Fernhill Estate

Eastern Subdivision
Bushfire Assessment

August 2013

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1. Introduction

1.1 Purpose of this report

This is a bushfire assessment report for the Eastern Precinct Fernhill, a proposed 54 lot subdivision (1177-1187 Mulgoa Road Mulgoa | Part Lot No. 6 Plan No. 173159 and 1147-1175 Mulgoa Road Mulgoa Part Lot No. 1 Plan No. 570484) (hereafter referred to as the '*subject land*') (Figure 1). The subject land is zoned as E3 Environmental Management.

This report has been prepared in accordance Section 100B of the *Rural Fires Act (1997)* and Section 91 of the *Environmental Planning and Assessment Act* (EP&A Act) to meet the aims and objectives of *Planning for Bushfire Protection 2006* (NSWRFS 2006) (PBP).

This report replaces previous assessments prepared for the subject land and issued to Penrith City Council.

1.2 Bushfire Prone Land

The subject land is designated as bushfire prone (See Figure 2) due to the presence of bushfire prone land within and adjoining the site. A site-based hazard assessment was used to confirm bushfire prone vegetation adjoining the subject land (See Section 2).

1.3 Description of the property

The location of the subject land is provided in Figure 1, with the subject land bounded to the:

- East by Mulgoa Road and Mulgoa village;
- Immediately west by an existing dam and a drainage basin (to be constructed)
- North and further west by woodland and cleared exotic grassland within the Fernhill Estate that has historically been grazed and will be used for grazing, equestrian activities, occasional public events and biodiversity conservation; and
- South by Mulgoa primary school and private rural-residential lots.

Access to the subject land is via Mulgoa Road at two separate entry points.

1.3.1 Environmental Features

The vegetation within and adjoining the subject land consists of:

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats (potentially River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions Endangered Ecological Community (EEC)#);
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin (potentially Cumberland Plain Woodland Critically EEC#); and
- Cleared land / exotic grassland.

potentially listed as threatened ecological communities under the schedules of the NSW *Threatened Species Conservation Act 1995* or *Environment Protection and Biodiversity Conservation Act 1999*.

Further details of vegetation including a map are provided in Section 2.1.

The Threatened Cumberland Plain Land Snail (*Meridolum corneovirens*) is recorded from the Eastern precinct.

No Aboriginal heritage items are known by the applicant to occur on the subject land.

278,000 280,000 282,000

6,256,000 6,254,000

BLUE MOUNTAINS NATIONAL PARK

NEPEAN RIVER

RILEYS MOUNTAIN TRACK

MAYFAIR ROAD

MULGOA ROAD

ST THOMAS ROAD

FARM ROAD

LITTLEFIELDS ROAD

ROXYS WAY

ALLAN ROAD

THE STRAIGHT ROAD

WINBOURNE ROAD

CHURCH ROAD

FAIRLIGHT ROAD

NEPEAN GORGE DRIVE

HENRY COX DRIVE

MULGOA

Western Precinct

Eastern Precinct

1

2

3

4

Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

1:14,000 (at A3)

0 50 100 200 300 400 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Development footprint
- Highways; Highways
- Major Roads; Major Roads
- Secondary Roads
- Other Roads
- waterways
- Nature Conservation Reserve

Fernhill East Biobank
BioBanking Assessment

Job Number	22-16689
Revision	0
Date	27 Jun 2013

Locality Map

Figure 1

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Data Source: Geoscience Australia: 250k Data - Jan 2011; Tough Mudder: Course Route, Obstacles, Car Parking and Base Area; 2013;ESRI World Imagery: Aerial Imagery, Accessed: 2013; GHD: Vegetation, 20-12-2012. Ecological: Grevillea Locations digitised from hard copy. Created by: sdwoodger

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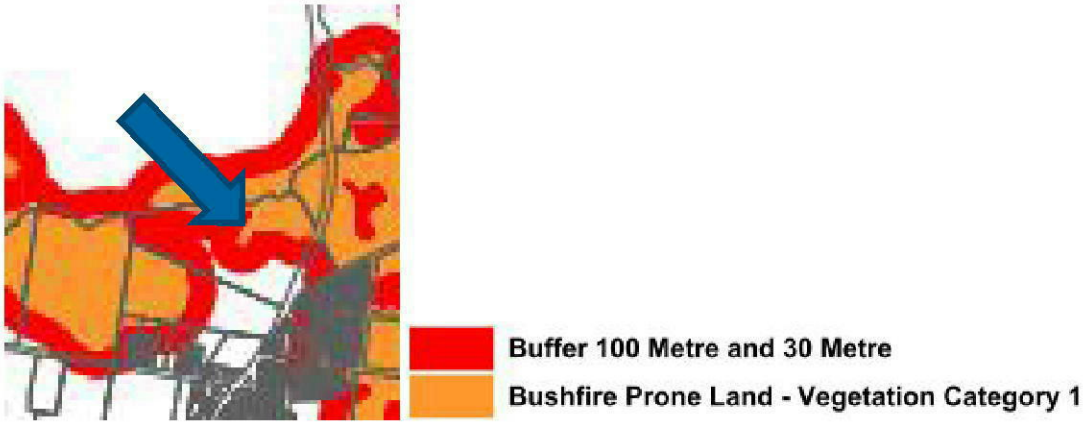
Figure 2 Bushfire Prone Lands Mapping



Source: Penrith City Council Website[1]

1.4 Scope and limitations

This report: has been prepared by GHD and *may only be used and relied on by for the purpose agreed as set out in Section 1.1 of this report.*

GHD otherwise disclaims responsibility to any person arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

1

http://www.penrithcity.nsw.gov.au/uploadedFiles/Content/Website/Our_Services/Planning_and_Development/Building__Development/Fact_Sheet/BushFireProneLandMap.pdf

2. Hazard Assessment

2.1 Vegetation

Survey transects of 140 m in length were completed on 7 June 2013 to confirm the "Predominant Vegetation Class Formation" in accordance with *Planning for Bushfire Protection.* The vegetation classes correspond with the vegetation types shown in Figure 3 and Table 1.

Table 1 Vegetation Type, Formation and Classification

Vegetation Type	Vegetation Formation (Keith 2004[2])	AS3959:2009[3] Classification
Grey Box - Forest Red Gum grassy woodland	Grassy woodland	Woodland
Forest Red Gum - Rough-barked Apple grassy woodland	Grassy woodland	Woodland
Cleared land / exotic grassland	*Grassy woodland*	Woodland

The woodland vegetation and exotic grassland communities above (Table 1) match the description of Grassy Woodland vegetation formation (NSWRFS 2006) for the following reasons;

- Open to sparse layer of eucalypts with crowns rarely touching;
- Foliage cover of approximately 30%; and
- Groundcover of grasses, tussocks and herbs with a sparse distribution of shrubs.

These vegetation formations can support high intensity bushfires, most likely burning as a faster moving surface fire in open woodland communities without a shrubby understorey, moving into the crown where there are sufficient ladder fuels (shrubs and near-surface fuels). The subject land has been subject to high intensity bushfires in the past as evidenced by bark scorching and stem damage.

2.2 Effective Slope

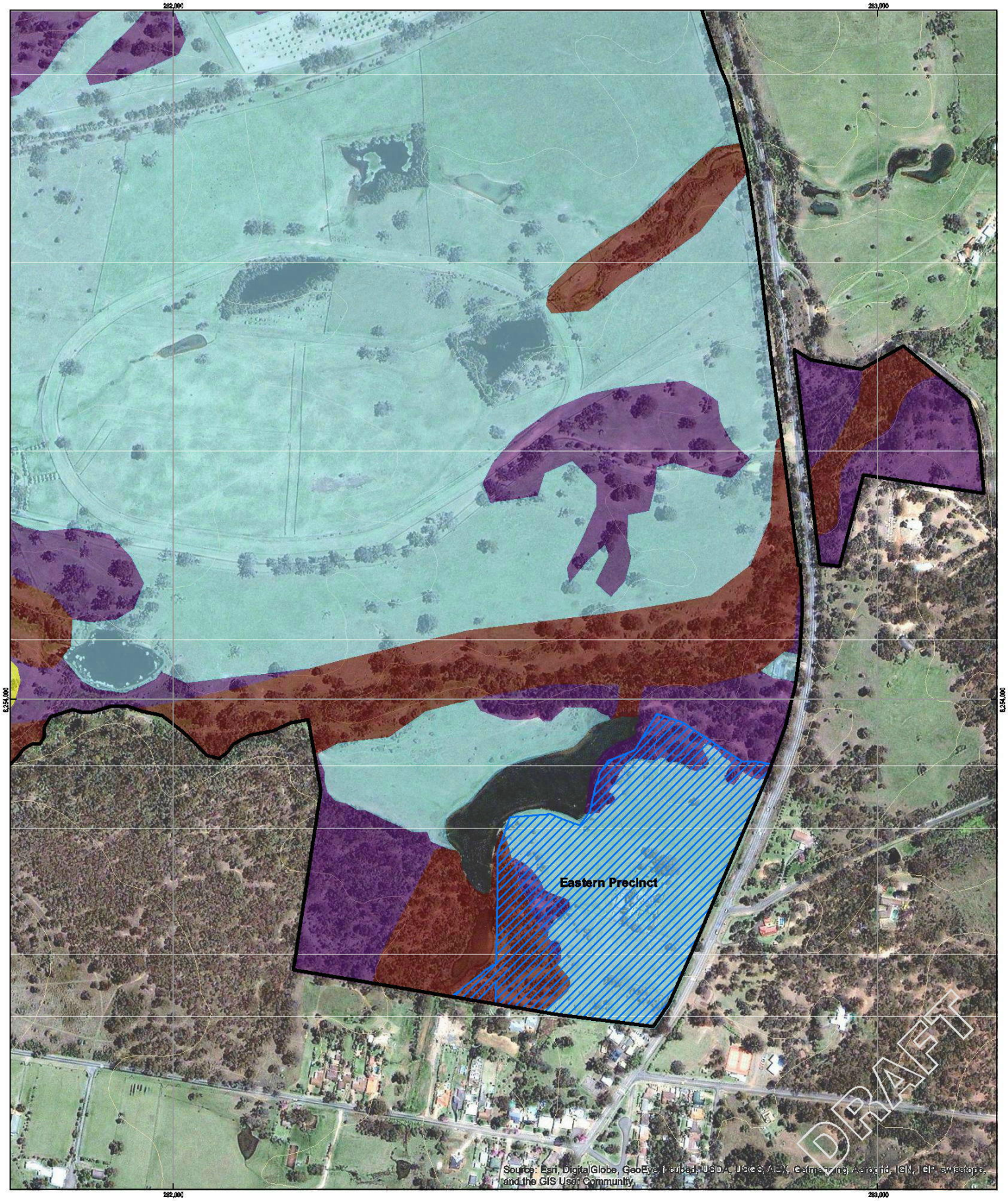
Survey transects, 140 m in length were utilised to confirm the "Effective Slope" in accordance with *Planning for Bushfire Protection.* Overall slope class within the vegetation hazard at the northern boundary was >5-10 degrees. The small rise up to lots in the south-western corner was taken into consideration but will not be the dominant contribution to potential fire behaviour (which is primarily a downslope influence across the dam) due to the proposed construction of a drainage basin in this area. The remainder of the western boundary adjoins the dam.

Slope classes for the subject land are shown in Figure 4.

2.3 Fire Weather

Penrith City Council being within the 'Greater Sydney Region' has a corresponding FDI rating of 100 (NSWRFS 2006).

[2] Keith, D.A. (2004) Ocean Shores to Desert Dunes, the native vegetation of New South Wales and the ACT. NSW Department of Environment and Conservation, Sydney.
[3] Standards Australia 2009. AS3959 – 2009 Construction of Buildings in Bushfire-prone areas. Standards Australia, Sydney.



LEGEND

Fernhill site boundary

Development footprint

Fernhill vegetation types

- Cleared land / exotic grassland
- Forest Red Gum - Grey Box shrubby woodland (HN524)
- Forest Red Gum - Rough-barked Apple grassy woodland (HN526)
- Grey Box - Forest Red Gum grassy woodland on flats (HN528)
- Grey Box - Forest Red Gum grassy woodland on hills (HN529)
- Grey Myrtle dry rainforest (HN538)
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556)
- Red Bloodwood - Grey Gum woodland (HN564)
- Turpentine - Smooth-barked Apple moist shrubby forest (HN606)

1:5,000 (at A3)

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Fernhill East Biobank
BioBanking Assessment

Job Number 22-16689
Revision A
Date 28 Aug 2013

Vegetation Zones

Figure 3

N:\AUSydney\Projects\22\16709\GIS\Maps\2216846_Z014_FernHill_East_Vegetation_Zones_Fire_Port_RevB.mxd

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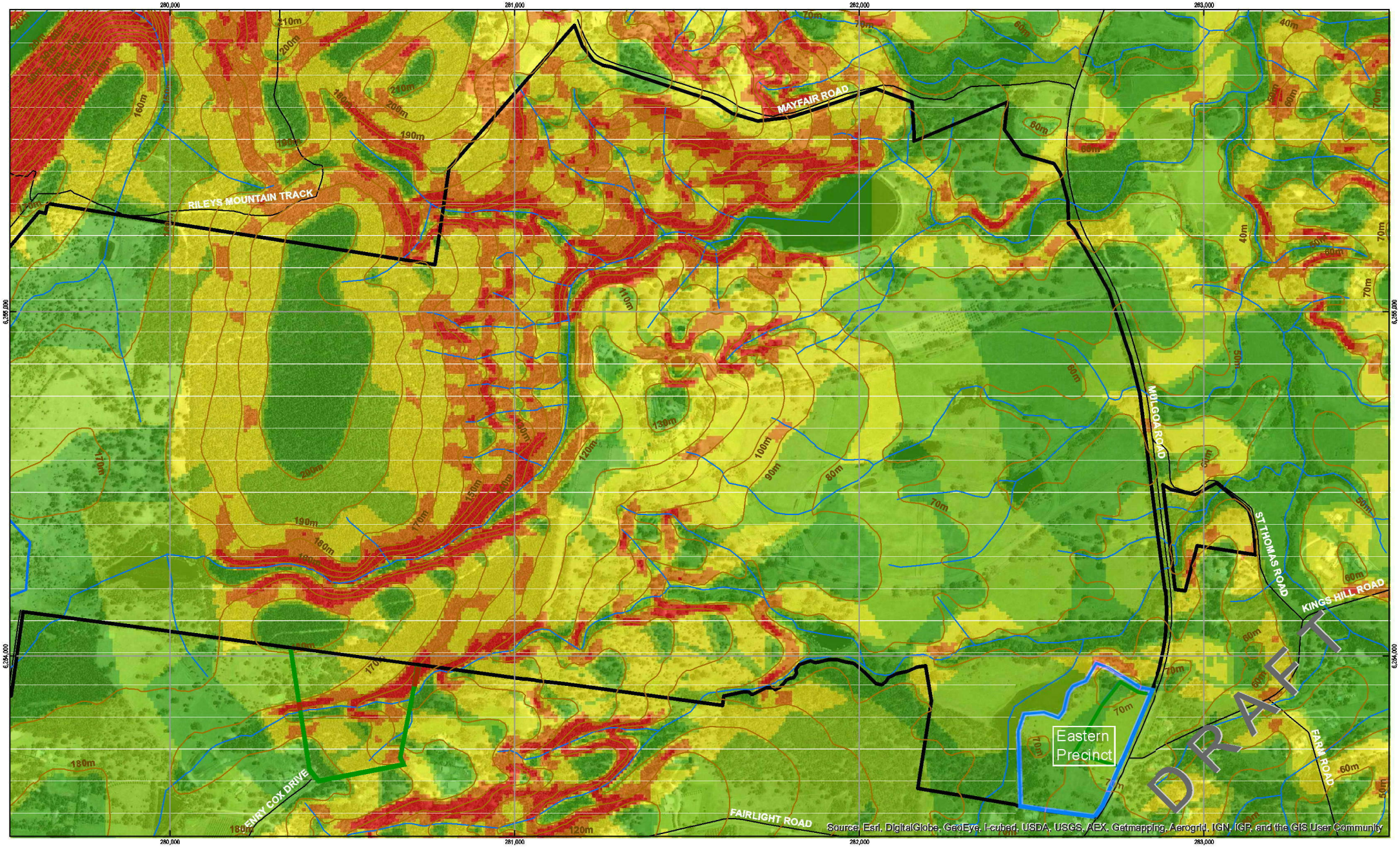
Data Source: Geoscience Australia: 250k Data - Jan 2011; Tough Mudder: Course Route, Obstacles, Car Parking and Base Area; 2013;ESRI World Imagery: Aerial Imagery, Accessed: 2013; GHD: Vegetation, 20-12-2012. Ecological: Grevillea Locations digitised from hard copy. Created by: qjchang



1:10,000 (at A3)

0 30 60 120 180 240 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Development footprint
- Site Boundary
- waterways
- Roads
- 10m Contour

Slope Degrees

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

Fernhill
Eastern Precinct

Job Number	22-16646
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Fern Hill Slope Eastern Precinct

Figure 4

Data Source: Geoscience Australia: 250k Data - Jan 2011; Tough Mudder: Course Route, Obstacles, Car Parking and Base Area; 2013;ESRI World Imagery: Aerial Imagery, Accessed: 2013; GHD: Vegetation, 20-12-2012. Ecological: Grevillea Locations digitised from hard copy. Created by: qjchung

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3. Bushfire Protection Measures for the Proposal

A range of bushfire mitigation measures are to be incorporated in the development of the subject land (Figure 5) including provision of Asset Protection Zones, and sealed road and fire trail access. These bushfire protection measures meet the aims and objectives of *PBP* (NSW RFS 2006) and are described in the following sections.

3.1 Asset Protection Zones

An Asset Protection Zones (APZ) is proposed (refer Figure 5) as shown in the table below. The residential dwelling is to be contained outside the APZ.

Table 2 APZ dimensions

Vegetation	Slope Class	APZ	Inner	Outer	Comment
Woodland	5-10 degrees	20 m	15 m	5	APZ may incorporate roads and trails and associated easements

Class 10b buildings (such as fences, retaining walls, walls and swimming pools) within the APZ need to be constructed of non-combustible materials. Where an above ground pool is erected it should not adjoin or be attached directly to the wall of the dwelling (NSWRFS 2006).

Class 10a buildings (such as a garage, carport, shed or other non-habitable buildings) need to be located greater than 10 m away from the dwelling. If the building is located within 10 m of the dwelling, the 10a building must meet the construction standard specified for the dwelling (NSWRFS 2006).

3.1.1 Inner Protection Area (IPA)

The IPA will extend from the building line. It is contained within the residential allotments and be maintained in accordance with *PBP* (NSWRFS 2006):

> *An IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 m from any part of the roofline of a dwelling. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 m from an exposed window of door. Trees should have lower limbs removed up to a height of 2 metres above ground.*

The property owner is responsible for the maintenance of the IPA.

3.1.2 Outer Protection Area (OPA)

The OPA will extend from the IPA (*i.e.* from the building line) towards the hazard. The landholder is responsible for the OPA contained within the subject land. Parts of the OPA may comprise a sealed access road or fire trail managed. The OPA within the residential allotments is to be maintained in accordance with *PBP* (NSWRFS 2006) as a minimum requirement:

> *An OPA should provide a tree canopy cover of less than 30% and should have understorey managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season (usually September).*

1:2,000 (at A3)

0 10 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- 10m Contour
- Fire Trail
- 20m APZ
- Subject site
- Lot Boundary

Fernhill Eastern Precinct
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Date	05 Sep 2013

Subject land layout including APZ Figure 5

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Data Source: Geoscience Australia: 250k Data - Jan 2011; Tough Mudder: Course Route, Obstacles, Car Parking and Base Area; 2013;ESRI World Imagery: Aerial Imagery, Accessed: 2013; GHD: Vegetation, 20-12-2012. Ecological: Grevillea Locations digitised from hard copy. Created by: qjchung

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3.1.3 Maintenance of bushfire fuel

Within the IPA and OPA fuels are to be managed in accordance with the *Standards for Asset Protection Zones* (NSWRFS 2005), this requires;

1. Raking or manual removal of fine fuels:

Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter), and bark should be removed on a regular basis.

2. Mowing of grass:

Grass needs to be kept short and where possible, green.

3. Removal or pruning of trees, shrubs and understorey:

Prune or remove trees so that there is discontinuous canopy leading from the hazard to the asset. Separate tree crowns by at least two to five metres. A canopy should not overhang within two to five metres of any building.

Native shrubs and trees should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.

3.2 Heat Shielding

Colorbond fences may be used for additional bushfire mitigation within the subject land. The CSIRO has identified (Leonard et al 2006[4]) that a Colorbond steel fence reduces the radiation levels within the fencing boundary to below 5 kw/m ^{2} immediately behind the fencing system during all radiation exposures, and reduces the radiant heat exposure on a structure 9 metres from the fencing by at least a factor of two. The research showed even at directly exposed peak heat flux on the front face of the fencing at 63 kW/m^2, the back face was 4 kW/m^2. .

3.3 Services

3.3.1 Water supply

Reticulated town water will supply the subject land.

Fire hydrants are installed to comply with the Rural Fires Regulation, fire hydrant spacing, sizing and pressures (AS2419.1 – 2005). These hydrants are located outside parking areas.

3.3.2 Electricity

All electricity lines within the subject land and servicing the proposed development will be underground.

3.3.3 Gas

In order to comply with the Rural Fires Regulation, all gas supplies are to be installed and maintained in accordance with AS 1596 – 2002.

[4] Leonard JE, Blanchi R, White N, Bicknell A, Sargeant A, Reisen F, Cheng M, Honavar K. 2006. Research and Investigation into the performance of residential boundary fencing systems in bushfires. CMIT-2006-186 Technical report for the Bushfire CRC and BlueScope Steel Ltd.

3.4 Access

3.4.1 Perimeter Access

Perimeter access in the form of a fire trail will provide suitable access for fire management and suppression purposes (Figure 6). The fire trail is accessible from three points within the subdivison.

Access is 6 m wide with a minimum trafficable width of 4 m. Where the access from the public road meets the fire-trail, reversing bays are provided. Gates/bollards will be installed at each end of the fire trail to limit unauthorised access.

The gradient and the crossfall of the fire trail is less than 10 degrees. The fire trail does not interrupt hydrological flows but will cross an intermittent drainage feature, and does not expose acid-sulphate soils.

For reasons listed below, the provision of a perimeter fire trail at this location provides many benefits over a perimeter public road:

- The perimeter fire trail will provide a strategic control line around the hazard side of the APZ;
- Fire suppression and management activities can be undertaken by combat and management agencies using the fire trail without obstruction from residential traffic;

The management specifications of the trails are as follows:

- A minimum carriageway of 4 m with a 1 m wide either side of the fire trail cleared of long grass and bushes.
- A minimum vertical clearance of 4 m to any overhanging obstructions.
- Gates are to be installed and locked with a key/lock system authorised by the Rural Fire Service.
- A management plan is prepared for the bio-banking land that details maintenance requirements to ensure that the fire trail is kept to the above specifications at all times.
- The management plan will also provide for weed management. Therefore the fire trail is not expected to spread or introduce weeds.

3.4.2 Public Roads

The subject land is accessed from Mulgoa Road. There are no dead-end roads within the subdivision.

The public road is to be a two-wheel drive, all weather road. The width of the road complies with Table 4.1 of *Planning for Bushfire Protection 2006,* as shown below.

Curve radius (inside edge)	Swept Path (metres width)	Single lane (metres width)	Two way (metres width)
<25	3.6	4.5	8.7
25-39	3.3	4.2	8.1
40-69	3.0	3.9	7.5
70-100	2.7	3.6	6.9
>100	2.5	3.5	6.5

Source: AS2890.2 – 2002.

Table 4.1 – Road widths for Category 1 Tanker (Medium Rigid Vehicle)

Traffic management devices are not installed and curves are minimal to allow rapid access and egress. Curves will have a minimum inner radius of six metres and the distance between the inner and outer curves is 6 m.

Maximum grades of the road do not exceed 10 m and the capacity will be sufficient to carry a fully loaded fire-fighting vehicle (15 tonnes).

Parking bays are not provided and therefore will not obstruct or reduce the paved width.

3.4.3 Property Access Roads

Fire appliance will generally be operating from the public road and / or the perimeter fire trail. Lot specific bushfire-related specifications are identified as part of the lot development application process.

3.5 Housing Construction Standards

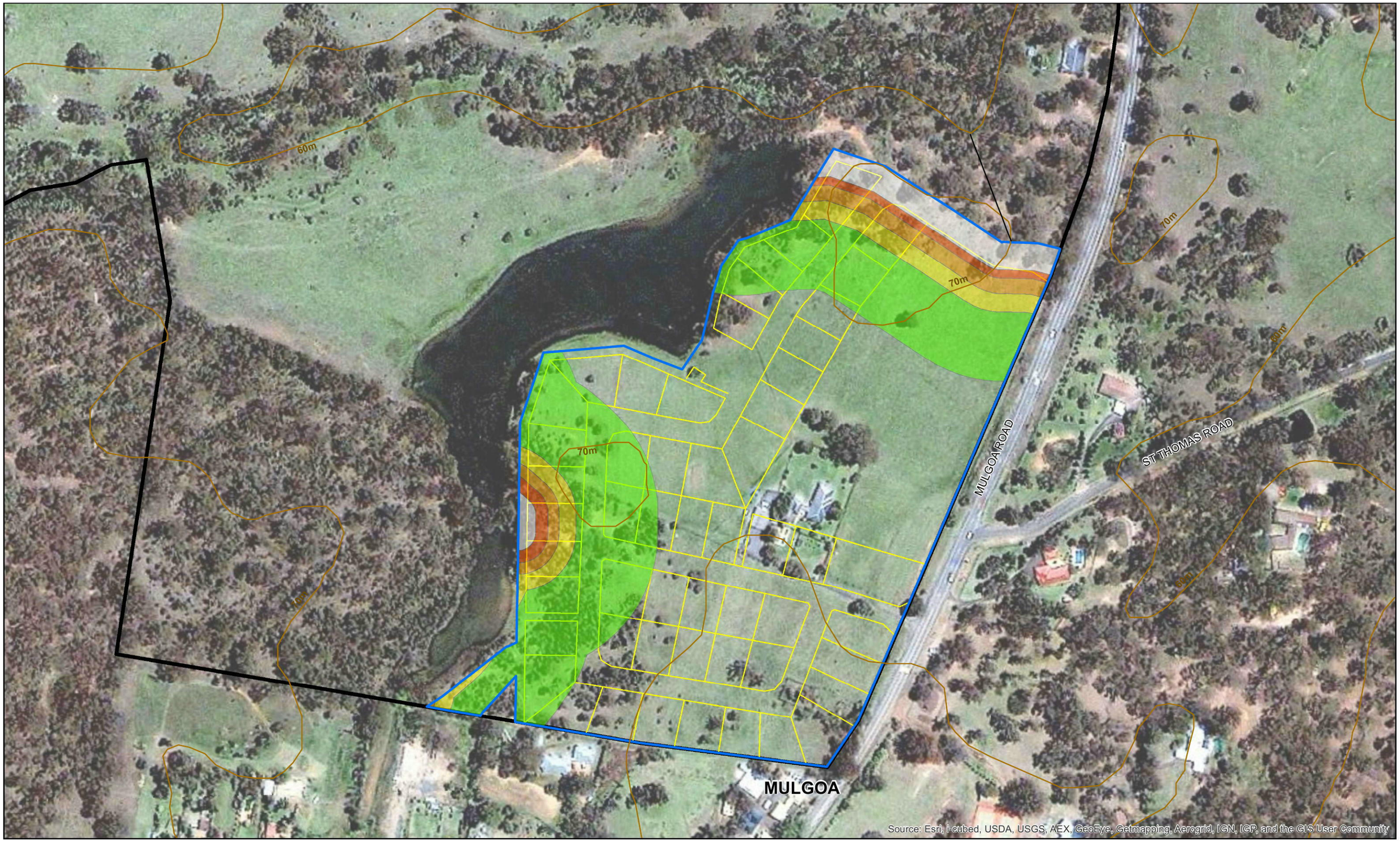
The Australian Standard AS 3959:2009 (*Construction of buildings in bushfire prone areas*) provides methodologies (*Method 1* (simplified) and *Method 2* (detailed)) to calculate bushfire attack level (BAL).

The simplified procedure methodology (*Method 1*) is based on a worst case scenario bushfire, burning at its highest intensity and rate of spread, with at least 100 metres flame front, under catastrophic weather conditions. Applying *Method 1* to subject land the following BAL requirements would be triggered for sections of the subdivision within vegetation and slope class shown below and identified in Figure 6.

As the BAL classification is based on slope and proximity to vegetation parts of the site which record the highest BAL ratings are those nearest the strip vegetation which crosses the lake (as it adjoins a larger patch of vegetation to the west) and the northern part of the subject land adjoining woodland vegetation on steeper slopes (5-10 degrees).

Table 3 AS 3959:2009 BAL Calculation

Vegetation	Slope Class	Flame Zone	BAL 40	BAL 29	BAL 19	BAL 12.5
		Distance from predominant vegetation in metres				
Woodland	flat | upslope	<12	12-<16	16-<24	24-<33	33-<100
Woodland	5-10 degrees	<20	20-<26	26-<37	37-<50	50-<100



1:2,500 (at A3)

0 10 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- 10m Contour
- Subject site
- Lot Boundary
- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5

Fernhill Eastern Precinct
Ecology Assessment

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Date	06 Sep 2013

Bushfire Attack Levels

Figure 6

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4. Summary Assessment of Compliance

The bushfire protection measures proposed for the subject land (Section 3) were designed to comply with all the "acceptable solutions" for each "performance measure" within Chapter 4 of *PBP.* As a result, compliance with the objectives of *PBP* has been achieved, as summarised in the table below . The development including the bushfire protection measures outlined in Section 3 of this report is therefore appropriate for the issuance of development approval in accordance with *Planning for Bushfire Protection.*

Table 4 Compliance with *Planning for Bushfire Protection 2006*

Measure	Assessment of Compliance
Asset Protection Zones	The proposed development has achieved the performance criteria by complying with the acceptable solutions, i.e. • An APZ is provided in accordance with Appendix 2 of Planning for Bushfire Protection 2006 (refer to Section 3.1) • The APZ is wholly within the boundaries of the development site (refer to Section 3.1) • The APZ will be managed in accordance with the requirements of Standards for Asset Protection Zones (RFS 2005) (refer to Section 3.1.3) • The APZ is located on lands with slopes less than 18 degrees (refer to Section 3.1)
Public Roads	The proposed development has achieved the performance criteria by complying with the acceptable solutions, i.e.; • Public roads are two-wheel drive (refer to Section 3.4.2) • Perimeter fire trail provides benefits over perimeter public road (refer to section 3.4.1) • Traffic calming devices are not proposed (refer to Section 3.4.2) • Public roads will have a crossfall not exceeding 3 degrees and grades not exceeding 10 degrees. • There are no dead-end roads and the sub-division has two points of access and egress by sealed road, with additional access and egress by fire trail. • Curves are minimal and have the required dimensions. • The capacity of the road will be greater than 15 tonnes.
Property Access Roads	Not applicable as fire suppression vehicles will operate from the perimeter fire trail or the public road. Residential driveways are unlikely to be utilised by bushfire suppression vehicles, however where this is required this will be addressed at the lot level development application.
Fire Trails	The proposed development has achieved the performance criteria by complying with the acceptable solutions, i.e.; • A minimum carriageway of 4 m will be provided with an additional 1 m strip either side cleared of long grass and bushes (refer to Section 3.4.1). • The trail will have a grade less than 10 degrees (refer to Section 3.4.1). • A minimum vertical distance of >4 m will be maintained (refer to Section 3.3.1). • The crossfall will be <10 degrees (refer to Section 3.4.1) • Each fire trail has two access points and no dead-ends. • The fire trail does not traverse wetlands drainage channels, and is not expected to expose acid-sulphate soils. • Gates will be installed with a lock and key system.

	• A plan of management for bio-banking will include control of weeds that may result from the fire trail.
Services – Water, electricity and gas	The proposed development has achieved the performance criteria by complying with the acceptable solutions, i.e.; Reticulated water and hydrants will be provided within the required specifications. Hydrants will not be located within designated parking spaces. Electricity will be underground. Gas supplies will be installed in accordance with AS 1596.

5. References

Gould JS, McCaw WL, Cheney NP, Ellis PF, Knight IK, Sullivan AL (2007) Project Vesta – Fire in Dry Eucalypt Forest: Fuel Structure, Fuel Dynamics and Fire Behaviour. Ensis – CSIRO, Canberra ACT

Leonard JE, Blanchi R, White N, Bicknell A, Sargeant A, Reisen F, Cheng M, Honavar K. 2006. Research and Investigation into the performance of residential boundary fencing systems in bushfires. CMIT-2006-186 Technical report for the Bushfire CRC and BlueScope Steel Ltd.

NSWRFS (NSW Rural Fire Service) 2005. *Standards for Asset Protection Zones*.

NSWRFS (NSW Rural Fire Service) 2006. *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities and Developers*. Prepared by NSW Rural Fire Service in cooperation with the Department of Planning.

Standards Australia 2009. *AS3959 – 2009 Construction of Buildings in Bushfire-prone areas*. Standards Australia and the Australian Building Codes Board, Sydney.

Standards Australia 2002 *AS/NZS 1596 The Storage and Handling of LP Gas*.

Standards Australia 2005. *AS2419.1 – 2005 Fire Hydrant installations – System design, installation and commissioning*

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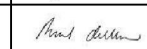
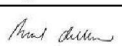
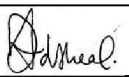
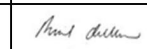
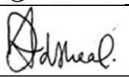
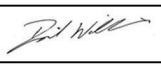
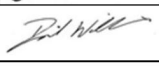
0	D.Adshead	P.de Mar		P.deMar		14/6/13
1	D.Adshead	F.Muller		D.Adshead		27/6/13
2	D.Adshead	P.de Mar		D.Adshead		19/8/13
3	D.Adshead	D.Williams		D.Williams		29/8/13

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