- Appropriate access standards for residents, fire-fighters, emergency 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.

This assessment adheres to Chapter 4.1.3 of PBP (RFS, 2006) 'Standards for Bush Fire Protection Measures for Residential and Rural Residential Subdivision' and Australian Standard 3959 – Construction of Buildings in Bush Fire Prone Areas (now referred to as AS3959-2009).

1.4 Development Estate Particulars

Locality – The proposed Gwandalan development estate is situated within land owned by Coal & Allied, on the Gwandalan peninsula.

LGA – Wyong Shire Council

Title(s) Entire Land Holdings – LOT 2 DP 1043151 and LOT 57 DP 755266.

Area – The site is 267.99ha of which 62.24ha is proposed for development and the remainder (205.75ha) will be dedicated as conservation lands to the NSW Government.

Zoning – The site is affected by multiple zonings as below;

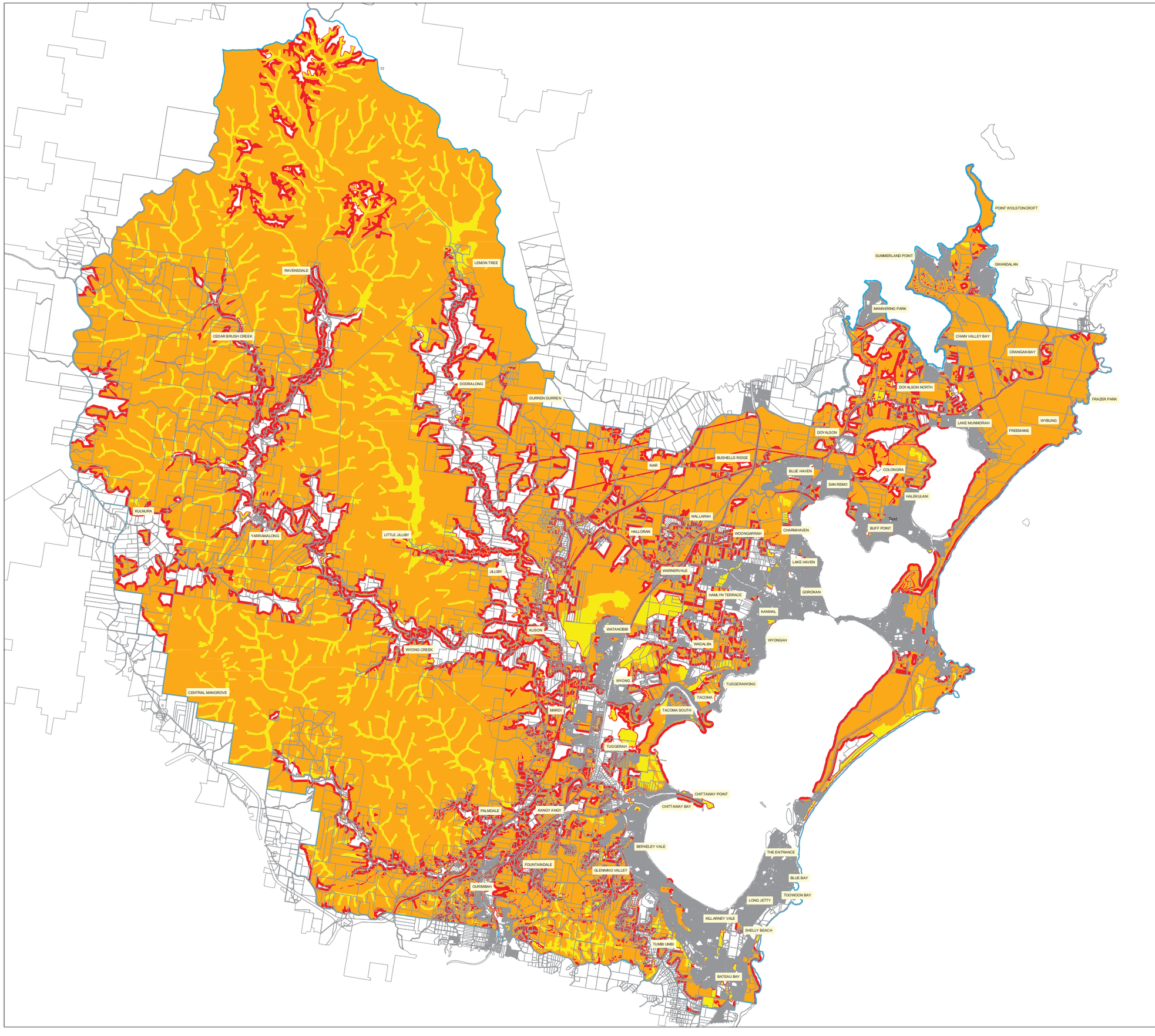
- Zone 5 (a) Special Uses Power Station
- Zone 7 (a) Conservation (Primary)
- Zone 7 (b) Scenic Protection
- Zone 7 (g) Wetlands Management

Bushfire Prone Land Zoning - The Wyong Shire Council (WSC) Bush Fire Prone Land Map (BFPLM), maps the development estate as containing Bushfire Vegetation Category 1 (Figure 1-2). Therefore, the proposed development needs to consider 'Planning for Bushfire Protection' (RFS, 2006) (hereafter referred to as 'PBP').

Boundaries – The villages of Gwandalan and Summerland Point occur to the north and Lake Munmorah State recreation area occurs to the south-west of the site. Conservation Land will occur to the west of the development estate across Kanangra Drive and to the south and east.

Current Land Use – Both the Development estate lands and the conservation lands are currently vacant native vegetation and the general public is currently utilising the lands for unauthorised motorbike and 4WD purposes.

Topography – The site is surrounded by low coastal hills, with a low northwest-southeast ridge upon which Kanangra Drive is situated. The land falls in both an easterly and westerly direction away from Kanangra Drive. To the west of Kanangra Drive, drainage flows into Tiembula Creek, which flows into Lake Macquarie. To the east of Kanangra Drive there is one unnamed creekline in the northeast of the site and in the site's lower southeast Strangers Gully supports a small wetland and also drains east into Lake Macquarie.



N

WYONG SHIRE COUNCIL

BUSH FIRE PRONE LAND MAP

Legend

- Bush Fire Prone Land - Vegetation Category 1
- Bush Fire Prone Land - Vegetation Category 2
- Bush Fire Prone Land - Vegetation Buffer - 100m & 30m
- WYONG SHIRE BOUNDARY

0 1 2 4 6
Kilometres

The information shown on this plan has been compiled by Wyong Shire Council to incorporate amendments and alterations to Environmental Planning instruments existing within the Shire of Wyong as at Dec 15 2003, but Council accepts no responsibility for errors or omissions. Any person whose legal rights may be affected or who intends to act on any information shown on this map should verify such information by consulting the original Orders and/or Ordinances and subsequent amendments in the Government Gazette. Any reference to cadastral information shown on this map should be referred to the Lands Department, Bathurst.

K. Yates
General Manager

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2 Vegetation Assessment

The vegetation in and around the development estate boundaries, to a distance of 140m, has been assessed in accordance with PBP (RFS, 2006). This assessment has been made via a combination of aerial photo interpretation and ground truthing exercises.

Vegetation Community classification has been undertaken across the development estate and within 140m of the development estate by RPS. The vegetation communities were delineated using the following adopted regional vegetation community mapping packages:

- Lower Hunter and Central Coast Regional Biodiversity Strategy (NPWS 2000; House 2002); and
- The Natural Vegetation of the Wyong Local Government Area (Bell, 2002).

Four vegetation communities were identified within the development estate and within 140m of the development estate; as follows:

1. Coastal Plains Scribbly Gum Woodland
2. Swamp Oak - Rushland Forest
3. Coastal Sheltered Apple - Peppermint Forest
4. Swamp Mahogany - Paperbark Swamp Forest

These vegetation communities have been classified for bushfire purposes into structure and formation using the system adopted by Keith (2004) and using Table A2.1 within PBP (RFS, 2006). Refer to Table 2-1 and Figure 2-1 overleaf. Generally the vegetation types adjacent to the proposed development estate are:

- Woodland to the west and south of the development estate.
- Open Forest on the north and eastern boundary of the development estate predominantly where the development estate adjoins Lake Macquarie, to the south associated with the drainage line and to the north.

With regards to the western portion of the site abutting Kanangra Drive, extant vegetation has been described within regional vegetation community mapping as ‘Coastal Plains Scribbly Gum Woodland’. Under the vegetation assessment criteria outlined within PBP 2006, the vegetation structure consists of an open woodland canopy and understorey with grassy groundcover as such has been determined as ‘Woodland’.

Considering the aforementioned, the Landscape Buffer to Kanangra Drive, has been identified as a Bushland reserve within the Concept Plan (Refer to Figure 1-3: Concept Plan). Furthermore this area has been identified as requiring ongoing management post development to an OPA standard. Notably the subject Bushland reserve was created resulting from being identified by RPS Ecologists as holding key ecological significance due to the presence of a population of the threatened species *Angophora inopina* (Charmhaven Apple), listed under the *TSC Act 1995.* Given the ecological significance of the proposed Bushland Reserve, it has been recommended within the ecological reporting that this area should be left in situ to ensure the ongoing viability of the *A. inopina* population.

This issue causes juxtaposition with regards to ongoing bushfire and ecological management. As such further discussion has been made in Section 4.3 below to develop a workable solution which caters for the bushfire management requirements while being sensitive to the ecological significance of the subject reserve.

Refer to Appendix 2 for examples of Vegetation Formations.

Note: For the purposes of this BTA, it has been assumed that vegetation within the development estate will be removed or managed as an APZ (with the exception of drainage lines / creeklines) as per the Concept Plan (Figure 1-3). This drainage line/creekline vegetation has been classified as Open Forest.

Table 2-1: Vegetation Classification

Vegetation Community	Classification of Vegetation formations
Coastal Plains Scribbly Gum Woodland	**Grassy Woodlands (Woodlands)**
Swamp Oak - Rushland Forest	**Dry Sclerophyll Forests (Open Forest) -** Subject to periodic inundation, however this community may remain dry for extended periods during which fuel loads will accumulate.
Swamp Mahogany - Paperbark Swamp Forest	**Dry Sclerophyll Forests (Open Forest) -** Subject to periodic inundation, however this community may remain dry for extended periods during which fuel loads will accumulate.
Coastal Sheltered Apple - Peppermint Forest	**Dry Sclerophyll Forests (Open Forest)**

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical portions should be obtained from RPS Newcastle.
Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries on the ground. Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

LEGEND
- 140m Buffer
- Development Estate
- Woodland
- Forest

N

0 400 800m

SCALE: 1:8500 AT A3 SIZE

TITLE: FIGURE 2-1 VEGETATION WITHIN 140M OF THE DEVELOPMENT ESTATE

LOCATION: GWANDALAN

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 8/4/2010
PURPOSE: BTA

LAYOUT REF: 24530\DRAFT\BUSHFIRE\NORTHALLWORKSPACES
VERSION (PLAN BY): \2010 \GWANFIGURE 2-1 VEGETATION MAP
A (A.P-M.D)

CLIENT: COAL & ALLIED INDUSTRIES LTD
JOB REF: 24530-1

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RPS

3 Slope Assessment

In accordance with PBP (2006), an assessment of the slope throughout the development estate and for 100m around was undertaken to identify both the average slope and by identifying the maximum slopes present. These values help determine the level of gradient which will most significantly influence fire behaviour on the development estate. Refer to Figure 3-1.

3.1 Slope Classes

A Slope Class Map (Figure 3-1) has been produced for land within 140m of the proposed development estates. The Slope Class Map has been produced using five slope classes as follows:

- 0 2^0;
- 2 - 3^0;
- 3 - 4^0;
- 4 – 6^0; and
- 6^0+.

Elevation across the development estate ranges from 28m AHD in the west of the development estate to 2m AHD in the east where the development estate adjoins the foreshore reserve of Lake Macquarie. The slope of vegetation surrounding the development estate to 140m is documented in Table 3-1.

Table 3-1: Slope Class Assessment

Direction of vegetation from development estate	Slope classes
North	Cross-slope/ Flat
South	Cross-slope/ Flat Upslope (0-5^0)
East	Downslope (0-5^0-) Flat
West	Upslope (0-5^0) Cross-slope

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

SCALE: 1: 6000 AT A3 SIZE

TITLE: FIGURE 3-1 SLOPE CLASS MAP

LOCATION: GWANDALAN

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 8/4/2010
PURPOSE: BTA

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3.2 Slope by Degrees

A Slope Degree Map has been produced for land within 100m of the development estate by using contours of 2 metres, derived from aerial photography, to determine the slope that will affect bushfire behaviour. This Slope Degree Map (Figure 3-2) has been created to assist in the determination of APZ's by the slope that will most likely influence bushfire behaviour. The slope of vegetation surrounding the development estate to 140m is documented in Table 3-2 below.

Table 3-2: Slope Degree Assessment

Direction of Vegetation from Development Estate	Slope of Vegetation
North	Cross-slope/ Flat
South	Cross – slope/ Flat 1.37° downslope
East	1.05° downslope 1.24° downslope 1.6° downslope 2.18° downslope 2.29° downslope 3.21° downslope 3.58° downslope 4.08° downslope
West	Cross-slope upslope 0-4° upslope

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

TITLE: FIGURE 3-2 SLOPE DEGREE MAP

LOCATION: GWANDALAN

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 8/4/2010
PURPOSE: BTA

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4 Asset Protection Zones

4.1 Definitions

4.1.1 APZs

An APZ is defined as an area surrounding a development zone that is managed to reduce the bushfire hazard to an acceptable level. The required width of the APZ varies with slope and the type of hazard. An APZ can consist of both an Inner Protection Area (IPA) and an Outer Protection Area (OPA). The respective IPA and OPA widths for the APZ's required under this proposal are as detailed in Section 4.4 and Figure 4-1.

An APZ can include the following:

- Lawns;
- discontinuous gardens;
- swimming pools;
- driveways;
- detached garages,
- open space / parkland;
- car parking;
- swales; and
- cycleways and formed walkways.

4.1.2 Inner Protection Area (IPA)

The IPA extends from the edge of the development to the OPA. The IPA aims to ensure that the presence of fuels which could contribute to a fire event / intensity, are minimised close to the development. The performance of the IPA must be such that:

- there is minimal fine fuel at ground level which could be set alight by a bushfire; and
- any vegetation in the IPA does not provide a path for the transfer of fire to the development – that is, the fuels are discontinuous.

The presence of a few shrubs or trees in the IPA is acceptable provided that they:

- do not touch or overhang any buildings;
- are well spread out and do not form a continuous canopy;
- are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and
- are located far enough away from any dwelling so that they will not ignite the dwelling by direct flame contact or radiant heat emission.

Woodpiles, wooden sheds, combustible material storage areas, large areas / quantities of garden mulch, stacked flammable building materials etc. should not be permitted in the IPA.

4.1.3 Outer Protection Area (OPA)

The OPA is located adjacent to the hazard. Within the OPA any trees and shrubs should be maintained in a manner such that the vegetation is not continuous. Fine fuel loadings should be kept to a level where the fire intensity expected will not impact on adjacent developments.

4.2 Determining APZs

In accordance with Table A2.4 within PBP (RFS, 2006), the appropriate width setbacks (depicted in Table 4-1 and Figure 4-1) have been calculated based on the topography and the vegetation present in and around the Development Estate. These prescribed distances will be required between neighbouring vegetation and the proposed residential development within the site. It is expected this area will be maintained to an APZ standard with minimal fuel loads and appropriate landscaping.

The Concept Plan indicates that proposed roadways provide a buffer between the adjacent vegetation and the development estate and vegetation therein, including foreshore parks, riparian buffers and vegetation buffers. The proposed perimeter and public roads within the development estate are therefore likely to provide either the entire or majority required APZ's, with any remaining part of the APZ (if required) being able to be established within the allotments.

Assessment of the Concept Plan shows that the layout provides for the required APZ's for all allotments.

Table 4-1: APZ Widths for Residential Development

Vegetation Type	Direction from Development Estate	Slope	APZ
Open Forest	North	Cross-slope	20m
Open Forest	South	1.37^0 downslope	25m
Open Forest	East	1.05^0 downslope	25m
Open Forest		1.24^0 downslope	25m
Open Forest		1.49^0 downslope	25m
Open Forest		1.6^0 downslope	25m
Open Forest		2.18^0 downslope	25m
Open Forest		2.29^0 downslope	25m
Open Forest		3.21^0 downslope	25m

Open Forest		3.58^0 downslope	25m
Open Forest		4.08^0 downslope	25m
Woodland	West	Cross-slope	10m
Woodland		0-4^0 upslope	10m

4.3 Solution Vegetation Assessment & *Angophora inopina*

The concept plan proposes a perimeter road running parallel to Kanangra Drive. As such the subject bushland reserve is surrounded on both sides by a public road and hence defendable space. The perimeter road totals 20 metres in width and will allow for adequate access per PBP criteria.

Given the information regarding slope (Downslope 0-5^0) and vegetation (Woodland – Grassy) and in accordance with Table A2.4 (pg 58 PBP, 2006) an APZ of 10m would be required between the development estate and the proposed bushland reserve. To this end, based on the additional assessment herewith it is considered that the proposed perimeter road within the development estate will ably provide for the recommended APZ and no ongoing bushfire management within the subject bushland reserve shall not be required.

Therefore *Angophora inopina* individuals and habitat will not need to be modified in order to achieve bushfire protection for the development.

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from RPS Newcastle.

LEGEND

- Site Boundary
- Development Estate
- Required APZ

N

0 300 600m

SCALE: 1:6000 AT A3 SIZE

TITLE: FIGURE 4-1 APZ MAP

LOCATION: GWANDALAN

DATUM: DATUM
PROJECTION: MGA ZONE 56 (GDA 94)

DATE: 8/4/2010
PURPOSE: BTA

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5 Water Supply

Associated with any kind of development upon the land, it is expected that water mains will be extended into the development estate. Access to this supply should be provided for fire-crews in the form of readily accessible and easily located fire hydrants. Fire hydrant spacing, sizing and pressure should comply with AS 2419.1 – 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Hydrants are not to be located within any road carriageway. All above ground water and gas service pipes external to the building are metal, including and up to any taps.

6 Access / Egress (Evacuation)

PBP (RFS, 2006) recommends a perimeter road be designed for any future residential development. A perimeter road forms part of the APZ and will provide a separation between the building and the boundary of the bush fire hazard.

Any **perimeter road** should be fully sealed and have a minimum road reserve width of 8m minimum kerb to kerb with the following design specifications:

- roads should be two wheel drive, all weather roads;
- roads should be two-way: i.e. at least two traffic lane widths with shoulders on each side, allowing traffic to pass in opposite directions;
- roads should be through roads where possible, any dead end roads should not be more than 200m in length with a 12m radius turning circle and clearly sign posted as such;
- the capacity of road surfaces and bridges should be sufficient to carry fully loaded fire fighting vehicles (approximately 28 tonnes or 8 tonnes per axle); and
- roads should be clearly sign posted and buildings clearly numbered.

The Concept Plan indicates that a perimeter road will be developed around the proposed development estate. The perimeter road complies with the above requirements. The perimeter road will be located between bushfire hazards and the boundary of allotments and therefore can form part of the APZ for development within this estate. This perimeter road will also provide fire fighters easy access to a defendable space between any dwellings and the hazard.

According to PBP (2006), the design specifications for **internal public road** require that roads:

- be two-wheel drive all weather roads;
- non perimeter roads comply with Table 6-1 (below) – Road widths for Category 1 Tanker;

Table 6-1: Minimum widths for fire fighting access of non-perimeter public roads

Curve radius (inside edge metres)	Swept Path (metres width)	Single land (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