceptable solution requirements.

6.1 Water

To comply with PBP, future development should ideally be serviced by a reticulated water supply. Fire hydrant spacing, sizing and pressures should comply with *AS 2419.1 :2005'Fire hydrant installations – Part 1: System design, installation and commissioning* (SA 2005). Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. Where future development is not supplied by reticulated water cannot be provided a static water supply for firefighting purposes is required on site for each occupied building in accord with the capacities outlined in PBP.

6.2 Electricity and gas

It is expected that future electricity supply to the study area will be underground where possible and compliant with PBP. If existing or future electrical transmission lines to the subject land are above ground, the following requirements apply:

- Lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; and
- No part of a tree is closer to a line than the distance set out in accordance with the specifications in *ISSC3 'Guide for the Management of Vegetation in the Vicinity of Electricity Assets' (ISSC3 2016).*

Reticulated or bottled gas is to be installed and maintained in accordance with Australian Standard AS/NZS 1596:2014 'The storage and handling of LP Gas' (SA 2014) and the requirements of relevant authorities (metal piping must be used).

Further detail regarding electricity and gas requirements are detailed in PBP. The acceptable solution requirements for these services are expected to be achievable for future development within the study area.

6.3 Adjoining Land

For any future development within areas contemplated for residential settlement, adherence to PBP is required, and should not require changes to existing bushfire management practices on adjoining land, this includes the provision of APZ's wholly within the study area or provided by public roads. Based on this requirement, there are no concerns regarding the impact of the proposal on adjoining land.

7. Evaluation

This section evaluates the residential settlement growth areas against the bushfire strategic planning requirements of PBP and based upon the assessment findings in the preceding sections, to determine whether:

- The proposal poses an unacceptable risk or provides for inappropriate development;
- Future development can adequately respond to the bushfire threat; and
- Future development can provide adequate bushfire protection measures to reduce the residual risk to an appropriate level.

The evaluation is based upon Chapter 4 of PBP and the Assessment Framework, along with consideration of the following:

- Residual risk – the level of residual risk after the application of bushfire protection measures is a key determinant in the strategic assessment of whether proposed development is appropriate;
- Risk to life – an appropriately low residual risk to human life is fundamental;
- Risk to property – the residual risk to property should meet the Acceptable Solutions within PBP;
- Emergency service response – the acceptability of proposed development should not be reliant on emergency service response / intervention;
- Adjoining lands – future development should not be reliant on fuel management on adjoining lands or effect those landowners' ability to undertake such works

A summary of the evaluation against the strategic requirements is provided in Table 9.

Table 9: Evaluation

	Evaluation
Risk: Generally within a highly moderated risk landscape, dominated by a rural landscape. Fragmented woody vegetation to the west is well is separated from the site	Future land uses (low density residential, commercial and SFPP) enabled by rezoning are not considered inappropriate for the risk setting
Land Use: Provision of bushfire protection measures for future development considered feasible	There is capacity for bushfire protection measures and therefore future land uses enabled by rezoning are not considered inappropriate
Access/Egress: Road network affording egress in multiple directions.	Multiple access points to the existing road network are proposed and evacuation routes are unlikely to be impacted by fire. Therefore future land uses are not considered inappropriate
Infrastructure: Provision of compliant water / electricity /gas services	Situated within the urban fringe and therefore the provision of reticulated water and infrastructure not considered a constraint to development
Adjoining Land and risk to adjoining land	Contemplated development would not increase the risk on adjoining land, nor would development be reliant on adjoining land for bushfire protection. Contemplated development would provide increased protection for

	Evaluation
	existing residential development, compliant with current guidelines.

8. Conclusion and Recommendations

8.1 Conclusion

In evaluating the study area contemplated for residential development against the bushfire strategic planning requirements of PBP, this assessment is based on our understanding of the growth contemplated and current hazards influencing the locations. The evaluation considers the merits for future residential development and potential for consistency with the strategic planning principles of PBP, with consideration to the following aspects:

- Future development will not pose or be subjected to an unacceptable risk; or provide for 'inappropriate development' outcomes;
- Adequate bushfire protection measures can be provided to reduce the residual risk to an appropriate level; and
- Future development will not adversely affect existing development or adjoining landowners and their ability to undertake bushfire management.

Based on the outcomes of this assessment, it is considered that rezoning and contemplated land uses for the study area have the potential to comply with the strategic bushfire planning requirements of Chapter 4 of PBP.

8.2 Recommendations

The following recommendations are made resulting from this assessment:

- Ensure perimeter roads are provided to lots on a hazard interface and to the appropriate specification;
- Ensure the overall design provides the best sitting for the provision of compliant APZ's;
- Ensure any contemplated SFPP development meets the APZ requirements set out in A.12.2 of PBP;
- Resolution of any APZ areas identified on slopes greater than 18 degrees;
- Confirmation of riparian corridors and hazard extent;
- Consideration to capacity of evacuation routes, particularly for connections into suburban areas to the east, ensuring sealed, two-way access should be the objective for any road upgrades; and
- Discussion with emergency services in regard to further resources required within the district resulting from the potential development.

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