

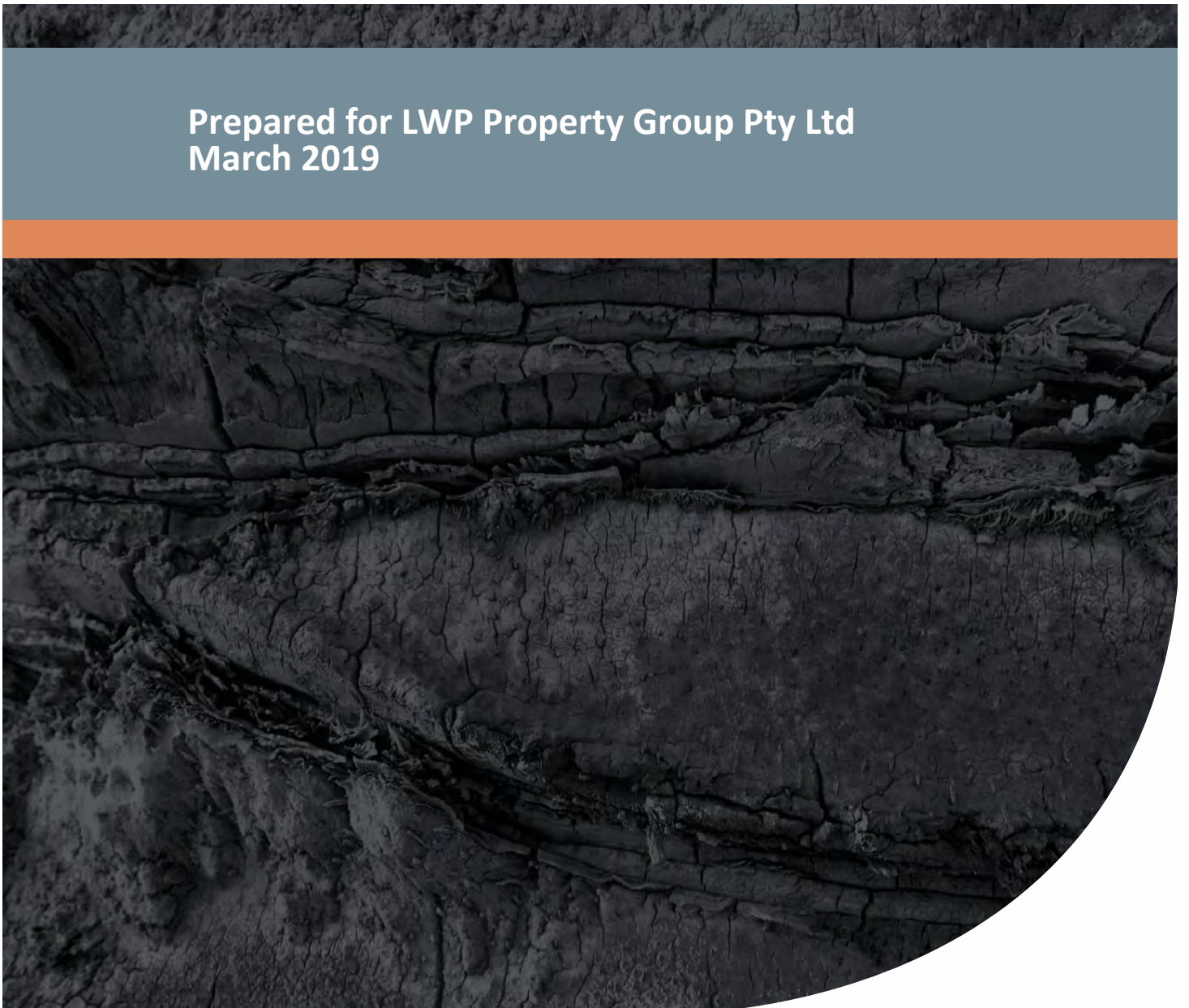
Bushfire Management Plan

The Glades at Byford - Local Structure Plan

Amendment

Project No: EP15-038(11)

Prepared for LWP Property Group Pty Ltd
March 2019



Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment



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This document has been prepared in good faith and is derived from information sources believed to be reliable and accurate at the time of publication. Nevertheless, it is distributed on the terms and understanding that the author is not liable for any error or omission in the information sources available or provided to us, or responsible for the outcomes of any actions taken based on the recommendations contained herein. It is also expected that our recommendations will be implemented in their entirety, and we cannot be held responsible for any consequences arising from partial or incorrect implementation of the recommendations provided.

This document has been prepared primarily to consider the layout of development and/or the appropriate building construction standards applicable to development, where relevant. The measures outlined are considered to be prudent minimum standards only based on the standards prescribed by the relevant authorities. The level of bushfire risk mitigation achieved will depend upon the actions of the landowner or occupiers of the land and is not the responsibility of the author. The relevant local government and fire authority (i.e. Department of Fire and Emergency Services or local bushfire brigade) should be approached for guidance on preparing for and responding to a bushfire.

Notwithstanding the precautions recommended in this document, it should always be remembered that bushfires burn under a wide range of conditions which can be unpredictable. An element of risk, no matter how small, will always remain. The objective of the Australian Standard AS 3959-2009 is to "prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the front passes" (Standards Australia 2009). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be lost.

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Executive Summary

This Bushfire Management Plan (BMP) has been prepared on behalf of LWP Property Group Pty Ltd (LWP) to support the proposed amendments to portions of the existing The Glades at Byford Local Structure Plan (“the Glades LSP”) in accordance with the current bushfire management framework (which was released after the approval of the current approved LSP). The proposed amendments to the Glades LSP are restricted to the portion of the LSP area north of Orton Road. This amendment area is herein referred to as “the site” and its extent and location are shown in **Figure 1**. The proposed amendments to the Glades LSP are relatively minor, and are intended to allow for a revision to the proposed development layout in portions of the site as well as the proposed residential density coding in targeted locations.

Currently, residential subdivision is being progressed in portions of the site in accordance with the approved *The Glades Local Structure Plan* (Taylor Burrell Barnett 2012). Where applicable, the outcomes of this BMP do not apply retrospectively to existing dwellings, or to subdivision stages that have approved detailed and stage specific BMPs already in place.

Portions of the site are currently identified as a “Bushfire Prone Area” under the state-wide *Map of Bush Fire Prone Areas* prepared by the Office of Bushfire Risk Management (OBRM 2017), as shown in Error! Reference source not found. below. The identification of Bushfire Prone Areas within any portion of the site requires further assessment of the bushfire hazard implications on proposed development to be undertaken in accordance with *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP 3.7) (WAPC 2015b) and the *Guidelines for Planning in Bushfire Prone Areas version 1.2* (the Guidelines) (WAPC and DFES 2017).

Existing bushfire hazards identified within 150 m of the site include woodland (Class B) and grassland (Class G) vegetation within and/or surrounding the site. In the assumed post development scenario for the site, all vegetation will be removed from the site or maintained to a low threat standard as part of the staged residential development. The majority of vegetation outside of the site is assumed to remain in its current state, and will therefore pose a long term bushfire risk to the site. Private landholdings south of the site fall under the ownership of LWP and form part of future development stages associated with the current approved LSP. Where titled lots occur within 100 m of these areas, the grassland will be maintained by LWP to a low threat standard until such a time as residential development progresses in accordance with the LSP and the hazard is permanently removed.

A Bushfire Attack Level (BAL) assessment has been undertaken as part of the BMP, and in order to evaluate the unique characteristics of the site (i.e. the use of an acoustic wall) this assessment has incorporated both a Method 1 assessment (in accordance with AS 3959) for the majority of the site and a Performance Solution Method 2 assessment for the western portion of the site, adjacent to the proposed future Water Corporation service easement and Tonkin Highway. The Performance Solution Method 2 assessment is consistent with *Part A 0.5 Assessment Methods in Housing Provisions of the Building Code of Australia 2017*.

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The Method 2 assessment includes:

- An assessment of extent of classified vegetation and effective slope beneath this vegetation in the post development scenario, in accordance with AS 3959.
- A design fire analysis of the reduction of the predicted radiant heat flux on future dwellings within the site due to the shielding provided by a non-combustible wall (which for the site is in the form of an acoustic wall constructed adjacent to the western boundary of the site).
- Modelling a design fire (based on the above) to determine the potential behaviour of a bushfire in the classified vegetation west of the site. This includes consideration of site specific variables such as flame height, fire breadth and subsequent predicted radiant heat flux outputs in accordance with the Detailed Procedure (Method 2) as outlined in Appendix B of AS 3959.

The results of the BAL assessment show that all future dwellings/habitable buildings within the site can achieve appropriate separation from bushfire hazards to ensure a BAL rating of BAL-29 is not exceeded. The results of the BAL assessment will be re-assessed and certified as part of future subdivision and/or building licenses as required.

Overall this BMP has been prepared in line with Appendix Four of the Guidelines and demonstrates that as development progresses, an acceptable solution and/or performance-based system of control can be adopted for each bushfire hazard management issue, as summarised below:

- **Location:** the BAL assessment indicates that future dwellings/habitable buildings can be located in an area that is or will, on completion, be subject to low or moderate bushfire hazard and future dwellings can be located to be subject to BAL-29 or below.
- **Siting and Design:** appropriate separation can be provided between future dwellings and post-development classified vegetation through the provision of public roads, public open space, firebreaks and internal asset protection zones (APZs) (where necessary) to ensure BAL-29 is not exceeded at future dwellings. Where required, BAL ratings and APZ requirements will be re-assessed and certified as part of future detailed BAL assessment/s prepared to support subdivision and/or building licence stages.
- **Vehicular Access:** The internal layout, design and construction of public vehicular access and egress in the development will be in accordance with the Guidelines, and will allow vehicles to move through the site easily and safely at all times. The development will have direct access to the existing residential areas within and surrounding the site allowing residents to move away from the main source of bushfire risk in rural properties south-east (north of Orton Road) and west of the site, and within Bush Forever site 321 east of the site.
- **Water:** The development will be provided with a permanent and secure reticulated water supply and will be installed in accordance with the specifications of the Water Corporation, including the installation of fire hydrants. This is a typical requirement of urban development.

This BMP sets out the roles and responsibilities of the developer, future residents and the Shire of Serpentine Jarrahdale to ensure the bushfire risk to the site is appropriately managed. It is important that the measures and procedures outlined in this BMP are adopted across the future subdivision and dwelling construction approvals processes.

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List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
AHD	Australian Height Datum
APZ	Asset Protection Zone
AS	Australian Standard
BAL	Bushfire Attack Level
BMP	Bushfire Management Plan
BPAD	Bushfire Planning and Design
FZ	Flame Zone

Table A2: Abbreviations – Organisations

Organisations	
DBCA	Department of Biodiversity, Conservation and Attractions (formerly Department of Parks and Wildlife)
DFES	Department of Fire and Emergency Services
DPAW	Department of Parks and Wildlife
OBRM	Office of Bushfire Risk Management
WAPC	Western Australian Planning Commission

Table A3: Abbreviations – Legislation and policies

Legislation and policies	
AS 3959	Australian Standard 3959-2009 Construction of buildings in bushfire prone areas
Guidelines	<i>Guidelines for Planning in Bushfire Prone Areas version 1.2</i> (WAPC and DFES 2017)
SPP 3.7	<i>State Planning Policy 3.7 Planning in Bushfire Prone Areas</i> (WAPC 2015)

Table A4: Abbreviations – Planning and building terms

Planning and building terms	
MRS	Metropolitan Region Scheme
TPS	Town Planning Scheme

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1 Introduction

1.1 Background

This Bushfire Management Plan (BMP) has been prepared on behalf of LWP Property Group Pty Ltd (LWP) to support the proposed amendment to portions of the existing The Glades at Byford Local Structure Plan (“the Glades LSP”). The proposed amendments to the Glades LSP are restricted to the portion of the LSP area north of Orton Road. This broader amendment area is herein referred to as “the site” and its extent and location are shown in **Figure 1**. The proposed amendments to the Glades LSP are relatively minor, and are intended to allow for a revision to the proposed development layout in portions of the site as well as the proposed residential density coding in targeted locations.

Currently, residential subdivision is being progressed in portions of the site in accordance with the approved *The Glades Local Structure Plan* (Taylor Burrell Barnett 2012). Where applicable, the outcomes of this BMP do not apply retrospectively to existing dwellings, or to subdivision stages that have approved detailed and stage specific BMPs already in place.

Portions of the site are currently identified as a “Bushfire Prone Area” under the state-wide *Map of Bush Fire Prone Areas* prepared by the Office of Bushfire Risk Management (OBRM 2017), as shown in Error! Reference source not found. below. The identification of Bushfire Prone Areas within any portion of the site requires further assessment of the bushfire hazard implications on proposed development to be undertaken in accordance with State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) (WAPC 2015b) and the *Guidelines for Planning in Bushfire Prone Areas version 1.2* (the Guidelines) (WAPC and DFES 2017).

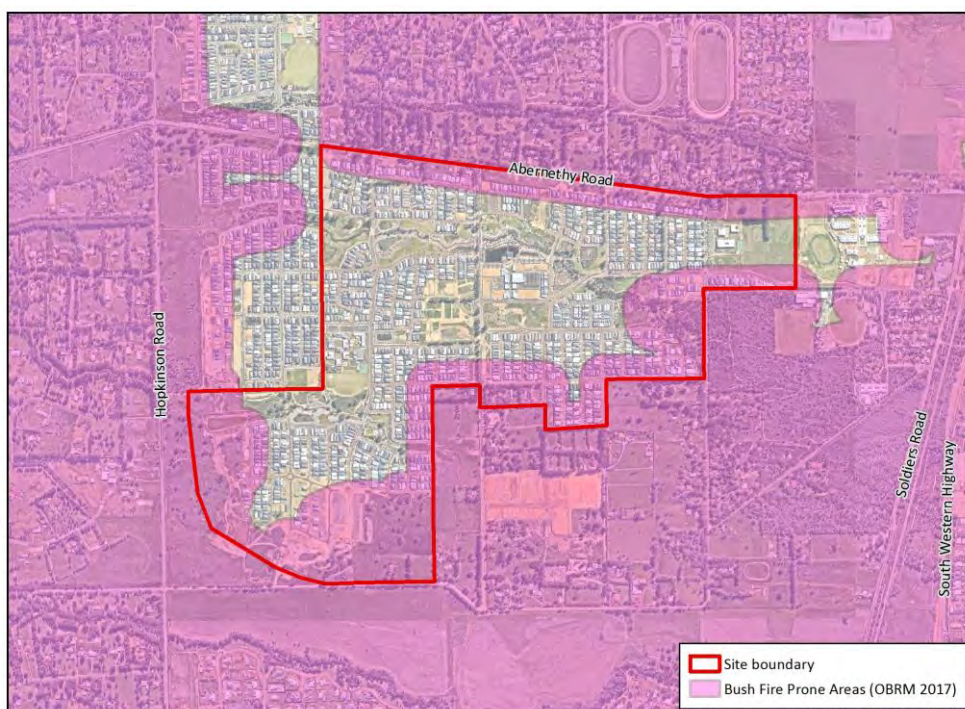


Plate 1: Areas within and surrounding the site identified as “Bushfire Prone Areas” (as indicated in purple) under the state-wide *Map of Bush Fire Prone Areas* (OBRM 2017).

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1.2 Aim of this document

The objective of this BMP is to support the proposed local structure plan amendment and future residential subdivision of the site, and to enable bushfire management issues (such as location, siting, vehicle access and water supply) to be addressed as part of the planning process.

This BMP addresses the requirements of SPP 3.7 (WAPC 2015), the Guidelines (WAPC and DFES 2017) and *Australian Standard 3959-2009 Construction of buildings in bushfire prone areas* (AS 3959) (Standards Australia 2009).

This BMP includes:

- An assessment of classified vegetation and associated bushfire hazard levels in the vicinity of the site (within 150 m) and consideration of hazards that will exist in the post development scenario.
- Identification of how the development will achieve the performance principles of the Guidelines by ensuring:
 - Development (i.e. future dwellings/habitable buildings) can be located, sited and designed to ensure that it is subject to low or moderate bushfire hazard or that a Bushfire Attack Level (BAL) rating of BAL-29 is not exceeded, supported by a BAL assessment. Where applicable, this includes consideration of asset protection zone requirements.
 - Vehicular access to and egress from the development is safe if a bushfire occurs.
 - Water is available to the development, so that life and property can be protected from bushfire.
- An outline of the roles and responsibilities associated with implementing this BMP (see **Section 4**).

1.3 Accreditation

This BMP has been prepared jointly by Emerge Associates and Bushfire Safety Consulting.

Bushfire Safety Consulting is owned and operated by Rohan Carboon, an experienced bushfire consultant to the urban planning industry. Rohan has an undergraduate degree in Environmental Management and postgraduate qualifications in Bushfire Protection and has been providing bushfire risk and hazard assessment and mitigation advice to the urban planning and development industry for more than six years. He first worked professionally in community bushfire safety education in 1999 and has been involved in land management including bushfire suppression since 1993.

Bushfire Safety Consulting is a Corporate Bronze Member of the Fire Protection Association of Australia and Rohan is an accredited Level 3 Bushfire Planning and Design Practitioner (BPAD accreditation no.: 23160).

Emerge Associates has been working jointly with Bushfire Safety Consulting for more than five years to undertake detailed bushfire assessments to support the land use development industry. Emerge Associates' personnel have undertaken BPAD Level 2 training and are in the process of finalising accreditation.

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1.4 Statutory policy and framework

The following key legislation, policies and guidelines are relevant to the preparation of a bushfire management plan:

- *Fire and Emergency Services Act 1998*
- *Bush Fires Act 1954*
- Planning and Development (Local Planning Scheme Amendment) Regulations 2015
- Building Regulations 2012
- *State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015b)*
- *Guidelines for Planning in Bushfire Prone Areas Version 1.2 (WAPC and DFES 2017)*
- *Australian Standard AS 3959 – 2009 Construction of buildings in bushfire prone areas (Standards Australia 2009)*

1.5 Historic bushfire assessments and management plans

In addition to this BMP, the following bushfire assessment reports have been historically prepared for the Glades at Byford residential estate:

- Fire Protection: The Glades at Byford (ICS Group 2010)
- Stage 9 Bushfire Management Plan (Emerge Associates and Bushfire Safety Consulting 2016)
- Lot 9049 & 9063 Warrington Road Bushfire Management Plan (Emerge Associates and Bushfire Safety Consulting 2016)
- Stage 12 Bushfire Management Plan (Emerge Associates and Bushfire Safety Consulting 2016)
- Lot 2662 Verrier Loop, Byford AS 3959 Method 1 BAL Assessment Report (Emerge Associates 2017)
- Various lots (Abernethy Road, Colesbrook Drive, Truman Promenade) Bushfire Management Plan (Emerge Associates and Bushfire Safety Consulting 2017)

Where applicable, the outcomes of this BMP do not apply retrospectively to existing dwellings, or to subdivision stages that have approved detailed and stage specific BMPs already in place.

1.6 Description of site and adjacent land uses

The site is zoned “Urban” under the Metropolitan Region Scheme (MRS) (as shown in Error! Reference source not found.) and “Urban Development” under the Shire of Serpentine Jarrahdale Town Planning Scheme No. 2 (TPS No. 2). The site is bound by Abernethy Road to the north, the future Tonkin Highway road reserve to the west, Orton Road to the south, and Warrington Road and Bush Forever Site 321 “Brickwood Reserve and Adjacent Bushland, Byford” (Bush Forever Site 321) to the east. A Water Corporation service corridor associated with the future Tonkin Highway extension occurs within the western portion of the site.

The site supports existing and future residential development associated with The Glades at Byford residential estate. Landholdings immediately south of Orton Road also form part of future residential stages, and fall under the ownership of LWP.

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Natural topographical contours (DoW 2008) indicate that the site and surrounding area is generally flat with a westerly aspect. Elevation ranges from 49 m Australian Height Datum (m AHD) in the east of the site, to 28 m AHD in the west of the site, as shown in **Figure 1**.

Significant earthworks have already occurred within the site as part of the staged residential development, and therefore elevations are not likely to be consistent with the natural topographic contours currently mapped. However these natural levels are applicable to areas surrounding the site and have informed the analysis of slope beneath classified vegetation, discussed further in **Section 2.4**.

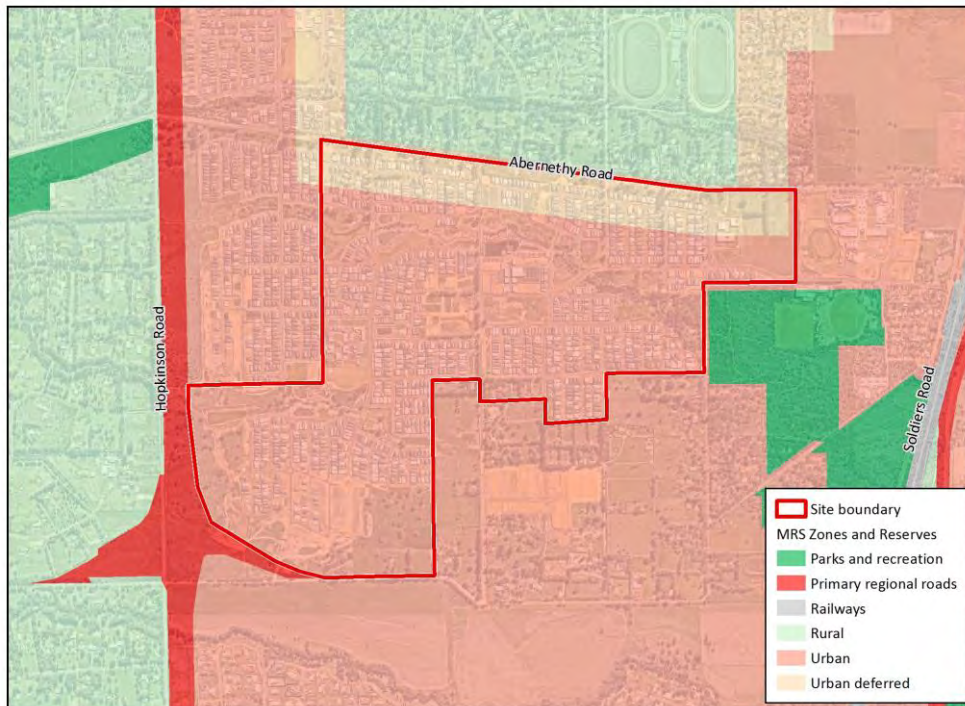


Plate 2: Land use zoning of the site and surrounding area, under the MRS

2 Bushfire Context

2.1 Bushfire history

Bushfires are relatively common in the Shire of Serpentine Jarrahdale, given the urban fringe interfacing with rural and rural-residential landholdings, and as such this BMP plays an important role in ensuring that the development of the land appropriately mitigates the risk and threat posed from bushfire.

As land use intensification occurs and urban development replaces rural land and/or areas of native vegetation, bushfire hazards are removed thereby reducing areas that can carry a bushfire. At the same time however, the number of people and assets in the community increases potentially increasing the risk at the bushland interface.

2.2 Bushfire risk

The risk management process described in AS/NZS ISO 31000:2009 *Risk management – Principles and guidelines* is a systematic method for identifying, analysing, evaluating and treating emergency risks.

Bushfire risk is determined by assessing:

- Bushfire hazard (i.e. bushfire prone vegetation)
- Threat level (i.e. proximity of the hazard to assets and people)
- Vulnerability of the asset
- Consequence rating (i.e. a rating for the potential outcome once the 'incident' has occurred)
- Likelihood rating (i.e. the chance of an event).

It is not necessary to undertake a standalone site specific bushfire risk assessment in accordance with AS/NZS ISO 31000:2009 as part of this BMP, as risk has been appropriately considered in the specific context of the Guidelines (WAPC and DFES 2017) and AS 3959.

AS 3959 specifies requirements for the construction of buildings in bushfire prone areas in order to improve their resistance to bushfire attack from embers, radiant heat, flame contact, and combinations of these attack forms.

The objective of AS 3959 is to provide detailed methods for assessing bushfire attack and to prescribe specific construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:

- Potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire.
- Intensity of the bushfire attack on the building.

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Two separate methods are outlined in AS 3959 for determining the impact of bushfire on dwellings and have been outlined below:

- **Method 1**, outlined in Section 2 and Appendix A of AS 3959, provides a basic assessment of radiant heat flux levels at various distances from classified vegetation (up to 100 m). This method assumes standard fuel loads for classified vegetation as outlined in AS 3959 and considers the effective slope beneath vegetation. This method can be used to determine appropriate setbacks to dwellings to achieve different levels of radiant heat exposure (i.e. BAL-12.5 to BAL-FZ, outlined in **Section 3.1.2.4** of this document).
- **Method 2**, outlined in Appendix B of AS 3959, provides a framework for a more rigorous and site specific assessment of radiant heat flux exposure for a site, involving bushfire engineering analysis and modelling using site specific data (e.g. climate/weather conditions during fire season, actual onsite fuel loads associated with classified vegetation etc.).

Vegetation that does not trigger a BAL assessment (i.e. low threat) according to Clause 2.2.3.2 of AS 3959 includes the following:

- a) Vegetation of any type more than 100 m from the site.
- b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified.
- c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site or each other.
- d) Strips of vegetation less than 20 m wide (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified.
- e) Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.
- f) Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parkland, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and wind breaks.

The vulnerability of assets such as dwellings is impacted by several factors. Some relate to the way a bushfire behaves at a site, others to the design and construction materials in the building and siting of surrounding elements. Infrastructure, utilities and human behaviour are also factors. Leonard (2009) identified the following factors as relevant considerations:

- Terrain (slope)
- Vegetation (overall fuel load, steady state litter load, bark fuels, etc.)
- Weather (temperature, relative humidity and wind speed)
- Distance of building from unmanaged vegetation
- Individual elements surrounding the building that are either a shield or an additional fuel source
- Proximity to surrounding infrastructure
- Building design and maintenance
- Human behaviour (ability to be present and capacity to fight the fire)
- Access to the building and how that influences human behaviour
- Water supply for active and/or passive defence
- Power supply.

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The bushfire threat for the site has been determined by undertaking both a Method 1 and a Performance Solution BAL assessment to ensure no future dwellings are exposed to a BAL rating greater than BAL-29, and is outlined in **Section 3.1.2.4**.

Where buildings are lost, this is likely to occur as a result of their vulnerability to the mechanisms of bushfire attack. Buildings constructed to increased standards under AS 3959 are more likely to survive a bushfire than buildings that do not conform to these construction standards, although building survival is not guaranteed.

2.3 Vegetation classification and bushfire hazard assessment

Assessing bushfire hazards takes into account the classes of vegetation within the site and surrounding area for a minimum of 100 m, in accordance with AS 3959. The assignment of vegetation classifications is based on an assessment of vegetation structure, which includes consideration of the various fuel layers of different vegetation types. For example, fuel layers in a typical forest environment can be broken-down into five segments as illustrated in **Plate 3** below. These defined fuel layers are considered when determining the classification of vegetation and associated bushfire hazard levels.



Plate 3: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

Table 1 below outlines the type of vegetation within the site and 150 m surrounding the site, classification of this vegetation in accordance with Section 2.2.3 and Table 2.3 of AS 3959, and its assumed post development classification and ongoing management (where applicable). The post development classification and associated effective slope (discussed in **Section 2.4**) is an important input for the assessment of radiant heat flux levels, discussed in **Section 3.1.2**.

The associated pre-development bushfire hazard assessment levels outlined in **Table 1** (based on existing conditions) were determined using Appendix Two of the Guidelines (WAPC and DFES 2017).

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2.4 Effective slope

The effective slope for classified vegetation that may affect the proposed residential land uses in the post-development scenario are shown in **Figure 5**. Due to the scale of the site the change in elevation discussed in **Section 1.6** does not present a significant slope that would impact the behaviour of a bushfire. Therefore all slopes under classified vegetation are considered effectively flat or upslope.

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Table 1: Vegetation type and future management




Pre-development			Post-development	
Plot no.	AS 3959 classification and bushfire hazard rating	Site photo/s (location points shown in Figure 2)	Plot no.	Post-development AS 3959 classification and assumption
1	<p>Bush Forever Site 321 east of the site (east of Warrington Road) supports a large area of remnant native vegetation that will remain in perpetuity.</p> <p>AS 3959 classification (Figure 2): Woodland (Class B)</p> <p>Bushfire hazard rating (Figure 3): Extreme</p>	 <p><i>Photo point 11</i></p>	1	<p>Area will remain in its current condition, and will therefore pose a long term bushfire hazard to the site.</p> <p>AS 3959 classification (Figure 4): Woodland (Class B)</p>
2	<p>Shrubland vegetation occurs in the Warrington Road reserve, east of the site.</p> <p>AS 3959 classification (Figure 2): Shrubland (Class C)</p> <p>Bushfire hazard rating (Figure 3): Moderate</p>	 <p><i>Photo point 12</i></p>	2	<p>Due to the location of this vegetation beneath an existing power line easement, the height of vegetation within this road reserve must be managed so as not to interfere with the existing infrastructure, which is generally less than 2 m high. Other than the maintenance of the height of vegetation, no further maintenance of fuel loads will be undertaken and therefore shrubland vegetation will pose a long term bushfire hazard to the site.</p> <p>AS 3959 classification (Figure 4): Shrubland (Class C)</p>

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Table 1: Vegetation type and future management (continued)

Pre-development			Post-development	
Plot no.	AS 3959 classification and bushfire hazard rating	Site photo/s (location points shown in Figure 2)	Plot no.	Post-development AS 3959 classification and assumption
5, 9	<p>Grassland (Class G) vegetation occurs in multiple areas within and surrounding the site and is associated with areas used largely for grazing purposes.</p> <p>AS 3959 classification (Figure 2): Grassland (Class G)</p> <p>Bushfire hazard rating (Figure 3): Moderate</p>	 <p>Photo point 1</p>  <p>Photo point 2</p>  <p>Photo point 3</p>  <p>Photo point 4</p>	10, 11	<p>It is assumed that all classified grassland vegetation within the site will be either removed or managed to a low threat standard as part of the future staged development in accordance with clause 2.2.3.2 of AS 3959.</p> <p>Areas of grassland associated with Plot 5 and 9 that will be converted to public open space will be landscaped and managed as low threat vegetation. This will be the responsibility of the proponent initially, then the Shire of Serpentine Jarrahdale following handover.</p> <p>AS 3959 classification (Figure 4): exclusion clause 2.2.3.2(e) or (f)</p> <p>Private landholdings south of the site (south of Orton Road) are owned by LWP and form future development stages of The Glades at Byford residential estate. Where titled lots occur within 100 m of this vegetation, grassland fuels in this area will be maintained to a low threat standard until such a time as development progresses in this area and the hazard is permanently removed. This can be enforced through the Shire of Serpentine Jarrahdale firebreak notice and this BMP. Therefore, this area is considered low threat in accordance with Clause 2.2.3.2(f) of AS 3959.</p> <p>AS 3959 classification (Figure 4): exclusion clause 2.2.3.2(f)</p>

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Table 1: Vegetation type and future management (continued)

Pre-development			Post-development	
Plot no.	AS 3959 classification and bushfire hazard rating	Site photo/s (location points shown in Figure 2)	Plot no.	Post-development AS 3959 classification and assumption
	Continued from above.	 <p>Photo point 6</p>  <p>Photo point 16</p>		<p>Areas of future road reserves, public open space and drainage reserves within the site will be designed, landscaped and maintained to a low threat standard in accordance with Clause 2.2.3.2(f) of AS 3959 and will therefore pose no hazard to development within the site. These areas will be maintained by the proponent initially and then the Shire of Serpentine Jarrahdale following handover.</p> <p>AS 3959 classification (Figure 4): exclusion clause 2.2.3.2(e)</p> <p>AS 3959 classification (Figure 4): exclusion clause 2.2.3.2(f)</p>

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Table 1: Vegetation type and future management (continued)

Pre-development			Post-development	
Plot no.	AS 3959 classification and bushfire hazard rating	Site photo/s (location points shown in Figure 2)	Plot no.	Post-development AS 3959 classification and assumption
3, 4, 6, 7, 8	<p>Grassland (Class G) vegetation occurs in multiple areas within and surrounding the site and is associated with areas used largely for grazing purposes.</p> <p>AS 3959 classification (Figure 2): Grassland (Class G)</p> <p>Bushfire hazard rating (Figure 3): Moderate</p>	 <p>Photo point 5</p>  <p>Photo point 9</p>	3, 4, 6, 7, 8	<p>Grassland identified as Plot 6 is in landholdings not owned by LWP, however are intended for future urban development in accordance with the current land use zoning (see Plate 2) and therefore grassland vegetation within these landholdings is considered temporary (see Figure 4). Given the timing for development in these landholdings is unknown, temporary classified vegetation may remain in proximity to future dwellings at the time development progresses within the site, therefore the temporary implications of this vegetation has been considered further as part of this BMP.</p> <p>All remaining grassland vegetation surrounding the site (associated with Plot 3, 4, 7 and 8) is assumed to remain in its current state and will therefore likely pose a long-term hazard to future development. Grassland vegetation within the Water Corporation service corridor and Tonkin Highway reserve has been subject to a Performance Solution BAL assessment, as outlined further in Section 3.1.2.</p> <p>AS 3959 classification (Figure 4): Grassland (Class G)</p>

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Table 1: Vegetation type and future management (continued)

Pre-development			Post-development	
Plot no.	AS 3959 classification and bushfire hazard rating	Site photo/s (location points shown in Figure 2)	Plot no.	Post-development AS 3959 classification and assumption
10	<p>Non-vegetated areas such as roads, existing dwellings, and areas of mineral earth within and surrounding the site have been excluded in accordance with Clause 2.2.3.2(e) of AS 3959.</p> <p>AS 3959 classification (Figure 2): Exclusion 2.2.3.2(e)</p> <p>Bushfire hazard rating (Figure 3): Low As required under the Guidelines, any areas within 100 m of moderate or extreme hazards have been shown as moderate, to reflect the increased risk.</p>	No photo provided.	10	<p>The existing maintenance regimes for all existing non-vegetated areas surrounding the site are assumed to continue in the long-term based on current land uses and management arrangements and/or will remain low threat as urban development is progressed.</p> <p>In addition, areas within the site that have been identified as non-vegetated will remain non-vegetated when converted to public roads and/or residential land uses as part of the proposed development of the site. It is noted that some of these areas may contain managed grass/garden areas, however for ease of reference has been excluded as non-vegetated on the basis that these will be part of developed lots/roads.</p> <p>AS 3959 classification (Figure 4): Exclusion 2.2.3.2(e)</p>

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Table 1: Vegetation type and future management (continued)




Pre-development			Post-development	
Plot no.	AS 3959 classification and bushfire hazard rating	Site photo/s (location points shown in Figure 2)	Plot no.	Post-development AS 3959 classification and assumption
11	<p>Areas that are actively managed to a low threat standard have been excluded in accordance with Clause 2.2.3.2(f) of AS 3959. This includes existing areas of public open space and drainage reserves, private gardens associated with residential dwellings, public road reserves, playing fields etc. within and surrounding the site.</p> <p>AS 3959 classification (Figure 2): Exclusion 2.2.3.2(f)</p> <p>Bushfire hazard rating (Figure 3): Low As required under the Guidelines, any areas within 100 m of moderate or extreme hazards have been shown as moderate, to reflect the increased risk.</p>	 <p>Photo point 7</p>  <p>Photo point 8</p>  <p>Photo point 10</p>  <p>Photo point 13</p>	11	<p>The maintenance regimes for all existing low-threat vegetation surrounding the site is assumed to continue in the long-term based on current land uses and management arrangements, in accordance with the requirements of the Shire of Serpentine Jarrahdale and community expectations.</p> <p>AS 3959 classification (Figure 4): Exclusion 2.2.3.2(f)</p>

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Table 1: Vegetation type and future management (continued)

Pre-development			Post-development	
Plot no.	AS 3959 classification and bushfire hazard rating	Site photo/s (location points shown in Figure 2)	Plot no.	Post-development AS 3959 classification and assumption
	Continued from above.	 <p>Photo point 14</p>  <p>Photo point 15</p>  <p>Photo point 17</p>		As above.

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3 Bushfire Mitigation Strategy

3.1 Bushfire risk management

As previously discussed, it is not necessary to undertake a standalone risk assessment as per AS/NZS ISO 31000:2009 *Risk management – Principles and guidelines*. Land use planning bushfire risk mitigation and building control strategies are detailed in the following sections and provide responses to the bushfire protection criteria outlined in Appendix Four of the Guidelines (WAPC and DFES 2017).

This BMP provides an outline of the mitigation strategies that will ensure that as development progresses, an acceptable solution and/or performance-based system of control is adopted for each bushfire hazard management issue, as outlined within Appendix Four of the Guidelines (WAPC and DFES 2017). The management issues addressed as part of this BMP are:

- Element 1: Location of the development
- Element 2: Siting and design of the development
- Element 3: Vehicular access
- Element 4: Water supply.

As the proposed residential development is located adjacent to the future Tonkin Highway road reserve, a noise wall is proposed to be built along the western and southern boundaries of the site to mitigate the likely acoustic impacts from Tonkin Highway and the associated access ramps. The noise wall at these interfaces will be constructed to the relevant Australian Standard for acoustic mitigation, and will meet the standards required for a BAL-FZ rating under AS 3959. As a result, in addition to providing for mitigation of acoustic impacts, the noise wall will be able to shield future dwellings against exposure to radiant heat should a bushfire move through the adjacent classified vegetation within these areas.

Given the radiant heat impact mitigation provided by the noise wall, a performance solution approach has been adopted for Element 2, to demonstrate that the respective performance principle can be achieved as well as the associated BAL rating for future dwellings, discussed in **Section 3.1.2** below. Element 1, Element 3 and Element 4 are able to achieve the bushfire protection criteria through an ‘acceptable solution’ approach. This is summarised in **Table 2**.

The compliance checklist with regard to the bushfire protection criteria is attached as **Appendix B** and the response detailed below.

Table 2: Summary of bushfire protection criteria and how each are addressed

Bushfire protection criteria	Solution type	Section of document
Element 1: Location	Acceptable	Section 3.1.1
Element 2: Siting and design	Acceptable and Performance	Section 3.1.2
Element 3: Vehicular access	Acceptable	Section 3.1.3
Element 4: Water	Acceptable	Section 3.1.4

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3.1.1 Element 1: Location

3.1.1.1 Intent

To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.

3.1.1.2 Acceptable Solution A1.1 Development location

As shown in **Figure 3**, the site is currently subject to low and moderate bushfire hazard, with the majority of the site likely to be subject to low bushfire hazard following the implementation of the remaining proposed residential development in accordance with the LSP. An area of extreme bushfire hazard is located adjacent to the eastern boundary of the site, associated with Bush Forever Site 321 “Brickwood Reserve and Adjacent Bushland”, however is separated from the site by an existing public road, Warrington Road, so does not extend into the site.

The Guidelines (WAPC and DFES 2017) state that for proposals to achieve an acceptable solution, they should be “*located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or [emphasis added] BAL-29 or below*”. Given the site is subject to low or moderate bushfire hazard, the proposal is able to achieve the acceptable solution. Mitigation of the nearby areas of potential bushfire hazard has been considered further as part of Element 2, Element 3 and Element 4.

3.1.2 Element 2: Siting and design of development

3.1.2.1 Intent

To ensure the siting and design of development minimises the level of bushfire impact.

3.1.2.2 Background

In order to comply with the acceptable solution for this Element, a project needs to be able to demonstrate that every habitable building is able to achieve an APZ that ensures BAL-29 is not exceeded at proposed building, measured from any external wall or supporting post or column. To demonstrate this, a BAL assessment is completed in accordance with AS 3959 (to determine the applicable BAL ratings). For the site, a Method 1 BAL assessment has been completed for the majority of proposed dwellings, with the western portion of the site (where a noise wall is proposed to be constructed adjacent to the Tonkin Highway road reserve) subject to a performance solution assessment, which includes a Method 2 assessment of BAL ratings in order to accommodate the radiant heat shielding provided by the noise wall.

AS 3959 provides six BAL ratings: BAL-LOW, BAL-12.5, BAL19, BAL-29, BAL-40 and BAL-FZ. These categories are based on heat flux exposure thresholds and are summarised in **Table 3**. The method for determining the BAL rating for any given site involves a specific assessment of vegetation and of topographic slopes. Each BAL rating is associated with appropriate construction standards that apply as a minimum for buildings in bushfire-prone areas (as per AS 3959).

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Table 3 : Summary of BAL ratings, heat flux thresholds and associated construction standards, as outlined within AS 3959

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the subject building and heat flux exposure thresholds	Description of the predicted bushfire attack and levels of exposure	Construction section (within AS 3959)
BAL-LOW	See Section 2.2.3.2 of AS 3959	There is insufficient risk to warrant specific construction requirements	4
BAL-12.5	$\leq 12.5 \text{ kW/m}^2$	Ember attack	3 & 5
BAL-19	$> 12.5 \text{ kW/m}^2$ to $\leq 19 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 6
BAL-29	$> 19 \text{ kW/m}^2$ to $\leq 29 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 7
BAL-40	$> 29 \text{ kW/m}^2$ to $\leq 40 \text{ kW/m}^2$	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with the increased likelihood of exposure to flame	3 & 8
BAL-FZ	$\leq 40 \text{ kW/m}^2$	Direct exposure to flames from fire front in addition to heat flux and ember attack	3 & 9

Portions of the site have already been subdivided and developed for residential purposes, including the creation of residential lots, public roads, and areas of public open space and drainage reserves in accordance with The Glades LSP. The remainder of the site will continue to be developed for residential purposes, and dwellings exposed to any bushfire hazard will be those located within 100 m of permanently retained classified vegetation outside of the site, as shown in **Figure 4**.

The extent of classified vegetation posing a bushfire risk to the site (within 100 m) in the post-development scenario (as shown in **Figure 4**) is restricted to the following main areas:

- Grassland (Class G) vegetation within the Water Corporation services corridor and Tonkin Highway reserve west of the site (Plot 7 and Plot 8).
- Grassland (Class G) vegetation within private landholdings north of the site (Plot 3, north of Abernethy Road).
- Grassland vegetation within private landholdings east of the site (Plot 6). These areas are intended for future urban development, however given the timing of development is unknown, the potential impacts of this temporary bushfire hazard have been considered as part this BMP.
- Woodland (Class B) vegetation within Bush Forever Site 321, and shrubland (Class C) vegetation within the Warrington Road reserve east of the site (Plot 1 and Plot 2 respectively). These areas have been assumed to remain in the existing condition given there is no known long-term or ongoing management of these bushfire fuels.

The BAL assessment completed for the site is outlined further below.

3.1.2.3 BAL Assessment methodology and assumptions

The BAL assessment for the site has been based on a combination of a Method 1 BAL assessment (as per AS 3959 and outlined in **Section 2.2**) and a Performance Solution assessment consistent with Part A 0.5 Assessment Methods in the Housing Provisions of the *Building Code of Australia 2017*, including a Method 2 BAL assessment in accordance with Appendix B of AS 3959. This approach has been undertaken in order to consider the shielding effects of the noise wall at these interfaces.

The assessment includes:

- Consideration of the classified vegetation within 150 m of the site following development, in accordance with AS 3959.
- Determination of the effective slope under the classified vegetation.
- A BAL assessment using either:
 - Method 1, as per Section 2 of AS 3959 and the following criteria:
 - Designated FDI: 80
 - Flame temperature: 1090
 - Effective slope: Flat or upslope
 - Vegetation class: woodland (Class B), grassland (Class G)
 - Setback distances: as per Table 2.4.2 of AS 3959, and summarised in **Table 4** below.
 - A performance solution assessment, including Method 2 BAL assessment which includes:
 - A design fire analysis to determine the shielding effect of the future noise wall (adjacent to Tonkin Highway road reserve) where a bushfire occurs within nearby classified vegetation. For the site, a detailed assessment of classified vegetation, effective slope and height of the noise wall was undertaken, which determined that two design fires were required to appropriately consider shielding effects. The location of each is shown in **Figure 4**.
 - Analysis of the reduction of the predicted radiant heat flux on a future dwelling within the site due to the shielding provided by a noise wall is based on the wall being constructed to a standard which achieves BAL-FZ standards of AS 3959.
 - Modelling of site specific variables such as flame height, fire breadth and subsequent predicted radiant heat flux outputs in accordance with the detailed method for determining BAL ratings (Method 2) as per Appendix B of AS 3959.

Detail on the performance solution assessment methodology is provided in **Appendix C**. Importantly, the flame temperature assumed for the performance solution is 1200°C, which is greater than the 1090°C flame temperature specified in AS 3959 for Method 1 and Method 2. This approach has been adopted based on advice provided by the Department of Fire and Emergency Services and is considered to be a conservative worst-case assessment, as flame temperature significantly influences radiant heat impacts.

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In addition to the above, the following key assumptions have informed this assessment:

- The majority of the site will be completely cleared of vegetation to support residential development in accordance with The Glades LSP, or where retained (or implemented), vegetation will be considered low threat in accordance with Section 2.2.3.2 of AS 3959. The development and implementation of public open space is a standard requirement of subdivision and development. These areas are required to be developed to minimum standards in accordance with *Liveable Neighbourhoods* (WAPC 2015a) and Shire of Serpentine Jarrahdale minimum standards, outlined in *Local Planning Policy No. 60 Public Open Space* (SSJ 2016).
- A strip of grassland (Class G) vegetation will remain in an unmanaged state adjacent to the western portion of the site, associated with the Water Corporation service corridor and the Tonkin Highway road reserve (Plot 7 and Plot 8). In the future, this area is likely to be developed to support the Tonkin Highway extension as well as future wastewater and water services (resulting in the removal of vegetation), however has been assumed to pose a bushfire hazard to the site given the timing for development is currently unknown.
- The landholding south of Orton Road is owned by the proponent, and when titled lots are located within 100 m of the landholding, the grassland (Class G) vegetation will be managed to achieve low threat in accordance with Section 2.2.3.2 of AS 3959. This can be enforced through the Shire of Serpentine Jarrahdale firebreak notice and this BMP. On this basis, this vegetation has been assumed to be low threat in accordance with Clause 2.2.3.2(f) of AS 3959.
- A noise wall will be constructed along the western and southern site boundaries (see **Figure 4**) to the appropriate noise mitigation standards, and will meet the minimum requirements of BAL-FZ standards of AS 3959.
- Areas of classified vegetation (or excluded vegetation) outside the site will remain in their existing condition and the current management regimes will continue to be implemented.
- Landholdings outside of the site will comply with the requirements of the Shire of Serpentine Jarrahdale Fire Control Notice/s as published, including the installation and maintenance of firebreaks and completion of fuel hazard reduction.

3.1.2.4 BAL assessment outcome

The outcomes of the Method 1 BAL assessment and performance solution assessment indicate that no future dwellings will be exposed to a BAL rating greater than BAL-29, and therefore the proposed development is able to achieve the acceptable solution. In addition, the performance solution assessment indicates that the shielding from the noise wall results in a reduced exposure to radiant heat flux for those dwellings adjacent to the Tonkin Highway road reserve when compared to no noise wall being present.

The results of the BAL assessment are outlined in **Table 4** below, and the associated BAL contour map is shown in **Figure 6**. **Table 4** details the separation distances required between future buildings and classified vegetation within 100 m of the site, to achieve the indicated various BAL ratings. The Method 1 distances are based on those specified within Table 2.4.3 of AS 3959, while the performance solution setbacks are based on the results detailed in **Appendix C**.

Where the performance solution has been applied adjacent to the Tonkin Highway road reserve, the BAL ratings for the applicable design fires (shown in **Figure 6**) and associated APZs have been shown in greater detail in **Figure 7**, **Figure 8** and **Figure 9**.

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Table 4: Results of BAL assessment

Vegetation classification	Plot	Effective slope	Method 1		Performance Solution		
			Separation distance	BAL achieved	Design Fire	Separation distance	BAL achieved
Woodland (Class B)	1	Flat	<10 m	BAL-FZ	N/A		
			10-<14 m	BAL-40	N/A		
			14-<20 m	BAL-29	N/A		
			20-<29 m	BAL-19	N/A		
			29-<100 m	BAL-12.5	N/A		
			>100 m	BAL-LOW	N/A		
Shrubland (Class C)	2	Flat	<7 m	BAL-FZ	N/A		
			7-<9 m	BAL-40	N/A		
			9-<13 m	BAL-29	N/A		
			13-<19 m	BAL-19	N/A		
			19-<100 m	BAL-12.5	N/A		
			>100 m	BAL-LOW	N/A		
Grassland (Class G)	3 - 8	Flat	<6 m	BAL-FZ	1	<4 m	BAL-FZ
						4-6 m	BAL-40
			6-<8 m	BAL-40		6-9.5 m	BAL-29
						9.5-14.5 m	BAL-19
			8-<12 m	BAL-29		14.5-50 m	BAL-12.5
						>50 m	BAL-LOW
			12-<17 m	BAL-19	2	<3.5 m	BAL-FZ
						3.5-4 m	BAL-40
			17-<50 m	BAL-12.5		4-7.5 m	BAL-29
						7.5-11.5 m	BAL-19
			>50 m	BAL-LOW		11.5-50 m	BAL-12.5
						>50 m	BAL-LOW

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The minimum separation distances necessary to achieve a BAL rating of BAL-29 or less at future dwellings (as indicated by distances detailed within **Table 4**) will be able to be accommodated in future development through a number of means including:

- The provision of appropriate sized lots to accommodate an asset protection zone to ensure BAL-29 is not exceeded at the future dwelling. This could include rear and/or front lot setbacks which could be specified as part of future Local Development Plans if required (which are typically prepared as a condition of subdivision approval). This is demonstrated within **Figure 7** and **Figure 8**, which shows that the proposed lots adjacent to the Tonkin Highway road reserve/water services corridor are sufficiently long enough to enable the 6 m-wide or 4 m-wide APZ (depending upon the applicable design fire) to be accommodated within the lot while providing suitable development areas for future dwellings.
- The location of public road reserves and public open space. **Figure 9** illustrates how public open space has been located adjacent to lots to provide an APZ adjacent to the Tonkin Highway road reserve/water services corridor. These spaces are typically designed and implemented as a condition of subdivision approval and will be the responsibility of the developer then local government, in accordance with the relevant state and local government standards.

The BAL ratings for future dwellings/habitable buildings will be re-assessed and confirmed/certified as part of either future BMPs or detailed BAL assessments (where these are required), or through the lot clearance title process to support the building licence stage.

3.1.2.5 Acceptable solution A2.1: Asset Protection Zone

One of the most important bushfire protection measures influencing the safety of people and property is to create an Asset Protection Zone (APZ) around buildings. The APZ is a low fuel area immediately surrounding a building. Non-flammable features such as irrigated landscapes, gardens, driveways and roads can form parts of an APZ. As outlined in the Guidelines, an APZ must be wide enough to ensure that the maximum BAL rating for residential dwellings adjacent to classified vegetation will not exceed BAL-29.

Research into land management and house losses during the 'Black Saturday' Victorian bushfires concluded that the action of private landholders who managed fuel loads close to their houses was the single most important factor in determining house survival when compared with other land management practices, such as broad scale fuel reduction burning remote from residential areas (Gibbons *et al.* 2012).

APZs are typically described as a low fuel area immediately surrounding a building and can include non-flammable features such as irrigated landscapes and gardens, as well as roads, driveways, pools or similar. The provision of a perimeter APZ where the site is adjacent to external bushfire hazard will ensure fuel loads in close proximity to the first row of buildings are managed to reduce the likelihood of ignition fuels adjacent to dwellings.

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Managing vegetation in the APZ has two main purposes:

- To reduce direct flame contact and radiant heat from igniting the building during the passage of a fire front.
- To reduce ember attack and provide a safer space for people to defend (if required) before, during and after a fire front passes.
- Proposed lots within the site that are situated in close proximity to identified bushfire hazards can accommodate an internal (within the site) APZ.

While Element 2 has been addressed through the use of a performance solution for the portion of the site adjacent to the Tonkin Highway road reserve/water services corridor, the associated BAL assessment indicates that the 'acceptable solution' for this element can be achieved through the provision of APZs to ensure BAL-29 is not exceeded at future dwellings/habitable buildings. Based on outcomes of the Method 1 and performance solution BAL assessment:

- A minimum 14 m-wide setback is required for dwellings adjacent to the woodland vegetation east of the site in order to achieve BAL-29. This setback is entirely accommodated within the existing Warrington Road reserve.
- A minimum 4 m-wide or 6 m-wide setback (depending upon the applicable design fire) is required for dwellings adjacent to the grassland vegetation within the future Tonkin Highway road reserve and Water Corporation services corridor. This is based on the outcomes of the performance solution assessment and consideration of the radiant heat shielding provided by the noise wall. This setback can be accommodated within the proposed lots (see **Figure 7** and **Figure 8**), with the APZ equating to less than 17% of the total lot area.
- A minimum 8 m-wide setback is required for dwellings adjacent to the temporary grassland vegetation identified south-east of the site (but north of Orton Road). The temporary vegetation south-east of the site (see **Figure 4**) will only require setbacks to be accommodated until such time the hazard is removed or managed as part of separate urban development. The accommodation of temporary bushfire risk mitigation measures can be addressed through the staged development of the site, to ensure no future dwellings are exposed to a BAL rating greater than BAL-29.

The setback distances for the required APZs (which enable the future dwellings within each lot to achieve BAL-29 or less) have been summarised in **Table 5** below. Where APZs are not provided for by public road reserves, or through the location of public open space, the requirement for an APZ within a residential lot will likely be specified within future Local Development Plans. Local Development Plans are able to restrict the location of buildings and specify particular requirements that must be achieved as part of the built form response. The use of APZs to restrict the placement of built form (i.e. dwellings) within areas of BAL-40 or BAL-FZ will ensure that the requirements of SPP 3.7 are met and BAL-29 is not exceeded for future dwellings.

It is also recommended that all future lots should be maintained to an APZ standard in order to reduce potential impacts on dwellings from ember attack (which may result from bushfires more than 100 m from the site). The APZ/s should be established and maintained to the standards outlined in Appendix Four of the Guidelines (WAPC and DFES 2017) and/or the Shire of Serpentine Jarrahdale Firebreak Notice and Fuel Hazard Reduction Notice (as published).

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Table 5: Asset Protection Zone requirements

Area of classified vegetation	Vegetation classification	Effective slope	Minimum APZ width	BAL rating based on minimum APZ width
Tonkin Highway reserve (Plot 7) & Water Corporation service corridor (Plot 8), west of the site	Grassland (Class G)	Flat/Upslope	6 m (Design Fire 1)	BAL-29
			4 m (Design Fire 2)	BAL-29
Private landholdings south (Plot 6), east (Plot 4) and north (Plot 3) of the site	Grassland (Class G)	Flat/Upslope	8 m	BAL-29
Bush Forever Site 321 (Plot 1)	Woodland (Class B)	Flat/Upslope	14 m	BAL-29
Warrington Road reserve, east of the site (Plot 2)	Shrubland (Class C)	Flat/Upslope	9 m	BAL-29

As part of future staging of development within the site, the proponent will be required to manage all vegetation within their landholdings that are within 100 m of title residential lots to a low threat standard in accordance with Section 2.2.3.2 of AS 3959. This may include:

- Regular slashing of grass fuels to a height less than 100 mm.
- Low pruning of existing trees, with all branches within 2 m of the ground removed.
- Removal/management of fine fuel loads (i.e. combustible vegetation matter, including leaves, branches or similar) to achieve two tonnes per hectare or less.
- Installation of firebreaks, as per the Shire of Serpentine Jarrahdale Firebreak Notice and Fuel Hazard Reduction Notice.

3.1.3 Element 3: Vehicular access

3.1.3.1 Intent

To ensure vehicular access serving a subdivision/development is available and safe during a bushfire event.

3.1.3.2 Background

As outlined within the Guidelines, to achieve the intent, all applicable 'acceptable solutions' must be addressed, or alternatively the performance principle achieved. The proposed development is able to achieve all applicable acceptable solutions.

3.1.3.3 Acceptable solution A3.1: Two access routes

The site is already being subdivided in accordance with the approved LSP, and will form part of the broader Byford community. The long-term internal road network of the site is shown in **Appendix A**, and shows direct access to numerous existing public roads through an extensive internal road system, which allows residents to move away from the main source of bushfire risk, associated with the Tonkin Highway road reserve west of the site, and Bush Forever Site 321 east of the site.

The existing and future road network for the site and surrounding residential development provides for at least two permanent access options at all times to future residents and emergency response personnel. This will achieve the acceptable solution, as outlined in Appendix Four of the Guidelines (WAPC and DFES 2017).

3.1.3.4 Acceptable solution A3.2: Public roads

Surrounding public roads and all new public roads within the site will comply with the minimum standards outlined in Appendix Four of the Guidelines (WAPC and DFES 2017). All public roads achieve a minimum 6 m width, as per the Guidelines (WAPC and DFES 2017).

3.1.3.5 Acceptable solution A3.3 Cul-de-sac (including dead-end road)

Cul-de-sacs are generally avoided within the site, however if proposed any cul-de-sacs will comply with the minimum standards outlined in Appendix Four of the Guidelines. It is likely that temporary cul-de-sacs will be required as part of the staging of development, until the proposed internal road network is fully developed, at which point these roads will connect with existing public roads within and surrounding the site. Temporary cul-de-sacs will comply with the minimum standards outlined in Appendix Four of the Guidelines, and will have suitable turn around areas.

3.1.4 Element 4: Water

3.1.4.1 Intent

To ensure water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.

3.1.4.2 Acceptable Solution A4.1: Reticulated water

The development is located within an Emergency Services Levy (ESL) Category 3 Urban Metropolitan Area, which indicates that bushfire events are responded to by a volunteer fire and rescue service brigade with the availability of a network of career fire stations, and the State Emergency Services (SES) as required. Fire response services require ready access to an adequate water supply during bushfire emergencies.

The development will be provided with a reticulated water supply, together with fire hydrants that will be installed by the developer to meet the standard specifications of Water Corporation (Design Standard DS 63) and DFES, achieving the acceptable solution. Fire hydrants on land zoned for residential purposes are required to be sited at or within 200 m of residential dwellings (Class 1a).

The Water Corporation would be responsible for all hydrant maintenance and repairs.

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3.2 Public education and preparedness

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. DFES has an extensive Community Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. The DFES publication '*Prepare. Act. Survive.*' (DFES 2014) provides excellent advice on preparing for and surviving the bushfire season. Other downloadable brochures are available from

<http://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/pages/publications.aspx>

The Shire of Serpentine Jarrahdale also provides bushfire safety advice to residents available from their website <http://www.sjshire.wa.gov.au/what-we-do/emergency-services/fire/>. Professional, qualified consultants also offer bushfire safety advice and relevant services to residents and businesses in high risk areas.

Future residents of the site are able to access additional bushfire information via the above sources, or through contacting the Shire of Serpentine Jarrahdale or DFES directly. In the case of a bushfire in the area, advice would be provided to residents by DFES, Department of Biodiversity, Conservation and Attractions (DBCA) and/or the Shire of Serpentine Jarrahdale on any specific recommendations to responding to the bushfire, including evacuation if required. It is recommended that future residents should make themselves aware of their responsibilities with regard to preparing and responding to a potential bushfire, regardless of whether their lot is bushfire prone or not.

Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment

4 Implementing the Bushfire Management Plan

Table 6 outlines the future responsibilities of the developer, future lot owners or residents, and the Shire of Serpentine Jarrahdale associated with implementing this BMP.

The future owners/occupiers of lots within the site, as created through future subdivision stages, are responsible for maintaining a reduced level of risk from bushfire within their properties (where applicable), and will be responsible for undertaking, complying and implementing measures to protect their own assets (and people under their care) from the threat and risk of bushfire.

Table 6: Responsibilities for the implementation of the BMP

Management action	Timing
Developer/s	
If required, prepare an updated BMP and/or BAL assessment in accordance with SPP 3.7 and the Guidelines to support future subdivision stages.	To support the subdivision application
Certify lot specific BAL ratings for lots that are designated as bushfire prone areas within the <i>Map of Bush Fire Prone Areas</i> , to support future building licences.	As part of subdivision and development
Where required, and based on the outcomes of the updated BMPs and/or BAL assessment/s, make spatial provision within the future subdivision layout to accommodate any applicable APZs (as a minimum, future dwellings must be able to achieve BAL-29 or less). This may include ensuring lots are of an adequate depth or width to accommodate the relevant setback distance, or through the provision of public roads and/or managed public open space.	To support the subdivision application
Make spatial provision for two access ways (either formal public roads and/or temporary emergency access ways) to be provided at all times for each subdivision stage.	To support the subdivision application
Make spatial provision for the following to be installed to the standards outlined in the Guidelines: <ul style="list-style-type: none"> • Public roads • Temporary cul-de-sacs • Temporary emergency access ways. 	To support the subdivision application
Ensure areas of public open space and drainage reserves are designed, landscaped and maintained to a low threat standard in accordance with AS 3959.	As part of subdivision and development
Reticulated water supply and hydrants to be installed as per standard Water Corporation requirements, unless otherwise agreed.	As part of subdivision and development
Ensure the site is completely cleared of vegetation or maintained to a low threat standard (within 100 m of each development stage) to ensure no temporary bushfire fuels impact on future dwellings.	Ongoing, where applicable
Ensuring that undeveloped portions of the site and broader LSP area comply with the Shire of Serpentine Jarrahdale Firebreak Notice/s and Fuel Hazard Reduction Notice/s as published.	Ongoing, where applicable
Lot owner/occupier	
Ensuring construction of dwelling/s complies with AS 3959, as detailed within future BAL assessments or BAL certifications as part of subdivision or building stages by the Developer.	As part of building design and construction
If dwellings are subject to additional construction in the future, such as renovations, AS 3959 compliance is required (i.e. where located within a designated bushfire prone area).	As part of building design and construction

Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment

Table 6: Responsibilities for the implementation of the BMP (continued)

Management action	Timing
Lot owner/occupier (continued)	
Ensuring that their property complies with the Shire of Serpentine Jarrahdale Firebreak Notice/s and Fuel Hazard Reduction Notice/s as published.	Ongoing, where applicable
Maintaining their property in good order to minimise bushfire fuels in accordance with the APZ requirements outlined Appendix D and in Appendix Four of the Guidelines.	Ongoing, where applicable
Ensuring that where hydrants are located, they are not obstructed and remain visible at all times.	Ongoing, where applicable
Shire of Serpentine Jarrahdale	
Providing fire prevention and preparedness advice to landowners upon request, including the <i>Homeowners Bush Fire Survival Manual: Prepare, Act, Survive</i> (or similar suitable documentation) and the latest Shire of Serpentine Jarrahdale Fire Break Notice.	Ongoing, as required
Monitoring vegetation fuel loads in public reserves and liaising with relevant stakeholders to maintain fuel loads at minimal fuel levels.	Ongoing, as required
Maintaining public road reserves to appropriate standards and ensuring compliance with the Shire of Serpentine Jarrahdale Fire Break Notice/s (as published).	Ongoing, as required
Water Corporation	
The Water Corporation is responsible for the ongoing maintenance and repair of water hydrants.	Ongoing, as required

5 Summary of Bushfire Management

The site is located within an area identified as bushfire prone within the state *Map of Bush Fire Prone Areas* (OBRM 2017). This BMP has been prepared consistent with Appendix Four of the Guidelines (WAPC and DFES 2017) and demonstrates that as development progresses, an acceptable solution and/or performance solution system of control can be adopted for each bushfire hazard management issue, as summarised below:

- **Location:** the BAL assessment indicates that the development (i.e. future dwellings) is located in an area that is or will, on completion, be subject to low or moderate bushfire hazard (even prior to development occurring) and within the proposed lots future dwellings can be located so that they are subject to BAL-29 or below.
- **Siting and Design:** appropriate separation can be provided between future dwellings and post-development classified vegetation through the provision of public roads, public open space, firebreaks and internal asset protection zones (APZs) (where necessary) to ensure BAL-29 is not exceeded at future dwellings. Where required, BAL ratings and APZ requirements will be re-assessed and certified as part of future detailed BAL assessment/s prepared to support subdivision and/or building licence stages.
- **Vehicular Access:** The internal layout, design and construction of public vehicular access and egress in the development will be in accordance with the Guidelines, and will allow vehicles to move through the site easily and safely at all times. The development will have direct access to the existing residential areas within and surrounding the site allowing residents to move away from the main source of bushfire risk in rural properties south-east (north of Orton Road) and west of the site, and within Bush Forever site 321 east of the site.
- **Water:** The development will be provided with a permanent and secure reticulated water supply and will be installed in accordance with the specifications of the Water Corporation, including the installation of fire hydrants. This is a typical requirement of urban development.

Table 6 of this BMP outlines the actions which should be implemented, and the parties responsible for their implementation, to reduce the bushfire risk to future residents and the community.

Community bushfire safety is a shared responsibility between state and local governments, fire agencies, communities and individuals. The future owners/occupiers of lots within the site are responsible for maintaining a reduced level of risk from bushfire within their properties, and will be responsible for undertaking, complying and implementing measures to protect their own assets (and people under their care) from the threat and risk of bushfire. Further information on bushfire preparedness is available directly from the Shire of Serpentine Jarrahdale and DFES.

Bushfire Management Plan
The Glades at Byford - Local Structure Plan Amendment



6 Applicant Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Signature:

A handwritten signature in blue ink, appearing to be 'Knox', written over a light blue horizontal line.

Name: Kirsten Knox

Company: Emerge Associates

Date: 3 April 2019

Signature:

A handwritten signature in black ink, appearing to be 'R. Carboon', written over a light blue horizontal line.

Name: Rohan Carboon

Company: Bushfire Safety Consulting

Date: 3 November 2017

BPAD Accreditation: 23160

Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment



7 References

7.1 General references

Department of Fire and Emergency Services (DFES) 2014, *Prepare. Act. Survive.*, Perth.

Gibbons, P., van Bommel, L., Gill, A., Cary, GJ, Driscoll, D., Bradstock, R., Knight, E., Moritz, M., Stephens, S. and Lindenmayer, D. 2012, *Land Management Practices Associated with House Loss in Wildfires*, PLoS One, 7(1).

Leondard, J. 2009, *Report to the 2009 Victorian Royal Commission Building Performance in Bushfires*, CSIRO.

S. o. S. Jarrahdale (SSJ) 2016, *Local Planning Policy No. 60: Public Open Space*, Serpentine.

Standards Australia 2009, *AS 3959-2009 Construction of buildings in bushfire-prone areas*, Sydney.

Western Australian Planning Commission (WAPC) 2015a, *Draft Liveable Neighbourhoods*, Department of Planning, Perth.

Western Australian Planning Commission (WAPC) 2015b, *State Planning Policy 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth, Perth.

Western Australian Planning Commission and Department of Fire and Emergency Services (WAPC and DFES) 2017, *Guidelines for Planning in Bushfire Prone Areas Version 1.2*, Western Australia.

7.2 Online references

Office of Bushfire Risk Management (OBRM) 2017, *Map of Bush Fire Prone Areas*, viewed October 2017, <<https://maps.slip.wa.gov.au/landgate/bushfireprone/>>

Figures



Figure 1: Site and Assessment Area

Figure 2: Existing Site Conditions - AS 3959 Vegetation Classification

Figure 3: Existing Site Conditions - Bushfire Hazard Rating

Figure 4: Post Development Site Conditions - AS 3959 Vegetation Classification

Figure 5: Effective Slope

Figure 6: BAL Contour Plan

Figure 7: Design Fire 1a BAL Contour Plan

Figure 8: Design Fire 2 BAL Contour Plan

Figure 9: Design Fire 1b BAL Contour Plan

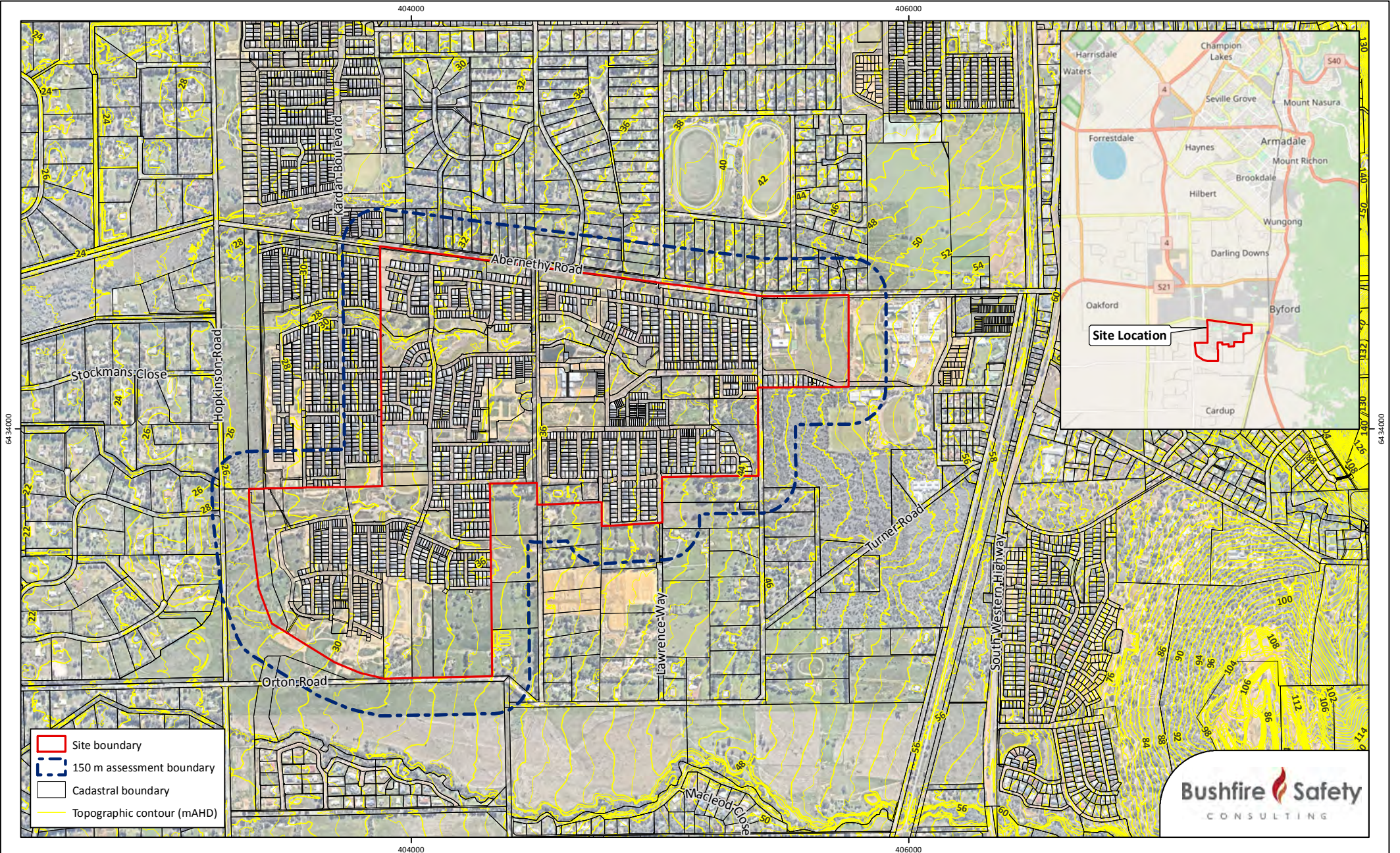
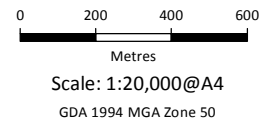


Figure 1: Site and Assessment Area

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment
Client: LWP Property Group Pty Ltd

Plan Number:
EP15-038(11)--F62
Drawn: KNM
Date: 30/10/2017
Checked: VMK
Approved: KK
Date: 03/11/2017



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used

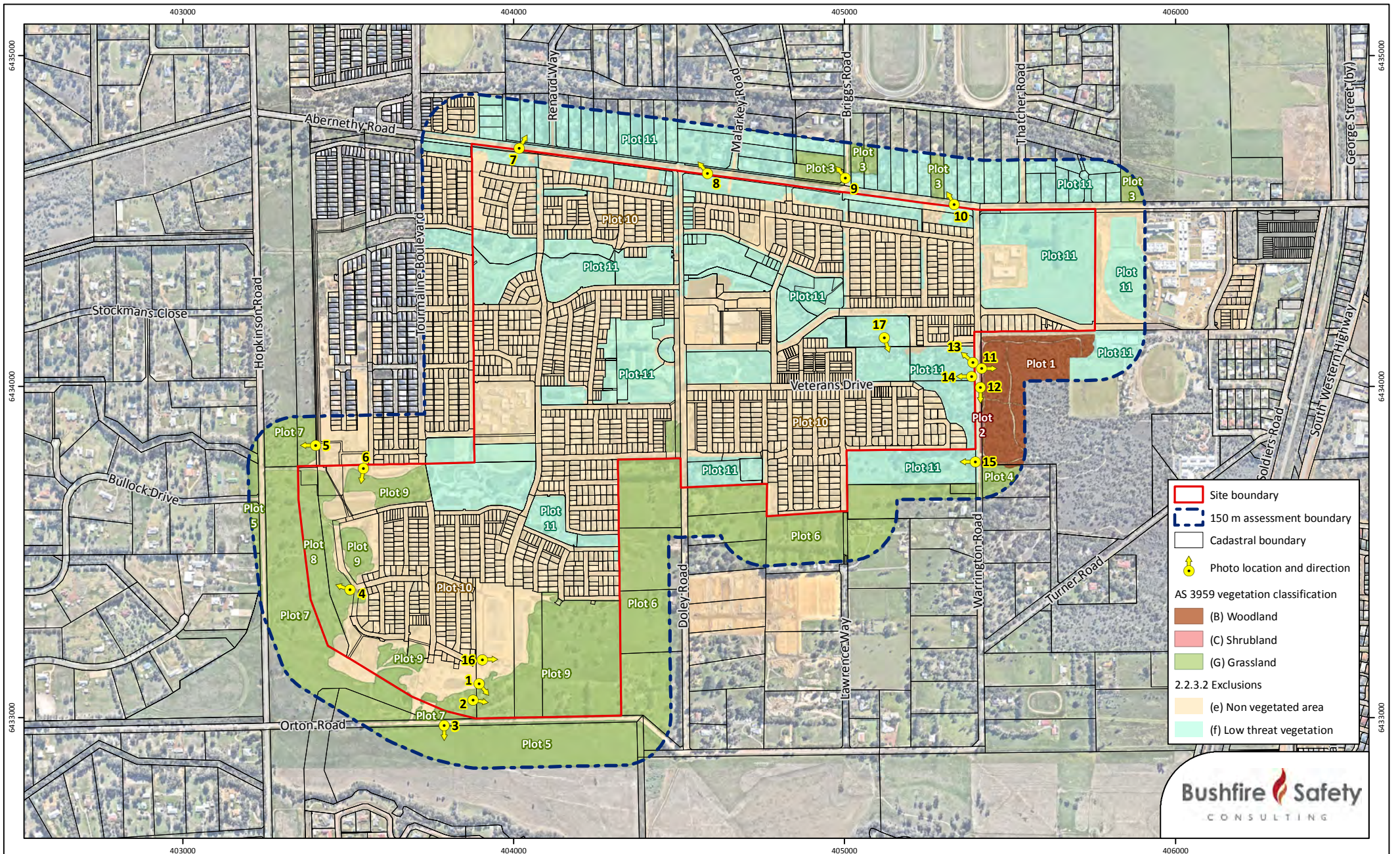


Figure 2: Existing Site Conditions – AS 3959 Vegetation Classification

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment
Client: LWP Property Group Pty Ltd

Plan Number:
EP15-038(11)-F63
Drawn: KNM
Date: 30/10/2017
Checked: VMK
Approved: KK
Date: 03/11/2017



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GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used

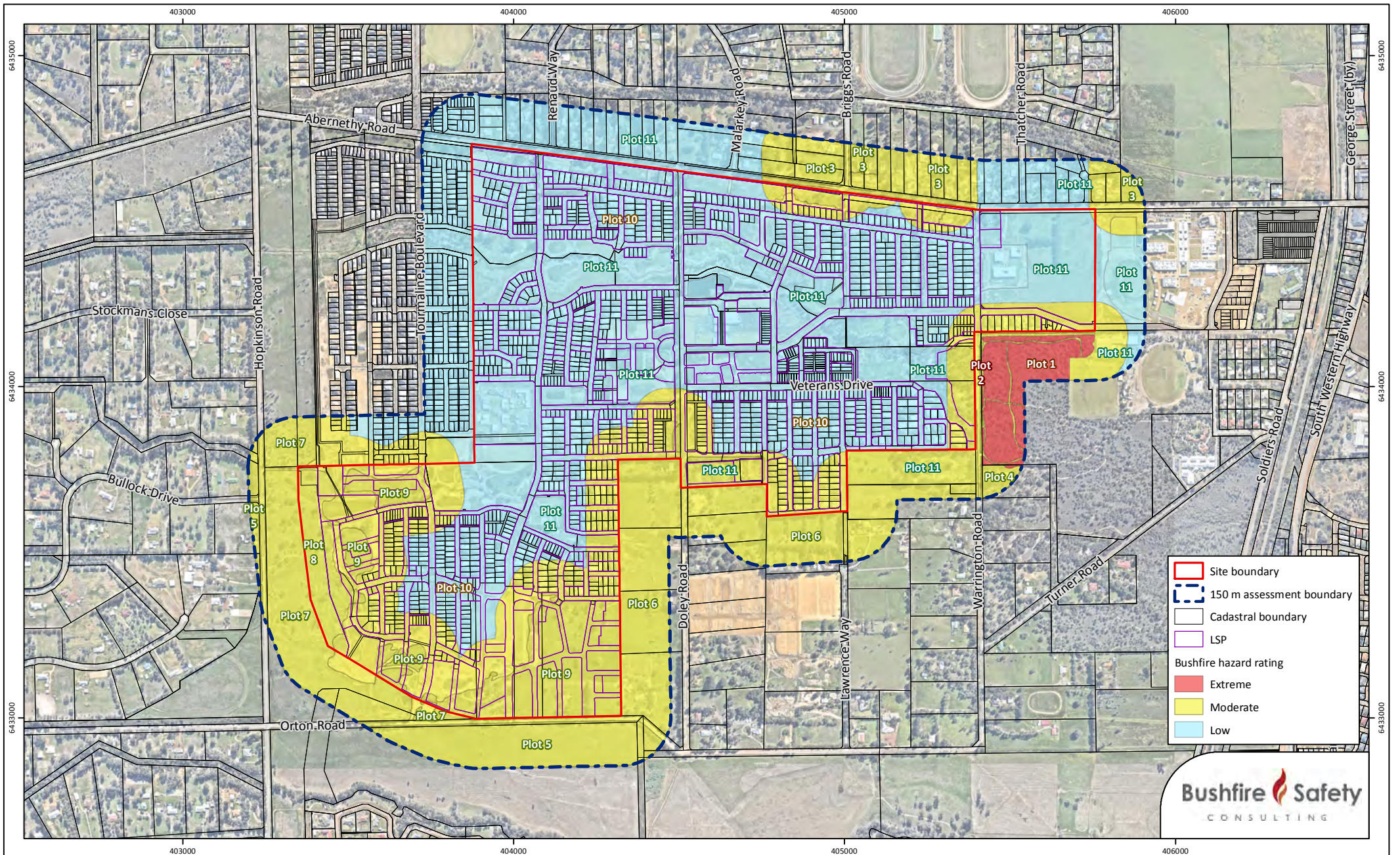


Figure 3: Existing Site Conditions – Bushfire Hazard Rating

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment
Client: LWP Property Group Pty Ltd

Plan Number:
EP15-038(11)--F64
Drawn: KNM
Date: 30/10/2017
Checked: VMK
Approved: KK
Date: 03/11/2017



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GDA 1994 MGA Zone 50

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emerge
ASSOCIATES

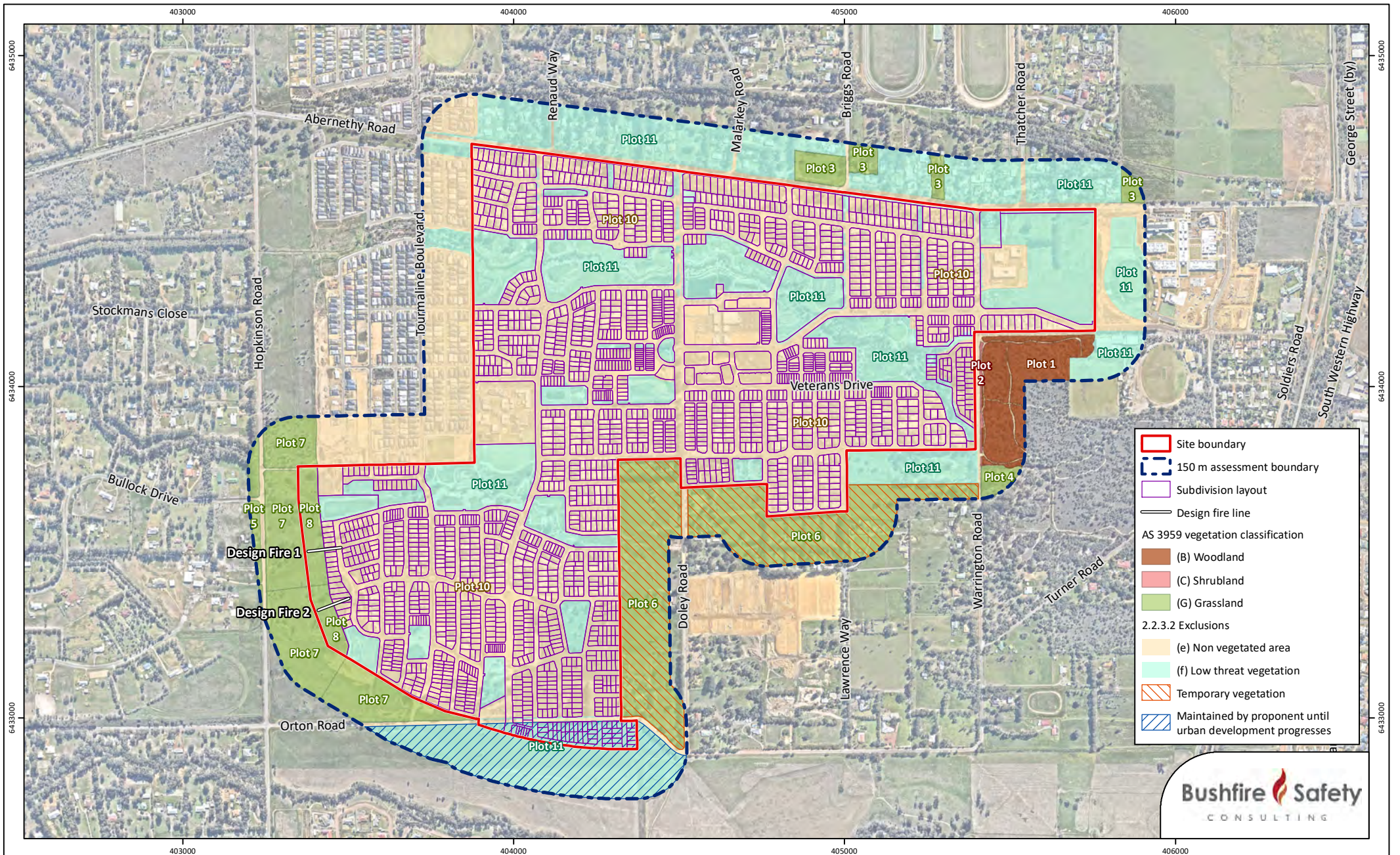


Figure 4: Post Development Site Conditions – AS 3959 Vegetation Classification

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment

Client: LWP Property Group Pty Ltd

Plan Number: EP15-038(11)--F65a
Drawn: SCM
Date: 29/03/2019
Checked: KK
Approved: KK
Date: 29/03/2019

Scale: 1:15,000@A4
GDA 1994 MGA Zone 50



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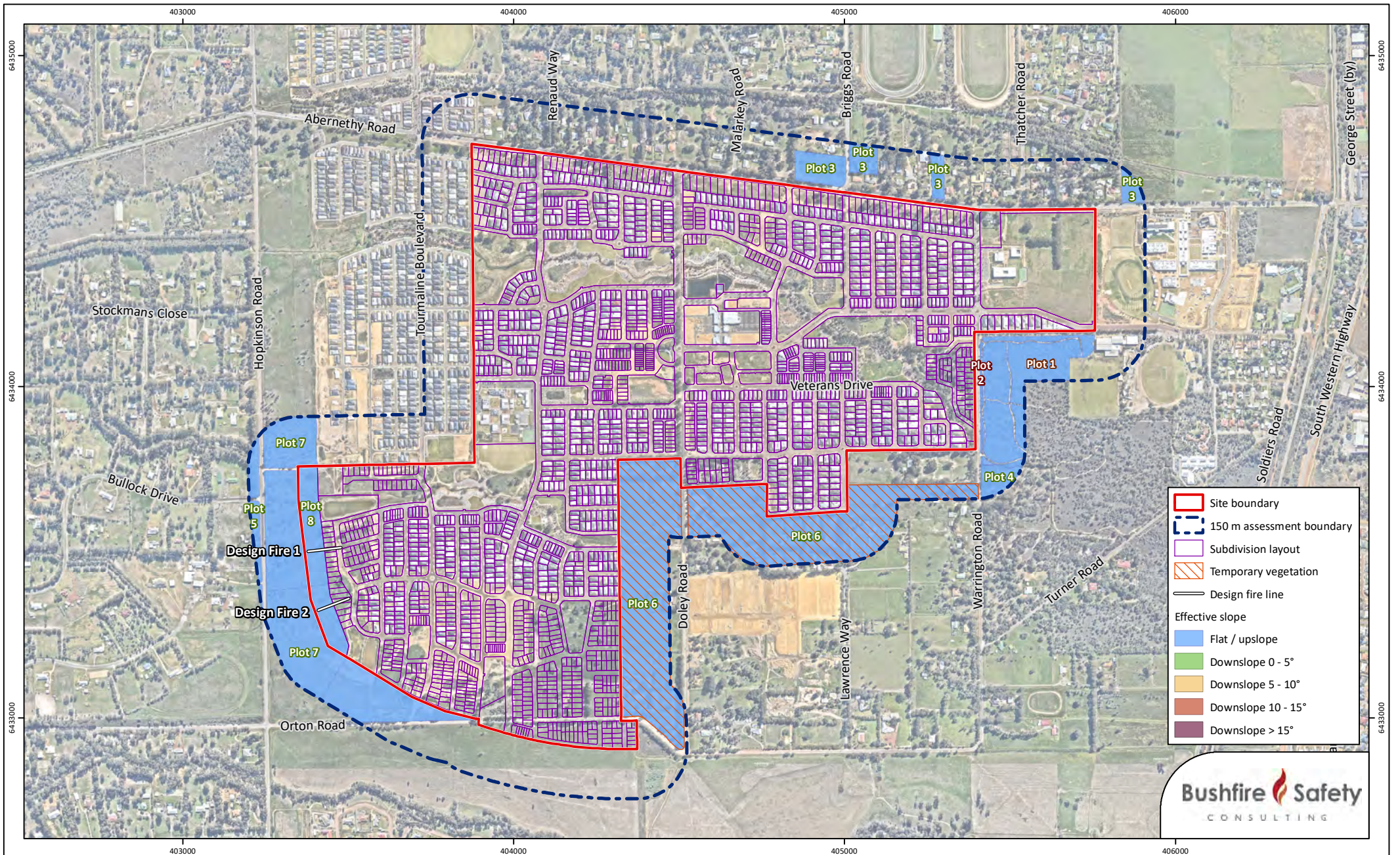


Figure 5: Effective Slope

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment
Client: LWP Property Group Pty Ltd

Plan Number:
EP15-038(11)-F66a
Drawn: SCM
Date: 29/03/2019
Checked: KK
Approved: KK
Date: 29/03/2019



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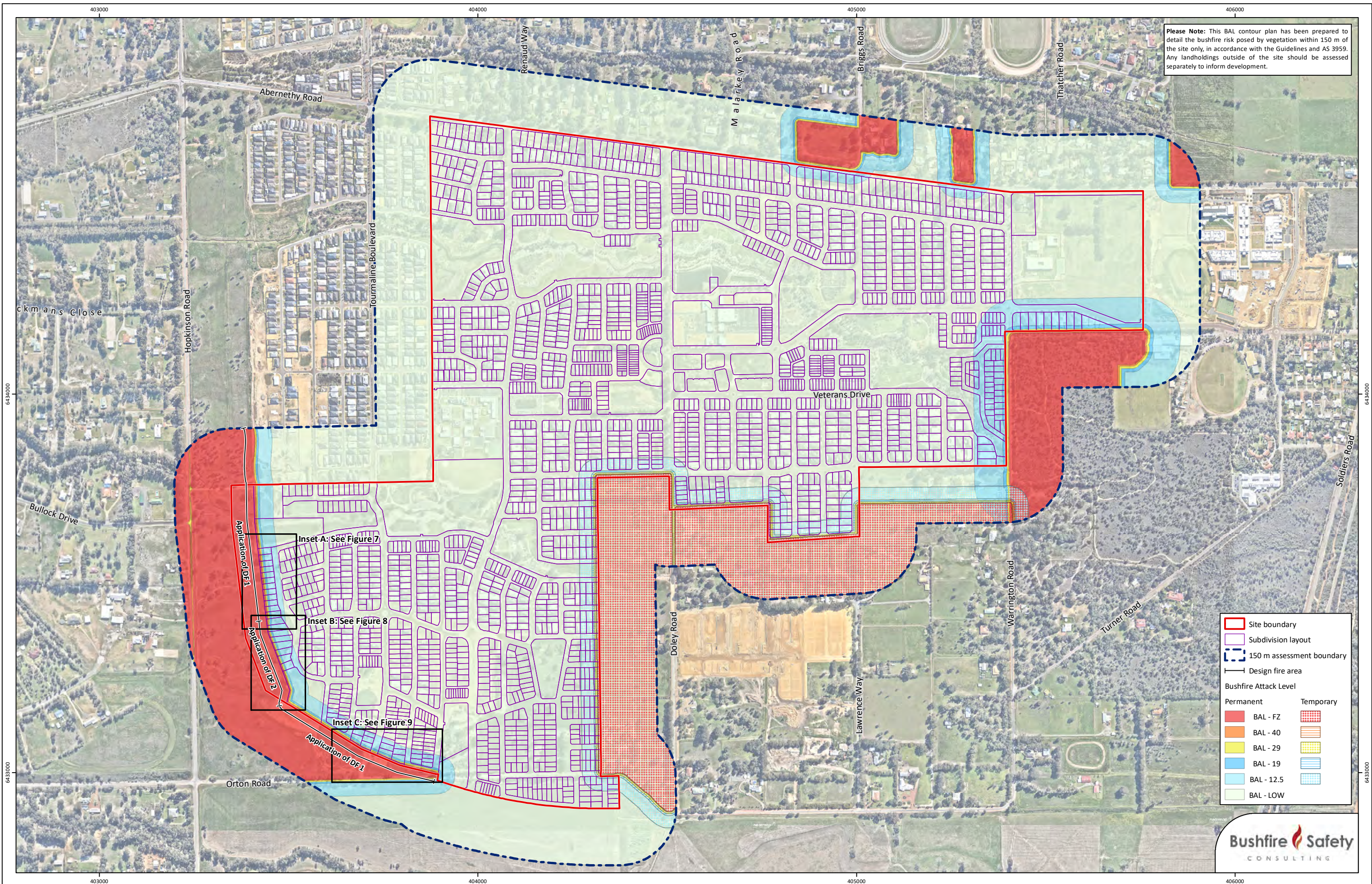


Figure 6: BAL Contour Plan

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment
Client: LWP Property Group Pty Ltd

Plan Number:
EP15-038(11)-F67a
Drawn: SCM
Date: 29/03/2019
Checked: KK
Approved: KK
Date: 29/03/2019



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Scale: 1:9,000@A3
GDA 1994 MGA Zone 50

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ASSOCIATES

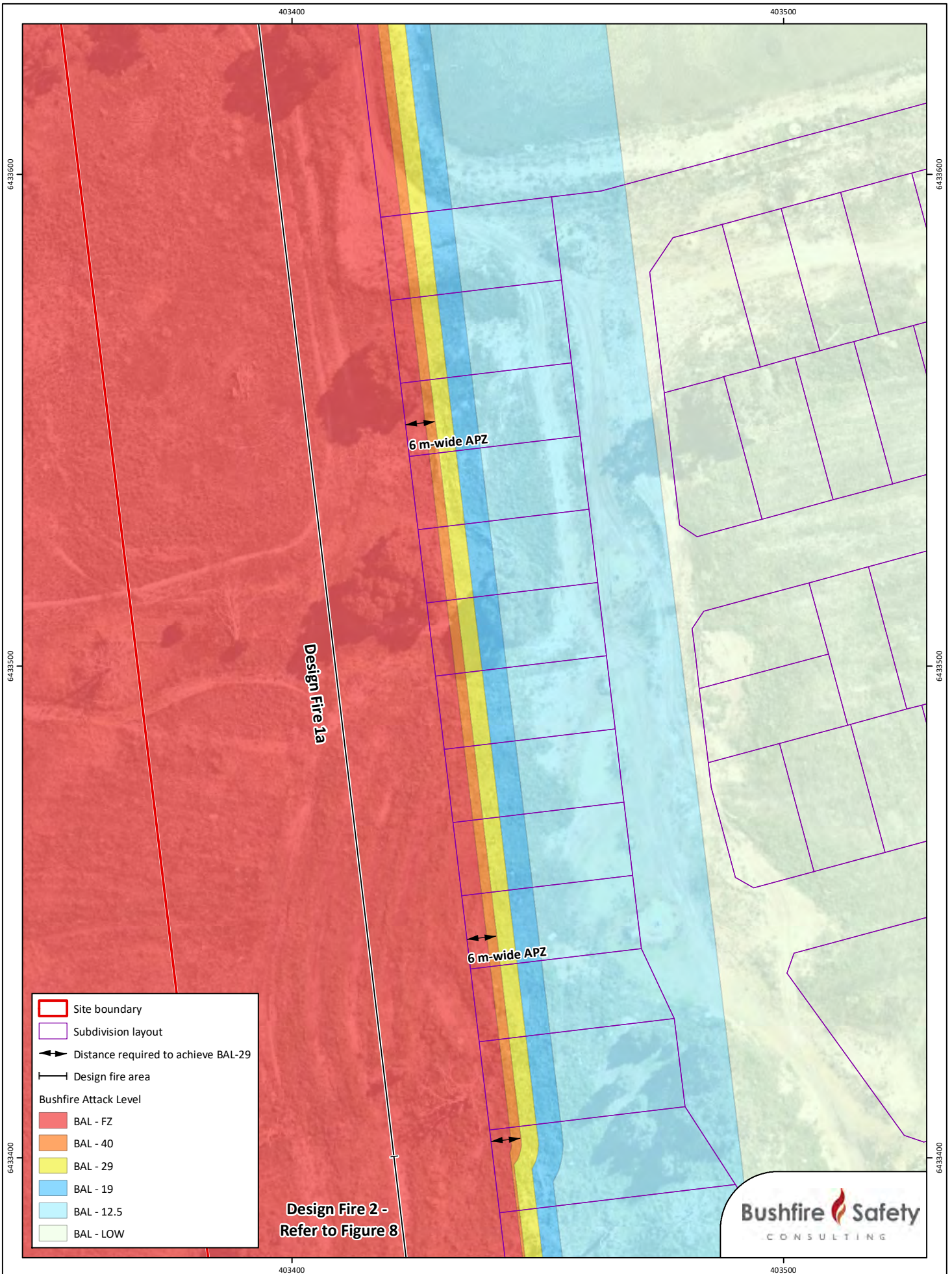


Figure 7: Design Fire 1a BAL Contour Plan

Plan Number:
EP15-038(11)--F94
Drawn: SCM
Date: 03/04/2019
Checked: KK
Approved: KK
Date: 03/04/2019



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Scale: 1:1,000@A4
GDA 1994 MGA Zone 50

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment
Client: LWP Property Group Pty Ltd



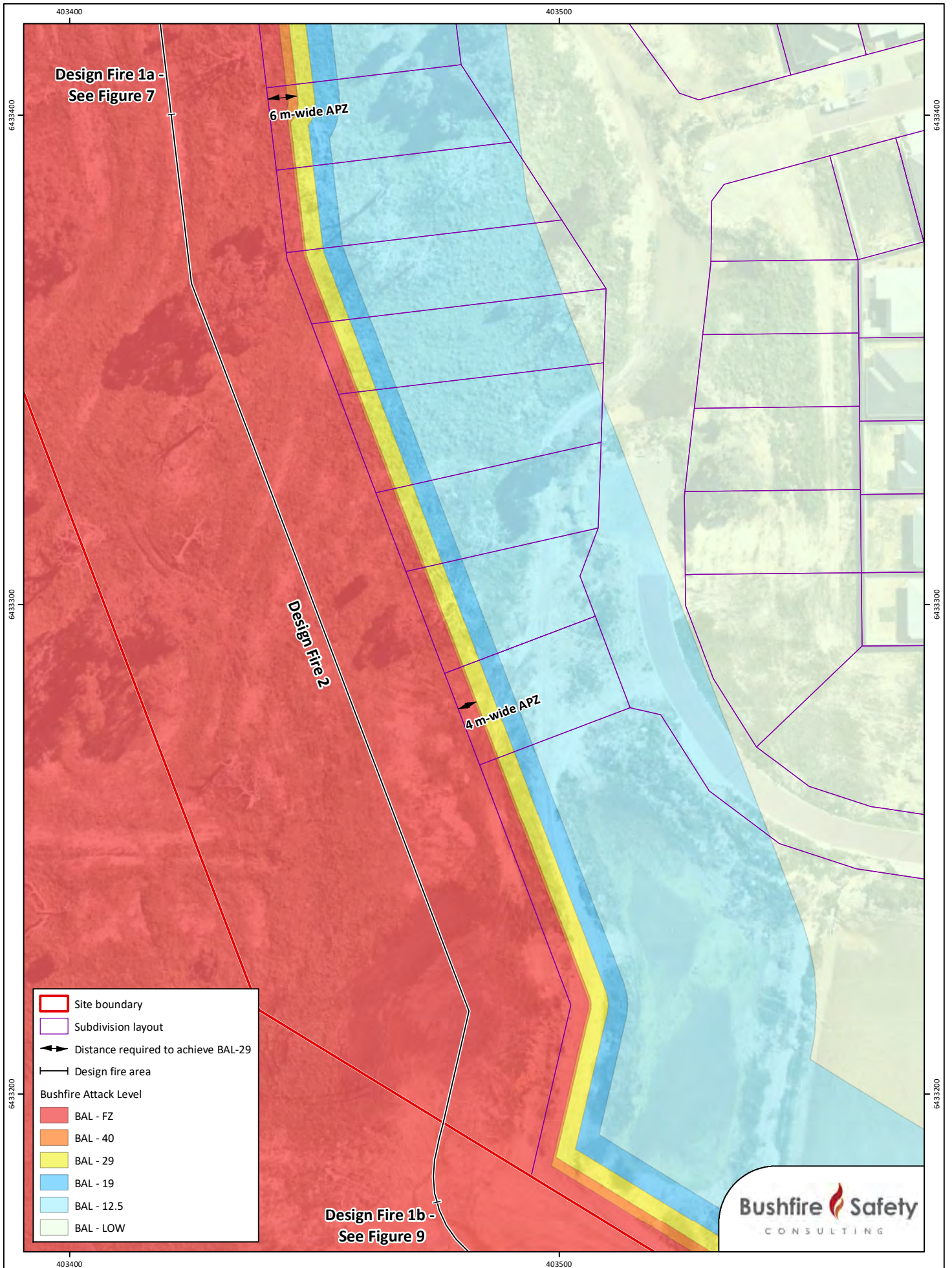
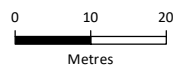


Figure 8: Design Fire 2 BAL Contour Plan

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment

Client: LWP Property Group Pty Ltd

Plan Number: EP15-038(11)--F95
Drawn: SCM
Date: 03/04/2019
Checked: KK
Approved: KK
Date: 03/04/2019



Scale: 1:1,000@A4
GDA 1994 MGA Zone 50



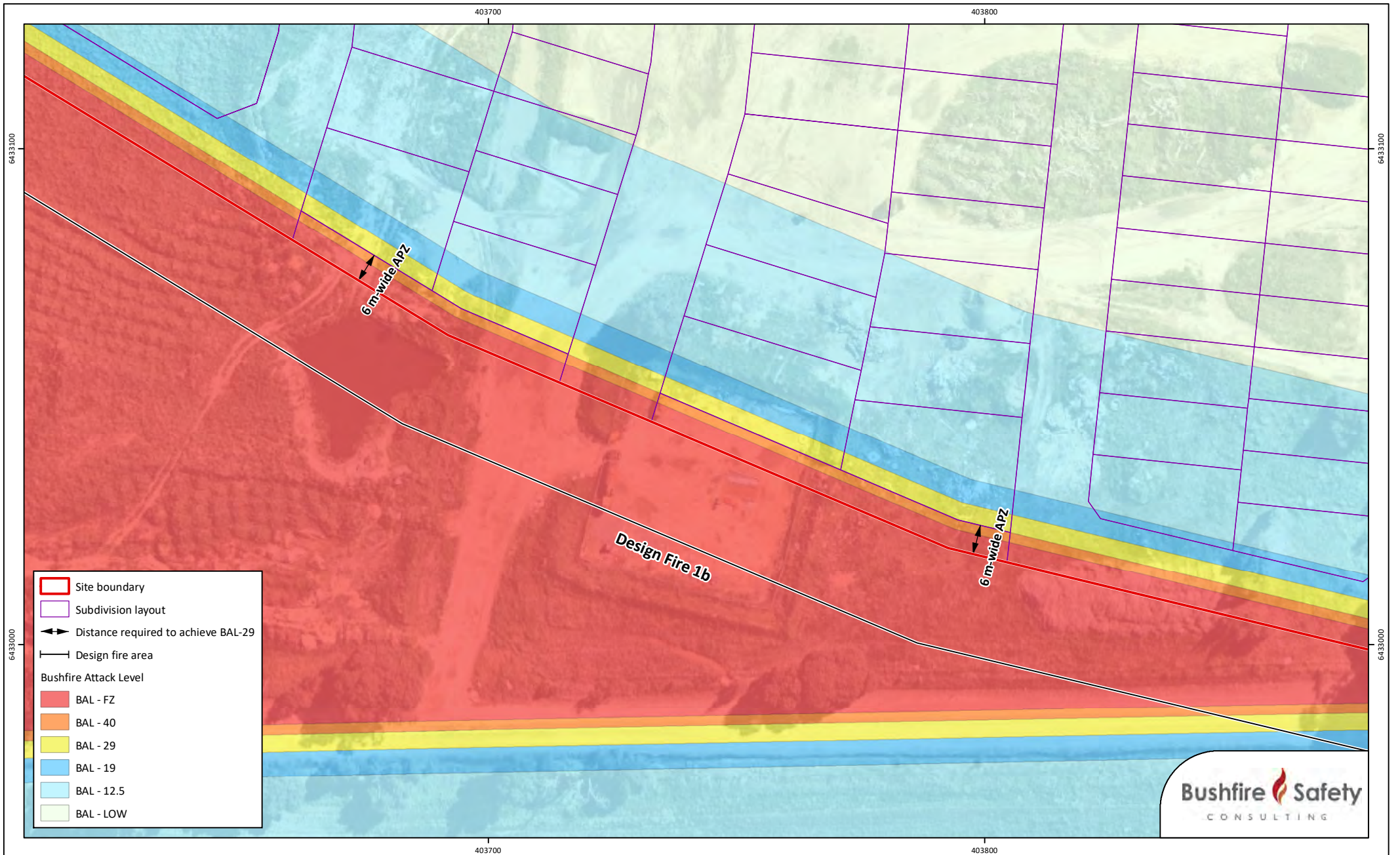


Figure 9: Design Fire 1b BAL Contour Plan

Project: Bushfire Management Plan
The Glades at Byford Local Structure Plan Amendment
Client: LWP Property Group Pty Ltd

Plan Number:
EP15-038(11)-F96
Drawn: SCM
Date: 03/04/2019
Checked: KK
Approved: KK
Date: 03/04/2019



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Scale: 1:1,000@A4
GDA 1994 MGA Zone 50



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Appendix A

The Glades at Byford LSP (TBB 2017)





LEGEND

GLADES STRUCTURE PLAN AREA	
	RESIDENTIAL
	RESIDENTIAL R10
	RESIDENTIAL R12.5
	RESIDENTIAL R20
	RESIDENTIAL R25
	RESIDENTIAL R30
	RESIDENTIAL R40
	RESIDENTIAL R50
	RESIDENTIAL R60

CENTRES	
	VILLAGE CENTRE (RESIDENTIAL R60)
	NEIGHBOURHOOD NODE (RESIDENTIAL R80)
	MIXED-USE (RESIDENTIAL R60)

OPEN SPACE	
	PUBLIC OPEN SPACE AND DRAINAGE
	FORESHORE RESERVE
	DRAINAGE CHANNELS SUBJECT TO DETAILED DESIGN
	30m FORESHORE BUFFER

OTHER	
	COMMUNITY
	SCHOOLS
	400m (5 MINUTE WALK) AND 800m (10 MINUTE WALK) WALKABLE CATCHMENTS
	AREA SUBJECT TO VILLAGE CENTRE LOCAL PLANNING POLICY

- 1 ABERNETHY ROAD TO BE WIDENED TO A 30m RESERVATION AS REQUIRED BY THE SHIRE OF SERPENTINE JARRADALE
- 2 ACCESS ARRANGEMENTS TO ABERNETHY ROAD TO BE DETERMINED AT THE TIME OF SUBDIVISION
- 3 INTEGRATOR B ROADS (30m + ROAD RESERVATION)
- 4 NEIGHBOURHOOD CONNECTOR ROADS (18m-30m ROAD RESERVATION)
- 5 PROPOSED LAKE
- 6 SEWER PUMP STATION
- 7 WATER CORPORATION SERVICE CORRIDOR (60m WIDE) - INDICATIVE
- 8 LOTS TO BE THE SUBJECT OF A DETAILED AREA PLAN ADDRESSING, AMONGST OTHER ITEMS, FIRE MANAGEMENT

NOTE:

1. THE SUBDIVISION AND DEVELOPMENT OF LAND WITHIN THE STRUCTURE PLAN AREA IS TO GENERALLY BE IN ACCORDANCE WITH THE STRUCTURE PLAN. MATTERS OF DETAILED DESIGN (I.e. PROVISION OF REAR LANES, PUBLIC OPEN SPACE, RATIONALISATION LOCAL ROAD ALIGNMENTS AND DETAILED INTERSECTION DESIGN) CAN BE CONSIDERED AND REFINED AT THE SUBDIVISION STAGE. SIGNIFICANT VARIATIONS IN DESIGN OR LAND USE WILL REQUIRE AMENDMENTS TO THE STRUCTURE PLAN IN ACCORDANCE WITH THE PROVISIONS OF CLAUSE 5.18 OF THE SCHEME.
2. THE PROVISION OF REAR LANEWAYS HAS NOT BEEN IDENTIFIED ON THE STRUCTURE PLAN. REAR LANEWAYS WILL BE INCORPORATED WHERE APPROPRIATE AS PART OF DETAILED SUBDIVISION DESIGN.

EXISTING TREES TO BE RETAINED WITHIN ROAD RESERVATIONS WHERE POSSIBLE, FOLLOWING DETAILED DESIGN PROCESS.

AMENDMENT NO.	OCM DATE	DESCRIPTION
1	24.10.11	DENSITY INCREASE (EAST OF VILLAGE CENTRE)
2	26.02.12	DENSITY INCREASE (WEST OF WARRINGTON ROAD)
3	11.06.13	DENSITY AND ROAD LAYOUT CHANGES (WEST OF DOLEY ROAD)
4	26.11.12	REMOVAL OF ROAD ACROSS MUC (WEST OF DOLEY ROAD)
5	10.12.12	DENSITY INCREASE (SOUTH OF FRENDAU WAY)
6	25.02.13	DENSITY INCREASE (WEST OF DOLEY ROAD)
7	09.12.13	ICARIA PRECINCT MODIFIED
8	VARIOUS
9	06.07.17	WOODLAND GROVE PRECINCT MODIFIED
10	VARIOUS

The Glades - Local Structure Plan - Figure 1

Appendix B

Compliance Checklist



Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment

Appendix B: Compliance Checklist

Element/Question	Response	Applicable Section of BMP
1: Location		
Does the proposal comply with the performance criteria by applying acceptable solution A1.1 (development location)?	Yes. Any new dwellings within the site can be located to ensure BAL-29 is not exceeded.	Section 3.1.1
2: Siting and design of the Development		
Does the proposal comply with the performance criteria by applying acceptable solution A2.1 (asset protection zone)?	Yes. Based on the outcomes of the Method 1 and Performance Solution BAL assessment, new dwellings can be located so that BAL-29 is not exceeded.	Section 3.1.2
3: Vehicular access		
Does the proposal comply with the performance criteria by applying acceptable solution A3.1 (two access routes)?	Yes. The internal loop road system connects with the broader public road network within and surrounding the site.	Section 3.1.3.3
Does the proposal comply with the performance criteria by applying acceptable solution A3.2 (public road)?	Yes. All roads will be able to achieve the minimum standards outlined in the Guidelines.	Section 3.1.3.4
Does the proposal comply with the performance criteria by applying acceptable solution A3.3 (cul-de-sac)?	If any permanent and/or temporary cul-de-sacs are proposed as part of future staged development, the applicable standards under Appendix Four of the Guidelines will be met.	Section 3.1.3.5
Does the proposal comply with the performance criteria by applying acceptable solution A3.4 (battle-axe)?	Not applicable.	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.5 (private driveway longer than 50 m)?	Not applicable.	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.6 (emergency access way)?	Not applicable.	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.7 (fire services access routes)?	Not applicable.	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.8 (firebreak width)?	Not applicable.	-
4: Water		
Does the proposal comply with the performance criteria by applying acceptable solution A4.1 (reticulated areas)?	Yes. A reticulated public water supply will be available to development within the site.	Section 3.1.4

Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment

Appendix B: Compliance Checklist (continued)

Element/Question	Response	Applicable Section of BMP
4: Water (continued)		
Does the proposal comply with the performance criteria by applying acceptable solution A4.2 (non-reticulated areas)?	Not applicable.	-
Does the proposal comply with the performance criteria by applying acceptable solution A4.3 (individual lots within non-reticulated areas)?	Not applicable.	-

Appendix C

Method 2 BAL & Performance Solution Methodology



Appendix C: Method 2 BAL & Performance Solution Methodology

Background

Below is an outline of the performance solution that has been applied to the site to calculate the required setbacks to ensure a Bushfire Attack Level (BAL) rating of BAL-29 is not exceeded for future dwellings within the site.

The Performance Solution is based on:

- *International Fire Engineering Guidelines 2005*
- *National Construction Code (NCC)*
- Part A 0.5 Assessment Methods in the Housing Provisions of the *Building Code of Australia 2017 (BCA)*
- *Australian Standard AS 3959 – 2009 Construction of buildings in bushfire prone areas (AS 3959)* (Standards Australia 2009)
- Design Fire modelling based on published research

In addition, Bushfire Safety Consulting has liaised with the Western Australian Department of Fire and Emergency Services (DFES) to ensure that the approach undertaken is in accordance with the requirements of the State Government of Western Australia.

Applicability of Performance Based Solution

In Western Australia, areas are designated as bushfire prone pursuant to the *Fire and Emergency Services Act 1998*. The site is located in an area that has been designated as bushfire prone, and as a result an assessment of the potential bushfire threat is required to determine the BAL rating applicable to the future dwelling. The BAL rating will inform future building construction requirements in accordance with the NCC and the BCA.

The NCC is a performance based code containing all performance requirements for the construction of buildings. It is based on a hierarchy of guidance and code compliance levels, with the Performance Requirements being the minimum level that buildings, building elements, and plumbing and drainage systems must meet. Under the NCC there is no obligation to adopt any particular material, component, design factor or construction method. This provides for a choice of compliance pathways, and the Performance Requirements can be met using either a Performance Solution (alternative solution) or using a Deemed-to-Satisfy (DTS) Solution.

Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment



A Performance Solution is unique for each individual situation and uses one or more of the assessment methods available in the NCC. Part 2.3 (Fire Safety) of the NCC outlines the considerations relevant to constructing buildings in bushfire prone areas and the relevant Performance Requirements. Specifically, under Part 2.3.4, a Class 1 building (including decks) or a Class 10a building that is constructed in a designated bushfire prone area is to be designed and constructed to reduce the risk of ignition from a bushfire, appropriate to:

- The potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire; and
- The intensity of the bushfire attack on the building.

Part 3.7.4 of the NCC provides three compliance options with regard to dwellings constructed in bushfire prone areas, and these include:

1. Complying with *Australian Standard 3959-2009 Construction of buildings in bushfire-prone areas*; or
2. Alternate bushfire protection design as a Performance Solution that meets P2.3.4; or
3. A combination of both Option 1 and Option 2.

The assessment approach applicable to the site is Option 3, and includes considering the reduction in the predicted radiant heat due to the presence of the noise wall with an FRL of 30/30/30, and use of Method 2 as per Appendix B of AS 3959 to determine the overall BAL rating. This has been outlined below. This is based on the methodology described in the International Fire Engineering Guidelines 2005. These Guidelines provide guidance for the design of performance solutions for the BCA in order to establish an acceptable level of compliance with the relevant Performance Requirement.

Assessment Approach

The BAL rating determined by the Performance Solution has been based on the following:

- An assessment of classified vegetation to determine the assumed fuel loads adjacent to the site (following development of the site) and the impact this would have on bushfire behaviour in accordance with AS 3959.
- An assessment of the effective slope beneath areas of classified vegetation.
- A design fire analysis to determine the shielding effect of the future noise wall (adjacent to Tonkin Highway road reserve) where a bushfire occurs within nearby classified vegetation. For the site, a detailed assessment of classified vegetation, effective slope and height of the noise wall was undertaken, which determined that two design fires were required to appropriately consider shielding effects. The location of each is shown in **Figure 4**.
- Analysis of the reduction of the predicted radiant heat flux on a future dwelling within the site due to the shielding provided by a noise wall is based on the wall being constructed to a standard which achieves BAL-FZ standards of AS 3959.
- Modelling of site specific variables such as flame height, fire breadth and subsequent predicted radiant heat flux outputs in accordance with the detailed method for determining BAL ratings (Method 2) as per Appendix B of AS 3959..

An outline of the relevant inputs for the assessment have been provided below.

Classified vegetation and fuel loads

The extent of classified vegetation posing a bushfire risk to the site (within 100 m) in the post-development scenario is shown in **Figure 4**.

The areas subject to this Method 2 BAL assessment are shown in **Figure 6**, and are limited to grassland (Class G) vegetation within the Water Corporation service corridor and Tonkin Highway reserve in the western portion of the site.

Effective slope

Natural topographical contours (DoW 2008) indicate that the site and surrounding area is generally flat with a westerly aspect. Elevation ranges from 49 m Australian Height Datum (m AHD) in the east of the site, to 28 m AHD in the west of the site, as shown in **Figure 1**. Due to the scale of the site this change in elevation does not present a significant slope that would impact the behaviour of a bushfire. Therefore all slopes under classified vegetation are considered effectively flat or upslope.

Radiant heat shielding

A wall built to acoustic standards (primarily for the purpose of reducing the impact of noise emissions from major roads on adjacent sensitive land uses) will also act as a shield against radiant heat produced from an adjacent bushfire. Acoustic walls are generally constructed of non-combustible materials such as compressed fibre cement, limestone/brick, etc. and will need to comply with the standards of BAL-FZ under AS 3959.

As outlined in Section 3.5 of AS 3959, the shielding effect of a radiant heat barrier (e.g. an acoustic wall) can significantly reduce the level of radiant heat exposure for buildings. In order to determine the level to which the radiant heat barrier will shield the site from radiant heat from an adjacent bushfire, the extent of radiant heat that would be produced by the unique site characteristics has been determined.

It is assumed that the noise wall will be composed of patterned wall panels of reinforced concrete, with a design life of 50 years, and will comply with the relevant acoustic standards as well as the requirements of BAL-FZ under AS 3959. The wall will be constructed within the rear of residential lots and is therefore owned by the lot purchaser/s. Maintenance of the wall is the responsibility of the lot owner.

Bushfire Management Plan

The Glades at Byford - Local Structure Plan Amendment

Under AS 3959, radiant heat flux is calculated using the 'view factor' model. The view factor model for an inclined flame requires five inputs including:

- Flame length
- Flame width
- Flame angle
- Elevation of receiver
- Site slope.

The view factor is assessed by an algorithm that tilts the flame as a flat panel emitting radiant heat to determine the worst possible scenario. An assumption of the view factor model is that the radiant heat panel is a blackbody of evenly distributed heat. Using this methodology, any shielding effect can be quantified by determining the proportion of the radiant heat shielded from the receiver.

The accepted method of establishing the reduced radiant heat flux with the influence of the proposed shielding by an acoustic wall with an FRL of 30/30/30 has been adopted. In this regard the view factor of the shielding calculation has been calculated and subtracted from the view factor when calculated without the radiant heat shield. The flame length is reduced by the height of the proposed radiant heat shield.

The performance solution assessment will demonstrate a reduction in flame length and radiant heat to the receiver (dwelling) by altering the view factor by excluding the lowest portion of the forecast flame length. The overall flame length will be reduced by the height of the radiant heat shield (acoustic wall and earth filled site).

Design Fires

The performance solution uses two design fires to assess the variable vegetation classification, vegetation width, slope, and wall height (based on finished lot levels) adjacent to the western boundary of the site.

Design Fire 1 (a and b) and 2 are each based on grassland (Class G) vegetation within the Water Corporation service corridor and Tonkin Highway reserve west of the site, and have been assessed separately based on slightly varying finished lot levels and subsequent differences in the shielding height provided by the noise wall. Both design fires have been assessed at a full 100 m fire run in line with AS 3959. The locations of the design fires are shown in **Figure 4** and **Figure 6**. The inputs and outcomes of the Method 2 performance solution assessments for each design fire are provided in **Attachment 1** and **Attachment 2**, of this appendix. An indicative cross section of Design Fire 1 is shown in **Plate C1** below.

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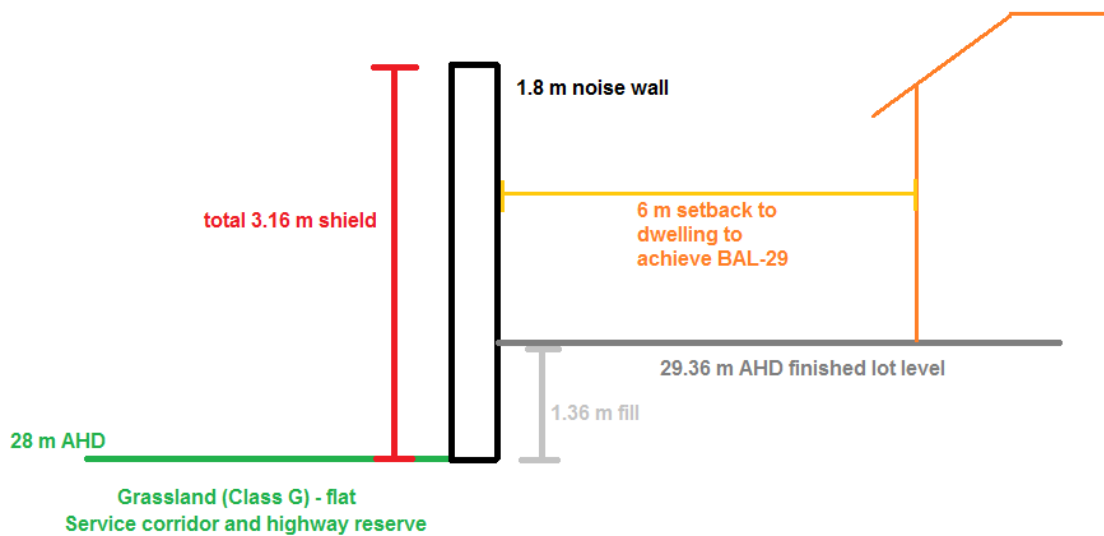


Plate C1: Indicative cross section showing Design Fire 1 (note: drawing not to scale)

BAL assessment and performance solution outcomes

The results of the Method 2 BAL assessments are shown in **Table C1** below, and in **Figure 6**, and are based on:

- Detailed modelling of the behaviour of a potential bushfire moving through the vegetation west of the site.
- The shielding effect of the noise wall
- The provision of an internal Asset Protection Zone of varying widths (where required) to achieve a maximum BAL rating of BAL-29, as discussed in **Section 3.1.2** and based on the distances in **Table C1**.
- The Method 2 assessment methodology outlined in Appendix B of AS 3959 has been used with the default fuel loading based on the assigned fuel loads within the standard.
- The flame temperature assumed for the performance solution is 1200°C, which is greater than the 1090°C flame temperature specified in AS 3959 for Method 1 and Method 2.

These results are incorporated into **Table 4** on page 21 of the BMP. The detailed calculation sheets for each Design Fire are provided in **Attachment 1** and **Attachment 2**.

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Table C1: Results of Method 2 BAL Assessment

Area of classified vegetation	Design fire	Vegetation classification	Effective slope	Distance to classified vegetation	BAL rating
Water Corporation service corridor & Tonkin Highway reserve	1	Grassland (Class G)	Flat	<4 m	BAL-FZ
				4-6 m	BAL-40
				6-9.5 m	BAL-29
				9.5-14.5 m	BAL-19
				14.5-50 m	BAL-12.5
	2	Grassland (Class G)	Flat	<3.5 m	BAL-FZ
				3.5-4 m	BAL-40
				4-7.5 m	BAL-29
				7.5-11.5 m	BAL-19
				11.5-50 m	BAL-12.5

Attachment 1

Design Fire 1a and b BAL Calculation Sheets





Calculated October 27, 2017, 3:50 pm (RHBC v.1.2)

The Glades Design Fire 1 - BAL-40 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	55 °
Overall fuel load	4.5 t/ha	Elevation of receiver	1.43 m
Vegetation height	n/a	Effective barrier height	3.16 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	19 °	Transmissivity	0.901
Distance to vegetation	4 m	Viewfactor	0.725
Flame width	100 m	Radiant heat flux	73 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.3306
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.3944
Flame temperature	1,200 K	Adjusted radiant heat flux	39.71 kW/m ²
Actual barrier height	3.16 m	Bushfire Attack Level	BAL-40

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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



Calculated October 27, 2017, 3:53 pm (RHBC v.1.2)

The Glades Design Fire 1 - BAL-29 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	69 °
Overall fuel load	4.5 t/ha	Elevation of receiver	1.82 m
Vegetation height	n/a	Effective barrier height	3.16 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	13 °	Transmissivity	0.89
Distance to vegetation	6 m	Viewfactor	0.5225
Flame width	100 m	Radiant heat flux	51.95 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.2315
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.2909
Flame temperature	1,200 K	Adjusted radiant heat flux	28.93 kW/m ²
Actual barrier height	3.16 m	Bushfire Attack Level	BAL-29

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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



Calculated October 27, 2017, 3:54 pm (RHBC v.1.2)

The Glades Design Fire 1 - BAL-19 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	77 °
Overall fuel load	4.5 t/ha	Elevation of receiver	2.01 m
Vegetation height	n/a	Effective barrier height	3.16 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	8 °	Transmissivity	0.875
Distance to vegetation	9.5 m	Viewfactor	0.3472
Flame width	100 m	Radiant heat flux	33.94 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.1558
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.1913
Flame temperature	1,200 K	Adjusted radiant heat flux	18.71 kW/m ²
Actual barrier height	3.16 m	Bushfire Attack Level	BAL-19

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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



Calculated October 27, 2017, 3:56 pm (RHBC v.1.2)

The Glades Design Fire 1 - BAL-12.5 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	82 °
Overall fuel load	4.5 t/ha	Elevation of receiver	2 m
Vegetation height	n/a	Effective barrier height	3.16 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	5.5 °	Transmissivity	0.857
Distance to vegetation	14.5 m	Viewfactor	0.2307
Flame width	100 m	Radiant heat flux	22.09 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.1048
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.1259
Flame temperature	1,200 K	Adjusted radiant heat flux	12.05 kW/m ²
Actual barrier height	3.16 m	Bushfire Attack Level	BAL-12.5

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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

Attachment 2

Design Fire 2 BAL Calculation Sheets





Calculated October 27, 2017, 3:57 pm (RHBC v.1.2)

The Glades Design Fire 2 - BAL-40 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	64 °
Overall fuel load	4.5 t/ha	Elevation of receiver	0.98 m
Vegetation height	n/a	Effective barrier height	3.9 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	31 °	Transmissivity	0.901
Distance to vegetation	3.5 m	Viewfactor	0.7384
Flame width	100 m	Radiant heat flux	74.36 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.4436
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.2948
Flame temperature	1,200 K	Adjusted radiant heat flux	29.68 kW/m ²
Actual barrier height	3.9 m	Bushfire Attack Level	BAL-40

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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



Calculated October 27, 2017, 3:59 pm (RHBC v.1.2)

The Glades Design Fire 2 - BAL-29 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	69 °
Overall fuel load	4.5 t/ha	Elevation of receiver	1.08 m
Vegetation height	n/a	Effective barrier height	3.9 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	28 °	Transmissivity	0.898
Distance to vegetation	4 m	Viewfactor	0.6779
Flame width	100 m	Radiant heat flux	68.02 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.3979
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.2799
Flame temperature	1,200 K	Adjusted radiant heat flux	28.09 kW/m ²
Actual barrier height	3.9 m	Bushfire Attack Level	BAL-29

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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



Calculated October 27, 2017, 4:00 pm (RHBC v.1.2)

The Glades Design Fire 2 - BAL-19 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	80 °
Overall fuel load	4.5 t/ha	Elevation of receiver	1.23 m
Vegetation height	n/a	Effective barrier height	3.9 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	16 °	Transmissivity	0.882
Distance to vegetation	7.5 m	Viewfactor	0.4214
Flame width	100 m	Radiant heat flux	41.52 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.2395
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.1818
Flame temperature	1,200 K	Adjusted radiant heat flux	17.92 kW/m ²
Actual barrier height	3.9 m	Bushfire Attack Level	BAL-19

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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



Calculated October 27, 2017, 4:01 pm (RHBC v.1.2)

The Glades Design Fire 2 - BAL-12.5 output

Radiant Heat Barrier calculator - AS3959-2009 (Method 2)

Inputs		Outputs	
Grassland Fire Danger Index	110	Rate of spread	14.3 km/h
Vegetation classification	Grassland	Flame length	6.87 m
Surface fuel load	4.5 t/ha	Flame angle	83 °
Overall fuel load	4.5 t/ha	Elevation of receiver	1.27 m
Vegetation height	n/a	Effective barrier height	3.9 m
Effective slope	0 °	Fire intensity	33,247 kW/m
Site slope	10.5 °	Transmissivity	0.866
Distance to vegetation	11.5 m	Viewfactor	0.2867
Flame width	100 m	Radiant heat flux	27.76 kW/m ²
Windspeed	n/a	Viewfactor of barrier	0.1626
Heat of combustion	18,600 kJ/kg	Adjusted viewfactor	0.1241
Flame temperature	1,200 K	Adjusted radiant heat flux	12.02 kW/m ²
Actual barrier height	3.9 m	Bushfire Attack Level	BAL-12.5

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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

Appendix D

Additional Information



About Australian Standard 3959-2009 (AS 3959)

Australian Standard 3959-2009 Construction of buildings in bushfire prone areas (AS 3959) (Standards Australia 2009) specifies requirements for the construction of buildings in designated bushfire prone areas in order to improve their resistance to bushfire attack from embers, radiant heat, flame contact, and combinations of these attack forms. In Western Australia, bushfire prone areas are designated within the *Map of Bush Fire Prone Areas*, prepared on behalf of the Fire and Emergency Services Commissioner by the Office of Bushfire Risk Management.

The objective of AS 3959 is to provide detailed methods for assessing bushfire attack and to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:

- Potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire.
- Intensity of the bushfire attack on the building.

The Bushfire Attack Level (BAL) rating is determined through identification and assessment of the following parameters:

- Fire Danger Index (FDI) rating of 80, as assumed for Western Australian sites.
- All vegetation within 100 m of the site is assessed as either being classified vegetation or an exclusion area.
 - Exclusions are those areas which comprises of low threat vegetation and non-vegetated areas, and are defined as:
 - Vegetation of any type that is more than 100 m from the site.
 - Single areas of vegetation less than 1 hectare (ha) in area and not within 100 m of other areas of vegetation being classified.
 - Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other.
 - Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified.
 - Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.
 - Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.
 - Classified vegetation can be grouped into one of seven classes:
 - Forest (Class A).
 - Woodland (Class B).
 - Shrubland (Class C).
 - Scrub (Class D).
 - Mallee/Mulga (Class E).
 - Rainforest (Class F).
 - Grassland (Class G).

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- Separation distance between the site and the classified vegetation source/s.
- Slope of the land under the classified vegetation. The effective slope under areas of classified vegetation will impact the direction and rate of spread of a bushfire, where it is assumed that fires travel slower down a hill, compared to flat or upslope areas.
 - Examples of effective slope are shown in **Plate D1**.

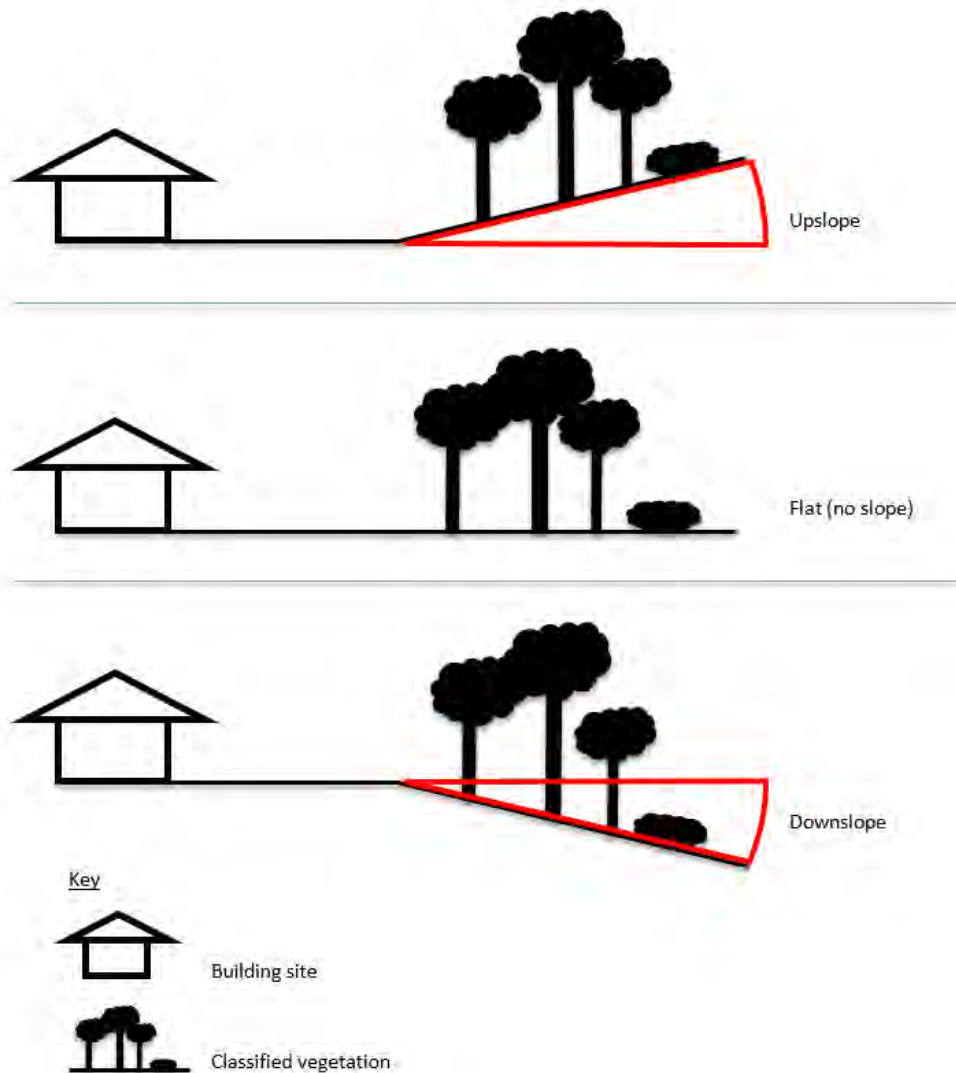


Plate D1: Examples of effective slope (Source: AS 3959).

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Based on the above assumptions and parameters which are used for either a Method 1 or Method 2 assessment, the site is assigned one of six BAL ratings: BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ, which are based on heat flux exposure thresholds. Each BAL rating is associated with appropriate construction standards that apply as a minimum for buildings in bushfire prone areas (as per AS 3959). A summary of each BAL rating, associated heat flux and applicable section of AS 3959 has been summarised in **Table D1**.

Table D1: Summary of BAL ratings, heat flux thresholds and associated construction standards (AS 3959).

BAL rating	Classified Vegetation within 100 m of the site and heat flux exposure thresholds	Description of predicted bushfire attack and levels of exposure	Relevant Section/s in AS 3959
BAL-LOW	See Clause 2.2.3.2 within AS 3959.	There is insufficient risk to warrant any specific construction requirements.	4
BAL-12.5	≤12.5 kilowatt per square meter (kW/m ²)	Ember attack.	3 and 5
BAL-19	>12.5 kW/m ² to ≤19 kW/m ²	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux.	3 and 6
BAL-29	>19 kW/m ² to ≤29 kW/m ²	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux.	3 and 7
BAL-40	>29 kW/m ² to ≤40 kW/m ²	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux with the increased likelihood of exposure to flames.	3 and 8
BAL-FZ	>40 kW/m ²	Direct exposure to flames within the flame zone (FZ) from fire front in addition to heat flux and ember attack.	3 and 9

Notwithstanding the precautions adopted in this document, it should always be remembered that bushfires burn under a wide range of conditions. An element of risk, no matter how small always remains. The objective of AS 3959 is to “prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the front passes” (Standards Australia 2009). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be lost.

Asset Protection Zones (APZ)

One of the most important bushfire protection measures influencing the safety of people and property is to create an Asset Protection Zone (APZ) around buildings. The APZ is a low fuel area immediately surrounding a building. Non-flammable features such as irrigated landscapes, gardens, driveways and roads can form parts of an APZ.

Managing vegetation in the APZ has two main purposes:

- To reduce direct flame contact and radiant heat from igniting the building during the passage of a fire front.
- To reduce ember attack and provide a safer space for people to defend (if required) before, during and after a fire front passes.

The *Guidelines for Planning in Bushfire Prone Areas* (the Guidelines) (WAPC and DFES 2017) state that an APZ needs to be wide enough to ensure that the maximum BAL rating for buildings adjacent to classified vegetation will not exceed BAL-29. The construction of habitable buildings is restricted in APZ areas.

It is recommended that within the site boundary the landowner consider the following:

- **Location:** Within the boundaries of the lot on which the future dwelling is situated and includes the verge.
- **Fine fuel load:** Reduced to and maintained at two tonnes per hectare.
- **Trees:** No trees located within two metres of the future dwelling and branches do not overhang the future dwelling within four metres. Crowns are a minimum distance of ten metres apart. A small group of trees within close proximity to one another may be treated as one crown provided the combined crowns do not exceed the area of a large or mature crown size for that species.
- **Shrubs:** No tall shrubs (i.e. greater than 1 m high) located within two metres of the future dwelling.
- **Fences:** Any fences within the APZ are constructed of non-combustible materials (see AS 3959 for further information).
- **Sheds:** Sheds within the APZ are constructed of non-combustible materials (or meet the requirements of AS 3959) and should not store volatile materials.

Shielding provisions

Under AS 3959 the construction requirements for the next lower BAL rating determined for a dwelling may be applied to the elevation of the building not exposed to the source of bushfire attack. For example, if the building was rated at BAL-19, certain elevations may only need to meet the building standards applicable to a BAL rating of BAL-12.5. Under AS 3959, an elevation is deemed to not be subject to the source of bushfire attack if all straight lines between the elevation and source of bushfire attack are obstructed by another part of the building. Examples of this are shown within **Plate D2** below.

It should be noted that where a BAL rating of BAL-12.5 or higher applies, the minimum construction standard, regardless of shielding, will be BAL-12.5. It is possible that the shielding provisions outlined above will apply to the future dwelling, with some elevations potentially subject to BAL-19. The specific elevations subject to shielding will be dependent upon the proposed building design. Separate specific advice on the applicable BAL ratings to different elevations can be provided upon request.

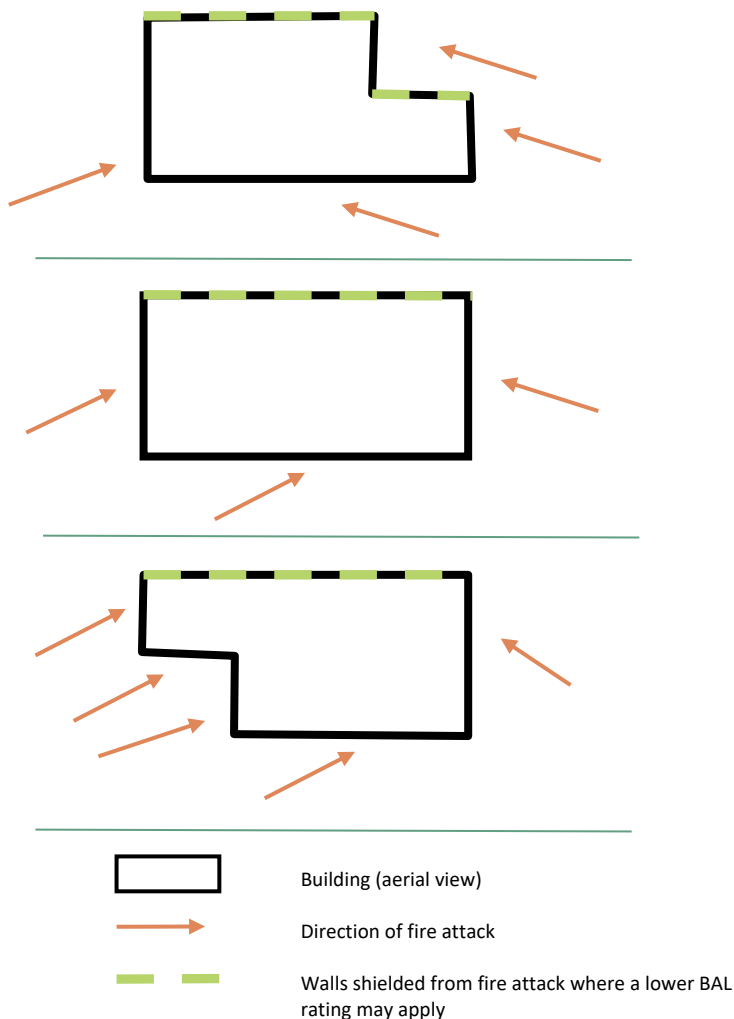


Plate D2: Examples of walls subject to shielding (Source: Standards Australia 2009)