



Report

Bushfire Management Plan



LOCATION: ROL05 (PRECINCT 103 AND 104),

KINDIRA, MONARCH GLEN, QLD 4285

LOCAL GOVERNMENT AREA: LOGAN CITY COUNCIL

CLIENT: MONARCH GLEN NO. 1 PTY LTD



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Executive Summary

Covey Associates have prepared this Bushfire Management Plan (BMP) to support the proposed Reconfiguring a Lot (ROL) Development Application (DA) for ROL05 of the Monarch Glen Master Planned Community. This report encompasses ROL05 DA being made under the Greater Flagstone Urban Development Area Development Scheme for Kindira, Monarch Glen, on Lot 2 in SP351245 being submitted to Economic Development Queensland (EDQ).

The entire site is currently identified as a bushfire prone area (BPA) under the State Planning Policy (SPP) Bushfire Hazard Mapping. This BMP assesses the risk of the proposed development within the defined Bushfire Prone Area, assessing specifically against the Logan City Council (LCC) Bushfire Hazard Overlay Code (BHOC) and Assessment Benchmarks in the *Natural Hazards, Risk and Resilience – Bushfire, State Planning Policy State Interest Guidance Material* (Queensland Government, 2019a). These requirements and a description of how they are addressed in the proposed development design are detailed in Section 5 of this report. This BMP focuses solely on bushfire-related risk and mitigation strategies.

The outcomes of this Bushfire Management Plan have identified that:

- Per the Assessment Benchmarks of the State Planning Policy, the proposed lots within ROL05 should be sufficiently located beyond bushfire prone vegetation such that they are not impacted by a Radiant Heat Flux (RHF) $>29 \text{ kW/m}^2$. Building envelopes within all lots within ROL05 achieve this requirement;
- The proposed State Primary School falls under the ‘vulnerable use’ (VU) definition per the SPP and as per SPP requirements, this school will be located entirely beyond RHF 10 kW/m^2 . Depending upon the building classifications, some buildings proposed within the school may be required to comply with Bushfire Attack Level construction requirements, per Australian Standard (AS) 3959:2018 ‘Construction of buildings in bushfire-prone areas’ (AS3959) and the National Construction Code (NCC, 2022; including Part G5, Spec 43 where applicable). NCC Part G5, Spec. 43 requirements may be able to be avoided by locating all Class 9b school buildings entirely outside of the post-development bushfire prone area (BPA) shown in Figure 4-4;
- The proposed WSUD corridors / basins have been considered as bushfire prone vegetation in the post development landscape, per Bushfire Resilient Communities technical reference guide. It has been recommended that the landscape design within WSUD align with the vegetation classification (VHC 29.5) in terms of species selection and vegetation structure; or a lower risk vegetation; and
- Any future landscape design as it is developed within operational works phases of the development shall not exacerbate or increase bushfire prone vegetation from what has been assessed (refer to Section 2.4.2). This includes any planting of vegetation that does not align with Clause 2.2.3.2 of AS3959.

By adopting the mitigation measures in this BMP, the level of bushfire hazard, risk and RHF for the proposed development are reasonable and are not likely to prohibit the proposed development of the site.

Abbreviations Used in Report

Abbreviation	Full Meaning
AS3959	AS 3959:2018 <i>Construction of buildings in bushfire-prone areas</i>
AWS	Automatic Weather Station
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BHOC	Bushfire Hazard Overlay Code
BMP	Bushfire Management Plan
BPA	Bushfire prone area
BRC	Bushfire Resilient Communities
DA	Development Application
DF	Drought Factor
EDQ	Economic Development Queensland
FFDI	Forest Fire Danger Index
KBDI	Keetch-Byram Drought Index
LCC	Logan City Council
MGM	Monarch Glen Masterplan
NCC	National Construction Code of Australia
PBI	Potential Bushfire Intensity
PDA	Priority Development Area
PS	Planning Scheme
RHF	Radiant heat flux
ROL	Reconfiguring a Lot
SPP	State Planning Policy
TCR	Trunk connector road (connecting P103 and P104)
VHC	Vegetation Hazard Class
VU	Vulnerable Use
w	Understorey fuel load
W	Total fuel load

Document	Prepared by	Date
<i>Context Plan – Rice Rd, Undullah</i> (endorsed by EDQ 31/10/2025)	SaundersHavill for Mirvac	03/09/2025
<i>ROL05 Layout Drawing 11731 P 69 Rev D</i>	SaundersHavill for Mirvac	04/06/2026

Contents

Executive Summary.....	iii
1 Introduction	1
1.1 Scope	1
1.2 Objectives	1
1.3 Planning Context	1
1.3.1 SPP - Natural hazards, risk and resilience state interest – Bushfire	1
1.3.2 Bushfire Prone Designation	2
1.3.3 Logan City Council Bushfire Hazard Overlay Code	2
1.4 Site Description.....	2
1.5 Development Description.....	2
1.6 Document Review.....	2
2 Bushfire Hazard Assessment.....	5
2.1 Bushfire Prone Area Mapping	5
2.2 Site Topography.....	5
2.3 Weather	7
2.3.1 Fire Danger Season	7
2.3.2 Rainfall	7
2.3.3 Wind Speed and Direction	8
2.3.4 Generalised Extreme Value Analysis.....	8
2.3.5 Selection of FFDI Value Using SPP.....	8
2.3.6 Climate Change Impact on FFDI	8
2.4 Bushfire Fuels	9
2.4.1 Site Assessment	9
2.4.2 Post-development VHC.....	12
3 Bushfire Risk Assessment.....	15
3.1 Bushfire Impact Analysis and RHF Ratings	15
3.2 Results	16
3.3 Potential human impact and sheltering sites.....	16
4 Bushfire Mitigation Measures.....	18
4.1 Setbacks / RHF exposure	18
4.1.1 Asset Protection Zones	21
4.2 National Construction Code (NCC)	23
4.3 Access	26

4.4	Firefighting Water Supply	26
4.5	Bushfire Landscaping Guidelines	27
4.5.1	WSUD / Drainage Areas	28
5	Performance Criteria and Compliance.....	29
6	Conclusion.....	34
	References	35

Figures

Figure 1-1: Proposed ROL05 development layout.....	3
Figure 1-2: SPP bushfire prone area (pre-development).....	4
Figure 2-1: Slope analysis (post-development).....	6
Figure 2-2: Pre-development VHC within ROL05 assessment area and site assessment points.....	11
Figure 2-3: Post-development VHC within ROL05/assessment buffer	14
Figure 3-1: RHF analysis showing vulnerable use / residential setbacks (10 / 29 kW/m ²)	17
Figure 4-1: P103 lots showing all BEs located at RHF ≤29 kW/m ² per SPP/BRC.....	19
Figure 4-2: P104 lots showing all BEs located at RHF ≤29 kW/m ² per SPP/BRC.....	20
Figure 4-3: APZs / managed fuel zones to comply with BRC (s 8.5) and AS3959 (s 2.2.3.2).....	22
Figure 4-4: Post-development BPA	24
Figure 4-5: P104 lots with potential AS3959 BAL assessment issues	25
Figure 4-6: Vehicle turning points (Queensland Fire and Emergency Services, 2019b)	26
Figure 4-7: Low Threat vegetation (left) and Low Threat public open space (right)	27
Figure 4-8: AS3959 Exclusions—Low threat vegetation and non-vegetated areas.....	27

Tables

Table 2-1: RHF model input values.	13
Table 3-1: VHC fuel loading, vegetation prone type and Rate of Spread model adopted	15
Table 3-2: Radiant heat flux impacts (Penney et al., 2020)	16
Table 5-1: Assessment of development against Logan City Council BHOC (8.2.3)	29

Appendices

Appendix A: Ember Weather Analysis
Appendix B: Site Assessment Photos
Appendix C: Inferno-BAL Methodology
Appendix D: NCC requirements for certain Class 9 Buildings
Appendix E: Preliminary BAL Impact Maps P103 and P104

1 Introduction

1.1 Scope

The client (Monarch Glen No. 1 Pty Ltd) engaged Covey Associates Pty Ltd (Covey) to prepare a site-specific Bushfire Management Plan (BMP) to support a development application for a Reconfiguration of a Lot (ROL) for Kindira (ROL05). ROL05 (Precinct 103 and 104) is part of the Kindira Master Plan and falls within the Greater Flagstone Priority Development Area (PDA). The development application is being made under the Greater Flagstone Urban Development Area Scheme (Greater Flagstone UDAS) to Economic Development Queensland (EDQ) as the assessment authority.

The proposed ROL05 development extent ('site'; Figure 1-1) is located within a single existing allotment – Lot 2 SP 351245.

The site is mapped entirely as 'High' and 'Medium' 'Potential Bushfire Intensity' (PBI) within the State Planning Policy (SPP) 'bushfire prone area' (BPA) mapping (refer to Figure 1-2). Consequently, the development should achieve the assessment benchmarks of the SPP – Part E Natural hazards, risk and resilience (The State of Queensland, 2017), as well as Performance Outcomes of the Logan City Council (LCC) Planning Scheme (PS) 2015: 9.2 and its associated Bushfire hazard overlay code (BHOC) 8.2.3.

This BMP assesses the bushfire risk to the proposed development given that it is located within a mapped BPA and details how the recommended bushfire mitigation measures achieve the assessment benchmarks of the SPP and LCC BHOC.

1.2 Objectives

The objectives of the BMP are to:

1. Achieve consistency with purposes and policy measures of the SPP guidance material, *Bushfire Resilient Communities Technical Reference Guide for State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire'* (BRC) (Queensland Fire and Emergency Services, 2019a), and the LCC BHOC;
2. Assess and refine mapping of the extent of potential bushfire risk for the site / BMP area by undertaking a Radiant Heat Flux (RHF) assessment (including future proposed revegetation areas) of all lands to a distance of 150 m surrounding the site as required under the BRC; and
3. Develop appropriate bushfire risk mitigation measures for all land subject to the plan, with due regard for people, property, infrastructure, and the environment.

1.3 Planning Context

1.3.1 SPP - Natural hazards, risk and resilience state interest – Bushfire

The SPP (2017) identifies two ways a site may be designated as bushfire prone as follows:

1. If the land is identified by a local government in a local planning instrument as a bushfire prone area (BPA) based on a localised bushfire study prepared by a suitably qualified person; or
2. If the local government has not identified BPAs in a local planning instrument in accordance with (1) above, the area is shown on the State Planning Policy Interactive Mapping System as a BPA.

1.3.2 [Bushfire Prone Designation](#)

Formal designation as a BPA provides the legislative trigger to enforce certain Building Classes to be constructed per AS 3959: 2018 'Construction of buildings in bushfire-prone areas' (AS3959; Standards Australia 2018).

1.3.3 [Logan City Council Bushfire Hazard Overlay Code](#)

The LCC BHOC applies to assessable development identified as bushfire hazard in the Bushfire Hazard Overlay Map OM-03.00. The Monarch Glen site requires assessment against the assessment benchmarks of the LCC BHOC as it is identified as a bushfire hazard area.

1.4 Site Description

Proposed ROL05 is located within the Greater Flagstone PDA approximately 11 km west of Jimboomba at Monarch Glen (Figure 1-1). The land adjoining the site to the south is planned for future development within the MGM including a mix of residential, recreational, community centre and drainage land use.

Land to the west and north of proposed ROL05 is not part of the MGM and will likely remain in its vegetated state for the foreseeable future while land to the east has already been developed within Monarch Glen ROL4 (Precincts 1 and 2) and the existing residential suburb of Flagstone.

The ROL05 site has a history of selective logging and grazing but is currently largely vegetated with a combination of native woodland and forest intersected by a series of informal vehicle and pedestrian tracks.

1.5 Development Description

Proposed ROL05 will contain a total of 670 allotments including residential allotments, a designated state school site and district sports fields along with neighbourhood parks and associated infrastructure including road network and reticulated water supply.

As shown in Figure 1-1, proposed ROL05 will be accessed via an extension of Homestead Drive through recently constructed ROL4 to the east. ROL05 consists of two Precincts – Precinct 103 on the south-eastern side of future Kindira Drive and Precinct 104 on the northern-western side.

These Precincts are connected via a 'trunk connector road' (TCR) along with a designated state school site to the east and district sports fields beyond the school.

1.6 Document Review

This BMP will remain valid until such time as there is a change to the development layout, bushfire hazard or relevant bushfire planning legislation.

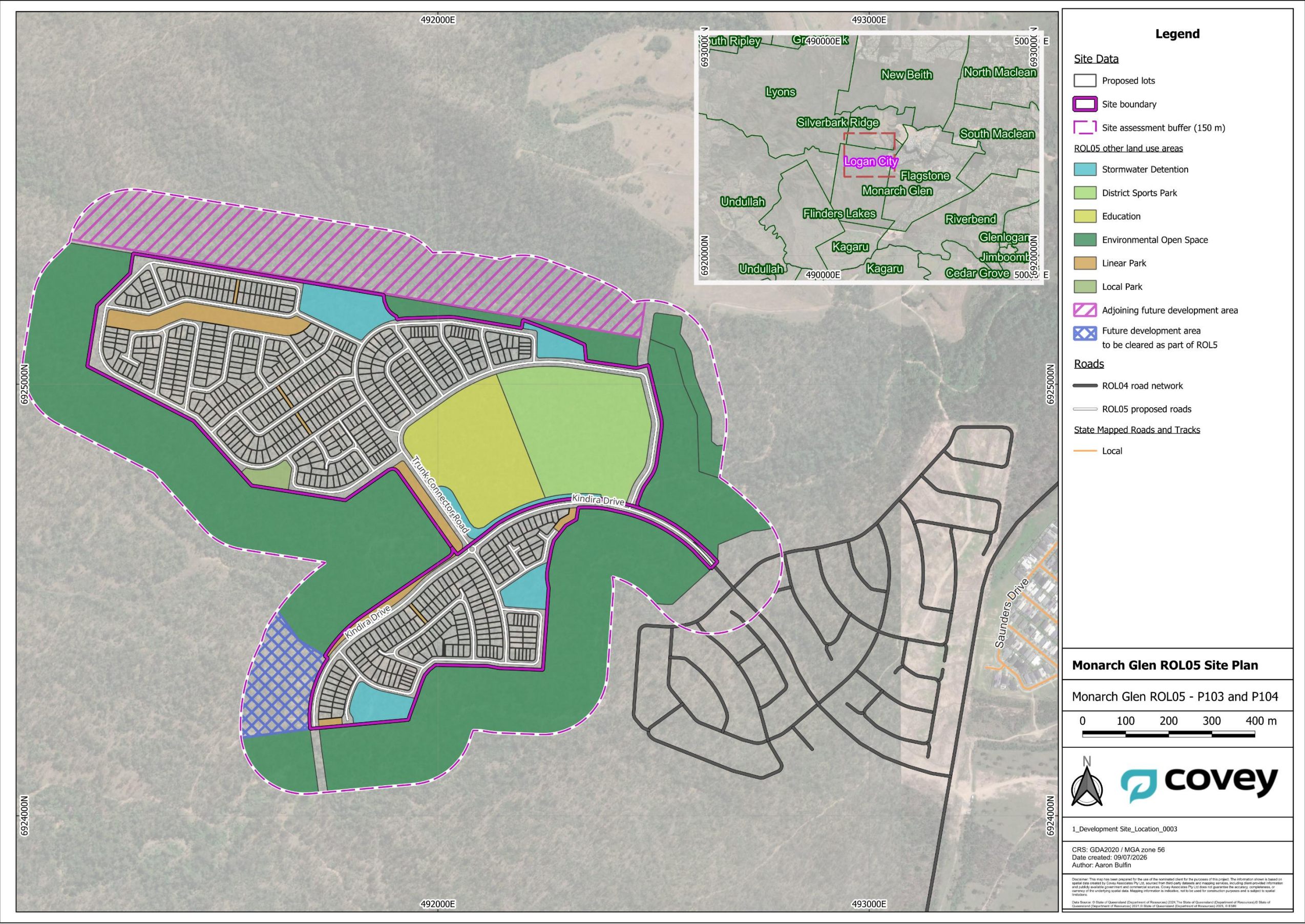


Figure 1-1: Proposed ROL05 development layout

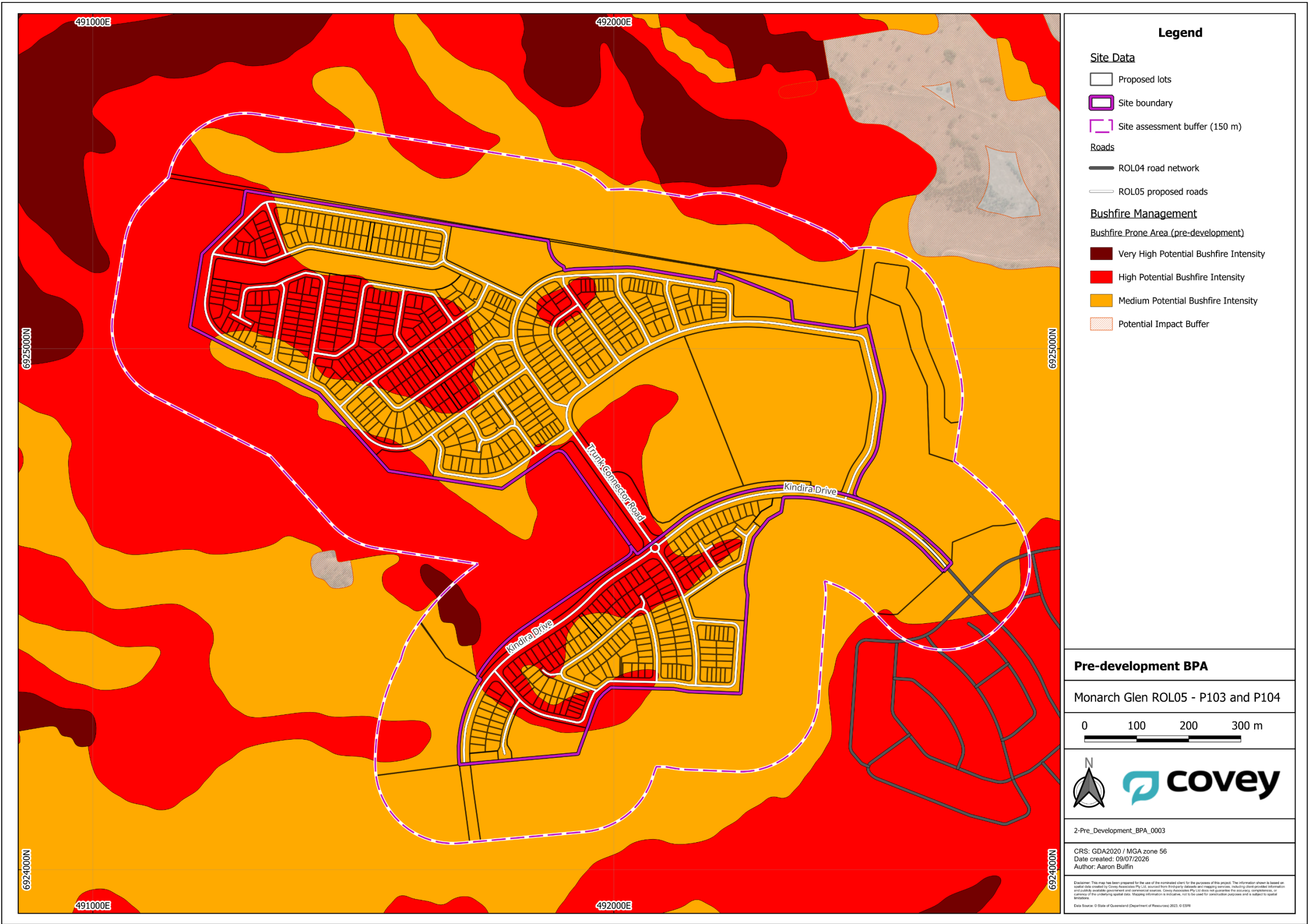


Figure 1-2: SPP bushfire prone area (pre-development)

2 Bushfire Hazard Assessment

Bushfire severity is predominantly influenced by topography, fuel and weather and these main influences will be explored within this section as they relate to the proposed ROL05 site.

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

2.1 Bushfire Prone Area Mapping

The SPP mapping identifies the site as subject to High and Medium PBI – see Figure 1-2. The LCC Planning Scheme Bushfire Overlay Map (OM-03 00) also identifies the site as subject to High and Medium PBI. Given there are no State provisions under the existing LCC PS, this BMP uses assessment methodologies outlined in BRC and the SPP.

Currently Logan City Council is in the process of drafting their new Planning Scheme Policy, which intends to adopt the SPP BPA mapping. Additionally, given that this development will be assessed by the state EDQ, the SPP BPA mapping has been determined as the assessment trigger.

As per the SPP BRC methodology, topography and fuel were both considered both within the ROL05 site and within a 150 m buffer from the site ('assessment area').

2.2 Site Topography

Topography was verified during the site assessment and was considered consistent with the Digital Elevation Model (DEM) obtained from *Elvis - Elevation and Depth - Foundation Spatial Data (2025)*. The client provided a one-metre resolution design DEM of the design terrain across the development site. The DEM provided is associated with the design surface (final surface) of the development works that will be undertaken for the proposed development. The design DEM was merged with downloaded Light Detection and Ranging (LiDAR) information from Elvis to provide an elevation model that covers the full extent of the assessment area.

The post-development slope analysis (Figure 2-1) confirms that the site is gently sloping to a ridge in the centre of the site, with a waterway gully to the south. Further, the stormwater management drainage areas to the north and east of the development contain small embankment depressions.

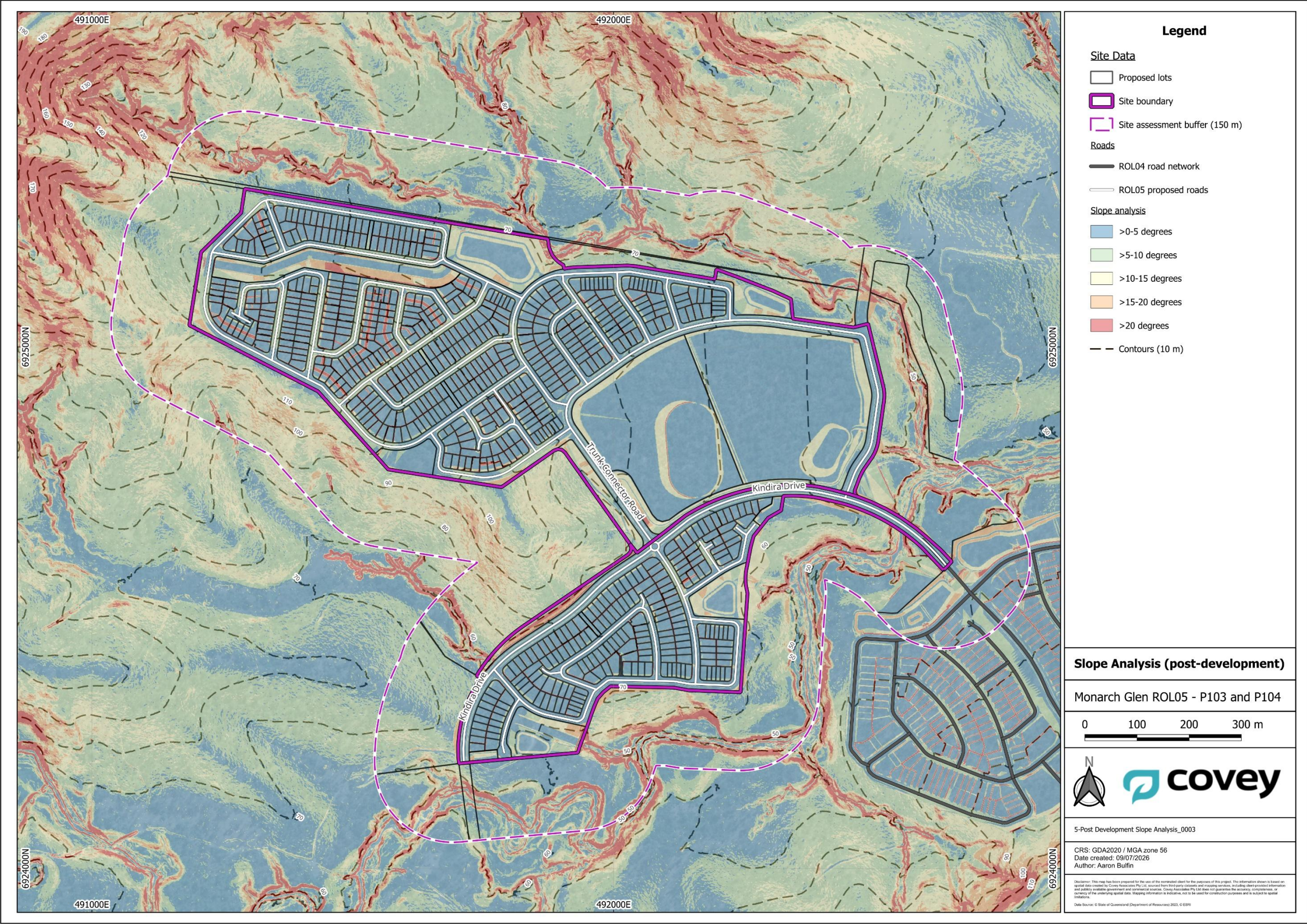


Figure 2-1: Slope analysis (post-development)

2.3 Weather

An assessment of the recent past weather patterns and trends was analysed for the site using data extracted from the Bureau of Meteorology recorded from all of Australia's Automatic Weather Stations (AWS). For this site, data was analysed from Beaudesert (Drumley Street; AWS 40983) which is located approximately 15.5 km south-east of the development site and to ensure a complete year-to-year assessment of historic weather, the assessment period used was 1 January 2008 to 31 December 2025 inclusive. The graphs and other supporting weather analysis data is contained in Appendix A.

2.3.1 Fire Danger Season

Fire weather is often associated with meteorological conditions that can generate increased fire behaviour, making wildfire suppression efforts difficult for emergency personnel. Fire weather can be influenced by many local factors, including temperature, wind, relative humidity, and drought factor – all of which are used to calculate the Forest Fire Danger Index (FFDI¹). Fire risk is typically linked to the occurrence of fire weather days or sequences of days of FFDI above 25 (Queensland Parks and Wildlife Service, 2013).

Analysis of monthly FFDI distribution indicates that the fire season for the ROL05 area typically extends between August and November, peaking in September (see graph in Appendix A Section A1). However, fire occurrences can have a random nature, and a few short sharp fire weather periods can result in conditions where fires may cause, or have the potential to cause, major damage. Damaging fires can occur in any given year, despite some years being drier and hotter than others.

The table in Appendix A Section A2 provides the 20 highest ranked FFDIs over the recorded period from Beaudesert (Drumley Street) AWS (18 years for Beaudesert from 2008-2025). These show that the highest ranked fire danger days are typically associated with:

- Air temperatures in excess of 30°C;
- Low RH ($\leq 21\%$);
- Westerly arc winds; and
- Relatively dry conditions (Drought Factor (DF) ≥ 8.8).

Though the number of years for which the AWS has been active is relatively short (just over 18 years), it still provides valuable information relating to typical high fire danger weather patterns. The year of 2019 stands out as the worst year on record (2007 to 2025) based on low annual rainfall accumulation through the year and high temperatures, combined with low relative humidity influenced by the dry inland air from the westerly winds. A total of 14 of the top 20 fire weather days during were recorded during 2019.

2.3.2 Rainfall

The occurrence of days with high fire danger is also influenced by annual rainfall by virtue of the Keetch-Byram Drought Index (KBDI) and DF. This is seen for the analysed AWS (Section A3 of Appendix A) where typically low annual rainfall results in higher accumulated annual FFDIs. Conversely, years of above-average rainfall can lead to increased vegetation growth. Therefore, although high rainfall levels are less conducive to extensive wildfire impact in the short term, this effect might be reversed in successive years, especially if a period of drought follows. As such, having an above-average year of rainfall cannot be perceived as reducing the ongoing fire risk.

¹ FFDI were used in this report, instead of the new Australian Fire Danger Rating System and Fire Behavior index, as the data we analyzed was historical. Also, FFDI values are used as input for in RHF modeling consistent with BRC and AS3959.

2.3.3 Wind Speed and Direction

Fire weather patterns are closely related to wind directions and synoptic setups. The wind roses in Section A4 of Appendix A show an analysis of wind directions for FFDI classes 0-11 (Low to Moderate), 12-24 (High), 25-49 (Very High) and 50-74 (Severe) for Beaudesert AWS assessed period (2008 to 2025). FFDIs greater than 74 have not occurred over the assessed period. The analysis reveals that FFDI above 25 tend to come from a westerly arc, under inland dry wind influences. Winds associated with lower FFDIs tend to be easterlies and have higher relative humidity due to a maritime influence.

2.3.4 Generalised Extreme Value Analysis

A Generalised Extreme Value Analysis (GEV), a regression technique was completed to determine the Annual Exceedance Probability (AEP) of FFDI values. The GEV technique is frequently used to predict extreme weather such as storms, cyclones and flooding events (Douglas et al., 2014). Covey completed a GEV analysis based on the recorded FFDI data at Beaudesert AWS for the study period (Appendix A Section A5).

This GEV analysis provides an indication of the Annual Return Interval (ARI) of fire weather. The table in Appendix A Section A6 contains the calculated FFDI values for key return intervals but it is important to note that the GEV recurrence value indicates the likely return period of fire weather and not a fire event. Extreme fire weather may come and go without a fire occurring. Therefore, the probability of a fire occurring within the right position within the landscape during these periods of extreme weather and impacting the development are orders of magnitude lower. The ARI FFDI reflects existing baseline conditions and not ARIs that are inclusive of the effect of climate change.

2.3.5 Selection of FFDI Value Using SPP

Per the recommendations of BRC for undertaking Method 2 (AS3959) radiant heat flux (RHF) calculation method, the mapped SPP 1:20 year ARI FFDI spatial data (available at [BRC MapViewer](#)) has been adopted for the RHF analysis within this BMP. The SPP-prescribed spatial FFDI for the site and for the Beaudesert BoM AWS location is 56. These calculations of the FFDI ARI are based on an A1F1 climate change scenario (Queensland Fire and Emergency Services, 2019a)

The SPP mapped FFDI spatial data, created in 2014, doesn't consider the latest 10 years of weather data. The Ember GEV analysis indicate that these values approximately represent a 1 in 14-year recurrence Interval for the site under baseline conditions.

Note, that the SPP prescribed FFDI is lower than the results of the Ember analysis. This difference can be attributed to the difference in the way the ARIs are determined as discussed above. Per the recommendations of BRC Method 2, an FFDI of 56 was used in the radiant heat flux (RHF) analysis outlined in Section 3.

2.3.6 Climate Change Impact on FFDI

Climate change relative to the project site can be referenced in the *Climate Change in Australia Report for East Coast Cluster* developed by CSIRO and BOM (A. Dowdy et al., 2015), key findings for projected climate change within the East Coast Cluster is summarised below:

Very high confidence in:

- Higher temperatures; and
- Hot and more frequent hot days, with less frost; and

High confidence in:

- Increased intensity of heavy rainfall events, though changes to drought less clear;
- Increase evaporation rates and reduced soil moisture;
- Little change in solar radiation and reduced humidity throughout the year;
- Some decrease in winter wind speed, with fewer 'East Coast Lows'; and
- A harsher fire weather climate is expected in the future.

Climate modelling projections for predicted fire weather and fire danger based on the latest IPCC reports (AR5 and AR6) are available and could provide valuable information when assessing potential future fire risk to the site – as projections exist from the current year to 2100. These climate models have been developed by the Department of Environment and Science, based on accepted climate models and data, and are available in gridded format relative to the project site (CSIRO et al., 2021).

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

- Fire behaviour at elevated FFDIs and under the influence of fire-induced winds driven by strong convection rates can become erratic and thus can be beyond the bounds of predictive models (Cruz et al., 2012); and
- Human-induced climate change may exacerbate fire behaviour and affect vegetation structure and floristics in different ways to those assumed in this project (A. J. Dowdy, 2018) but the changes predicted above are predicated on current human behavioural and climate trends and point to increased bushfire risk.

2.4 Bushfire Fuels

Fuel load and arrangement significantly impact the bushfire behaviour, potential severity, and scale. Fuel characteristics vary along with changes in type, density, and extent of vegetation communities and land use. The SPP through BRC requires assessment of the 150 m of vegetation adjacent to assets. The State-mapped Vegetation Hazard Classes (VHC) map (Figure 2-2) was modified in accord with BRC methodology (Queensland Fire and Emergency Services, 2019a) to accurately represent the vegetation within the study area as outlined below.

BRC assigns specific fuel loads based on the type of the mapped vegetation community (mapped as VHC), which is based on Queensland Regional Ecosystems (RE) mapping. BRC defines Bushfire Prone vegetation as a VHC that can have a potential fireline intensity greater than 4,000 kW/m², with values lower than this considered as vegetation associated with grassfire prone, or low hazard areas. BRC requires the bushfire assessment to consider vegetation up to 150 m around the development lot, which has been desktop reviewed and refined to understand the bushfire risk and potential by evaluating the fuel type and continuity across the whole development site.

2.4.1 Site Assessment

A site inspection was undertaken on 28 April 2026 to assess the mapped regional ecosystems and verify the corresponding vegetation hazard classes at the site. The site was traversed on foot to document dominant species composition of site vegetation and compare these with State mapped REs and VHCs. A sample of photographs collected during the inspection is contained in Appendix B.

During the site inspection the majority of the development site contained remnant forest vegetation with scattered smaller patches of previously disturbed, regenerating forest. Some earth access tracks had been established.

The forests on the higher slopes are dominated by eucalypt species primarily *Corymbia citriodora*, *Eucalyptus crebra* and *Corymbia tessellaris*, with a mixture of shrub (including weed species such as *Lantana camara*) and native grass understorey. The forests are generally consistent with regional ecosystems 12.9-10.2 and 12.9-10.7.

Areas surrounding the vegetated creek lines within the site consist of a canopy of eucalypts including *Eucalyptus tereticornis*, *Eucalyptus acmenoides*, *Eucalyptus major* and *Corymbia intermedia*. These areas have an understorey of *Acacia* and *Melaleuca spp*, with patchy introduced *Lantana camara* shrubs. The ground layer of these creek lines consists of a mix of weed species such as *Ageratina riparia* and *Praxelis clematidea* and an intact or degraded native grass ground layer including species such as *Imperata cylindrica*, *Themeda triandra* and *Lomandra spp*. These areas are analogous with RE 12.3.11 and 12.9-10.17. .

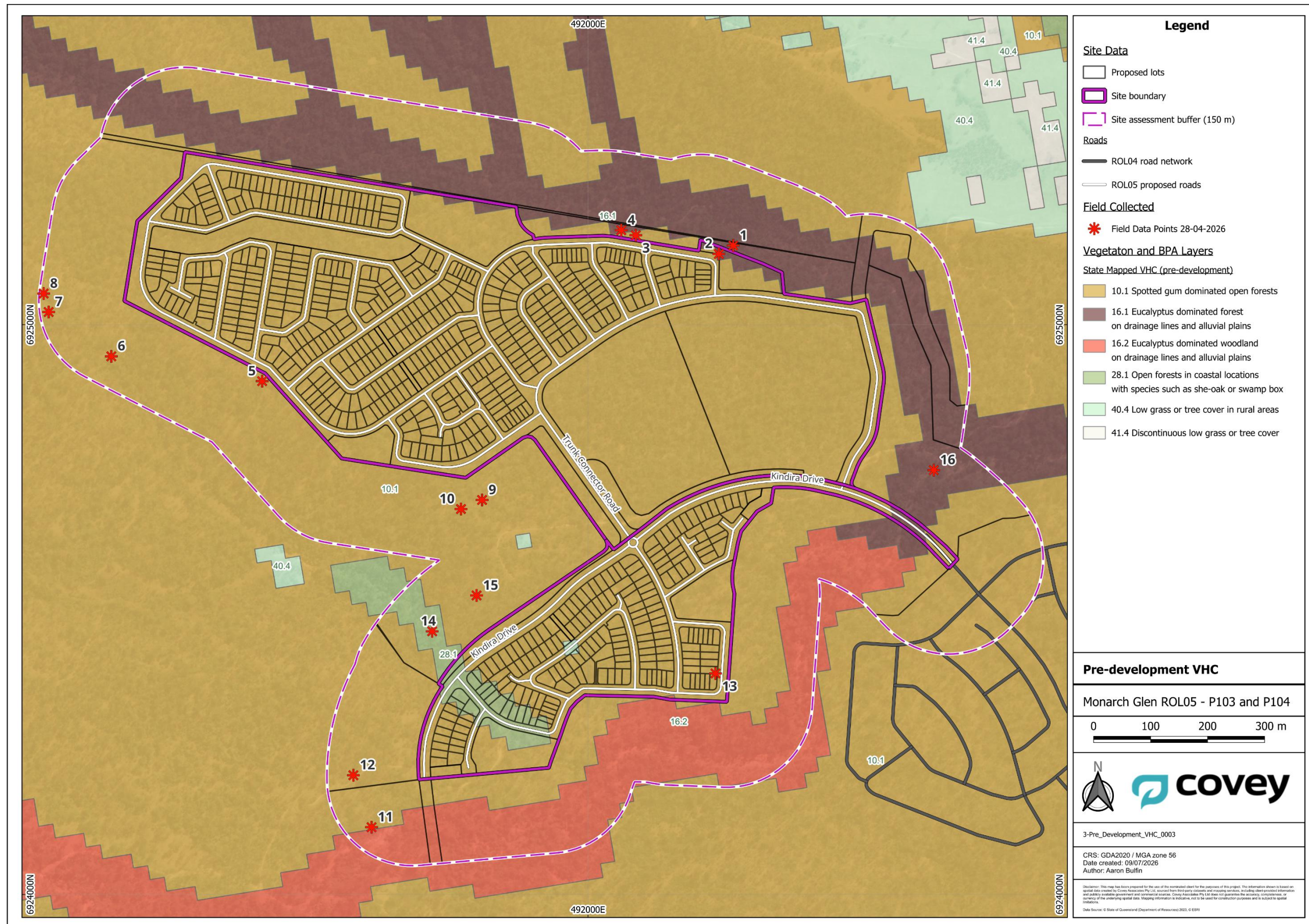


Figure 2-2: Pre-development VHC within ROL05 assessment area and site assessment points

2.4.2 Post-development VHC

The VHC mapping within the site and surrounding 150 m has been refined per BRC methodologies (Queensland Fire and Emergency Services, 2019) based on:

- Site-verified Regional Ecosystem data from field observations on 28 April 2026;
- State Regional Ecosystem spatial data (<https://qldspatial.information.qld.gov.au/catalogue>);
- Vegetation Hazard Class (<https://qldspatial.information.qld.gov.au/catalogue>) (see Figure 2-2);
- Aerial imagery;
- Site assessment findings; and
- Draft landscape plans and advice received from Vee Design.

The mapped VHC was modified to account for the post-development vegetation for the proposed ROL05 development as per Figure 2-3. This included assessment of the landscape intent of proposed local linear parks, neighbourhood parks, linear pockets and stormwater management areas. The VHCs outlined below were identified within ROL05 and its associated 150 m assessment buffer.

Bushfire Prone Vegetation

The 150 m post-development vegetation assessment buffer for the site is dominated by forest VHC in all directions (Figure 2-3) with *VHC 10.1 – Spotted gum dominated open forests* (on elevated areas) and *VHC 16.1 – Eucalyptus dominated forest on drainage lines and alluvial plains* (around gullies) being the most prevalent vegetation types.

- A small area of *VHC 28.1 - Open forests in coastal locations with species such as she-oak or swamp box* occurs in the south-west.
- There is a narrow corridor of woodland (*VHC 16.2 – Eucalyptus dominated woodland on drainage lines and alluvial plains*) within the central east surrounding bioretention basins associated with constructed sedgeland within the basins (*VHC 34.5 – Sedgeland dominated wetlands*);
- There is another 40 m drainage corridor of *VHC 16.2 woodland* in the northern section of P104; and,
- All WSUD basins within the site will be planted as *VHC 29.5 – Sedgeland communities associated with heathlands, scrubs and shrublands*

Bushfire prone VHCs and their associated RHF model inputs are provided in Table 2-1.

Low-hazard and Excluded Vegetation

- Using the methodology from the BRC (Section 4.2.6), patches of vegetation were excluded from bushfire hazard analysis based on their size and disconnection to other patches of continuous fuel. Specifically, narrow corridors of vegetation <50 m wide and surrounded by discontinuous fuel were excluded as these areas are unlikely to support hazardous running fires and are considered low hazard. Within ROL05 this includes the proposed drainage corridor (*VHC 16.2, 40 m wide*) running from west to east within the northern portion of P104 (see Figure 2-3) and the even narrower drainage corridor adjoining the school site / district sports fields that are both surrounded by discontinuous fuel; and

- The following areas have been classified as *VHC 39.2 – Low to moderate tree cover in built-up areas*:
 - Neighbourhood Park in the southern side of P104;
 - Linear Park along the south-western side of the road linking P103 and P104 (TCR), opposite the proposed school site;
 - The proposed school site on the north-eastern side of the TCR;
 - The proposed sports fields site adjoining the eastern boundary of the proposed school; and
 - A neighbourhood park on the western side of P103.

This vegetation is assumed to be managed in a minimal fuel condition per AS3959 Exclusion Clause 2.2.3.2(f).

Table 2-1: RHF model input values.

FFDI	Vegetation Criteria				Rate of spread
	Vegetation Class	Vegetation Type	SFL (t/ha)	TFL (t/ha)	
56	VHC 10.1	Forests	19.3	20.8	$R = 0.0012 * \text{FFDI} * \text{SFL}$
56	VHC 16.1	Forests	13.8	16	$R = 0.0012 * \text{FFDI} * \text{SFL}$
56	VHC 28.1	Forests	24.9	26.9	$R = 0.0012 * \text{FFDI} * \text{SFL}$
56	VHC 29.5	Scrub	8	11.5	$R = 0.023 * V^{1.21} * VH^{0.54}$
56	VHC 34.5	Scrub	8	13	$R = 0.023 * V^{1.21} * VH^{0.54}$

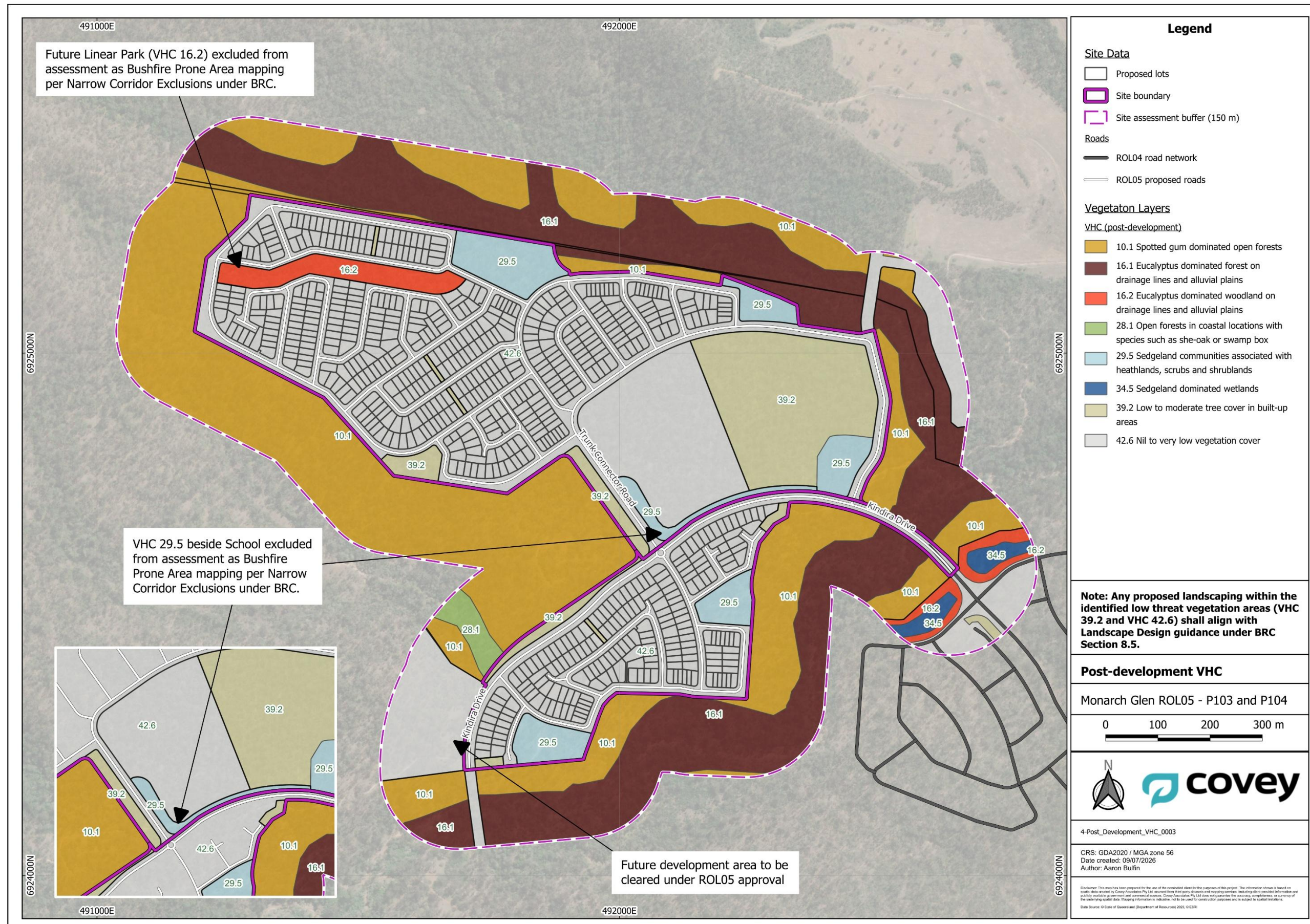


Figure 2-3: Post-development VHC within ROL05/assessment buffer

3 Bushfire Risk Assessment

3.1 Bushfire Impact Analysis and RHF Ratings

Radiant heat flux (RHF) modelling identifies the rate at which heat transfers to a receiver from a potential fire and how the energy dissipates with increasing distance from the fire. Covey completed Radiant Heat Flux modelling per Method 2 of AS3959, with the adoption of BRC prescribed Forest Fire Danger Index (FFDI) and fuel loads from the SPP (Table 3-1). Also, given that a Vulnerable Use (VU) is included in the proposed development, Covey undertook two RHF models, adopting:

- 1,090 K flame temperature for residential allotments within with the development; and
- 1,200 K flame temperature for proposed Vulnerable Use lots within ROL05 (specifically the State Primary School between Precincts 103 and 104 along the TCR).

Note, the results of the VU flame temperature model only assess the line of RHF 10 kW/m² which is considered the minimum requirement for developments involving the VU per BRC.

Covey completed the RHF model using Inferno modelling software, developed in-house by Covey / Cedaryn (refer to Appendix C for further details). The model incorporated the following input values, satisfying BRC:

- The 5% annual exceedance probability (1:20 ARI) fire weather FFDI 56, according to SPP Bushfire Prone Area Input Mapping [BRC MapViewer](#) (Queensland Fire and Emergency Services, 2019a).
- Site specific vegetation hazard classes and their associated potential fuel loads for Bushfire Prone vegetation only (see Table 3-1 below). Vegetation bushfire-prone type, understorey and total fuel loading (referred to as *w* and *W*, respectively) were derived from BRC, and
- 1 metre DEM of a combined design and existing terrain surface.

According to Section 7.6 of the BRC, radiant heat flux is not required to be calculated for grassfire-prone VHCs or low-hazard VHCs (Queensland Fire and Emergency Services, 2019a). VHC 39.2 is considered *low hazard* and contains *discontinuous bushfire fuel*; as such, this vegetation community was not included in the RHF model (refer to BRC Figure 14 and s 7.6(5)).

Table 3-1: VHC fuel loading, vegetation prone type and Rate of Spread model adopted

VHC	VHC Description	Vegetation Type	<i>w</i> (t/ha)	<i>W</i> (t/ha)	Prone Type	Modelled
10.1	Spotted gum dominated open forests	Forests	19.3	20.8	Bushfire	Y
16.1	Eucalyptus dominated forest on drainage lines and alluvial plains	Forests	13.8	16	Bushfire	Y
16.2	Eucalyptus dominated woodland on drainage lines and alluvial plains	Woodlands	11.1	11.6	Bushfire	N*
28.1	Open forests in coastal locations with species such as she-oak or swamp box	Forests	24.9	26.9	Bushfire	Y
29.5	Sedgeland communities associated with heathlands, scrubs and shrublands	Scrub	8	11.5	Bushfire	Y
34.5	Sedgeland dominated wetlands	Scrub	8	13	Bushfire	Y
39.2	Discontinuous low to moderate tree cover in built-up areas	Low-threat	5	8	Low Hazard	N

* Excluded as a 'Narrow Corridor'

3.2 Results

The BRC states that development footprints should be exposed to $RHF \leq 29 \text{ kW/m}^2$, and VU to be exposed to $RHF \leq 10 \text{ kW/m}^2$ (calculated with an input flame temperature of 1,200 K). Further, LCC BHOC requires development to be located and constructed to have a bushfire attack level (BAL) $\leq \text{BAL-29}$.

Based on the RHF modelling results (see Figure 3-1), building envelopes within all of the proposed lots within ROL05 of Kindira are located to have $RHF \leq 29 \text{ kW/m}^2$ during credible worst-case bushfire events impacting the development. Several lots which adjoin bushfire prone vegetation are subject to between $RHF 12.5 \text{ kW/m}^2$ and $RHF 29 \text{ kW/m}^2$ (except for the lots outlined below). Extending beyond these areas there are lots that remain within 100 m of the vegetation corridor (shown as $RHF < 12.5 \text{ kW/m}^2$). Per the Building Code of Australia (BCA), certain buildings within these allotments (or within 100 m of hazardous vegetation) must be designed and constructed with the relevant Bushfire Attack Level (BAL) construction standards per Australian Standard, AS3959:2018 (refer to Section 4 for further information).

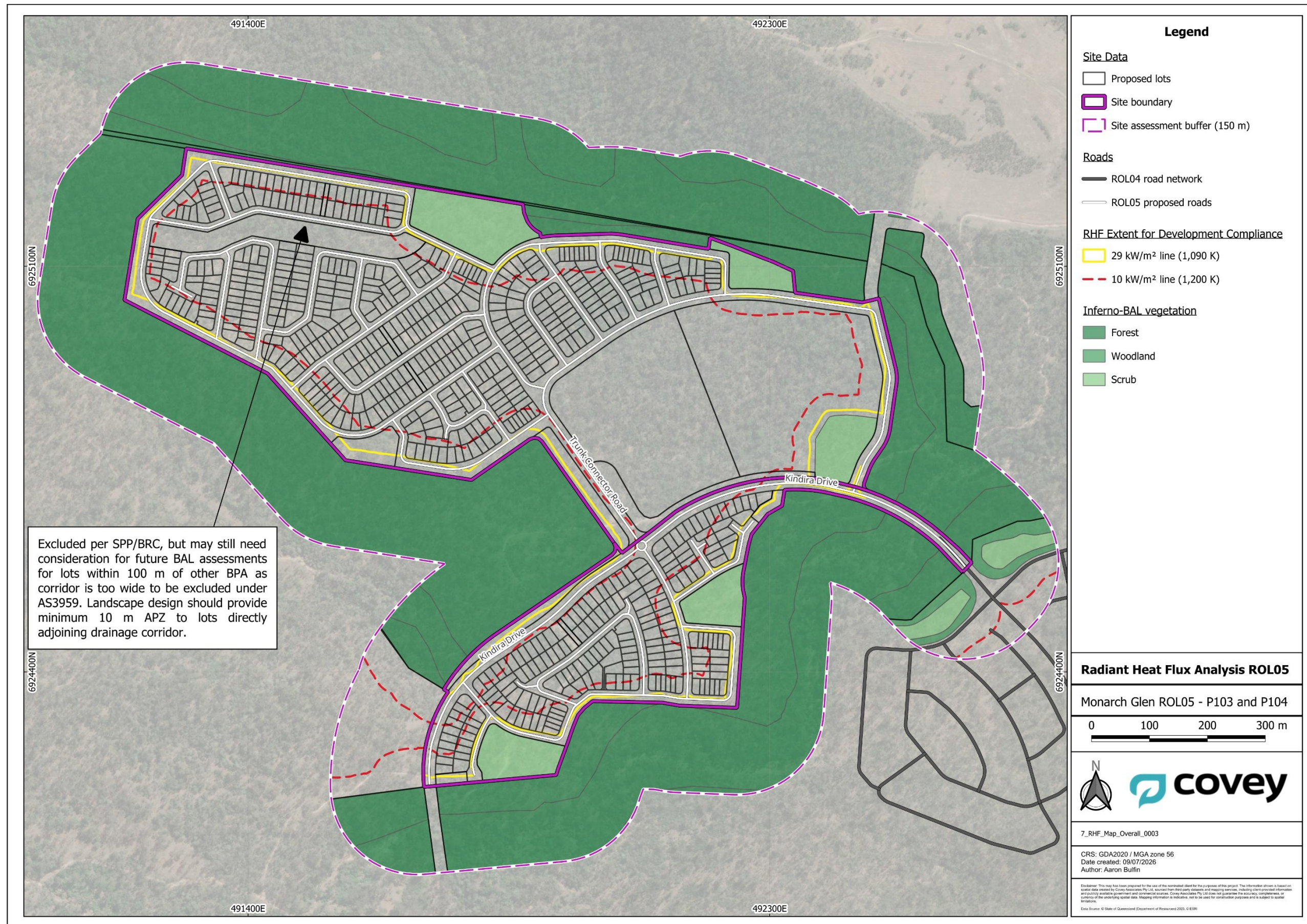
The VU which comprises the proposed school is entirely exposed to $RHF \leq 10 \text{ kW/m}^2$ (calculated with an input 1,200 K flame temperature Figure 3-1).

3.3 Potential human impact and sheltering sites

Radiant heat flux exposure from bushfires can be detrimental to people and property, expected impacts on the human body are outlined in Table 3-2 for reference.

Table 3-2: Radiant heat flux impacts (Penney et al., 2020)

RHF (kW/m ²)	Human Effect
30	Significant chance of instantaneous fatality for unprotected exposed persons
23.5	Likely fatality for extended exposure / chance of fatality for unprotected exposed people
16.7	Significant chance of fatality for unprotected extended exposure
10	Tenability threshold for bushfire fighters
5	Limited human trials indicated no adverse effects
4.2	Will cause pain in 15-20 seconds of unprotected exposure and injury after 30 seconds
3	Operational threshold for bushfire fighters attempting suppression
2.5	Level of exposure permitted for evacuating occupants in the Building Code of Australia
2.1	Minimum heat radiation required to cause pain after 60 seconds of unprotected exposure
1.3	Exposure from midday sun

Figure 3-1: RHF analysis showing vulnerable use / residential setbacks (10 / 29 kW/m²)

4 Bushfire Mitigation Measures

The following section outlines bushfire mitigation measures to be incorporated into the proposed development design. These measures aim to comply with the BRC and SPP guidance material. Provided that the mitigation measures outlined in this section are implemented, the bushfire risk for the proposed development is deemed to be acceptable.

4.1 Setbacks / RHF exposure

The modelling indicates that all of the building envelopes within proposed lots within ROL05 provide a suitable setback from bushfire hazard vegetation so that they will be exposed to RHF $\leq 29 \text{ kW/m}^2$ (see Figure 4-1 for P103 and Figure 4-2 for P104)

The proposed lot for the proposed school allows for the opportunity to locate buildings anywhere within the site as the entire site is located at RHF $\leq 10 \text{ kW/m}^2$ with APZs located within the adjoining TCR and the linear park on the western side of the TCR. However, as outlined in Section 4.2, consideration should be given to designing the school such that any Class 9b buildings are located outside the post-development bushfire prone area to avoid triggering additional construction requirements under the National Construction Code 2022 (NCA; Australian Building Codes Board (ABCB) 2022).

Preliminary Bushfire Attack Level (BAL) figures have been provided in Appendix E for P103 and P104 reflecting the descending levels of RHF with increasing distance from the surrounding bushfire hazards. However, more accurate BALs for future dwellings will need to be determined under AS3959 once their exact footprints have been determined within the designated building envelopes (see Section 4.2 for further information).

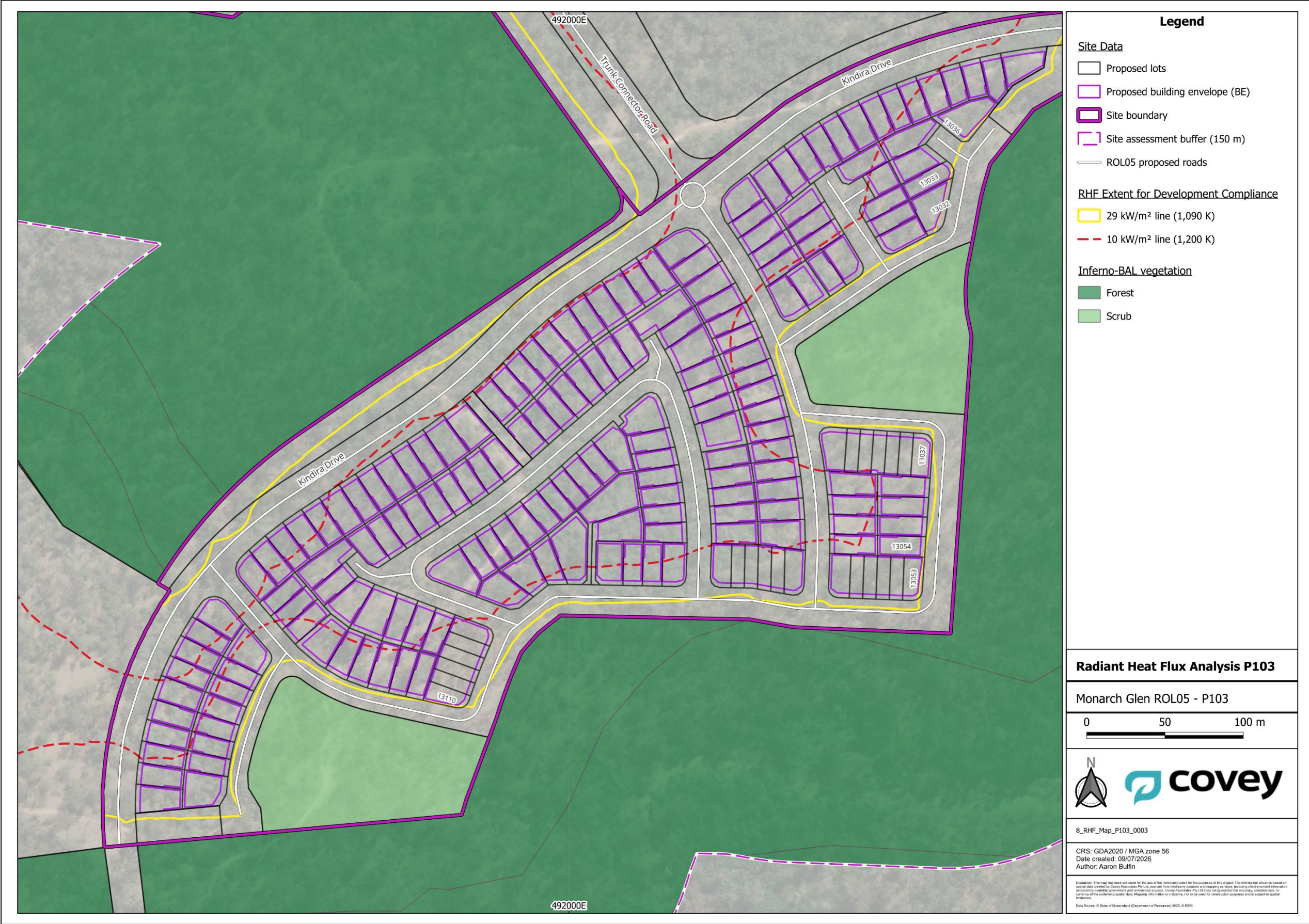
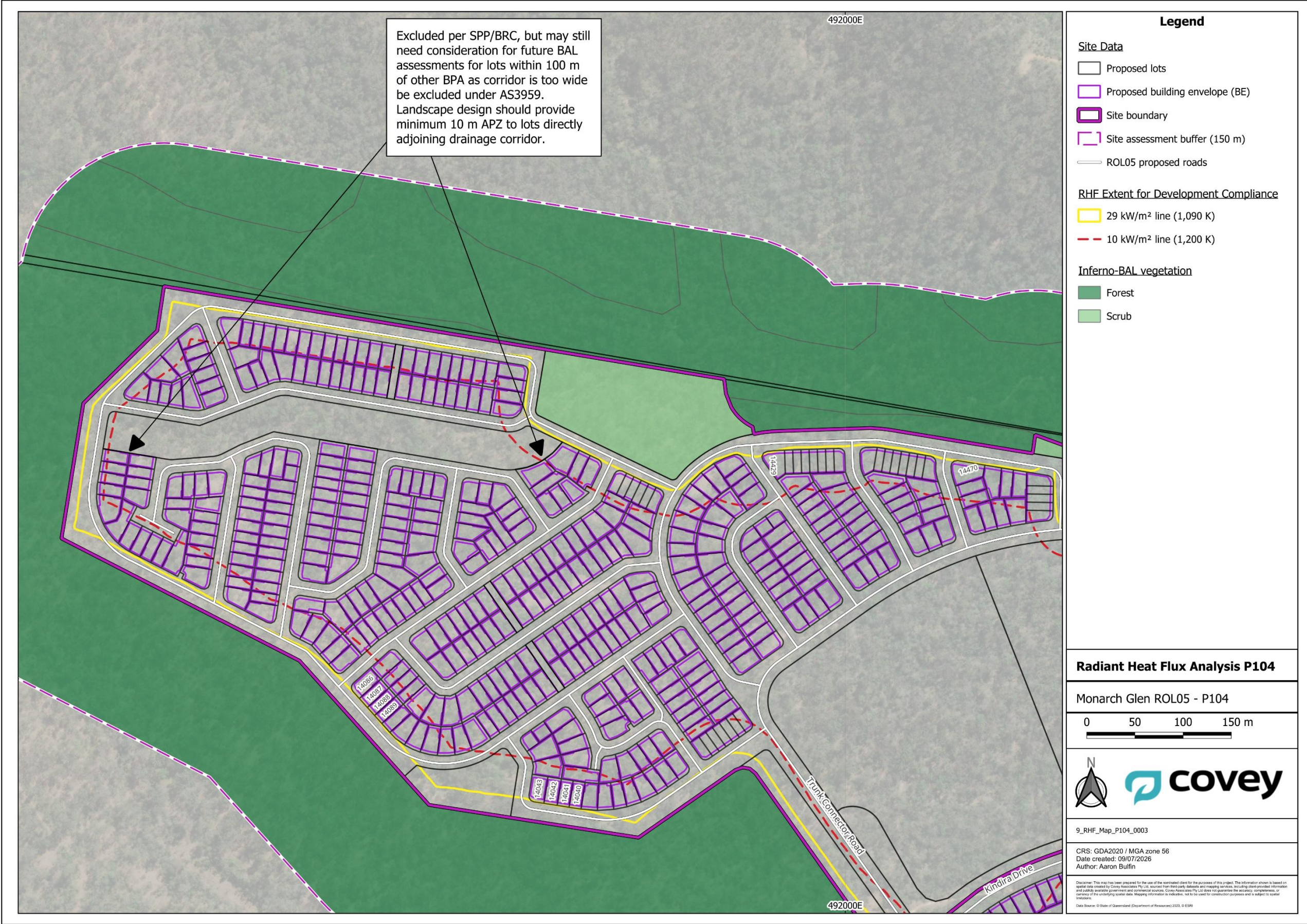


Figure 4-1: P103 lots showing all BEs located at RHF ≤29 kW/m² per SPP/BRC



4.1.1 Asset Protection Zones

All neighbourhood recreation parks, linear open spaces, local recreation parks, landscape buffers, sports fields and building setbacks within the areas shaded in Figure 4-3 should have landscape intent that ensures low threat or minimal fuel conditions per Clause 2.2.3.2 of AS3959 (examples being mown grass and maintained public reserves, parklands, nature strips). The vegetation within these APZ areas should be modified and/or maintained to reduce fuel load and mechanisms of bushfire attack (such as flame and radiant heat) and to ensure that there is no continuity of fuel across the landscape. These management practices within APZ areas are to continue for the life of the development.

Generally, the landscape intent should be to not increase planting density beyond what has been assessed within this BMP (see Figure 2-3), unless it achieves the exclusions clause of AS3959. Specifically, APZs are required to ensure that building envelopes are exposed to RHF $\leq 29 \text{ kW/m}^2$ in perpetuity. The APZs are to follow the Bushfire Landscaping Guidelines detailed in Section 4.5.

APZs will be established through development activities including the establishment of roads, verges, and pathways within road reserve corridors that will exist between bushfire prone vegetation and development lots. These APZs have not specifically been identified within this BMP; though it is understood the intent of development activities within the road reserves will ensure separation from bushfire prone vegetation to the extent of RHF $\leq 29 \text{ kW/m}^2$ towards development lots will be established and maintained in perpetuity. Road reserves that exist between bushfire prone vegetation and development lots as identified within this BMP shall not have landscaped vegetation that extends the bushfire risk beyond the extent that has been assessed herein.

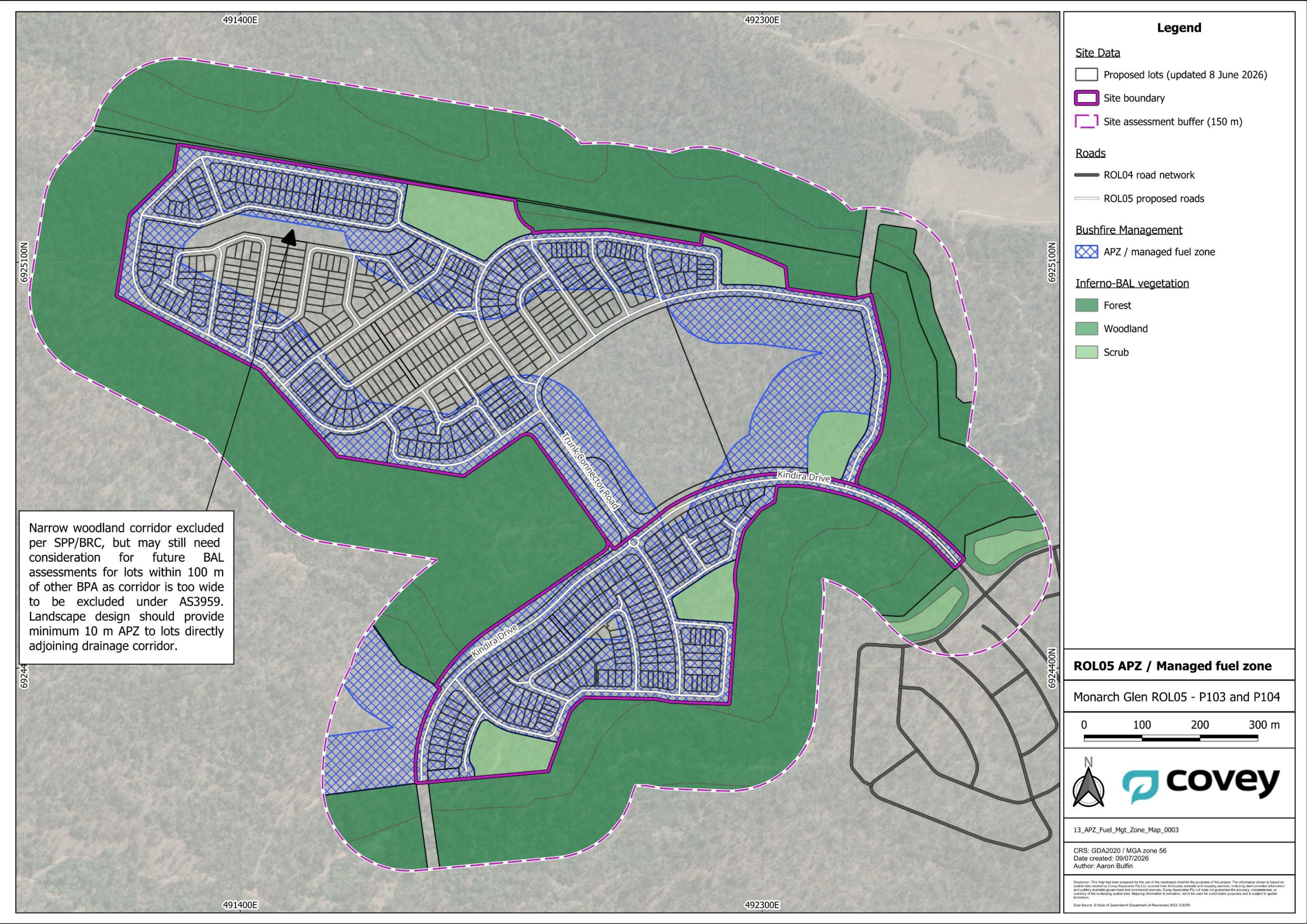


Figure 4-3: APZs / managed fuel zones to comply with BRC (s 8.5) and AS3959 (s 2.2.3.2)

4.2 National Construction Code (NCC)

Per the Building Code of Australia, any buildings within 100 m of hazardous vegetation must be designed and constructed with the relevant Bushfire Attack Level (BAL) construction standards per Australian Standard, AS3959:2018. Note that a BAL assessment may be required to be undertaken in accordance with AS3959 before building design or construction works of the proposed buildings on the created lots. A Bushfire Attack Level (BAL) assessment does not form part of the assessment within this report. A BAL assessment will identify the potential RHF exposure encountered to the proposed dwelling or relevant structure based upon the siting of the building at the building approval application stage. For example, though some lots have been identified as being impacted by RHF $>12.5 \text{ kW/m}^2$, the placement of the dwelling within the lot may be such that the proposed dwelling may be situated within the lot to be exposed to RHF $<12.5 \text{ kW/m}^2$, therefore changing the BAL requirement of that dwelling.

The BCA requires Class 1, Class 2, Class 3 buildings, and a Class 10a building or deck associated with a Class 1, 2 or 3 to be constructed per AS3959 (National Construction Code, 2022a, 2022b). The NCC was updated in 2022, and certain Class 9 Buildings (including schools) are now subject to additional bushfire requirements (see Appendix D); refer to Part G5 and Specification 43 of NCC Volume 1 (National Construction Code, 2022). The four RHF values (40 kW/m^2 , 29 kW/m^2 , 19 kW/m^2 and 12.5 kW/m^2) trigger specific construction requirements under the Building Code of Australia. Only two small portions of the proposed school site are mapped as bushfire prone area in the post-development BPA map in Figure 4-4, and careful design under the guidance of a qualified bushfire consultant and fire engineer is recommended to minimise the design / cost implications of the addition G5 / Specification 43 requirements of the NCC on the future school.

It is important to note that the RHF assessment undertaken within this assessment may not negate the need to undertake a separate BAL assessment for each proposed dwelling as part of a building approval application.

Furthermore, any allotments that are within 100 metres from the identified post development bushfire prone area will need future BAL consideration from all landscaping areas that do not achieve the exclusion clauses under s 2.2.3.2 of AS 3959. This may include the drainage corridors ($<50 \text{ m}$ wide) excluded under BRC.

However, at the time of building approval for these residential dwellings, AS3959:2018 only allows exclusion of strips of vegetation $<20 \text{ m}$ in width and not within 20 m of the site or other areas of classified vegetation.

Consequently, the while the drainage corridor (VHC 16.2) in the northern portion of P104 can be excluded from the assessment under the planning approval, and from the post-development bushfire prone area (BPA) map (Figure 4-4), it will not be excluded under AS3959. The corridor will be classified as 'woodland' under AS3959 for the purpose of BAL assessment for future dwelling construction on adjoining allotments within 100 m of the forest beyond the boundary of the development site and, given the lack of a perimeter roads, may result in BAL-40 / BAL-FZ impacts to future dwellings within these lots.

There are 6 lots adjoining this excluded woodland drainage corridor that are not separated by a perimeter road and outlined below:

- (i) Western Lots 14291 and 14292 (mapped in post-development BPA area as per Figure 4-5);
- (ii) Central Lots 14230 and 14231 (not mapped in post-development BPA area, but mapped in current BPA (Figure 1-2) as are the western and eastern lots); and
- (iii) Eastern Lots 14161 and 14162 (mapped in post-development BPA area as per Figure 4-5).

Consideration should be given to maximising building setbacks and any vegetation management that can occur within the adjoining corridor (footpaths, fitness stations, playgrounds etc) to reduce the RHF impact on these lots to achieve a minimum APZ width of 10 m for future dwellings.

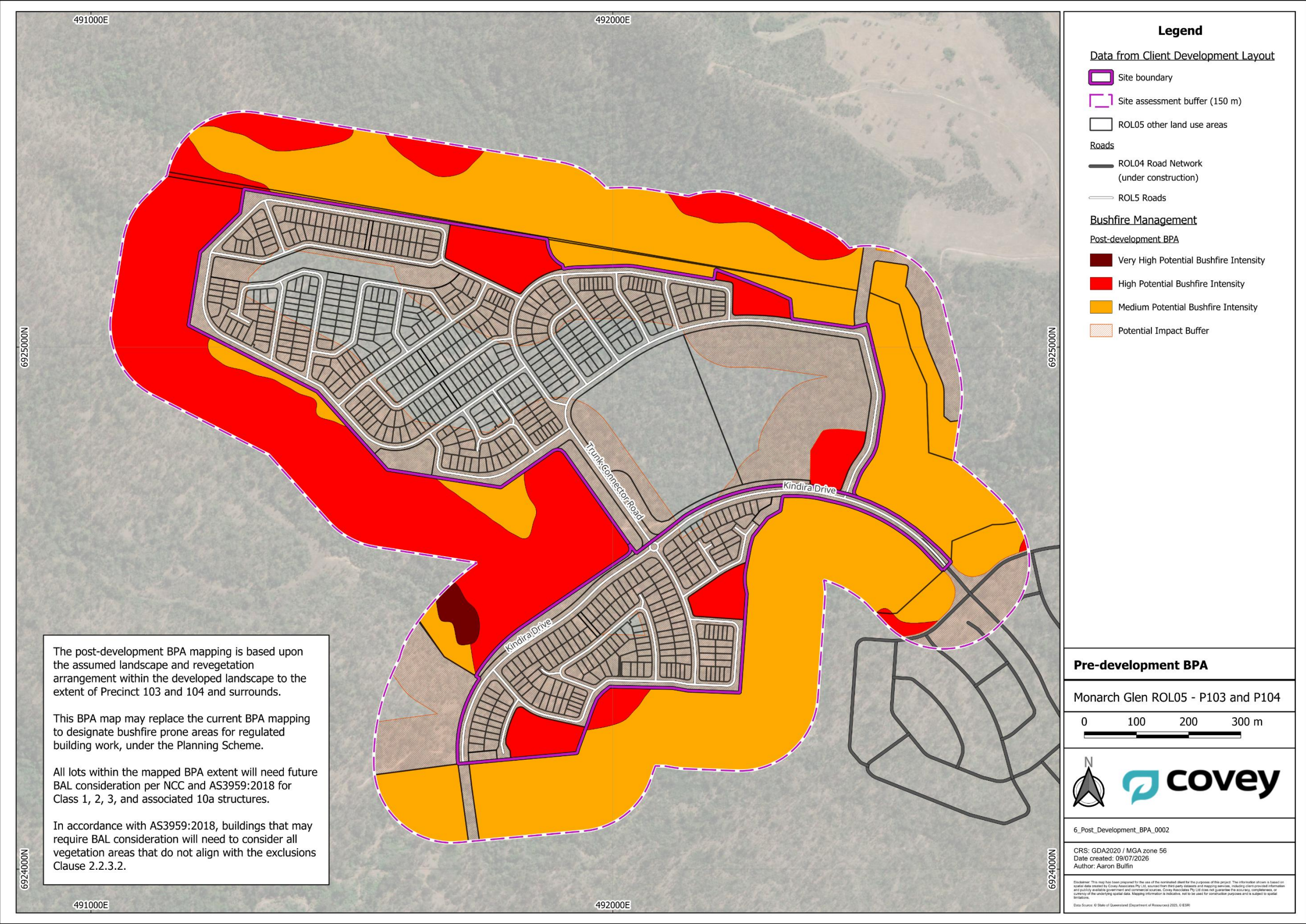


Figure 4-4: Post-development BPA

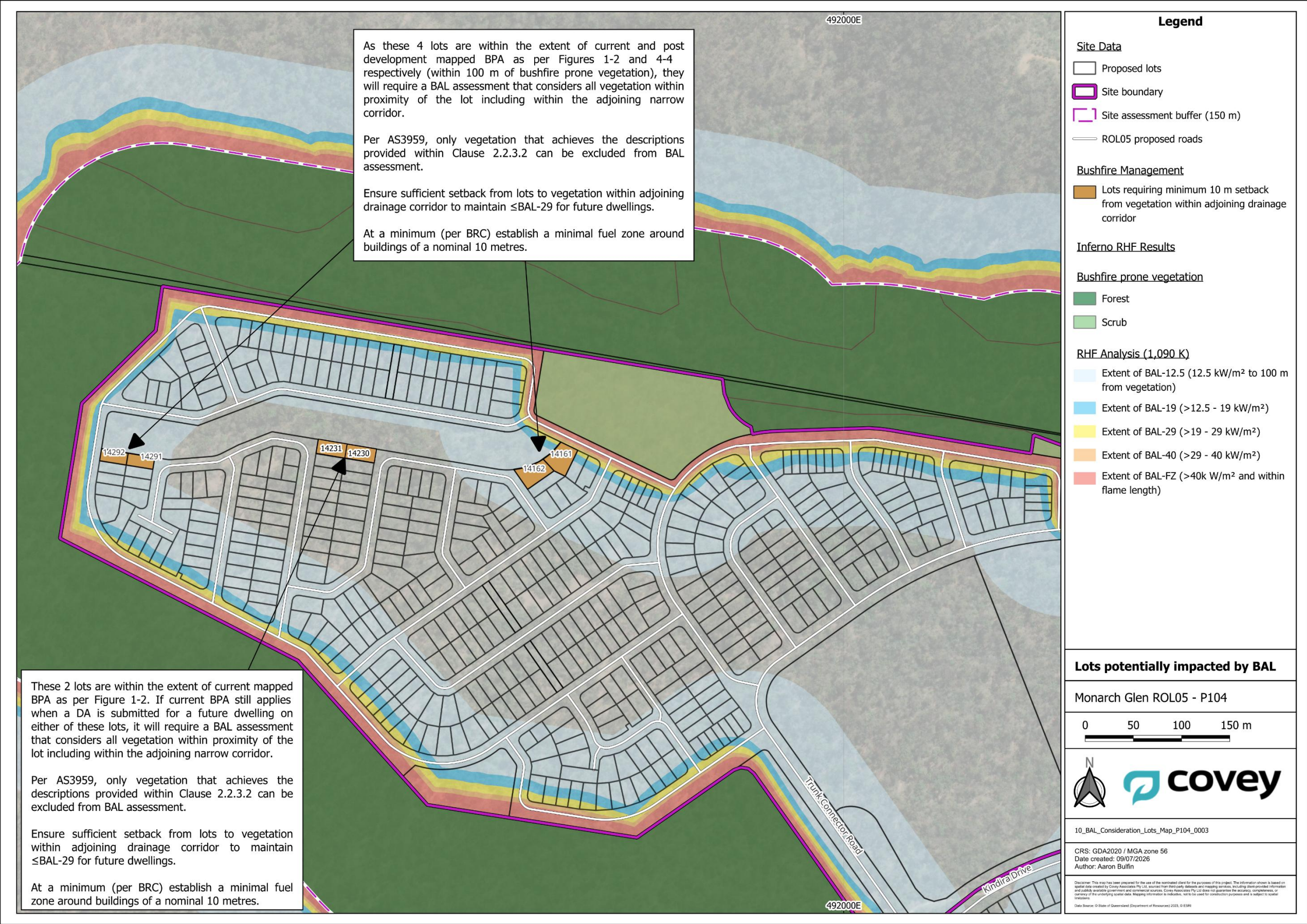


Figure 4-5: P104 lots with potential AS3959 BAL assessment issues

4.3 Access

The proposed development will be accessed via an extension of the recently constructed Kindira Drive from ROL4 to the east. Additional trunk connector and neighbourhood connection roads will facilitate access to future proposed developments to the south and south-east.

Per AO4(a) of the LCC BHOC, perimeter roads shall be a minimum of 20 m wide between the premises and adjoining vegetation.

Where the road reserve width of perimeter roads is less than 20 m, an APZ shall be established between the perimeter road and the vegetation (such as mown grass) to achieve the balance of the width and ensure 20 m is achieved. These APZs shall be maintained as low-fuel load such that would constitute the APZ to be classified as excluded vegetation per Clause 2.2.3.2 of AS3959.

The design and construction of infrastructure is to ensure accessibility to all existing and proposed infrastructure to emergency services. Access roads, including internal driveways are to follow *Fire hydrant and vehicle access guidelines* (Queensland Fire and Emergency Services, 2019d). This guideline defers to the *Road Planning and Design Manual – 2nd Edition* (Department of Transport and Main Roads, 2021). Access design and construction should incorporate the following parameters:

- Minimum roadway clearance of 3.5 m wide by 4.8 m high to allow access for a fire truck;
- Be accessible in all weather conditions and able to accommodate a vehicle of 15 tonnes for the trafficable road width;
- Road grades must facilitate the safe passage of fire trucks;
- Roads must allow for fire trucks to turn at the end of dead-end roads; and
- Provision is made for fire trucks to turn at the end of dead-end roads (Figure 4-6).

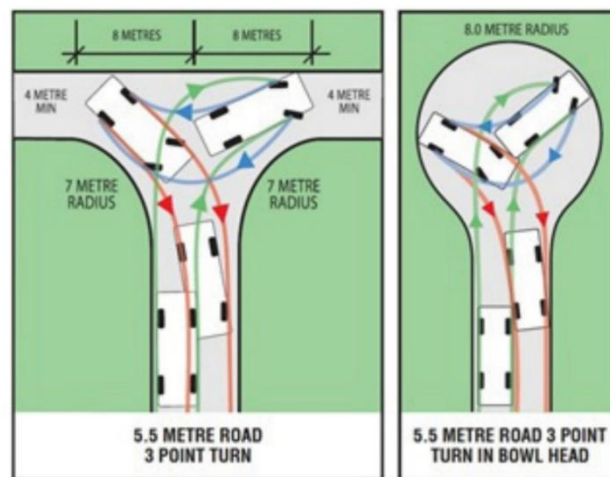


Figure 4-6: Vehicle turning points (Queensland Fire and Emergency Services, 2019b)

4.4 Firefighting Water Supply

The proposed development will be conditioned to provide a connection to the mains water supply, including for firefighting purposes. Provision will be made to connect to the water mains supply, with suitable allocation of fire-fighting infrastructure (hydrants) in accordance with the SEQ Water Supply Code and Australian Standard (AS) 2419.1:2021 *Fire hydrant installations system design, installation and commissioning* (AS 2419.1:2021).

4.5 Bushfire Landscaping Guidelines

Landscaping within the site, including areas mapped as low-hazard vegetation (refer to Section 2.4 and 4.1.1 of this BMP) should utilise plant species that do not exacerbate the level of bushfire threat. Aside from the drainage areas, the landscaping design within the proposed development must not constitute a bushfire threat. The proposed neighbourhood recreation parks, district sports fields, other internal parks, landscape buffers and building setbacks should all be maintained regularly to reduce woody regrowth, weeds and keep grass mown to no more than 100 mm, per exclusions under AS3959 s 2.2.3.2 (f).

These areas are to be maintained in minimal fuel condition comprising only low-threat vegetation as follows:

- (i) Establish a minimal fuel zone around buildings of a nominal 10 metres, per BRC s. 8.5.1;
- (ii) Landscaping design within the low fuel zone, being consistent with AS3959 s 2.2.3.2(f) to ensure vegetation does not create vertically and horizontally continuous fuel structures that may contribute to bushfire intensity (Figure 4-7);
- (iii) Where areas of bushland are to be included as part of landscaping design in the low fuel zone, ensure they are consistent with AS3959 s 2.2.3.2, being less than 0.25 ha in area and not within 20 m of each other or proposed dwellings (Figure 4-8);
- (iv) Utilise non-vegetated areas within the development consistent with AS3959 s 2.2.3.2 (e) to provide enhanced separation between buildings and vegetation identified as a bushfire threat external to the site boundaries;
- (v) Follow landscape guidance provided within BRC Section 8, and plant section aligned with BRC Section 8.5.2 (2019b), and,
- (vi) Utilise 'Fire-Wise' plant species that are resistant to the effects of fire (guidance can be found at <http://www.cfa.vic.gov.au/plan-prepare/landscaping-for-bushfire>).



Figure 4-7: Low Threat vegetation (left) and Low Threat public open space (right)

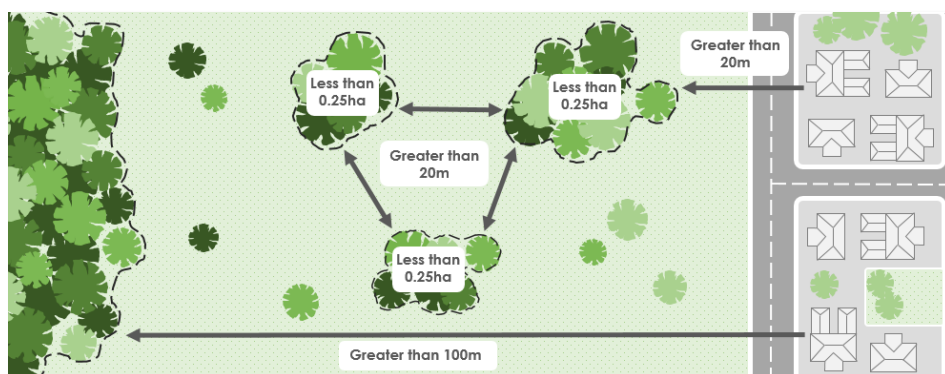


Figure 4-8: AS3959 Exclusions—Low threat vegetation and non-vegetated areas

4.5.1 [WSUD / Drainage Areas](#)

Covey has recommended planting within the WSUD / drainage areas marked as VHC 29.5 in Figure 2-3 be consistent with a sedgeland community with a minimal shrub/tree layer. The total WSUD planted areas and widths includes the basin bottoms, embankments, tops, and batters.

Alternatively, specific landscape maintenance outcomes may be incorporated into the WSUD areas landscape design plans to ensure these basins remain as low-threat vegetation in perpetuity (e.g. ongoing vegetation maintenance such as mowing, thinning etc.).

5 Performance Criteria and Compliance

This proposed development will be assessed by EDQ as a Monarch Glen falls under the Greater Flagstone Priority Development Area. EDQ exists as a State governing body, as such the SPP assessment benchmarks have been assessed within this BMP. Though as the example SPP BHOC does not hold Statutory effect itself, the LCC BHOC will be used for the compliance assessment below.

This BMP has been prepared using the BRC, which outlines the Assessment Benchmarks outlined within the SPP. This BMP also applies acceptable outcomes to achieve the Performance Outcomes as assigned by Logan City Council's Bushfire Hazard Overlay Code (8.2.3). The Performance Outcomes detailed in the LCC BHOC are addressed in the development design are summarised in Table 5-1. It has been assumed for the purpose of this compliance assessment that setbacks to the building envelopes on Lots 13032 and 13036 will be of sufficient size to ensure future dwellings are subject to RHF ≤ 29 kW/m².

Table 5-1: Assessment of development against Logan City Council BHOC (8.2.3)

Performance outcomes	Acceptable outcomes	Assessment
For accepted development (subject to requirements) and assessable development		
Location, design and siting of development		
PO1 Development is designed to: - minimise risk of bushfire hazard. - provide safe premises. - create efficient emergency access for firefighting and other emergency vehicles. Note - Planning scheme policy 6 - Management of bushfire hazard provides guidelines on how to achieve this outcome.	AO1 Development: - does not increase the number of persons living in, or lots in, the Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00; or - is on a site that a bushfire hazard assessment prepared in accordance with the methodology in Planning scheme policy 6 - Management of bushfire hazard determines is of low bushfire hazard.	<u>Satisfies Acceptable Outcome</u> This bushfire management plan has been prepared in accordance with the methodology outlined in the Logan City Planning Scheme 2015 – Planning Scheme Policy 6: Management of bushfire hazard. The majority of the proposed ROL05 development is located within areas of low bushfire hazard, subject to RHF 12.5 kW/m ² or less. Asset Protection Zones have been proposed that will provide defensible space for emergency response in the event of a bushfire around the proposed development. It has been demonstrated that the development can be undertaken to ensure future dwellings will be subject to RHF ≤ 29 kW/m ² , which is the assessment benchmark of the BRC. Appropriate BAL construction requirements shall be applied to the relevant buildings.

Performance outcomes	Acceptable outcomes	Assessment
PO2 Development is sited and constructed to minimise the bushfire hazard and maximise the protection of life and property from bushfire. Editor's note - Planning scheme policy 6 - Management of bushfire hazard contains guidance on the preparation of bushfire management plans.	AO2 Development is located and constructed: - where there is no bushfire management plan approved by an existing development approval: - such that the bushfire attack level is less than or equal to BAL-29; - away from the most likely direction of a fire front; - so that elements of the development least susceptible to fire are sited closest to the bushfire hazard; - such that asset protection zones are sited on land with a slope less than 18 degrees; and - such that asset protection zones are entirely within the boundaries of the private property of the development site; or - where an approved bushfire management plan directs development to be located. Note - BAL = Bushfire attack level is the radiant heat flux a building will experience during a bushfire and is a measure of heat energy impacting on a surface expressed as kW/m². BAL is calculated from the following factors; vegetation type, fuel loads, distance to vegetation, Forest Fire danger Index (FDI), flame length, fire behaviour/intensity and slope. BAL is used to determine the required construction level of a building and the size of asset protection zones (inner and outer radiation zones). Further information on calculating the BAL can be obtained from AS3959-2009. Editor's note - Asset protection zones are not located on slopes greater than 18 degrees to ensure maintenance is practical, soil stability is not compromised and the potential for crown/canopy fires is reduced.	<u>Satisfies Acceptable Outcome</u> No previous bushfire management plan exists for ROL05. The proposed development has been designed so that all building envelopes are subject to RHF $\leq 29 \text{ kW/m}^2$ – equating to BAL-29 or lower. Appropriate BAL construction requirements shall be applied to the relevant infrastructure. The proposed development provides divided access along Kindira Drive to facilitate emergency service vehicles and is situated to provide suitable egress away from the likely direction of a bushfire from the south. To the west a perimeter road is located between the bushfire prone vegetation and proposed lots to ensure the elements of the development least susceptible to fire are sited closest to the bushfire hazard. The proposed development and APZs are positioned on gently sloped terrain (less than 18 degrees) and APZs are entirely within the development site. APZs have been proposed that will provide defensible space for emergency response in the event of a bushfire around the proposed development. These APZs are to be maintained as having low fuel in perpetuity by undertaking regular mowing activities, such that would constitute the APZ to be classified as excluded vegetation per Clause 2.2.3.2 of AS3959. RHF calculations have been undertaken using the methodology set out in the BRC. This methodology is based on the methodology defined in AS3959.

Performance outcomes	Acceptable outcomes	Assessment
PO3 Reconfiguring a lot ensures that lots are designed to minimise bushfire hazard and provide safe sites for people, property and buildings.	AO3 Lots: - are suitable for people, property and buildings by: - having a bushfire attack level less than or equal to BAL-29; or - containing a development envelope area that has a bushfire attack level less than or equal to BAL-29; - provide asset protection zones that: - are located on land with a slope less than 18 degrees; - are located on the same lot.	Satisfies Acceptable Outcome As outlined in previous section (PO2).
Vehicular access and fire maintenance trails		
PO4 Access for fire management and evacuation is provided by access that: - separates premises from adjoining vegetation; - is safely accessible by fire fighting vehicles; - has regular vehicular access points for bushfire management, response and evacuation; - has regular vehicle passing and turning areas for bushfire management, response and evacuation; - allows access at all times for fire fighting vehicles; - allows for maintenance, burning off and bushfire response; - has vehicular links to an alternative through road; - is readily maintained. Editor's note - Planning scheme policy 6 - Management of bushfire hazard provides details on alternative solutions for providing fire management access and evacuation.	AO4 Access for fire management and evacuation is provided by vehicular access in the form of a perimeter road: - with a minimum reserve width of 20 metres; - located between the premises and adjoining vegetation; - with a maximum gradient of 12.5 percent; - constructed to otherwise comply with section 3.4 - Movement infrastructure standards of Planning scheme policy 5 - Infrastructure; - that has a layout that does not include a cul-de-sac.	Satisfies Acceptable Outcome The Precincts within ROL05 will be accessed from Kindira Drive which is a divided trunk road. Internally, all-weather trunk, local and connector roads will be constructed throughout the development to facilitate safe and efficient access for fire management and evacuation. A perimeter road has been established between the premises and adjoining vegetation within the 150 m wide assessment buffer. The road has a minimum reserve width of 20 metres in most areas, and where the width is less than 20 m, APZ areas are proposed (such as mown grass) to maintain low-fuel load such that would constitute the APZ to be classified as excluded vegetation per Clause 2.2.3.2 of AS3959.

Performance outcomes	Acceptable outcomes	Assessment
Water supply		
PO5 Development has access to adequate water supply for firefighting purposes.	AO5 Development: a. is connected to a reticulated water supply scheme that has sufficient flow and pressure characteristics for firefighting purposes at all times with a minimum pressure and flow of 10 litres per second at 200 kPa; or b. has an on-site water storage in accordance with Table 8.2.3.3.2 - Water storage for firefighting, dedicated or retained for firefighting purposes that is made of fire resistant materials and is: i. a separate tank; or ii. a reserve section in the bottom part of the main water supply tank. Editor's note - The requirement in AO5 is: - in addition to the requirement for potable water supply/storage in AO2 in Table 9.4.3.3.1 - Infrastructure code: accepted development (subject to requirements) and assessable development; - reflected in AO5 in Table 9.4.3.3.1 - Infrastructure code: accepted development (subject to requirements) and assessable development.	<u>Satisfies Acceptable Outcome</u> The development will be connected to a reticulated water supply suitable for firefighting purposes.

Performance outcomes	Acceptable outcomes	Assessment
For assessable development		
<u>Community infrastructure</u>		
PO6 <u>Community infrastructure</u> is not located in a bushfire hazard area or is able to function effectively during and immediately after a bushfire event.	AO6 <u>Community infrastructure</u> is: - not located in a Bushfire hazard area identified on Bushfire hazard overlay map OM-03.00; or - located to ensure that: - the core services provided by the <u>community infrastructure</u> is able to function effectively during bushfire events; - access to the <u>community infrastructure</u> is not compromised by bushfire events; and - the safe storage of valuable records, public records and items of cultural or historic significance is able to be maintained during a bushfire event.	<u>Satisfies Acceptable Outcome</u> The school site is located to ensure that it will not be comprised by bushfire events. All school buildings within the site will be subject to $RHF \leq 10 \text{ kW/m}^2$ and located outside of the defined APZ area defined within Section 4.1.1. This APZ is to be maintained as having low fuel in perpetuity by undertaking regular mowing activities, such that would constitute the APZ to be classified as excluded vegetation per Clause 2.2.3.2 of AS3959.
Hazardous materials		
PO7 Public safety and the environment are not adversely affected by the adverse impacts of bushfire on hazardous materials including fuels, explosives and flammable chemicals manufactured or stored in bulk on premises.	AO7 Hazardous materials: - storage is in compliance with AS1940 - The storage and handling of flammable and combustible liquids; and - manufacturing does not occur in a Bushfire hazard area on Bushfire hazard overlay map OM-03.00.	<u>Not applicable to this development</u> Storage or manufacturing of hazardous materials will not occur on site as part of the proposed development.

6 Conclusion

The Monarch Glen ROL05 development site is currently subject to a High and Medium Potential Bushfire Intensity per SPP BPA mapping, though much of the site will be cleared of vegetation as part of the ROL05 development. Covey has assessed the post-development vegetation landscape per BRC within ROL05 to identify the residual bushfire hazard.

This BMP detailed the bushfire hazards to which the development is exposed and the bushfire mitigation measures required to be implemented to reduce the risk to acceptable levels per *Natural Hazards, Risk and Resilience, State Planning Policy State Interest guidance material* (Queensland Government, 2019a) and BRC.

Specifically, this report outlines the required bushfire mitigation measures required for the development to satisfy SPP Assessment Benchmarks and LCC BHOC Assessment Criteria (Section 4).

This BMP has identified that:

- Building setbacks of variable widths up to 6.3 m will need to be incorporated within the residential lots outlined in Figure 4-1 and Figure 4-2 to ensure that building envelopes are located such that future dwellings are not impacted by RHF >29 kW/m²;
- Asset Protection Zones shall be established between bushfire prone vegetation and proposed lots where identified;
- The proposed school site falls under the Vulnerable Use definition per the SPP but the entire site is located beyond the extent of RHF 10 kW/m² so there are no bushfire constraints precluding where future buildings are located within this site. However, other NCC considerations may apply as outlined in Section 4.1.1 of this BMP;
- The landscape design for proposed stormwater treatment basins aligns with the vegetation hazard class per this BMP, in terms of species selection and vegetation structure, or a lower risk vegetation. If the landscaping for the proposed stormwater basins is amended, this BMP may require amendment to reconsider the potential bushfire RHF impact; and
- All future landscape design as it is developed within operational works phases of the development shall not exacerbate or increase bushfire prone vegetation from what has been assessed including any planting of vegetation that does not align with Clause 2.2.3.2 of AS3959.

Provided that the bushfire mitigation measures detailed in this BMP are implemented and maintained in perpetuity, the bushfire hazard level, bushfire-related risk level and RHF level applicable to the proposed development are not considered unreasonable and should not prohibit the proposed development of the site. The ROL05 development in its current proposed format is compliant with the specifications and requirements of the SPP (Bushfire) and LCC Bushfire Hazard Overlay Code.

This BMP is valid for 5 years, or until such time that the precinct layout or landscape amendments alter potential bushfire risk interface areas (in particular, bushfire prone vegetation / slope within or up to 150 m from the development).

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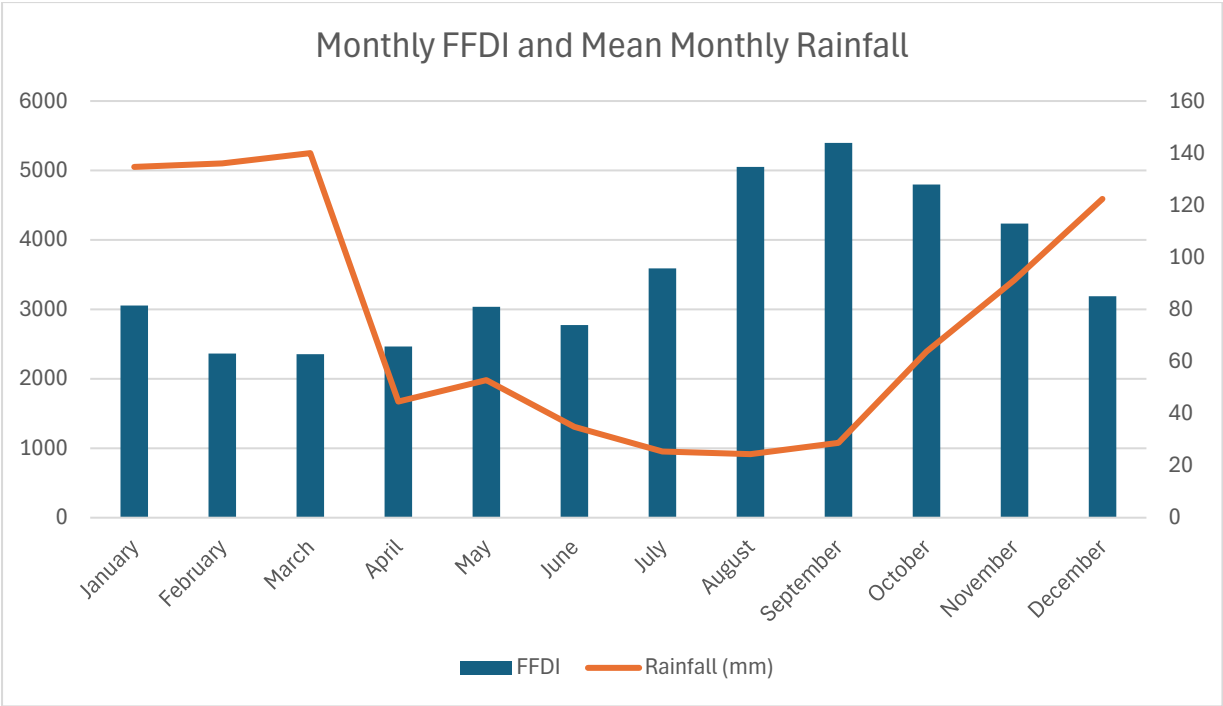
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Appendix A

Ember Weather Analysis

Beaudesert Drumley Street (AWS 40983)
1 January 2008 – 31 December 2025

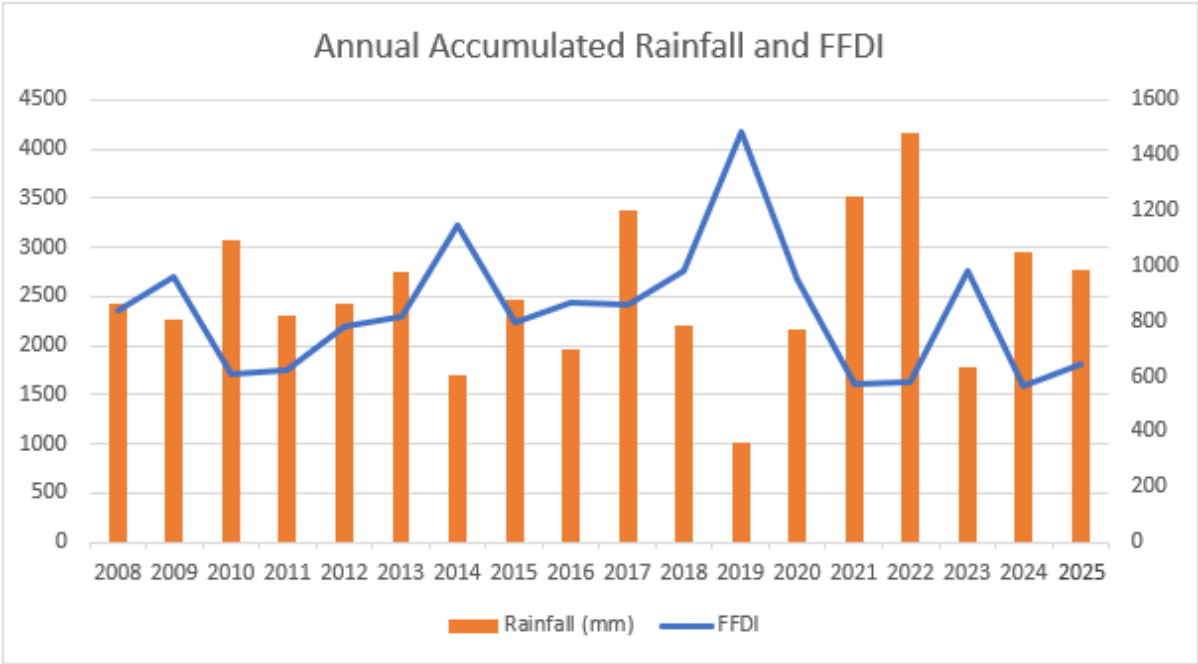
A1. Accumulated Monthly FFDI vs Average Monthly Rainfall



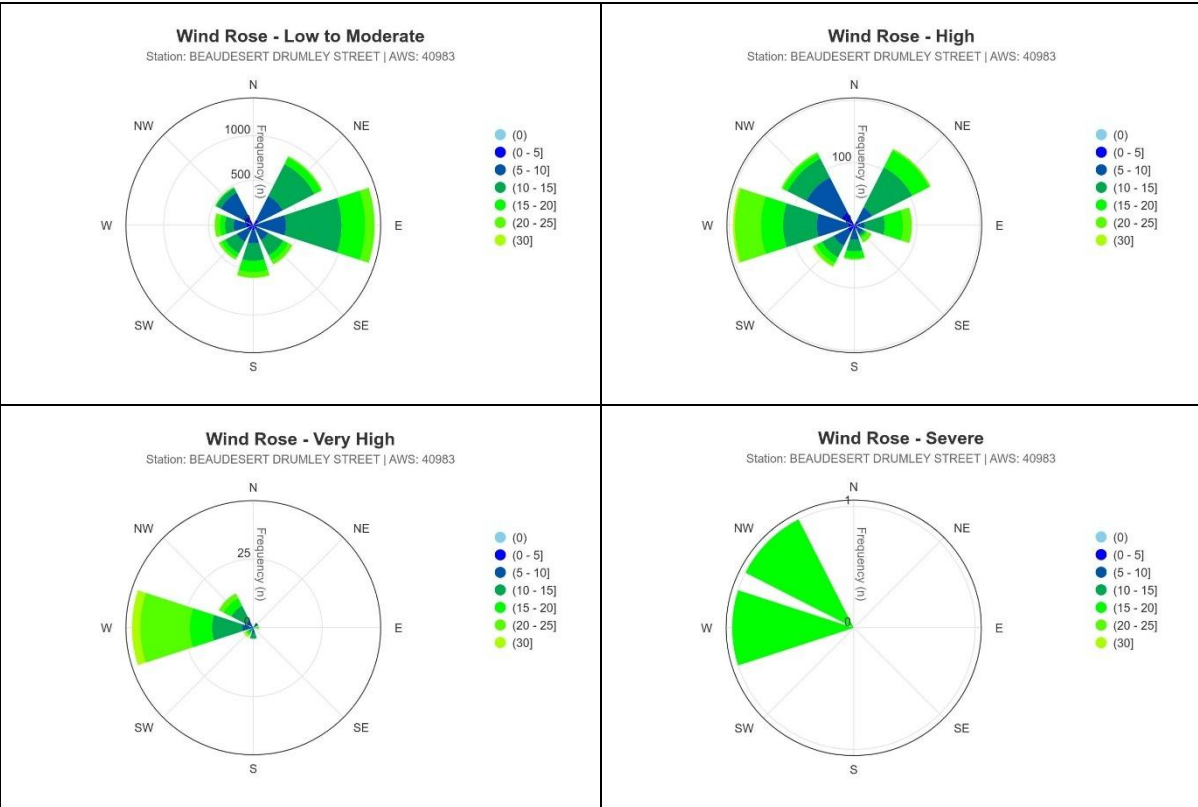
A2. Top 20 FFDI Readings

Rank	FFDI	FDR	Date	Month	T (°C)	Dew Point (°C)	RH (%)	Wind Speed (kph)	Wind direction (degrees)	Wind Cardinal Direction	KBDI	Drought Factor
1	58.02	Severe	8/11/2019	November	38.3	-3.5	4	16.6	300	WNW	181	10
2	56.14	Severe	15/11/2019	November	37.1	-8.7	5	18.4	290	W	185	10
3	47.95	Very High	7/11/2019	November	36.4	-9.2	4	11.2	330	NW	181	10
4	47.58	Very High	5/11/2019	November	28.6	8.3	9	29.5	260	WSW	180	10
5	47.26	Very High	6/09/2019	September	34.5	-10.6	5	14.8	310	WNW	168	10
6	45.96	Very High	5/12/2019	December	38.2	-3.6	7	16.6	250	WSW	184	8.8
7	45.75	Very High	5/10/2015	October	34.8	-21.3	2	9.4	60	NE	129	9.8
8	44.99	Very High	16/11/2014	November	40.1	12.1	17	22.3	270	W	169	10
9	44.66	Very High	6/12/2019	December	40.5	-0.1	8	11.2	290	W	185	9.3
10	43.38	Very High	9/09/2019	September	23.6	-14.2	8	31.3	250	WSW	170	10
11	42.94	Very High	16/12/2019	December	41.1	11.2	23	27.7	90	E	191	10
12	41.94	Very High	5/11/2016	November	34.6	4.2	14	24.1	260	WSW	110	9.7
13	41.61	Very High	10/11/2019	November	33	-9.3	6	13	200	S	182	10
14	40.19	Very High	8/09/2019	September	26.1	-9.2	9	25.9	250	WSW	170	10
15	40.09	Very High	16/11/2019	November	38.5	2.8	20	24.1	90	E	186	10
16	39.77	Very High	4/09/2019	September	33.7	-5.1	8	13	250	WSW	166	10
17	39.54	Very High	27/10/2025	October	37.8	7.7	18	22.3	280	W	172	9.83
18	38.31	Very High	7/10/2012	October	35.6	5	15	20.5	280	W	153	9.65
19	38.27	Very High	28/11/2018	November	35.6	13.1	21	31.3	280	W	90	9.2
20	36.88	Very High	12/03/2019	March	39.5	9	16	25.9	230	SW	180	7.4

A3. Annual accumulated rainfall and FFDI

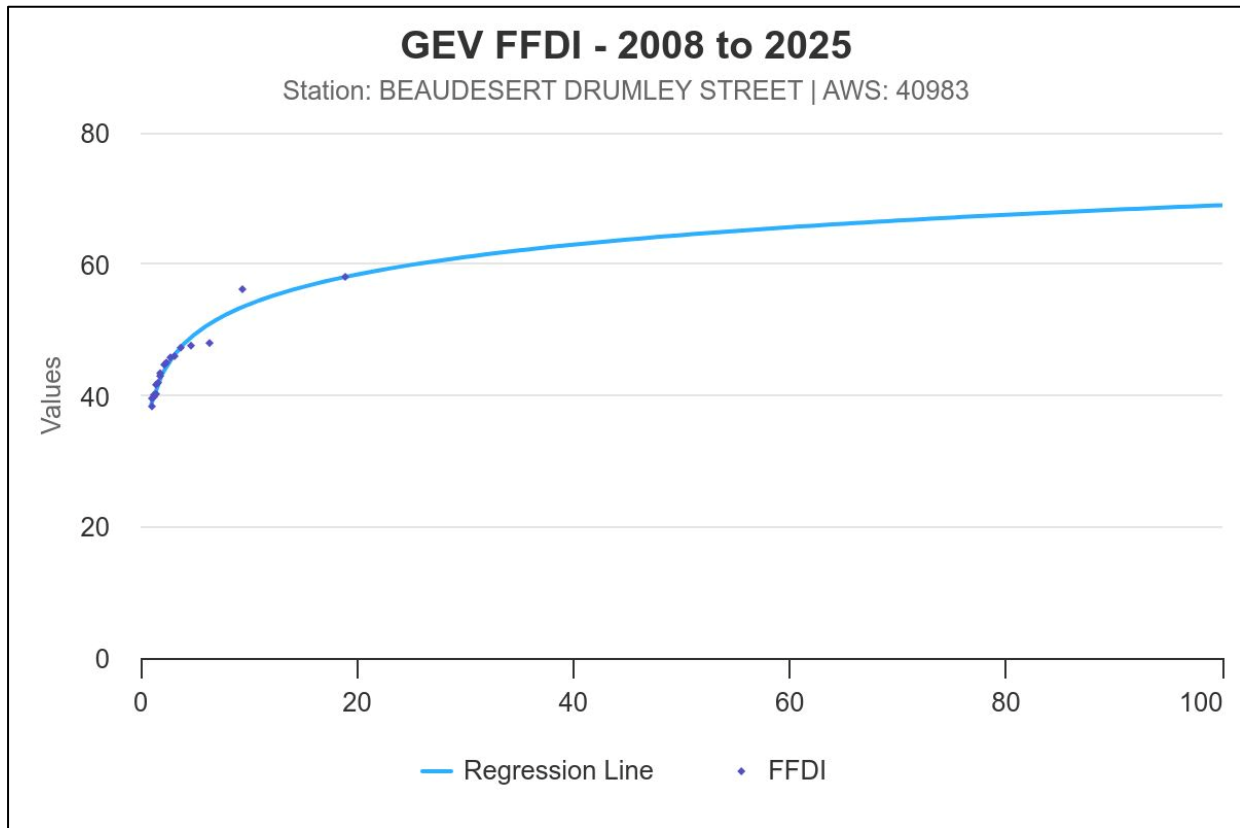


A4. Wind roses



A5. GEV regression equation

$$y = 38.7266 + 6.5645 \ln(x) \quad r = 0.9787$$

**A6. GEV Annual Return Interval (ARI) of FFDI**

Annual Recurrence Interval (Years)	Beaudesert AWS FFDI
1	39
20	58
25	60
50	64
100	69
200	74
500	80

Appendix B

Site Assessment Photos

Site Photos for VHC verification site assessment taken 28 April 2026 (Covey)

Photo Point 1



Photo Point 2



Photo Point 3



Photo Point 4



Photo Point 5	Photo Point 6
	
Photo Point 7	Photo Point 8
No Image at 7	

Photo Point 9	Photo Point 10
	
Photo Point 11	Photo Point 12
	

Photo Point 13	Photo Point 14
	
Photo Point 15	Photo Point 16
	

Appendix C

Inferno-BAL Methodology

Inferno-BAL is a module of the Inferno geospatial system designed by Covey Associates, to calculate radiant heat flux and Bushfire Attack Level (BAL) from Method 2 in the AS3925 standard. Rather than calculating radiant heat flux at a single point, Inferno-BAL assesses heat flux at each point within a given area. This allows contours of radiant heat flux to be determined, as well as the maximum potential radiant heat flux and subsequent BAL level over plots and structures. The system is designed to work over very large areas (10s of kilometres) at high spatial resolution (meter scale). All intensive computations utilise graphics processing units (GPUs) where possible allowing the rapid calculation of radiant heat flux over these large spatial scales. The system also utilises a server-driven approach where calculations can be queued until resources are available, then data delivered on request.

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

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

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

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

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

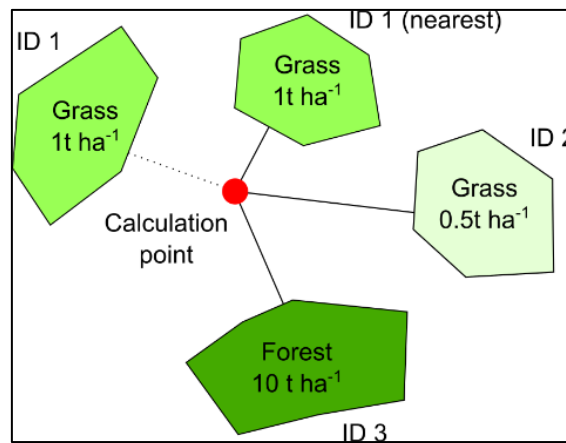
Pre-Processing

Given that (1) radiant heat flux calculations are computationally intensive and (2) Inferno-BAL was designed to be able to calculate radiant heat flux over entire Local Government Areas, each combination of fuel load and fuel type is categorised and the RHF calculations are run only on nearest vegetation type/load combination. Specifically, the software undertakes the following pre-processing actions:

1. Verify the input layers;
2. Rate-of-spread model and fuel load values are populated for each vegetation patch. Any patches with an un-burnable fuel type are removed (e.g., VHC 43.6 waterbodies).
3. All combination of fuel type and fuel load are categorised, and each combination assigned an ID.
4. For each unique ID the polygon nearest to the calculation point, is used in radiant heat flux calculations.

An example of this categorisation is shown in Figure 1. The four vegetation patches depicted are classified as ID 1 (Grass fuel type of 1 t/ha fuel load), ID 2 (Grass fuel type of 0.5 t/ha fuel load, and ID 3 (Forest fuel type of 10 t/ha). The radiant heat flux calculation is performed three times, one for each

of the nearest ID patches. In this case, the grass patch of ID 1 located at a greater distance from the calculation point (shown with a dashed line) is not included in the radiant heat flux model.



B1. Pre-processing of vegetation.

Figure 1 – Pre-processing of vegetation.

Note that this methodology may, in very marginal cases, result in a potential underestimation of radiant heat flux. This would only occur if ID patches at further distances were located on very steep terrain. This shortcoming will be addressed in future revisions of the system.

Distance Calculation

The distance is determined by searching for the point on the nearest edge over all polygons surrounding the calculation point. Once this nearest point is found the direction and distance to the patch can be found from the vector connecting the calculation point to the point on the edge (as shown by the arrow in Figure 2).

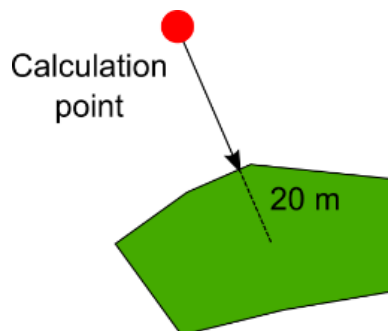


Figure 2 - Path to assess effective slope.

Site Slope Calculation

The site slope is calculated using the arctangent of the difference in elevation over the vector divided by the length of the vector. The site slope is clamped from -20 to 20 degrees, as in the AS3959 Method 2 standard.

Effective Slope Calculation

The effective slope is determined by extending a path 20 m into the vegetation patch (as shown by the dashed line in Figure 2) and calculating the slope over this path, per the method used in site slope calculations. The effective slope is clamped from -15 to 30 degrees, as in the AS3959 Method 2 standard.

Radiant Heat Flux calculation

The encoded vegetation characteristics from the vegetation vector layer are then used to determine which of the eight AS 3959 rate-of-spread models to adopt. From each of these a model for flame length is used (which may depend on an intermediate fire intensity empirical model for some fuel types, as in the AS3959 standard Eqns. B3, B4 and B5). The flame length is then used in the AS3959 iterative process to determine the flame angle giving the view factor, and hence maximum radiant heat flux, at the calculation point. This step involves some significant assumptions as outlined in the AS3959 standard, including the application of an empirical model for the atmospheric transmissivity (Eq. B9) and use of formula for view factor assuming a rectangular flame with a fixed width (Eq. B8 of AS 3959).

This process is repeated for each of the vegetation IDs and the maximum value over all these calculations is used as the final value of the radiant heat flux. The final steps in the process are to find the maximum radiant heat flux in each polygon plot, if supplied, and to categorise these into the BAL levels and to generate the vector isolines of the radiant heat flux.

Appendix D

NCC requirements for certain Class 9 Buildings

The proposed State Primary School would be considered a *primary school* classified as a Class 9b building within the National Construction Code (NCC) Building Code of Australia (2022). Class 9b buildings describe buildings where people may gather for social, theatrical, political, religious or civil purposes, which includes childcare centres and schools (National Construction Code, 2019). Five BAL standards (BAL-FZ, BAL-40, BAL-29, BAL-29 and BAL-12.5) calculated per AS 3959 trigger specific construction requirements under the Building Code of Australia. Further, certain Class 9 buildings are subject to additional bushfire protection requirements. This Appendix replicates relevant sections of the NCC, particularly focusing on deem-to-satisfy solutions.

Part G5 Construction in bushfire prone areas

G501 Objective

The Objective of this Part is to—

- (a) safeguard occupants from injury from the effects of a bushfire; and
- (b) protect buildings from the effects of a bushfire; and
- (c) facilitate temporary shelter for building occupants who may be unable to readily evacuate the building prior to a bushfire.

Applications

- (1) G501(a) and (b) apply in a designated bushfire prone area to—
 - (a) a Class 2 or 3 building; or
 - (b) a Class 10a building or deck associated with a Class 2 or 3 building.
- (2) G501(a), (b) and (c) apply in a designated bushfire prone area to—
 - (a) a Class 9a health-care building; and
 - (b) a Class 9b—
 - (i) early childhood centre; and
 - (ii) primary or secondary school; and
 - (c) a Class 9c residential care building; and
 - (d) a Class 10a building or deck immediately adjacent or connected to a building of a type listed in (a) to (c).

G5P2 Additional bushfire requirements for certain Class 9 buildings

A building that is constructed in a designated bushfire prone area and occupied by people who may be unable to readily evacuate the building prior to a bushfire must, to the degree necessary—

- (a) (a)reduce the risk of an untenable indoor environment for occupants during a bushfire event, appropriate to the—
 - (i) location of the building relative to fire hazards, including—
 - (A) classified vegetation; and
 - (B) adjacent buildings, structures and movable objects; and
 - (C) carparking areas and allotment boundaries; and
 - (D) other combustible materials; and
 - (ii) number of occupants to be accommodated within the building; and
 - (iii) intensity of bushfire attack on the building; and

- (iv) duration of occupancy; and
 - (v) intensity of potential consequential fires; and
 - (vi) occupant tenability within the building before, during and after the bushfire event; and
 - (vii) (vii) combined effects of structural, fire exposure and other effects to which the building may reasonably be subjected; and
 - (viii) provision of firefighting equipment and water supply to facilitate protection of the building; and
- (b) be provided with vehicular access to the site to enable firefighting and emergency personnel to defend or evacuate the building; and
 - (c) have access to a sufficient supply of water for firefighting purposes on the site; and
 - (d) provide safe access within the site to the building (including carparking areas), as well as safe egress after the bushfire event.

Applications

G5P2 applies to the following buildings located in a designated bushfire prone area—

- (a) a Class 9a health-care building; and
- (b) a Class 9b—
 - (i) early childhood centre; and
 - (ii) primary or secondary school; and
- (c) a Class 9c residential care building; and

Notes

For a building that is subject to G5P2, and therefore outside the scope of G5V1, the building would need to comply with either—

- (a) Performance Requirement G5P2 by means of a Performance Solution; or
- (b) the Deemed-to-Satisfy Provisions of G5D4 if the building is located in an area subject to a Bushfire Attack Level (BAL) not exceeding BAL – 12.5.

Deemed-to-Satisfy Provisions

G5D4 Protection – certain Class 9 buildings

- (1) In a designated bushfire prone area, the following must comply with Specification 43:
 - (a) a Class 9a health-care building; and
 - (b) a Class 9b—
 - a. early childhood centre; and
 - b. primary or secondary school; and
 - (c) a Class 9c residential care building; and
- (2) In a designated bushfire prone area, a Class 10a building or deck immediately adjacent or connected to a building of a type listed in (1) must comply with S43C2 and S43C13.

Deemed-to-Satisfy Provisions

Specification 43 – Bushfire Protection for Certain Class 9 Buildings

The following section outline the additional bushfire protection measures required within Specification 43 of the NCC Building Code of Australia (National Construction Code, 2019).

S43C2 Separation from classified vegetation

- (1) The building must be separated from classified vegetation –
 - a. By not less than the minimum distance specified in Table S43C2; or
 - b. Such that radiant heat flux on exposed building elements will not exceed 10 kW/m².
- (2) For the purposes of (1), the term ‘classified vegetation’ has the meaning that it has in AS 3959.

Table S43C2: Minimum distance of building to classified vegetation

Vegetation Classification	Slope	Minimum distance (m) of the building to classified vegetation
High risk	Upslope and flat land	60
High risk	Downslope max 20 degrees	110
Medium risk	Upslope and flat land	40
Medium risk	Downslope max 20 degrees	80
Low risk	Upslope and flat land	30
Low risk	Downslope max 20 degrees	50

Table Notes

- (1) Table values are based on FDI of 100 in accordance with AS 3959.
- (2) High risk equates to vegetation classification of forest and woodland in accordance with AS 3959.
- (3) Medium risk equates to vegetation classification of scrub and rainforest in accordance with AS 3959.
- (4) Low risk equates to vegetation classification of shrubland, mallee/mulga and grassland in accordance with AS 3959.

S43C3 Separation between buildings

- (1) The building must be located not less than 12 m from any other building.
- (2) The separation distance *required* by (1) need not be complied with if the building is constructed:
 - a. With *external walls* that have an FRL of not less than 60/60/60 when tested from the outside, including any openings protected in accordance with AS 3959 for BAL – 19 or greater; or
 - b. For *external walls* and roof, using a material or system that satisfies the test criteria of AS 1530.8.1 for a radiant heat flux of 10 kW/m² or greater.

S43C4 Separation from allotment boundaries and carparking areas

- (1) The building must be located not less than 10 m from any allotment boundary or open carparking area/spots.
- (2) The separation distance *required* by (1) need not be complied with if the building is constructed:
 - a. With *external walls* that have an FRL of not less than 60/60/60 when tested from the outside, including any openings protected in accordance with AS 3959 for BAL – 19 or greater; or
 - b. For *external walls* and roof, using a material or system that satisfies the test criteria of AS 1530.8.1 for a radiant heat flux of 10 kW/m² or greater.

S43C5 Separation from hazards

The *external walls* and roof of the building must be protected from potential hazards on the *site* such as liquefied petroleum gas bottles, fuel storage, storage of combustible materials, waste bins, vehicles, machinery and the like, by –

- (a) A separation distance of not less than 10 m; or
- (b) Where within the 10 m separation described in (a), constructed with *external walls* that have an FRL of not less than 60/60/60 when tested from the outside, including any openings protected in accordance with AS 3959 for BAL – 19 or greater; or
- (c) For *external walls* and roof, using a material or system that satisfies the test criteria of AS 1530.8.1 for a radiant heat flux of 10 kW/m² or greater.

S43C6 non-combustible path around building

A *non-combustible* pathway directly adjacent to the building and not less than 1.5 m wide must be provided around the perimeter of the building.

S43C7 Access pathways

- (1) Access pathways that lead to a road or *open space* must:
 - a. be readily identifiable; and
 - b. have an even surface; and
 - c. have a minimum clear width of not less than 1 m.
- (2) If the access pathway is an *accessway* that is *required* to comply with Part D4, the requirements of Part D4 override (1) to the extent of any inconsistency.

S43C8 Exposed external areas

An external area designed to hold people unable to be safely accommodated within the building, that may be exposed to radiant heat flux from a fire front during a bushfire event, must not be exposed to an incident radiant heat flux from the fire from exceeding 1 kW/m² above background solar radiant heat flux.

S43C9 Internal tenability

To maintain internal tenability throughout the duration of occupancy during a bushfire event, the building must comply with the following:

- (a) An air handling system must be provided that is capable of—

- (i) being adjusted for full recycling of internal air for a period of not less than 4 hours to avoid the introduction of smoke into the building; and
 - (j) maintaining an internal air temperature of not more than 25°C.
- (b) The building envelope must be designed such that if an air handling system required by (a) fails, then—
 - (i) internal air temperatures can be maintained below 39°C; and
 - (j) internal surface temperatures can be maintained below 60°C.
- (c) If the building is divided into separate compartments, then for the purposes of (a), each compartment must have a separate air handling system.
- (d) Each air handling system required by (a) must be designed to account for the activation of smoke detectors from low concentrations of smoke from external sources, so as to ensure that air-conditioning and other essential systems remain operational.

S43C10 Building envelope

The building envelope must be constructed in accordance with AS 3959 – BAL 19 or greater, except that where the use of combustible materials is permitted by AS 3959, they are not to be used unless permitted by C2D10(4), (5) or (6).

S43C11 Supply of water for fire-fighting purposes

Water for fire-fighting purposes must be available and consist of—

- (a) a fire hydrant system complying with E1D2, or
- (b) a static water supply consisting of tanks, swimming pools, dams or the like, or a combination of these, together with suitable pumps, hoses and fittings, capable of providing the required flow rate for a period of not less than 4 hours, determined in consultation with the relevant fire brigade.

S43C12 Emergency power supply

- (1) Emergency power must be provided to support, for not less than 4 hours before and 2 hours after the passing of the fire front during a bushfire event, the ongoing operation of—
 - a. air handling systems to maintain internal tenability; and
 - b. any pumps for firefighting; and
 - c. any emergency lighting and exit signs; and
 - d. any other emergency equipment listed in C3D14(6) and required to be provided.
- (2) Manual control for emergency back-up power supply must be provided to facilitate manual intervention where the power supply fails or runs out.

S43C13 Signage

Signage must be provided to warn building occupants against storing combustible materials under or adjacent to the building.

S43C14 Vehicular access

Vehicular access to the building must be provided in accordance C3D5(2), as if the building were a large, isolated building for the purposes of C3D4.

Appendix E

Preliminary BAL Impact Maps P103 and P104

