

Marsden Park Industrial Precinct Bushfire Constraints Assessment

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Executive Summary

This report considers the bushfire hazard located across the Marsden Park Industrial Precinct (MPIP) and identifies any limitations to development, integrated bushfire and environmental management actions as well as the location and adequacy of emergency response facilities. The bushfire hazard across the site is generally considered to be low, reflecting the flat topology across the majority of the site and low fuel accumulation levels associated with the grassy woodland vegetation that is prevalent. This report has demonstrated that development at the subject site can meet the requirements of *Planning for Bushfire Protection* (PBP) (NSW RFS 2006b) given the incorporation of a number of strategies designed to minimise the risk from bushfire.

A number of strategies have been provided in the form of planning controls such that the risk from bushfire can be minimised and further that the approvals process can be streamlined.

Asset Protections Zones (APZ) are a key component of bushfire planning and the issue which often has the greatest impact on development yields. Residential APZs have been addressed, as a guide for industrial development, according to the specifications contained within PBP 2006. Based on the bushfire hazard analysis, 25m APZs have been recommended adjacent to Bells Creek Riparian Zone, 15m APZs have been recommended adjacent to surrounding 'Woodland' vegetation and 10m APZs have been recommended adjacent to the thin riparian zone extending from Dora Creek in the south-east. The size of each zoning parcel is more than adequate to accommodate the required APZs.

Perimeter roads are provided along the western non-certified areas boundary and in particular around each residential area. For a variety of reasons, the provision of a perimeter road is deemed essential and it is anticipated that in most situations, required APZs can be wholly contained within the perimeter road easement and standard setbacks (6 metres). Therefore, for urban design inputs, it is likely that provision of an adequate perimeter road system will meet setback, access and egress requirements.

Water supply is to be via a ring main system, engineered to the requirements of *AS 2419.1-1994 Fire Hydrant Installations* (SAI Global, 1994).

With regards to construction, later stages of site development will need to consider the requirements of Appendix 3 of PBP 2006 and *AS 3959-1999 Construction of Buildings in Bushfire Prone Areas* (SAI Global, 1999).

Specifications for management of ecological bushfire regimes within the Conservation areas have also been provided, emphasising the need to implement regimes consistent with the *DEC Guidelines for Ecologically Sustainable Fire Management* (DEC, 2004)

Finally, Department of Planning (DoP) should undertake consultation with the NSW Rural Fire Service (RFS) and NSW Fire Brigades (NSW FB) when the draft Indicative Layout Plan is finalised. The purpose of this consultation is to advise the RFS and NSW FB of the proposed land use changes, to discuss any operational changes required due to this change in land use (including additional emergency resources that may be required). In addition, Council will need to review its bushfire prone land mapping (according to NSW RFS 2006) with regard to land use changes and also incorporating "environmental lands" or other areas that may pose a threat into the future (if not already).

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1. Introduction

1.1 Aims and Structure of Report

This report aims to identify potential bushfire constraints to future development of the Marsden Park Industrial Precinct (hereafter referred to as the precinct).

The objectives of the report are to:

1. Ensure statutory requirements for bushfire protection are met; and
2. Achieve innovative management frameworks across bushfire and vegetation issues which enable long term conservation and management of these issues while facilitating development outcomes for the site.

The report assesses the potential bushfire hazard across the site, in the context of existing remnant vegetation as well as the potential for revegetation. It then identifies planning requirements as per *Planning for Bushfire Protection (PBP)* (NSW RFS 2006b).

Management of Asset Protection Zones (APZ) and environmental areas are considered. The location of emergency response facilities is mapped and the potential for future emergency response resources is discussed. Potential planning controls that integrate with PBP 2006 are also presented as are requirements for staged development.

1.2 Study Area

The study area is located within the North West Sydney growth centre in the suburb of Marsden Park, New South Wales. The precinct is the first to be released under the NSW Government's Precinct Acceleration Protocol, which allows planning and development to proceed earlier than proposed by the Growth Centres Commission. The precinct falls within the Blacktown City Local Government Area (LGA). The study area is larger than the current precinct boundary as the precinct boundary is currently under review.

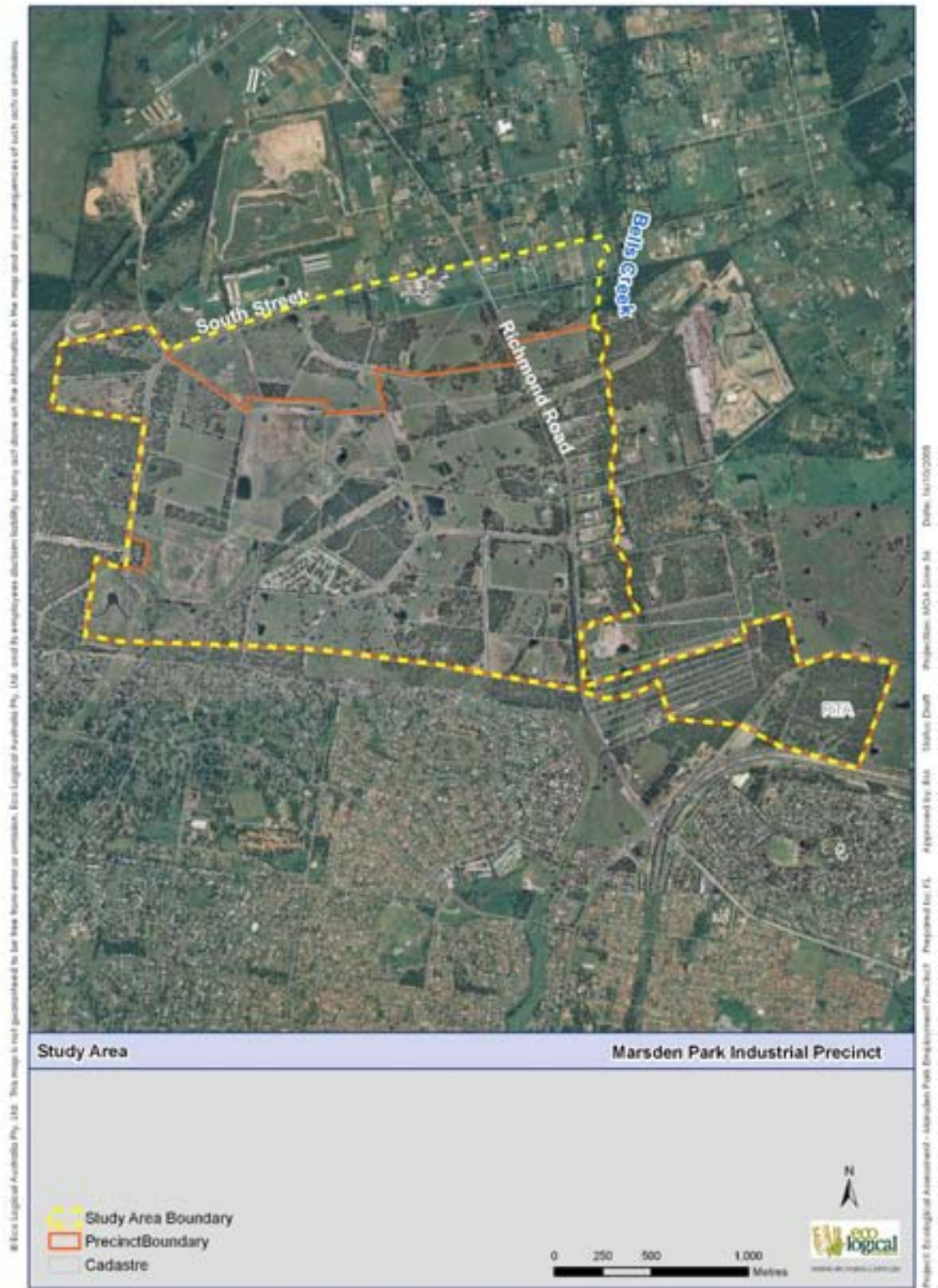
The study area includes approximately 548.7ha of land that is bounded to the north and west by South Street, Bells Creek to the east, and Hassell Grove to the south. Figure 1 illustrates the broad location of the study area. The study area incorporates a number of landowners, including Marsden Park Developments Pty Ltd, private landowners, the Town and Country Caravan Park, Valad Property Group, the Ahmadiyya Muslim Association of Australia, Winten Property Group, the RTA and small businesses along Richmond Road.

1.3 Proposed Zonings

The study area is planned for rezoning primarily for industrial and business uses with some areas planned for residential use. The planned zonings are shown in (figure 3) and include:

- Business Park,
- Business Development
- Light Industrial,
- Low Density Residential,
- Medium Density Residential,
- Conservation Areas
- Drainage and Infrastructure
- Recreation Area
- Riparian Corridor and
- Roads

Figure 1 Study Area



1.4 Legislative Requirements

1.4.1 *Environmental Planning and Assessment Act 1979*

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments, such as the NSW *Threatened Species Conservation Act 1995* (TSC Act) and *Rural Fires Act 1997* (RF Act) are integrated with the EP&A Act.

LEP requirements in relation to bushfire are identified through Direction 19, under Section 117 of the EP&A Act. This direction effectively points to the need to satisfy the requirements of *Planning for Bushfire Protection* (NSW RFS, 2006). This direction requires councils to consult with the Rural Fire Service (RFS) through section 62, and have regard to the planning principles of PBP (NSW RFS 2006b) as follows:

1. Provision of a perimeter road with two way access which delineates the extent of the intended development;
2. Provision, at the urban bushland interface, for the establishment of adequate asset protection zones for future housing;
3. Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads;
4. Minimising the perimeter of the area of land, interfacing the hazard, which may be developed;
5. Introduction of controls which avoid placing inappropriate developments in hazardous areas; and
6. Introduction of controls on the placement of combustible materials in asset protection zones.

1.4.2 *Threatened Species Conservation Act 1995*

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The TSC Act is integrated with the EP&A Act and requires consideration of whether a development (Part 4 of the EP&A Act 1974) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

In relation to bushfire, the TSC Act also identifies high frequency fire regimes as a key threatening process.

1.4.3 *Rural Fires Act, 1997*

Bushfire issues are regulated by the *Rural Fires Act, 1997* (RF Act). Both the EP&A Act and the RF Act were modified by the *Rural Fires and Environmental Assessment Legislation Amendment Act*, in 2002 to enhance bushfire protection through the development assessment process (NSW RFS 2006b).

Key requirements of the RF Act include:

- The need for a bushfire safety authority to be issued by the RFS under section 100B of the RF Act for any development applications for subdivision (therefore considered integrated development); and
- All landowners to exercise a duty of care to prevent bushfire from spreading on or from their land under section 63 of the RF Act. This relates to the appropriate provision and maintenance of APZs, landscaping and any retained vegetation when developing land (NSW RFS 2006b).

2. Bushfire Hazard Assessment

The bushfire hazard was assessed in the field and using recent aerial photographs for at least a distance of 140m from the subject site (in line with PBP 2006) in order to address the potential bushfire threat from both within and outside of the site and allow for a prediction of required asset protection zones for future development.

Vegetation

Vegetation was assessed according to Keith (2004). Vegetation on the study site currently consists of patches of native vegetation communities comprising of 'Woodland' vegetation formation with patches of 'Forest' vegetation formation within the riparian corridor.

Slope

Slope was assessed across the site using 2m contours. Slope was generally less than 5 degrees across the entire site. The following slope categories have been used to identify **relative** potential future bushfire hazard across the site;

- 0 = very low
- $>0^{\circ} - 5^{\circ}$ = low
- $>5^{\circ} - 10^{\circ}$ = moderate
- $>10^{\circ} - 15^{\circ}$ = high
- $>15^{\circ} - 18^{\circ}$ = very high
- $>18^{\circ}$ = extreme

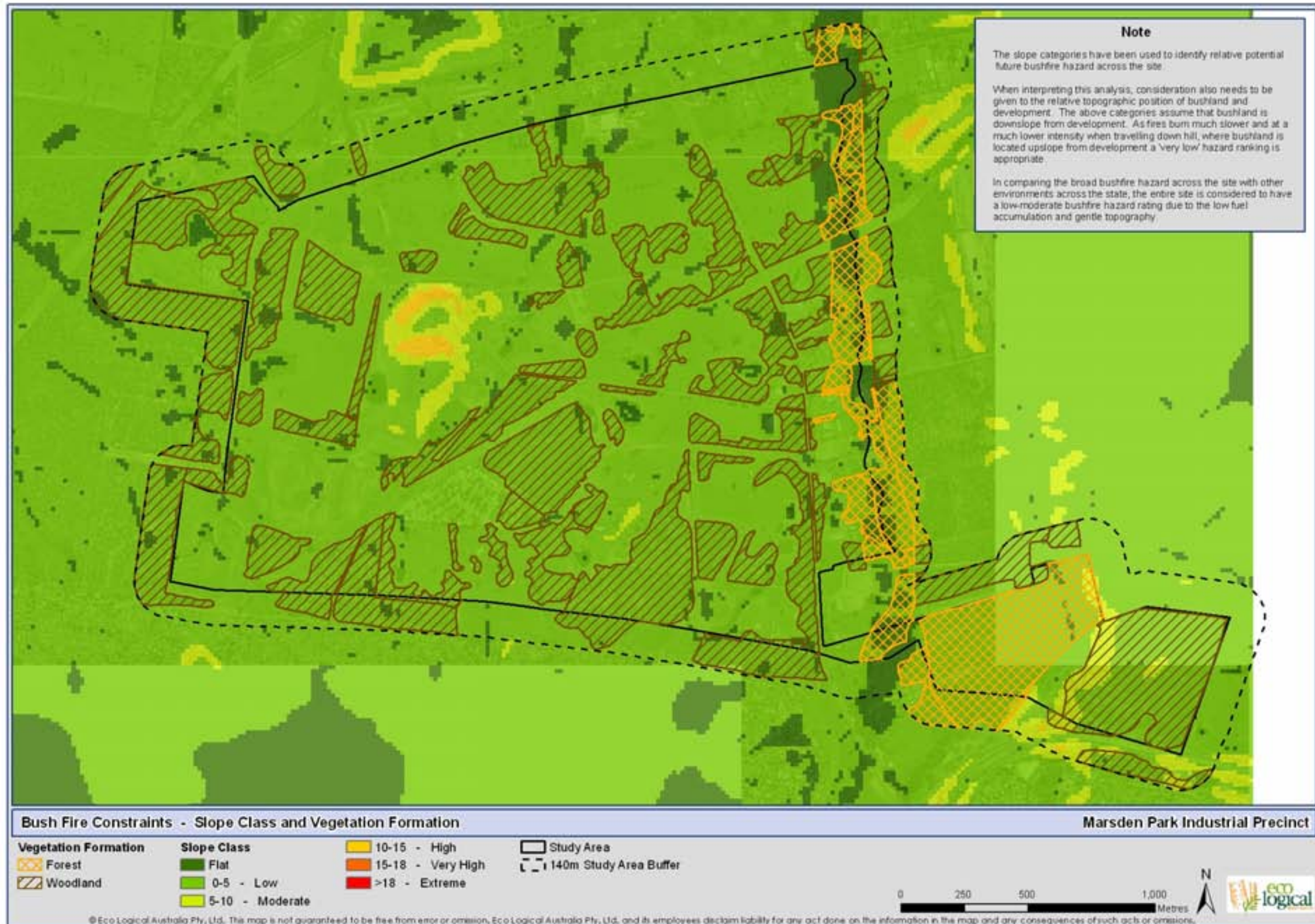
When interpreting this analysis, consideration also needs to be given to the relative topographic position of bushland and development. The above categories assume that bushland is downslope from development. As fires burn much slower and at a much lower intensity when travelling down hill, where bushland is located upslope from development a 'very low' hazard ranking is appropriate.

Conclusions

In comparing the assessed bushfire hazard across the site with other environments across the state the site is considered to have a low-moderate hazard rating. Figure 2 shows the relative hazard rating across the site as well as an indication of the required APZs for these areas. Table 1 and Figure 2 have been used in conjunction to estimate indicative APZ distances for different areas across the site (see section 3.1.1).

In interpreting the hazard assessment map consideration needs to be given to future vegetation. The hazard assessment map considers that the site will be vegetated. However, It is assumed that once development begins all vegetation outside of the Conservation and Non-certified lands, and riparian corridors will be cleared or managed as open space (such that it would no longer be considered bushfire prone) while areas within the non-certified lands and riparian corridors will be actively regenerated (and comprise the future bushfire prone vegetation). Clearly if there is no vegetation, the bushfire hazard will be 'very low' across the majority of the site with the only chance of bushfire attack coming from the regenerated areas and offsite (eg Shanes Park to the west).

Figure 2 Bushfire Hazard Assessment



3. Planning for Bushfire Protection (2006) Assessment

3.1 Assessment Framework

The following section outlines the how various types of development proposed for the site (through the rezoning) will be assessed if the proposed rezoning is approved.

3.1.1 Industrial

Commercial, employment and/or industrial uses are classified in PBP 2006 as 'Other Development'. As such these developments need to satisfy the aims and objectives of PBP and the proposal will need to incorporate these considerations along with an adequate combination of relevant bushfire protection measures (BPM). Generally, the BPMs listed in PBP 2006 for residential development can be used as a guide and are discussed in the following sections. The aim and objectives of PBP 2006 are as follows.

Aim of PBP

to use the NSW development assessment system to provide for the protection of human life (including firefighters) and to minimise impacts on property from the threat of bush fire, while having due regard to development potential, on-site amenity and protection of the environment.

Objectives of PBP

- (i) afford occupants of any building adequate protection from exposure to a bush fire;*
- (ii) provide for a defensible space to be located around buildings;*
- (iii) provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;*
- (iv) ensure that safe operational access and egress for emergency service personnel and residents is available;*
- (v) provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ); and*
- (vi) ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bush fire fighting).*

3.1.2 Residential

Residential development will be assessed under section 100B of the RF Act and a Bush Fire Safety Authority (BFSA) must be obtained from the NSW Rural Fire Service (RFS). Section 100B of the RF Act specifies conformance with the intent and performance criteria of the Bushfire Protection Measures outlined in PBP. The bushfire protection measures relevant to 100B of the RF Act within PBP 2006 are listed below:

- *The provision of clear separation of buildings and bushfire hazards, in the form of fuel-reduced APZ (and their subsets, inner and outer protection areas and defensible space);*
- *Construction standards and design;*
- *Appropriate access standards for residents, fire fighters, emergency service workers and those involved in evacuation;*
- *Adequate water supply and pressure;*
- *Emergency management arrangements for fire protection and/or evacuation; and*
- *Suitable landscaping, to limit fire spreading to a building.*

3.1.3 Special Fire Protection Purpose (SFPP)

SFPP developments include developments where occupants may be more vulnerable to bushfire attack e.g. schools, hospitals, aged care, short term accommodation etc. There are no planned SFPP developments within the precinct. If these types of development are planned in the future, the specific objectives of SFPP developments within PBP should be followed in addition to the requirements for residential developments. These are listed below:

- *Provide for the special characteristics and needs of occupants. Unlike residential subdivisions, which can be built to a construction standard to withstand the fire event, enabling occupants and firefighters to provide property protection after the passage of fire, occupants of SFPP developments may not be able to assist in property protection. They are more likely to be adversely affected by smoke or heat while being evacuated.*
- *Provide for safe emergency evacuation procedures. SFPP Developments are highly dependent on suitable emergency evacuation arrangements, which require greater separation from bushfire threats. During emergencies, the risk to firefighters and other emergency services personnel can be high through prolonged exposure, where door-to-door warnings are being given and exposure to the bushfire is imminent*

3.2 Bushfire Protection Measures

Bushfire protection measures described in PBP are an effective way to design developments to minimise the risks from bushfire and ensure that the aims and objectives of PBP are met.

3.2.1 Asset Protection Zones (APZs)

APZs are areas located between bushfire hazards and development to provide a defensible space in which to undertake emergency operations and to provide a buffer from direct flame contact, radiant heat, smoke and embers.

The width of APZs is based on a combination of;

- Vegetation structure
- Slope
- Topographic position (i.e. if the asset is above, or below the hazard)
- Fire Danger Index (FDI) (the FDI for Marsden Park is 100)

The appropriate fire (weather) area was assessed, according to Table A2.3 in PBP. An FDI rating of 100 has been applied to the Greater Sydney Region of NSW, including this site. The FDI index is a relative number (1 to 100) providing an evaluation of suppression difficulty or rate of spread for specific combinations of wind speed, fuel and fuel moisture.

Vegetation across the precinct currently consists predominantly of grassland/pasture with patches of bush fire prone vegetation. The bulk of this vegetation meets the 'Woodland' classification according to Keith (2004) with 'Forest' vegetation following the riparian zone which runs along the eastern boundary. It is assumed that all vegetation outside of the non-certified lands and riparian corridors will be cleared or managed as open space.

APZs meeting 'acceptable solution' requirements for residential development have been mapped across the precinct (Figure 3) based on the widths in table 1 below. PBP2006 does not specify APZ requirements for industrial and business uses however a defensible space is required around these types of buildings. As such, residential distances have been used a

surrogate as they are the minimum distances required to ensure a building remains outside of the flame zone. All APZs have been located within the building footprint.

Table 1 PBP 2006 APZ Requirements for Residential Development

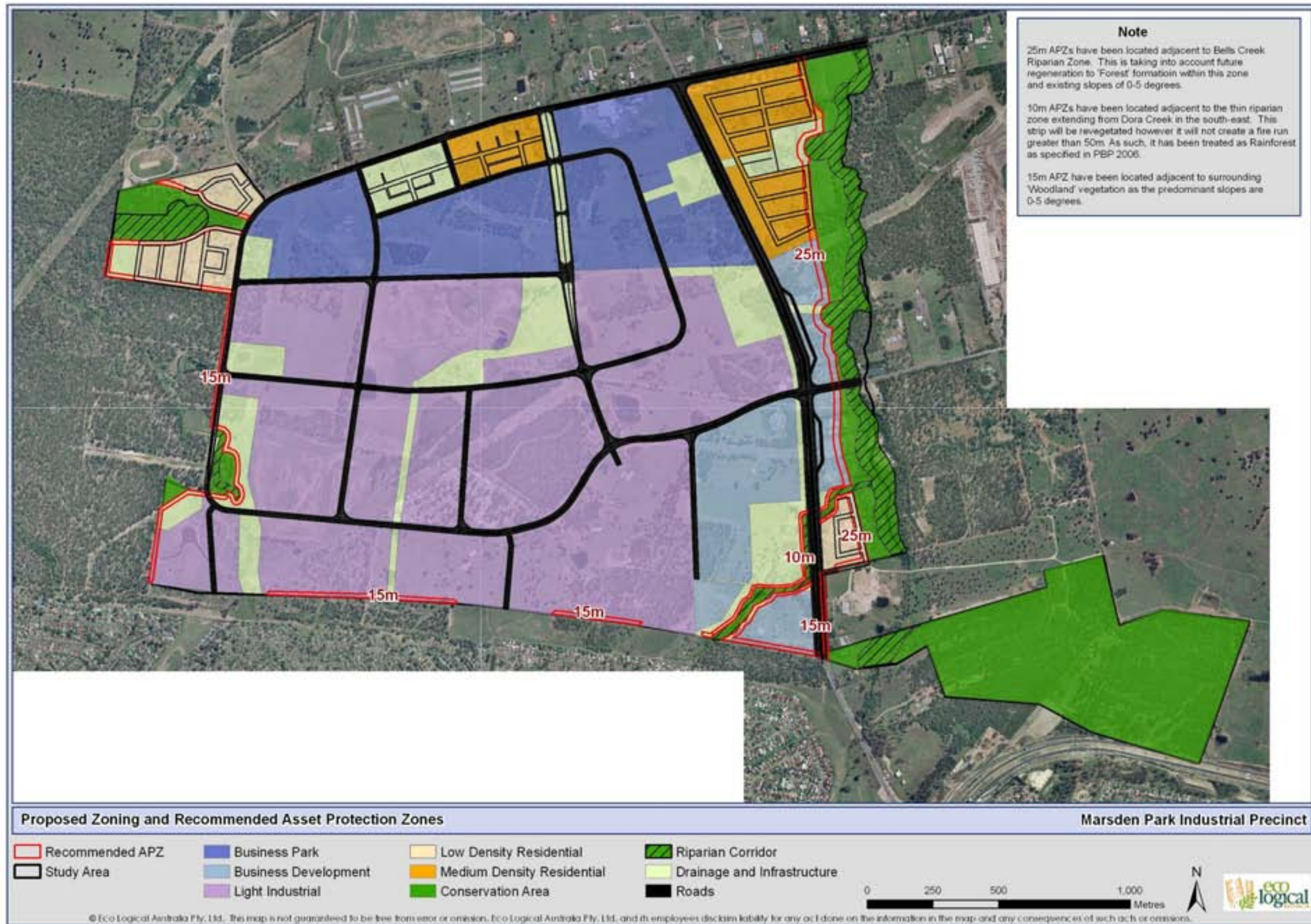
Slope (degrees)	Woodland (Keith 2004)	Forest (Keith 2004)	Rainforest (Keith 2004)
Upslope/flat	10m	20m	10m
Downslope			
>0 - 5	15m	25m	10m
>5 - 10	15m	35m	15m
>10 - 15	20m	50m	20m
>15 - 18	25m	60m	25m

Specifically, APZs have been recommended adjacent to non-certified lands, riparian corridors and vegetation on neighbouring properties in the following situations:

- 25m APZs have been located adjacent to Bells Creek Riparian Zone. This is taking into account future regeneration to 'Forest' formation within this zone and existing slopes of 0-5 degrees.
- 15m APZ have been located adjacent to surrounding 'Woodland' vegetation as the predominant slopes are 0-5 degrees.
- 10m APZs have been located adjacent to the thin riparian zone extending from Dora Creek in the south-east. This strip will be revegetated however it will not create a fire run greater than 50m. As such, it has been treated as Rainforest as specified in PBP 2006.

Under PBP 2006, APZs only comprise Inner Protection Areas (IPA). If the minimum APZs identified below are implemented, residential buildings immediately adjacent to the APZ will require construction to Level 3 of AS3959-1999. If lower construction standards are desirable, APZ widths should be increased beyond those shown in table 1 above.

Figure 3 Asset Protection Zones and Zoning



3.2.2 Emergency Access/Egress

Emergency access/egress relates to the provision of safe access, egress and defensible spaces for emergency services. It also relates to emergency management arrangements such as procedures and routines for evacuation and consideration of safe havens.

Specific management and evacuation plans may be required at a later stage especially where SFPP developments are proposed. Additionally, emergency management arrangements should be discussed with the RFS especially in regard to the capacity of existing resources to service the precinct.

For this precinct the provision of a simple layout for a perimeter road with direct access to the internal road system will provide easy and rapid access/egress in the case of an emergency and should also radiate away from the bushfire hazard. Fire trails are only permitted in exceptional circumstances and as such, have not been addressed in this report. Specifications for public roads and property access roads are outlined in the following sections.

3.2.2.1 Public roads

Public roads include both the perimeter road and the internal road system. The intent is to provide safe operational access to structures and water supply for emergency services, while residents are seeking to evacuate from an area.

Internal roads must comply with the widths specified in AS2890.2-2002 reproduced in table 2 below.

Table 2 Internal Road Specifications

Curve Radius (inside edge) (metres)	Swept path (metres width)	Single lane (metres width)	Two way (metres width)
<40	3.5	4.5	8.0
40-69	3.0	3.9	7.5
70-100	2.7	3.6	6.9
>100	2.5	3.5	6.5

Perimeter road requirements are identified below and full specifications are included in Appendix 1;

(i) Location:

The perimeter road which lies between (or within) the Asset Protection Zone and the boundary of the allotments. A perimeter road should be the preferred option where possible.

(ii) Purpose:

- provide fire fighters with easier access to structures, allowing more efficient use of fire fighting resources;
- provide a safe retreat for fire fighters; and
- provide a clear control line from which to conduct hazard reduction or back burning operations.

(iii) Specifications:

- The perimeter road should preferably provide 2 way access (carriageway 8 metres kerb to kerb).
- Comply with the design specifications relating to slope, capacity etc identified in PBP 2006 (reproduced in Appendix 1 of this report)

3.2.2.2 Property Access

PBP 2006 states that property access is access from a public road system onto private land and access to the habitable building by fire fighters. The intent is to provide safe access to/from the public road system for fire fighters providing property protection during a bush fire and for occupants faced with evacuation.

Property access road requirements are identified below and full specifications are included in Appendix 2:

- Short access roads are preferable; therefore buildings should be located as close as possible to the public road system.
- No access requirements apply to a n urban development where the furthers part of the building is no farther than 70m (unobstructed) from the public road system.
- Any building located more than 200m from a public through road must one alternative property access road.
- Access roads should have a minimum width of 4 meters.

3.2.3 Supply of Services

The purpose of this measure is to provide adequate services of water for the protection of buildings during and after the passage of a bushfire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.

It is recommended that water supply to the site is provided via a ring main system. The ring main system must be of sufficient pressure and fire hydrants located to comply with AS 2419.1-2005 *Fire Hydrant Installations (SAI Global, 2005)*.

If water supply is non-reticulated then a dedicated static water supply reserve must be created and maintained. The quantity of water required is determined on the basis of lot size and density and is shown in Table 3 below. Swimming pools, creeks and dams are not a suitable substitute for a dedicated static supply.

Table 3 Static Water Requirements

Development Type	Water Requirements
Residential Lots (<1,000m²)	5,000 l/lot
Rural-residential Lots (1,000m² - 10,000 m²)	10,000 l/lot
Large Rural/Lifestyle Lots (>10,000m²)	20,000 l/lot

Electricity and gas services should be located such that they do not post a hazard to surrounding bushland and buildings, or provide an obstacle for emergency service personnel. Ideally they would be located underground. Powerlines must undergo regular inspection to ensure that no part of a tree is closer than the distances set out in 'Vegetation safety clearances' issued by energy Australia (NS179, April 2002)

3.2.4 Construction Standards

Construction of new residential dwellings must comply with the Appendix 3 of PBP 2006 and AS3959-1999 *Construction of Building in Bushfire Prone Areas (SAI Global, 1999)*. The APZs mapped in Figure 3 provide the minimum setback required to keep development outside of the flame zone. As such, if lower construction standards are desirable, setback/APZ widths should be increased beyond those shown.

The Building Code of Australia (BCA) does not provide building requirements relating to bushfire threat for non-residential classes of buildings under classes 5 to 8 and 10 of the (BCA) including: offices, factories, warehouses, public car parks and other commercial or industrial facilities. As such, general fire safety construction should be acceptable unless the proposed use or construction poses a specific risk to or from bushfire.

4. Management

4.1 Asset Protection Zones

The management regime of areas designated as APZs are detailed in the Table 4 below for those located in road reserves, allotments and neighbourhood parks.

Table 4 APZ Management Guidelines

Location	Management Regime
Road Reserve	Roadways are to be maintained as paved areas including adjacent footpaths and cycleways. Where they are adjacent to retained vegetation, street trees are to have a minimum 2 metre gap between the canopies when fully grown. Shrubs are not to be planted directly under trees, but may be planted in gaps between trees. Groundcover should be either mown grass or plant species that do not grow more than 10cm in height or are subject to a management regime that keeps them under 10cm height. Where native tussock grasses are used these should be in clumps.
Allotments	APZs located within allotments are to be identified through a Section 88b instrument. Management is to comprise primarily of mown lawns and landscaped areas. No trees are permitted to overhang dwellings or industrial buildings and shrubs must be located a minimum of 2 metres from buildings. Landscape clumps should not be more than 10m ² in size, a minimum separation distance of 2m should occur between clumps.
Neighbourhood Parks	Neighbourhood parks are to be managed in a manner consistent with an Outer Protection Area (OPA) where they are adjacent to residential areas. Where they are adjacent to schools or other Special Protection Developments they are to be managed as an Inner Protection Area (IPA). It is recognised that many of these areas are located in a manner that provides for retention of remnant trees, management emphasis has therefore been placed upon how the understorey is to be landscaped/maintained. Generally, no more than 30% of neighbourhood parks should be subject to landscaping, the remainder of the park is to be grassed and subject to regular mowing. It is recommended that native landscape areas are not placed on the boundary of lots, unless it is where they border a road.

4.2 Protected Vegetation

Vegetation within the riparian corridor, conservation and non-certified areas will be retained and revegetated. Vegetation that is retained or regenerated is to be managed for biodiversity protection, and as such APZs are not permitted within these areas. Fire is an important ecological process, and as such must be integrated with long term environmental management. As such, it is recommended that a conservation and bushfire management plan be prepared for these areas prior to any construction.

The main factors contributing to bushfire management relate to;

- Fire frequency
- Fire seasonality
- Fire intensity

It is important to ensure that fire regimes are varied spatially across the site, and temporally at any one point, the objectives being;

1. Ensuring a variety of interfire periods are present across the site
2. Ensuring that the season, intensity and frequency of burns are varied at any one area

This is referred to as mosaic management and is aimed at ensuring a diversity of life cycles are present across the site and that a homogenous fire regime is avoided that may benefit certain species at the expense of others.

4.2.1 Fire Frequency

Fire frequency is usually presented as interfire periods. The minimum interfire period is the minimum amount of time between fires that will enable sufficient recruitment and recharge of seedbanks. Maximum interfire period refers to the maximum amount of time between fires before senescence may begin. Table 5 below provides the recommended maximum and minimum fire intervals for the vegetation communities within the study area. Successive fires at the minimum recommended fire interval may have a severe impact on species diversity, therefore, fire regimes erring towards the maximum interval are recommended.

As the conservation areas within the precinct will be actively regenerated, the entire precinct should be excluded from fire for a minimum of 15 years to allow for the development of a soil seed bank. In addition, Prescribed Burning is not permitted in vegetation adjacent to a 4th order stream (i.e Bells Creek) within 20 m (NSW RFS, 2006c).

Table 5 Recommended Interfire Periods

Source	Keith (2004) Classification	Minimum Fire Interval	Maximum Fire Interval
DEC 2004 "Guidelines for Ecologically Sustainable Fire Management. NSW NP&WS	Grassy Woodland	5 years	40years
DEC 2004 "Guidelines for Ecologically Sustainable Fire Management. NSW NP&WS	Dry sclerophyll forests (Shrub/Grass sub formation)	5 years	50 years

4.2.2 Fire Seasonality

Fire seasonality needs to integrate with the lifecycles of native species, and preferably be counter to the requirements of exotic species. As such ecological burns are recommended between the periods of August and January to coincide with native plant life cycles (DEC 2005). However, due to bushfire danger periods it may not be practical to burn over the summer months, hence the window of opportunity narrows to August – November. Occasional autumn burns may also be implemented.

Burning may also be complemented with slashing of grasses, preferably immediately prior to flowering of exotic annual grasses.

4.2.3 Fire Intensity

Hotter burns are preferable as they may encourage native species over exotic species. However, this will be significantly limited by the amount of fuel available for burning and constraints on burning during the hotter months. More moderate burns are recommended for steeper slopes to reduce the potential for exposure of mineral earth and subsequent erosion.

4.3 Maintenance

The best bushfire mitigation measures and design can be undone by poor landscaping and property maintenance. It is recommended that the measures described in Appendix 5 of PBP 2006 be adopted in all lots within 100m of bushland. These measures are equally important for residential, industrial and public zoned lots. A summary of these measures is described below:

4.3.1 APZ Creation/Maintenance

The site is currently dominated by Woodland vegetation with patches of Forest vegetation. Vegetation within the APZ area (Figure 3) and any remnants or landscaping within the development area should be managed by the owner of the land in line with the following:

- Tree canopy separation (by at least 2 metres where possible);
- Discontinuous shrub layer (clumps or islands of shrubs not rows);
- Vertical separation between vegetation stratum;
- Tree canopies not overhanging structures;
- Management and trimming of trees and other vegetation in the vicinity of power lines and tower lines in accordance with the specifications in "Vegetation Safety Clearances" issued by Energy Australia (NS179, April 2002);
- Retain low ground covers:
 - Mowing / brush cutting / slashing during the summer months;
- Use of non-combustible mulch e.g. stones.

Where landscaping is to include plantings, local provenance stock is recommended. Emphasis should be placed on species that are less flammable, particularly in close proximity to any buildings.

4.3.2 Vegetation Management

Landscaping around buildings should adhere to the following:

- maintaining a clear area of low cut lawn or pavement adjacent to the house;

- keeping areas under fences, fence posts and gates and trees raked and cleared of fuel;
- utilising non-combustible fencing and retaining walls
- breaking up the canopy of trees and shrubs with defined garden beds;
- organic mulch should not be used in bush fire prone areas and non flammable material should be used as ground cover, eg Scoria, pebbles, recycled crushed bricks.
- planting trees and shrubs such that:
 - the branches will not overhang the roof;
 - the tree canopy is not continuous; and
 - there is a windbreak in the direction from which fires are likely to approach.

4.3.3 *Building Maintenance*

- removal of material such as litter from the roof and gutters;
- ensure painted surfaces are in good condition with decaying timbers being given particular attention to prevent the lodging of embers within gaps;
- check pumps and water supplies are available and in working order;
- driveways are in good condition with trees not being too close and forming an obstacle during smoky conditions;
- check roof lines for broken tiles or dislodged roofing materials;
- screens on windows and doors are in good condition without breaks or holes in flyscreen material and frames are well fitting into sills and window frames;
- drenching or spray systems are regularly tested before the commencement of the fire season;
- hoses and hose reels are not perished and fittings are tight and in good order;
- doors are fitted with draught seals and well maintained; and
- woodpiles, chemical storage, sheds and other combustible materials are located downslope and well away from buildings.

5. Emergency Response

An assessment of the RFS and NSW Fire Brigade stations surrounding the site was completed (see Table 4 below) in order to determine proximity to the subject site.

Table 6 Local Fire Stations

Name	Location	Distance*
Marsden Park (RFS)	Garfield Rd, Marsden Park NSW	2km
Shanes Park (RFS)	Palmyra Ave, Shalvey NSW	8.3km
Blacktown (NSW Brigades)	222 Richmond Rd, Woodcroft NSW	6km
Schofields (RFS)	Railway Tce, Schofields NSW	3km

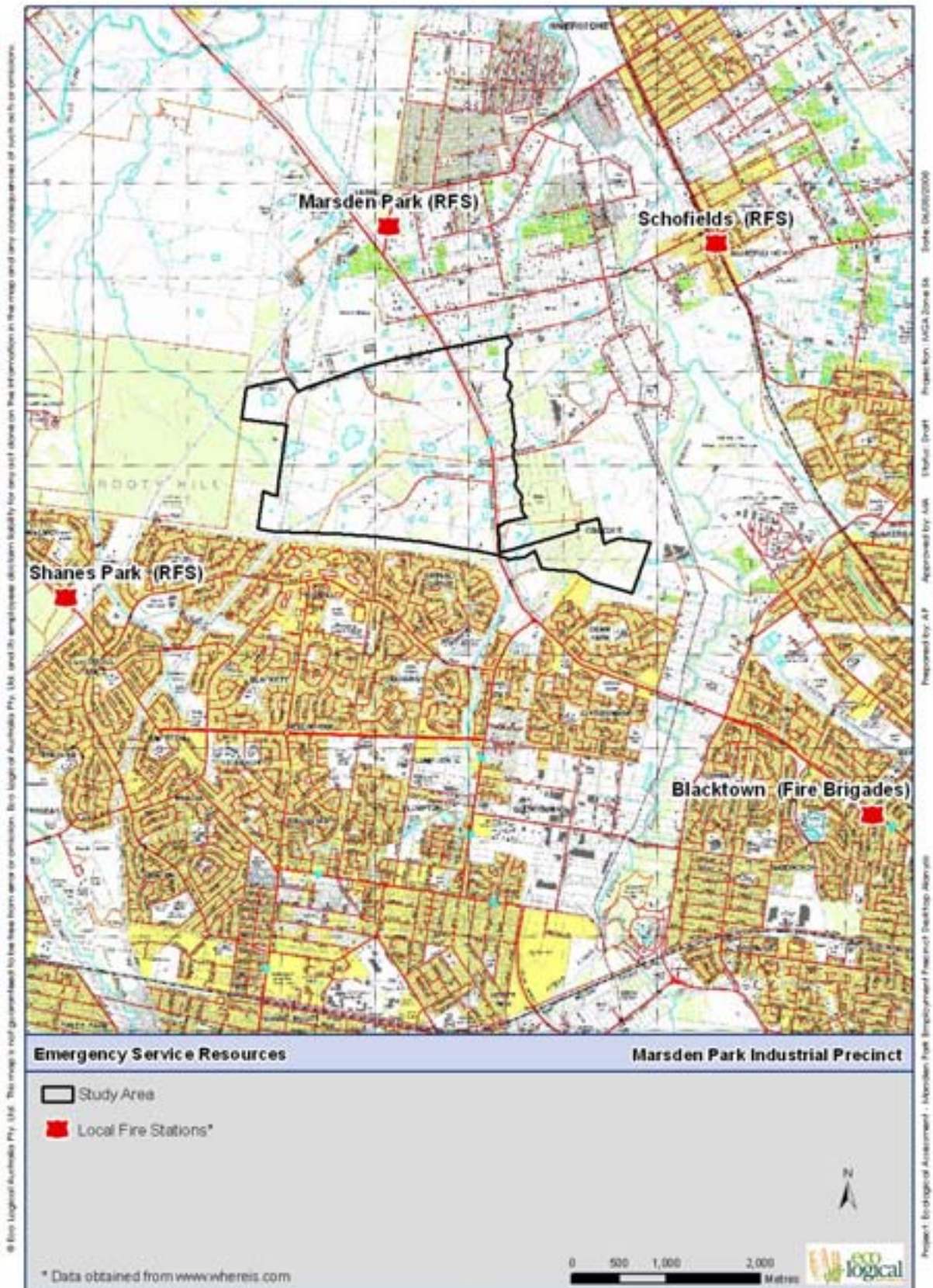
Notes: *Distance from the station location, via the current road network, to the closest point of the site. (calculated from www.whereis.com)

The location of fire stations in relation to the study site is indicated in figure 5. In the current emergency response situation the Marsden Park and Schofields NSW RFS Brigades are likely to be the first stations to reach the precinct. These stations have easy access to Richmond Road, which runs through the eastern section of the site from the south to the north.

Given that the majority of the precinct is to be zoned for industrial use, there will likely be hazardous substances stored within the precinct. If a HAZMAT emergency is declared, The NSW Fire Brigade will be required to handle the situation. The closest NSW Fire Brigade station is the Blacktown Brigade.

Consultation with the RFS and NSW Brigade is required to confirm whether existing stations can adequately service the proposed development site (or otherwise) as well as the need for additional resources at these existing stations (and a section 94 – developer contributions plan).

Figure 4 Emergency Service Resources



6. Planning Controls

Based on the recommendations contained within PBP 2006 the following planning controls are recommended for rezoning;

1. Controls relating to the BCA and Australian Standards should be adopted as per section 3.2.4.
2. Controls relating to the provision of asset protection zones be consistent with Figure 3 and requirements of section 3.2.1. An additional control should be adopted that states that asset protection zones must not be located on Council owned and/or managed land unless located within a dedicated public road reserve.
3. Fire trails are not recommended and will only be supported in special circumstances.
4. Controls relating to special fire protection purpose developments in section 3.1.3 be adopted if applicable.
5. Controls relating to public roads in 3.2.2.1 be adopted.
6. Controls relating to property access in section 3.2.2.2 be adopted.
7. Controls relating to infrastructure in section 3.2.3 be adopted and an additional control be included that states 'where reticulated supply is inadequate, water can be supplemented with the provision of a dedicated static water supply in the form of tank storage however that where supplementary supplies of water are required, swimming pools, creeks and dams are not a suitable substitute for a dedicated static supply'.
8. Controls relating to landscaping in section 4.3 be adopted.
9. Controls on the placement of combustible materials in asset protection zones.
10. Controls relating to submission requirements with development applications in the form of Bushfire Assessments as per PBP 2006 be adopted.

PBP 2001 identifies a series of recommended clauses for inclusion in LEPs, these clauses are suitable for consideration for this study;

Objectives

- To prevent loss of life and property due to bushfires, by discouraging the establishment of incompatible uses in bushfire-prone areas
- To encourage sound management of bushfire-prone areas

When these principles apply

These principles will apply when a council is required to prepare an amending LEP that permits land which is bushfire-prone to be developed. Such land would be identified on council's bushfire prone land mapping in accordance with RFS (2006a).

What a council should do if these principles apply

A council should not prepare the amending LEP unless it is justified by an environmental study. When preparing an environmental study, the council should consider PBP 2006.

If an amending LEP proposes to permit development of land which, has been found to be bushfire-prone, the plan should, as appropriate:

- provide an Asset Protection Zone (APZ) incorporating at a minimum:
 - an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development, and has a building line consistent with the incorporation of an APZ within the property
- contain provisions for two way access which links to the road or fire trail network
- minimise the perimeter of the area of land, interfacing the hazard, which may be developed
- introduce controls which avoid placing inappropriate developments in hazardous areas

- introduce controls on the placement of combustible materials within the Inner Protection Area

The NSW Rural Fire Service should be consulted in the preparation of the LEP which affects a bushfire-prone area.

Suggested Clause

The following extract from Shoalhaven Council LEP, 1985 demonstrates how bushfire protection provisions can be incorporated into LEPs:

Sub-Clause (1)

In deciding whether to grant consent to any development on land which in its opinion is likely to be affected by bushfire, the Council must take into account whether:

- a) the development is likely to have a significant adverse effect on the implementation of any strategies for bushfire control and fuel management adopted by council;
- b) a significant threat to the lives of residents, visitors or emergency services personnel may be created or increased as a result of the development or the access arrangements to and from the development;
- c) the increased demand for emergency services during bushfire events created by the development would lead to a significant decrease in the ability of the emergency services personnel to effectively control major bushfires; and;
- d) the measures adopted to avoid or mitigate the threat from bushfire, including siting of the development, design of structures and materials used, clearing of vegetation, fuel free and fuel reduced areas and landscaping and fire control aids such as roads and water supplies are inadequate for the locality or would result in unacceptable environmental impacts.

Sub-Clause (2)

In exercising its consideration of sub-clause (1), the council shall have regard to, and as much as possible, be satisfied that the provisions of Planning for Bushfire Protection, as produced by the NSW Rural Fire Service, have been met.

7. Development Staging

The staging of the development should be considered from a bushfire perspective such as to minimise the risks to the development during construction. Ideally, lots fronting the bushland interface would be developed first and APZs established upfront.

Notwithstanding the above, temporary APZs should be established around each stage of the development and identified in a section 88b instrument, which would then cease once the adjacent stage of the development is undertaken. APZ widths could be identified on a site basis, based on the hazard assessment map (figure 2) which corresponds directly with the APZ categories identified in Table 1. Where bushland is located upslope from developments, an APZ of 10 metres should be applied.

As the bushfire hazard will change during various stages of development, due to the creation of new vegetation, removal of old vegetation and creation of new lots, 'Bushfire Prone Area' mapping (BPA mapping), the trigger for assessment under the EP&A Act and the RF Act will also change. It is recommended that Council review BPA mapping following development stages.

8. Indicative Layout Plan Assessment

An assessment of the proposed rezoning and layout plan for the precinct has been undertaken to determine the capacity of the site to provide appropriate bushfire protection measures given the level of bushfire hazard affecting the site. The zoning layout for the Marsden Park Industrial Precinct Indicative Layout Plan (herein referred to as the ILP), can be seen in Figure 5.

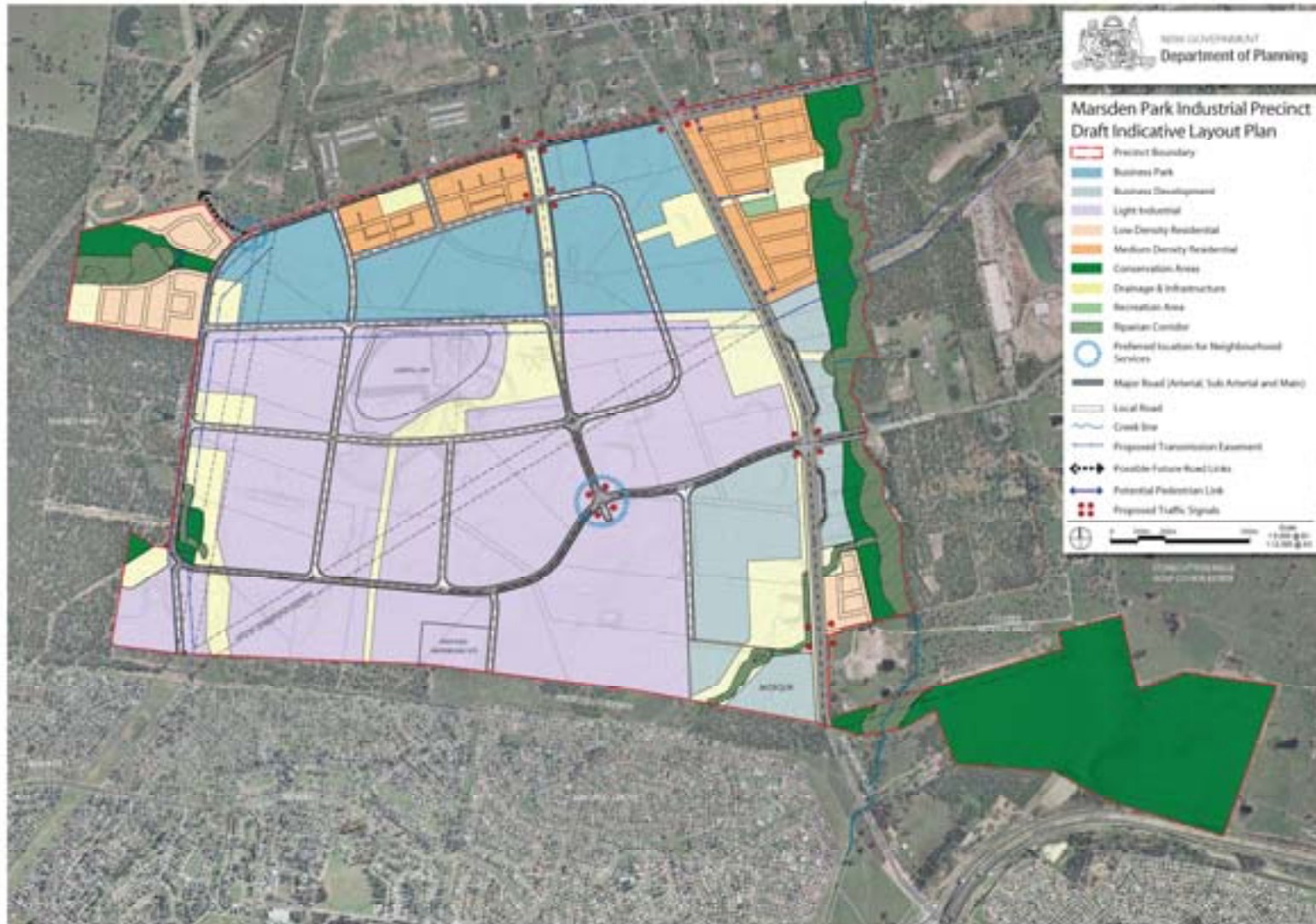
The following table (Table 7) assess the ILPs ability to meet the planning principles of PBP (NSW RFS 2006b).

Table 7 Planning principles of the ILP

Planning Principals of PBP (NSW RFS 2006b)	ILP Assessment
<p>Provision of a perimeter road with two way access which delineates the extent of the intended development</p>	<p>The indicated road widths shown on the Indicative Layout Plan have a minimum trafficable width of 9m wide within a road reserve of 16m. This width meets the minimum 8 meters required under PBP 2006 for emergency access/egress. All roads are two way.</p> <p>The majority of residential/bushland interfaces are delineated by perimeter roads.</p> <p>The indicative road layout shows many roads providing access/egress to the precinct to the north, east and south. Many alternate escape routes exist if any roads are cut off by fire or blocked by traffic. Internal access throughout the precinct is adequate as the majority of roads are through roads with no dead ends. The one exception is the road leading to the Mosque in the south-east. This road should either continue south towards the existing residential development south of the precinct or cut through to the east to meet up with Richmond Road.</p> <p>There are a number of major road crossings proposed over Bells Creek, the design of these crossings will need to be in accordance with PBP 2006 guidelines for internal roads and bridges i.e. bridges clearly indicate load rating and pavements and bridges are capable of carrying a load of 15 tonnes.</p>
<p>Provision, at the urban bushland interface, for the establishment of adequate asset protection zones for future housing</p>	<p>It is anticipated that in most situations APZs can be wholly contained within the perimeter road easement and standard setbacks (6 metres). Therefore, for urban design inputs, it is likely that provision of additional perimeter roads will meet setback requirements.</p>
<p>Specifying minimum residential lot depths to accommodate asset protection zones for lots on perimeter roads</p>	<p>The size of each zoning parcel is more than adequate to accommodate the required APZs. Minimum lot depths are not specifically known at this stage however lots should be developed to allow for the incorporation of the required APZs.</p>

<p>Minimising the perimeter of the area of land, interfacing the hazard, which may be developed</p>	<p>The ILP incorporates a simple design with the development/hazard interface generally following straight lines to minimise the interface. The exception is the residential zone in the north-west which is bent around a conservation area. This area has a large interface which would be affected by both on site and off site hazards. Ideally this area should have a different use such parkland.</p>
<p>Introduction of controls which avoid placing inappropriate developments in hazardous areas</p>	<p>No SFPP developments are proposed for the precinct.</p> <p>The industrial zonings are large enough to incorporate any hazardous industries away from the bushfire hazard. These industries are specified within PBP 2006 and include power generating works, sawmill chemical industries and service stations etc.</p>
<p>Introduction of controls on the placement of combustible materials in asset protection zones.</p>	<p>N/A</p>

Figure 5 Indicative Layout Plan



9. Conclusions

Bushfire hazard has been assessed across the site and found to be low, based on the gentle slopes and low fuel accumulation of the vegetation present. On the basis of this assessment, indicative APZs have been mapped across the precinct. 25m APZs have been located adjacent to Bells Creek Riparian Zone. 15m APZs have been located adjacent to surrounding 'Woodland' vegetation and 10m APZs have been located adjacent to the thin riparian zone extending from Dora Creek in the south-east. The size of each zoning parcel is more than adequate to accommodate the required APZs.

A number of strategies have been provided in the form of planning controls such that the risk from bushfire can be minimised and further that the approvals process can be streamlined. Further, it has been found that development is indeed possible at the subject site from a bushfire planning perspective.

The main strategies suggested include:

- Ensure adequate setback from bushfire prone vegetation;
- Integrate non combustible infrastructure within APZs such as roads, easements and parking areas.
- Ensure adequate access and egress from the site including perimeter roads along the residential/bushland interface;
- Consider the adequacy of water supply and the delivery of other services (gas and electricity);
- Provide temporary APZs during any staged development; and
- Consider the requirements of ongoing APZ maintenance.

A number of existing fire stations are in close proximity to the precinct and are considered likely to be able to adequately service the area. Consultation with the RFS and NSW Fire Brigade is however required to confirm this (or otherwise) as well as the need for additional resources at these existing stations.

Lastly, further bushfire advice and input into the planning process can be provided when a development footprints are determined. Formalised bushfire assessments will be required to facilitate the development approvals process if the proposed rezoning is approved and proceeds to subdivision.

10. References

(DEC) Department of Environment and Conservation (NSW) 2005. *Recovering Bushland on the Cumberland Plain: Best practice guidelines for the management and restoration of bushland*. Department of Environment and Conservation (NSW), Sydney.

Energy Australia (2002) "Vegetation Safety Clearances" (NS179).

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NSW RFS, 2001. *Planning for Bushfire Protection. A guide for Councils, Planners, Fire Authorities, Developers and Home Owners*.

NSW RFS, 2006a. *Guideline for Bush Fire Prone Land Mapping*. Version 3. NSW Rural Fire Service.

NSW RFS, 2006b. *Planning for Bushfire Protection. A guide for Councils, Planners, Fire Authorities and Developers*.

NSW RFS (2006c). *The Bush Fire Environmental Assessment Code for New South Wales*.

SAI Global (1994). AS 2419.1-1994 Fire Hydrant Installations.

SAI Global (1999). AS3959-1999 Construction of Building in Bushfire Prone Areas.

Appendix 1 – PBP 2006 Public Road Specifications

Performance Criteria	Acceptable solutions
<p>The intent may be achieved where:</p>	
<ul style="list-style-type: none"> • firefighters are provided with safe all weather access to structures (thus allowing more efficient use of firefighting resources) 	<ul style="list-style-type: none"> • public roads are two-wheel drive, all weather roads.
<ul style="list-style-type: none"> • public road widths and design that allow safe access for firefighters while residents are evacuating an area 	<ul style="list-style-type: none"> • urban perimeter roads are two-way, that is, at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb), allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 4.1 – Road widths for Category 1 Tanker (Medium Rigid Vehicle). • the perimeter road is linked to the internal road system at an interval of no greater than 500 metres in urban areas. • traffic management devices are constructed to facilitate access by emergency services vehicles. • public roads have a cross fall not exceeding 3 degrees. • all roads are through roads. Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end and direct traffic away from the hazard. • curves of roads (other than perimeter roads) are a minimum inner radius of six metres and minimal in number, to allow for rapid access and egress. • the minimum distance between inner and outer curves is six metres. • maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient. • there is a minimum vertical clearance to a height of four metres above the road at all times.
<ul style="list-style-type: none"> • the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles. 	<ul style="list-style-type: none"> • the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles (approximately 15 tonnes for areas with reticulated water, 28 tonnes or 9 tonnes per axle for all other areas). Bridges clearly indicate load rating.
<ul style="list-style-type: none"> • roads that are clearly sign- posted (with easily distinguishable names) and buildings/properties that are clearly numbered. 	<ul style="list-style-type: none"> • public roads greater than 6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water for fire suppression. • public roads between 6.5 metres and 8 metres wide are No Parking on one side with the services (hydrants) located on this side to ensure accessibility to reticulated water for fire suppression.

<ul style="list-style-type: none"> • there is clear access to reticulated water supply 	<ul style="list-style-type: none"> • public roads up to 6.5 metres wide provide parking within parking bays and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression. • one way only public access roads are no less than 3.5 metres wide and provide parking within parking bays and locate services outside of the parking bays to ensure accessibility to reticulated water for fire suppression.
<ul style="list-style-type: none"> • parking does not obstruct the minimum paved width 	<ul style="list-style-type: none"> • parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within the parking bays. • public roads directly interfacing the bush fire hazard vegetation provide roll top kerbing to the hazard side of the road.

Appendix 2 – PBP 2006 Property Access Specifications

Performance Criteria	Acceptable solutions
The intent may be achieved where:	
<ul style="list-style-type: none"> access to properties is provided in recognition of the risk to fire fighters and/ or evacuating occupants. 	<ul style="list-style-type: none"> at least one alternative property access road is provided for individual dwellings (or groups of dwellings) that are located more than 200 metres from a public through road
<ul style="list-style-type: none"> the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles. all weather access is provided. 	<ul style="list-style-type: none"> bridges clearly indicate load rating and pavements and bridges are capable of carrying a load of 15 tonnes roads do not traverse a wetland or other land potentially subject to periodic inundation (other than a flood or storm surge).
<ul style="list-style-type: none"> road widths and design enable safe access for vehicles 	<ul style="list-style-type: none"> a minimum carriageway width of four metres for rural-residential areas, rural landholdings or urban areas with a distance of greater than 70 metres from the nearest hydrant point to the most external part of a proposed building (or footprint). <p><i>Note: No specific access requirements apply in a urban area where a 70 metres unobstructed path can be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles (i.e. a hydrant or water supply).</i></p> <ul style="list-style-type: none"> in forest, woodland and heath situations, rural property access roads have passing bays every 200 metres that are 20 metres long by two metres wide, making a minimum trafficable width of six metres at the passing bay. a minimum vertical clearance of four metres to any overhanging obstructions, including tree branches. internal roads for rural properties provide a loop road around any dwelling or incorporate a turning circle with a minimum 12 metre outer radius. curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress. the minimum distance between inner and outer curves is six metres. the crossfall is not more than 10 degrees. maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads. <p><i>Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5m), extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. The gradients applicable to public roads also apply to community style development property access roads in addition to the above.</i></p> <ul style="list-style-type: none"> access to a development comprising more than three dwellings have formalised access by dedication of a road and not by right of way.