

BUSHFIRE PROTECTION ASSESSMENT

FOR THE PROPOSED
RESIDENTIAL SUBDIVISION

OF

PART LOT 95 in DP 1111430 LAKES DRIVE

&

LOT 10 in DP 10711628, LOT 1 in DP 1089778 &

LOT 2 in DP 607602

NORTH BOAMBEE ROAD,

NORTH BOAMBEE

FOR

NOUBIA PTY LTD.



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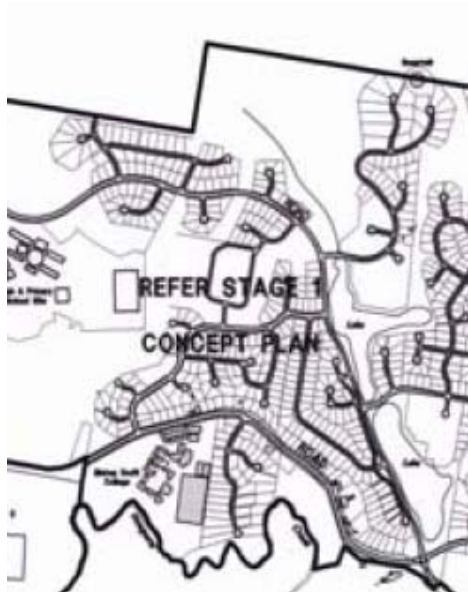
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EXECUTIVE SUMMARY

Australian Bushfire Protection Planners Pty Limited, at the request of *Noubia Pty Ltd*, has undertaken the bushfire consultancy to inform the concept planning process, under Part 3A [Major Projects under State Environmental Planning Policy] of the *Environmental Planning & Assessment Act 1979*, on the bushfire protection measures required for the residential subdivision of land within Part Lot 95 in DP 1111430 Lakes Drive and Lot 10 in DP 1071628, Lot 2 in DP 607602 and Lot 1 in DP 1089778 North Boambee Road, North Boambee Road.

The land over which the residential subdivision proposal is being undertaken is land within the northern portion of Stage 1 of the North Boambee Valley residential release area.

Figure 1 – Coffs Harbour LEP - Stage 1 of the North Boambee Valley Residential Release Area.



The subdivision proposal extends to the west, northwest and north of the existing approved development within the Lakes Estate, located to the north of North Boambee Road.

The western development precinct occupies the land to the west of the existing development, extending to the western property boundary north from North Boambee Road [within Lot 1 in DP 1089778, Lot 2 in DP 607602 and part of Lot 10 in DP 1071628] and contains proposed Lots 1 – 79 and Lots 130 – 136. The north-western development precinct occupies the western leg of the development site [within Lot 10 in DP 1071628] and is severed by the proposed Pacific Highway corridor. This precinct contains proposed Lots 80 – 129, Lots 181 – 186 and Lots 197 – 199 which are located to the east of the Highway corridor and Lots 187 – 196 to the west of the Highway corridor.

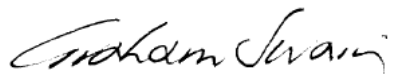
The northern development precinct is located within the north-eastern corner of the development site, within Lot 95 in DP 1111430 and extends to the north of the approved lots within the Lakes Estate. This precinct contains Lots 137 – 180.

The vegetation within the development site consists of Tall Open Forest Type 1 [Flooded Gum – Tallowwood]; Tall Open Forest Type 2 [Blackbutt – Tallowwood – Broad-leaved White Mahogany; Pasture; Pastoral Woodland – Swamp Mahogany; Disturbed or re-generating vegetation and Lowland Rainforest.

The unmanaged forest vegetation within the development site and within the land adjoining the development site is mapped as Category 1 Bushfire Prone Vegetation on the Certified Coffs Harbour Council Bushfire Prone Land Map. Therefore, the proposed lots located adjacent to the bushfire prone vegetation, retained within the proposed subdivision and on adjoining lands, will require the provision of an Asset Protection Zone to a width which complies with the deemed-to-comply provisions of *Planning for Bushfire Protection 2006*.

The Director Generals Environmental Assessment Requirements includes, under the subheading “*Natural Hazards and Contamination*” the advice that the Environmental Assessment must address the requirements of *Planning for Bushfire Protection 2001 (Rural Fire Service)*. Since the issue of the DGRs, *Planning for Bushfire Protection* has been updated to the 2006 version.

Therefore, this report undertakes an assessment to determine the deemed-to-satisfy requirements of *Planning for Bushfire Protection 2006* and provides recommendations on the provision of Asset Protection Zones to the buildings; emergency access/egress; fire-fighting access and water supplies; construction standards of the buildings and the management of the Asset Protection Zones and residual vegetation so as to address the aim and objectives of *Planning for Bushfire Protection 2006*.



Graham Swain,
Managing Director,
Australian Bushfire Protection Planners Pty Limited.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
TABLE OF CONTENTS.....	5
SECTION 1	7
INTRODUCTION	7
1.1 Development Proposal.....	7
1.2 Aim of this Assessment.....	8
1.3 Statutory Requirements.	8
1.3.1 Legislation.	8
1.3.1 Legislation.	8
1.3.2 Planning Policies.	8
1.4 Documentation reviewed in this Assessment.....	9
1.5 Site Inspection.	9
1.6 Authority Consultation.....	9
SECTION 2	10
PROPERTY DESCRIPTION	10
2.1 Location.	10
2.2 Existing Land Use.....	11
2.3 Surrounding Land Use.	11
2.4 Topography.	13
2.4.1 Within the Development Precinct.....	13
2.4.2 Beyond the Development Precinct.....	14
2.5 Vegetation.	16
2.5.1 Vegetation within the Development Site.	16
2.5.2 Vegetation within 140m of the Development Precinct.....	18
2.6 Significant Environmental Features within the Development Site.	19
2.7 Known Threatened Species, Population or Ecological Community within the Development Site.	19
2.8 Details and location of Aboriginal relics or Aboriginal place.	19
SECTION 3.....	20
FIRE MANAGEMENT RESPONSIBILITIES	20
3.1 Coffs Harbour City Council.	20
3.2 New South Wales Rural Fire Service.....	20
3.3 New South Wales Fire Brigade.	20
3.4 Bush Fire Coordinating Committee	20
3.5 Public Authorities & owners/occupiers of land.	21
3.6 Management of the Asset Protection Zones to the Development.	22
SECTION 4	23
PRECINCT LEVEL ASSESSMENT.....	23
4.1 Certified Bushfire Prone Land Map	23
SECTION 5	24
BUSHFIRE PROTECTION ASSESSMENT.....	24
5.1 Introduction.....	24
5.2 Determination of Asset Protection Zones.....	24
5.3 Assessment of Bushfire Attack (Construction Standards).....	31
5.4 Water Supplies for Firefighting Operations.	33
5.5 Access for Fire Fighting Operations.....	33
5.5.1 Public Roads:	33
5.5.2 Fire Trail Access.....	35
5.5.3 Emergency Response Access / Egress.	35
5.6 Adequacy of Bushfire Maintenance Plans and Fire Emergency..... procedures.....	36
5.7 Emergency Management for Fire Protection / Evacuation.	36
5.8 Bushfire Hazard Management.	36

SECTION 6	37
RECOMMENDATIONS	37
SECTION 7	39
CONCLUSION	39
REFERENCES:	40
SECTION 9	41
ATTACHMENT A – Concept Plan showing Bushfire Protection Measures.....	41

SECTION 1

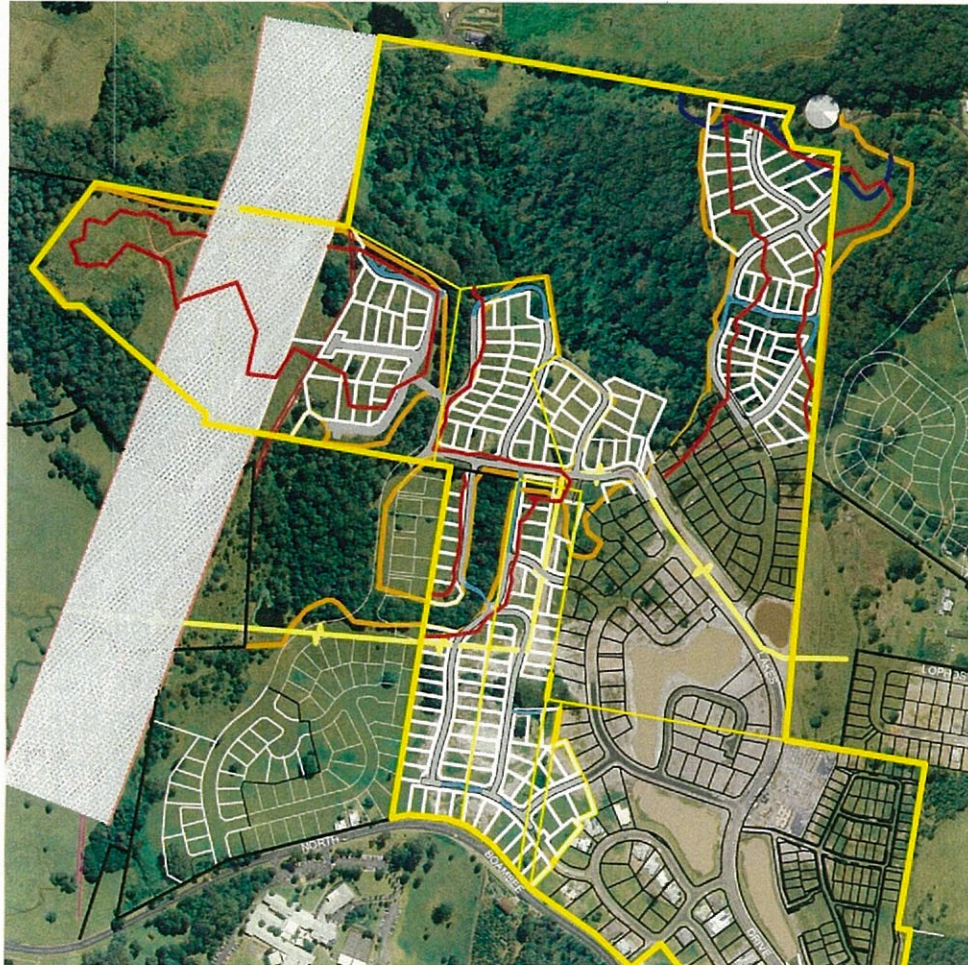
INTRODUCTION

1.1 Development Proposal.

Australian Bushfire Protection Planners Pty Limited, at the request of *Noubia Pty Ltd*, has undertaken the bushfire consultancy to inform the concept planning process, under Part 3A [Major Projects under State Environmental Planning Policy] of the *Environmental Planning & Assessment Act 1979*, on the bushfire protection measures required for the residential subdivision of land within part Lot 95 in DP 1111430 Lakes Drive and Lot 10 in DP 1071628, Lot 2 in DP 607602 and Lot 1 in DP 1089778 North Boambee Road, North Boambee.

The concept proposal seeks approval to create approximately one hundred and ninety nine [199] residential lots ranging in sized from 500m² to 4320m² with access from Lakes Drive and a road network which provides a perimeter road/fire trail between the bushfire hazard and the lots adjoining the bushfire hazard interface.

Figure 1 – Subdivision Plan.



1.2 Aim of this Assessment.

The aim of this assessment is to address the Director General's Environmental Assessment Requirements, requires compliance with the requirements of *Planning for Bushfire Protection 2006 (RFS)*.

This report examines the requirements of *Planning for Bushfire Protection 2006* and provides advice on the bushfire protection measures deemed necessary to address the potential bushfire threat to the development.

1.3 Statutory Requirements.

This report has been prepared having regard to the following legislative and planning requirements:

1.3.1 Legislation.

1.3.1 Legislation.

Environmental Planning and Assessment Act - 1979 (EPA Act)

Planning and development within NSW is regulated by the *Environmental Planning & Assessment Act, 1979* (EPA Act). Part 3A [Major Projects] of the Act commenced on the 1st August 2005 and consolidated the assessment and approval regime for all major projects previously addressed under Part 4 [Development Assessment] or Part 5 [Environmental Assessment] of the Act.

1.3.2 Planning Policies.

Planning for Bushfire Protection – 2006. [Rural Fire Service]

This document provides guidance on the planning and development control processes in relation to bushfire protection measures for rural residential and residential subdivision, “*Special Fire Protection*” and Class 5 – 8 and 10 buildings in bushfire prone areas.

The document provides deemed-to-satisfy specifications on the provision of Asset Protection Zones to residential and “*Special Fire Protection*” developments; defendable space requirements to other developments and access/water supply provisions for developments in bushfire prone areas. Provision for the assessment of construction standards to buildings and management /maintenance of the Asset Protection Zones/defendable space to buildings is also provided in the document.

1.4 Documentation reviewed in this Assessment.

The following documents were reviewed in the preparation of this report:

- North Boambee Local Environment Plan;
- Subdivision Plans prepared by Coomes Consulting;
- Coffs Harbour Council Bushfire Prone Land Map;
- *Planning for Bushfire Protection 2006* prepared by the NSW Rural Fire Service;
- Australian Standard AS3959 *Construction of Buildings in Bushfire Prone Areas*;
- *Rural Fires Regulation 2002*.

1.5 Site Inspection.

Graham Swain of *Australian Bushfire Protection Planners Pty Limited* inspected the site and surrounding areas on the 25th September 2007 to assess the topography, slopes and vegetation classification within and adjoining the development property and to validate the future subdivision's compliance with the requisite deemed-to-satisfy Asset Protection Zones and access provisions. Adjoining properties were also inspected to determine the surrounding land use / vegetation communities land management.

1.6 Authority Consultation.

In accordance with the Director Generals Requirements, consultation with the NSW Rural Fire Service was held on the 25.6.2008.

This consultation occurred between Mr Catoral, Development Control Officer with the NSW Rural Fire Service and Graham Swain, Director of *Australian Bushfire Protection Planners Pty Limited*.

There were no issues raised by Mr Catoral that warrants modification to the development layout or the contents of this report and the recommendations in respect to the provision of fire protection measures and compliance with the deemed-to-satisfy provisions of *Planning for Bushfire Protection 2006*.

SECTION 2

PROPERTY DESCRIPTION

2.1 Location.

The development site occupies land within Part Lot 95 in DP 111430 Lakes Drive and Lot 10 in DP 1071628, Lot 2 in DP 607602 and Lot 1 in DP 1089778 North Boambee Road, North Boambee.

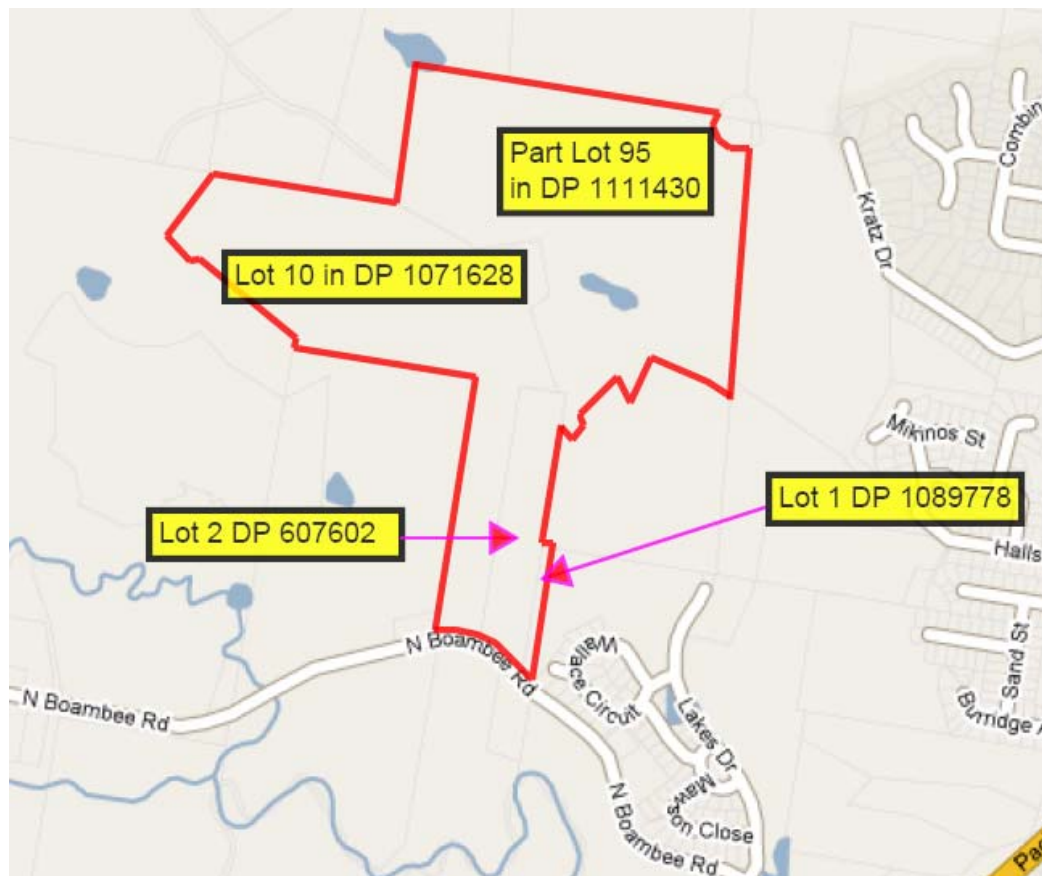
The land over which the residential subdivision proposal is being undertaken is land within the northern portion of Stage 1 of the North Boambee Valley residential release area.

The subdivision proposal extends to the west, northwest and north of the existing approved development within the Lakes Estate, located to the north of North Boambee Road.

The western development precinct occupies the land to the west of the existing development, extending to the western property boundary north from North Boambee Road [within Lot 1 in DP 1089778, Lot 2 in DP 607602 and part of Lot 10 in DP 1071628] and contains proposed Lots 1 – 79 and Lots 130 – 136. The north-western development precinct occupies the western leg of the development site [within Lot 10 in DP 1071628] and is severed by the proposed Pacific Highway corridor. This precinct contains proposed Lots 80 – 129, Lots 181 – 186 and Lots 197 – 199 which are located to the east of the Highway corridor and Lots 187 – 196 to the west of the Highway corridor.

The northern development precinct is located within the north-eastern corner of the development site, within Lot 95 in DP 111430 and extends to the north of the approved lots within the Lakes Estate. This precinct contains Lots 137 – 180.

Figure 2 – Location of Development Site.



2.2 Existing Land Use.

The land within the development precinct is vacant land which is used for agricultural grazing.

2.3 Surrounding Land Use.

(a) North

The land adjoining the northern aspect of the development precinct [to the north of Part Lot 95 in DP 1111430 and Lot 10 in DP 1071628] consists of agricultural land used for banana cultivation. A narrow corridor of 7A Environmental Protection Habitat zoned land extends along the northern boundary of both lots. [Refer to Figure 3 – Coffs Harbour Zoning Map].

(b) East

The land to the east of Part Lot 95 in DP 1111430 [within the north-eastern corner of the development site] contains vacant land, most of which is zoned for future residential development. An area of vacant 7A Environmental Protection Habitat zoned land also adjoins the eastern boundary.

The existing Lakes Estate adjoins the eastern aspect of Lot 1 in DP 1089778 and Lot 2 in DP 607602 within the southern portion of the development precinct.

(c) South

The land adjoining the southern aspect of the proposed development within Part Lot 95 in DP 1111430 consists of existing residential development within the Lakes Estate. The land adjoining the southern portion of the development site [Lot 1 in DP 1089778 and Lot 2 in DP 607602 and the southern leg of Lot 10 in DP 1071628, consists of the North Boambee Road with agricultural land [zoned for future residential development] located to the south of the road reserve.

The land to the south of the western leg of the development precinct [Lot 10 in DP 1071628] consists of vacant bushland that is zoned 7A Environmental Protection Habitat.

(d) West

The land to the west of the southern leg of Lot 10 in DP 1071628 consists of vacant agricultural land which is grazed and is zoned for future residential development. A residential subdivision has been approved for the land within DP 1082747. The land to the southwest and west of the western leg of Lot 10 in DP 1071628 consists of vacant bushland that is zoned 7A Environmental Protection Habitat.

Figure 3 – Coffs Harbour LEP Zoning Map.

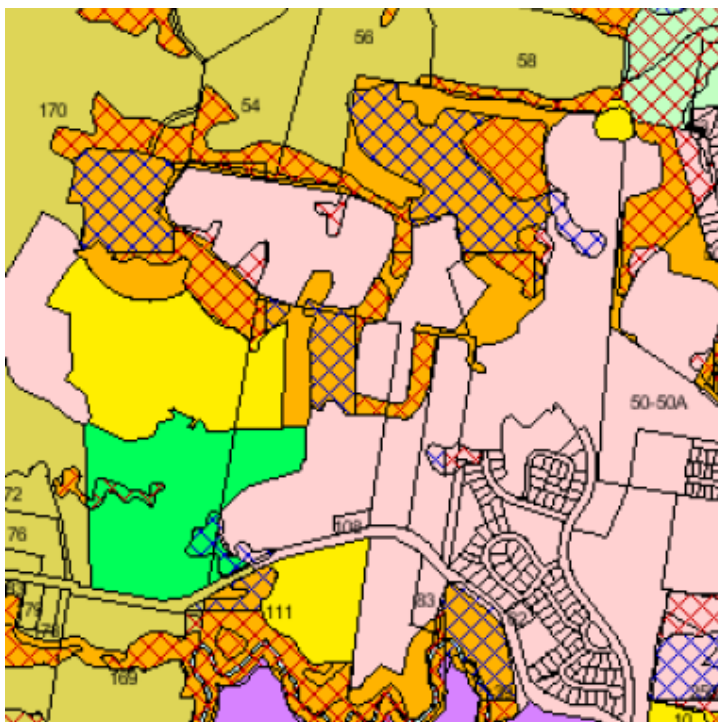
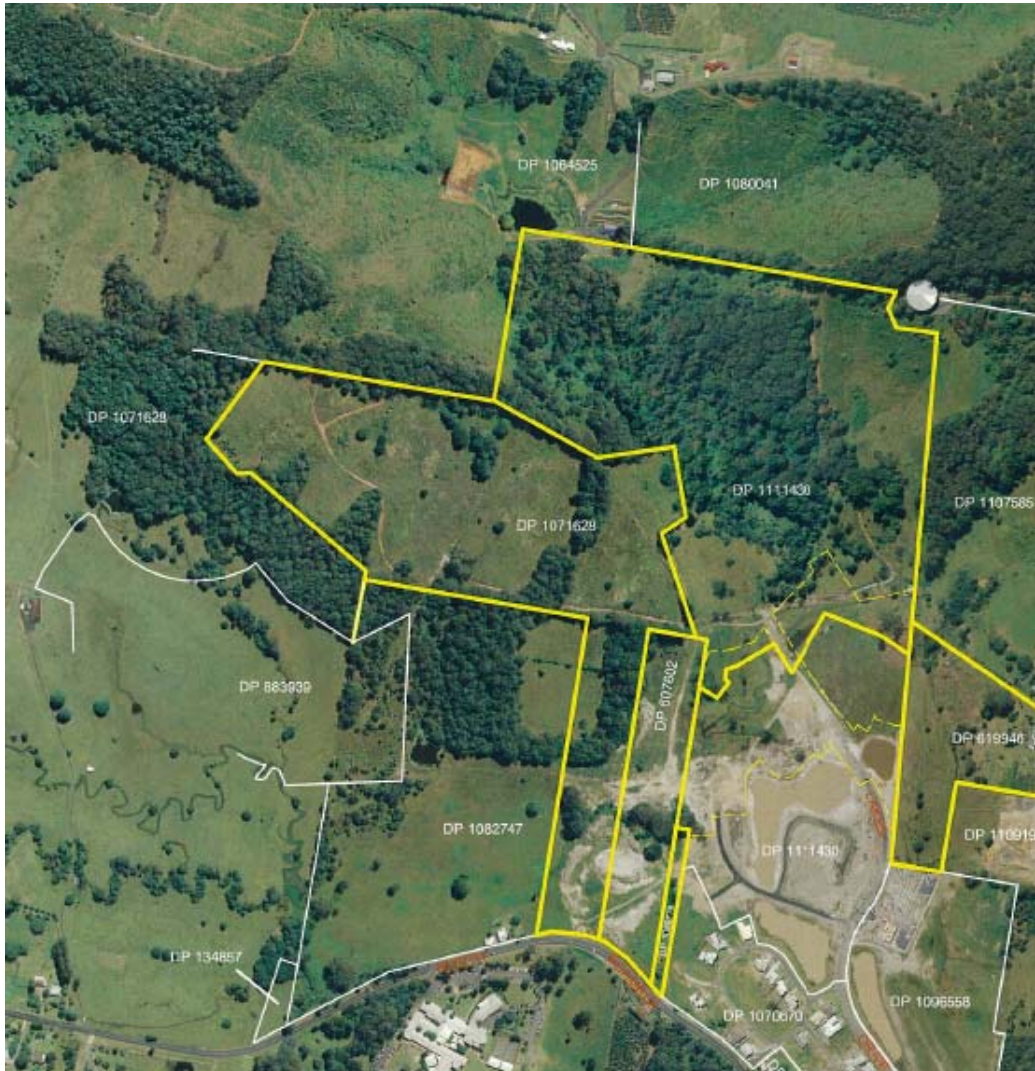


Figure 4 – Aerial Photograph of Development Site.



2.4 Topography.

Appendix 2 of *Planning for Bushfire Protection 2006* states that slopes should be assessed, over a distance of at least 100m from a development site and that the gradient of the land should be determined which will most significantly influence the fire behaviour to the site.

2.4.1 Within the Development Precinct.

The topography of the landform within the development precinct consists of gently to steep ridgelines formed by the upper tributaries to New Ports Creek. The eastern tributary flows from northwest to southeast across Lot 95 in DP 1111430, continuing to the southeast through the existing Lakes Estate.

The north-eastern corner of the development site rises from the creekline at < 10 degrees across the vegetated corridor, increasing to 15 – 18 degrees across the residential zoned land. To the southwest of the creekline, the topography rises to the ridgeline within the eastern portion of Lot 10 in DP 1071628 at < 10 degrees.

Within the western portion of the development precinct, the ridgeline to the east of the western tributary rises to the east at < 5 degrees whilst the land to the west rises steeply to a spur located in the western portion of the development precinct. This spur falls to the south from the higher ridgeline to the north of Lot 10 in DP 1071628. The land on this spur slopes to the east, south and west towards the lot boundaries at 15 – 18 degrees.

2.4.2 Beyond the Development Precinct

(a) North of proposed Lots 101 – 103, 128, 129, 185, 186, 189 – 192, 170 - 173.

The topography of the land to the north of the proposed subdivision precincts on Lot 95 in DP 1111430 and Lot 10 in DP 1071628 forms the higher ridgelines to the north of the development precinct. Slopes on these ridgelines range from > 5 degrees to > 18 degrees upslope from the future residential development.

(b) East of proposed Lots 139 – 142, 162, 163, 167, 168 & 170.

The topography of the land to the east of the development precinct rises to the northeast at > 10 degrees.

(c) South.

The topography of the land to the south of the proposed lots within Lot 95 in DP 1111439, being the northern part of the existing Lakes Estate, falls gently to the southeast along the creek corridor from proposed Lot 137 and Lots 148 - 151.

The land to the south of North Boambee Road, to the south of the proposed Lots 1 – 12, rises to the southwest of Lots 1 – 7 and falls to the southwest of Lots 8 – 12 at < 10 degrees.

The land to the south of proposed Lot 116 – 118, to the east of the proposed Pacific Highway corridor within the western portion of the development precinct, falls to the south beyond the southern boundary of Lot 10 in DP 1071628 at 6 degrees, following the slope of the creek tributary.

The land to the south of the lots within the western portion of the development site, to the west of the proposed Pacific Highway corridor, slopes to the south at 14 – 15 degrees across the Habitat Corridor.

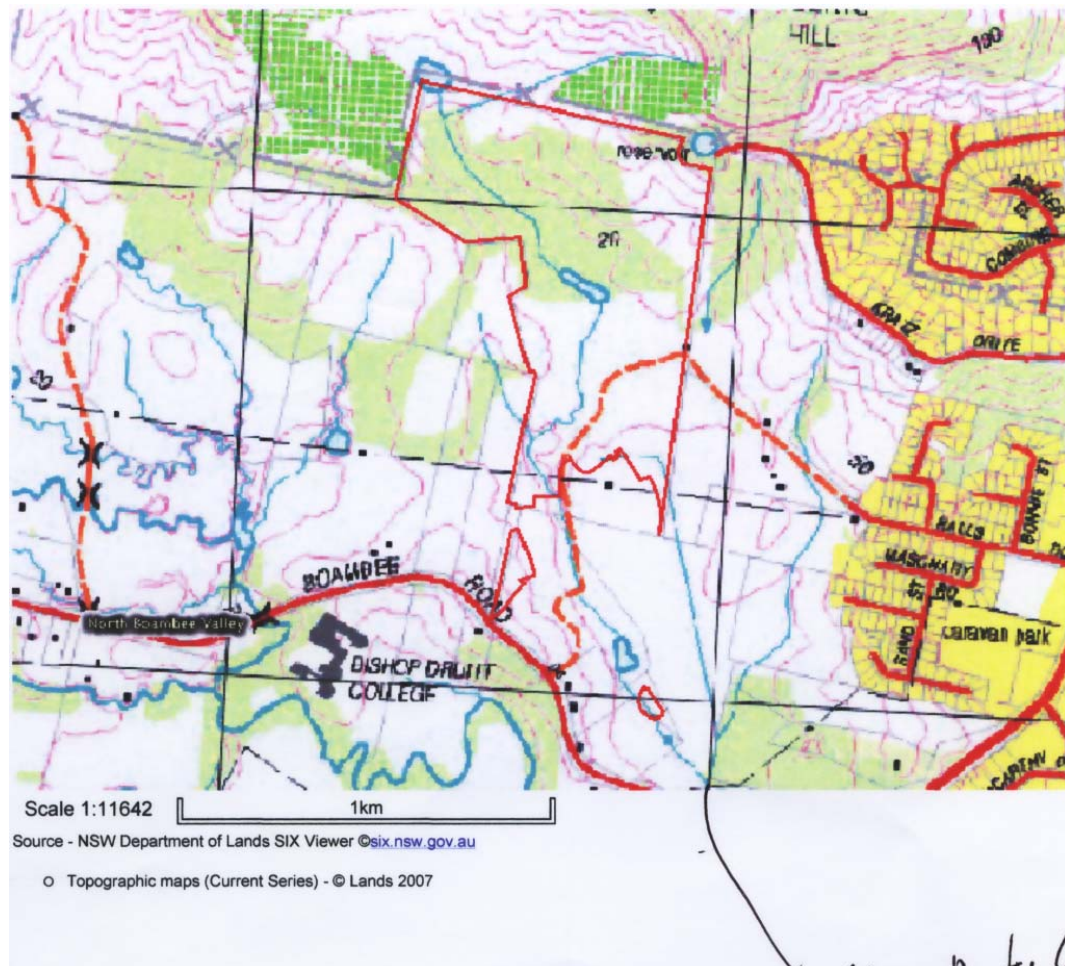
(d) West.

The topography of the land to the west of proposed Lots 151 – 154, Lot 157 and Lots 173 – 178, within the north-eastern corner of the development precinct, slopes to the west/southwest into the creek corridor at 10 degrees.

The topography of the land to the west of proposed Lots 12 – 23 slopes to the west from the saddle, across the approved residential subdivision at < 5 degrees.

The topography of the land to the west of proposed Lots 195 & 196, within the western portion of the development precinct, to the west of the Pacific Highway corridor, falls to the west at 8 degrees into the creek corridor which is located to the west of the development site.

Figure 5 – Topographic Map showing contours.



2.5 Vegetation.

Appendix A2.3 of *Planning for Bushfire Protection 2006* provides a methodology for determining the predominant bushfire prone vegetation for at least 140 metres in all directions from the future development on the site.

Vegetation is classified using Table A2.1 of *Planning for Bushfire Protection 2006*, which classifies vegetation types into the following groups:

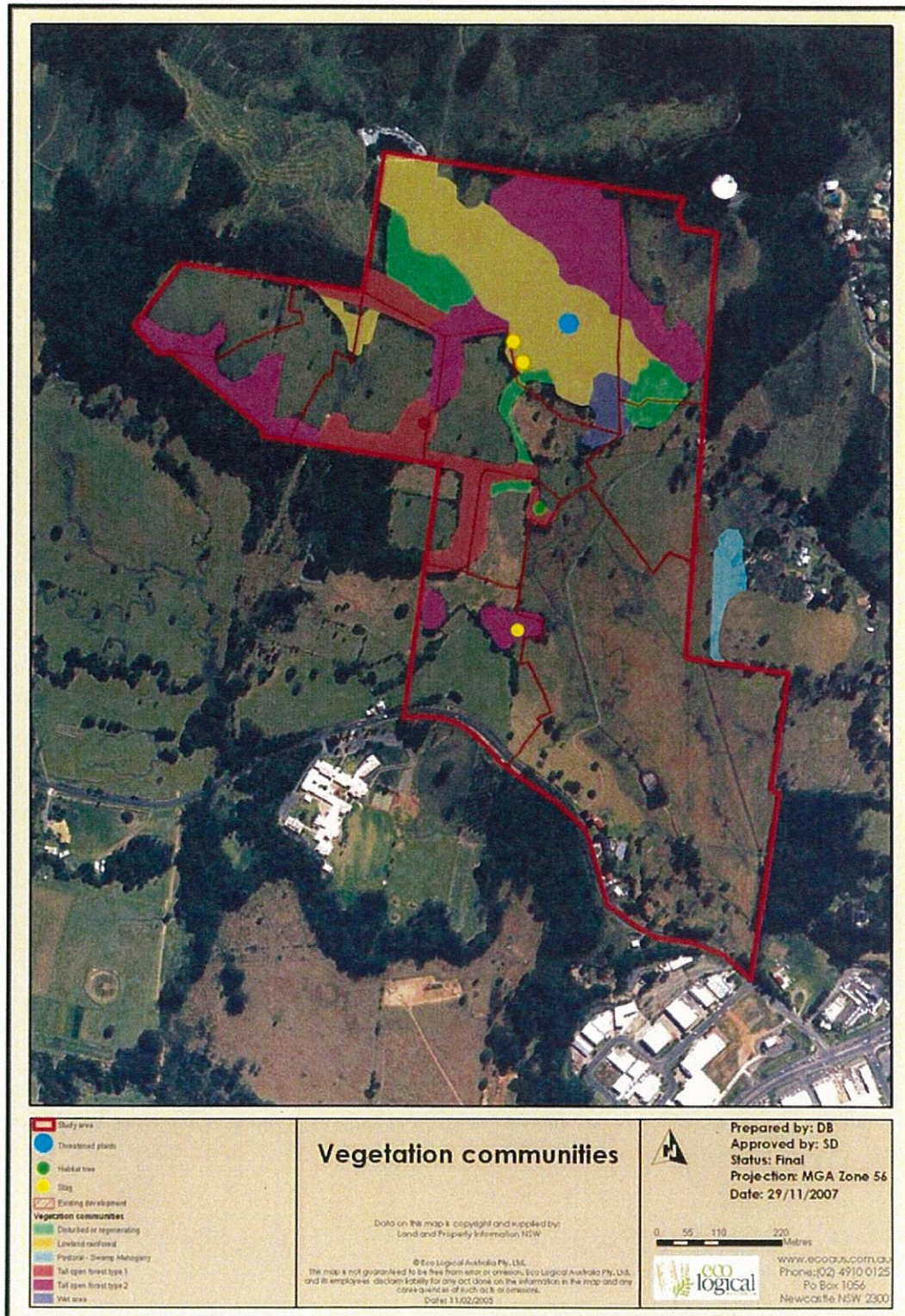
- (a) *Forests [wet & dry sclerophyll forests];*
- (b) *Woodlands;*
- (c) *Plantations – being pine plantations not native plantations;*
- (d) *Forested Wetlands;*
- (e) *Tall Heaths;*
- (f) *Freshwater Heaths;*
- (g) *Short Heaths;*
- (h) *Alpine Complex;*
- (i) *Semi – arid Woodlands;*
- (j) *Arid Woodlands; and*
- (k) *Rainforests.*

2.5.1 Vegetation within the Development Site.

The vegetation within the development site was mapped in the preparation of the North Boambee Local Environment Plan [LEP] with further site investigation being undertaken by Eco Logical Australia. Figure 6, below, shows the vegetation communities found within the development site, as mapped by Eco Logical Australia.

[Refer to Figure 6 below].

Figure 6 – Vegetation Communities within the development site.



2.5.2 Vegetation within 140m of the Development Precinct.

(a) North of proposed Lots 172 & 173; Lots 101 – 102, Lots 128 & 129, 185 & 186; Lots 189 – 192.

The predominant vegetation to the north of these future residential allotments consists of Tall Open Forest.

(b) Northeast of proposed Lots 81 – 83 and Lots 99 – 101.

The predominant bushfire prone vegetation to the northeast of proposed Lots 81 – 83 and Lots 99 – 101 is Lowland Rainforest within the creek corridor.

(c) East of proposed Lots 162, 163, 167 and 168.

The predominant vegetation to the east of proposed Lots 162, 163, 167 & 168, on the vacant residential zoned land to the east of the north-eastern corner of the development precinct, contains managed grassland within the former banana plantation.

(d) South of proposed Lots 1 – 12.

The predominant vegetation to the south of proposed Lots 1 – 12, on the lands to the south of North Boambee Road, consists of managed grassland and orchard. The vegetation to the southeast of proposed Lot 1 consists of Tall Open Forest within the 7A Environmental Protection Habitat zoned land on the southern side of North Boambee Road.

(e) South & southwest of proposed Lots 116 – 119, Lot 181 and Lots 187, 193 – 195.

The predominant vegetation to the south of the proposed lots within the western portion of the development precinct, east and west of the proposed Pacific Highway corridor, consists of Tall Open Forest.

(f) West of proposed Lots 12 – 23.

The predominant vegetation to the west of proposed Lots 12 – 23 consists of managed grassland on the land approved for future residential development.

(g) West of proposed Lots 67 – 73.

The predominant vegetation to the west of proposed Lots 67 – 73 consists of managed grassland on the adjoining disused banana plantation.

(h) West of proposed Lots 195 & 196.

The predominant vegetation on the land to the west of proposed Lots 195 & 196, on the western boundary of the development precinct, consists of Tall Open Forest.

(i) West of proposed Lots 146 – 154 and Lots 173 - 178.

The predominant vegetation to the west of proposed Lots 146 – 154 consists of Lowland Rainforest within the creekline.

The predominant vegetation to the west of proposed Lots 173 – 178 consists of Tall Open Forest.

2.6 Significant Environmental Features within the Development Site.

The development site does not contain areas of SEPP 14 Wetland; land of geological interest; land slip areas, National Parks Estate, or steep lands [>18 degrees].

The development site contains SEPP 44 Koala Habitat, very high and high value vegetation within the defined 7A Environmental Protection Habitat zoned areas. The proposed subdivision maintains the habitat vegetation within the development precinct.

The riparian corridor to New Ports Creek flows through the north-western corner of Lot 95 in DP 1111430, within the Lowland Rainforest vegetation. This vegetation/riparian corridor is not impacted by the proposed subdivision.

2.7 Known Threatened Species, Population or Ecological Community within the Development Site.

A number of constraints were identified by Eco Logical Australia. These include a large area of Lowland Rainforest, which is classified as an Endangered Ecological Community [EEC] and koala habitat threatened species and hollow bearing trees and stags.

The layout of the proposed subdivision minimises the potential impact on the threatened species and the Endangered Ecological Community.

2.8 Details and location of Aboriginal relics or Aboriginal place.

The Archaeological Assessment undertaken as part of the examination of the route of the new Pacific Highway recorded no aboriginal relics or places within the development site. An isolated artefact was identified by on the land to the north of existing Lot 10 in DP 1071628 [Godwin 82].

SECTION 3

FIRE MANAGEMENT RESPONSIBILITIES

Fire management within the development site is the responsibility of:

3.1 Coffs Harbour City Council.

The Coffs Harbour City Council has responsibility, under Section 66 of the *Rural Fires Act*, to issue a notice in writing requiring an owner / occupier of any land within the LGA to carry out bushfire hazard reduction works on that land. Section 100E of the *Rural Fires Act* requires Council to issue bushfire hazard reduction certificates for hazard reduction to be undertaken on private lands.

3.2 New South Wales Rural Fire Service.

The NSW Rural Fire Service (RFS) has the responsibility for undertaking fire suppression activities, hazard management activities and other functions relative to emergency management, within its areas of operation. *Section 73* of the *Rural Fires Act (1997)* enables the Commissioner to carry out bush fire hazard reduction works on any land as required by a bush fire risk management plan if the work has not been carried out satisfactorily. Incurred costs can be recovered as a debt owed to the Crown.

3.3 New South Wales Fire Brigade.

The NSW Fire Brigade has the responsibility for undertaking fire suppression activities, and other functions relative to emergency management, within its area of operation and through Mutual Aid Agreements, provide assistance to the NSW Rural Fire Service, particularly for structural fire operations within the NSW Rural Fire Brigade Districts. Hazmat management within New South Wales is the responsibility of the NSW Fire Brigade.

3.4 Bush Fire Coordinating Committee.

The NSW Bush Fire Coordinating Committee has the responsibility of planning for co-ordinated fire fighting activities / hazard management activities within the State. It is not an operational organization, a fire fighting organization or a funding source for fire management activities.

The Bush Fire Coordinating Committee is supported by the following provisions of the Rural Fires Act 1997:

- **Section 50(1)** of the Act requires the Bush Fire Co-ordinating Committee to constitute a Bush Fire Management Committee for the whole of the area of any local Council area for which a rural fire district is constituted.

- **Section 50 (1A)** requires the Bush Fire Coordinating Committee to constitute a Bush Fire Management Committee for the area of a local authority for which a fire district is constituted if there is a reasonable risk of bushfires in that area;
- **Section 50(2)** requires that a Bush Fire Coordinating Committee to constitute a Bush Fire Management Committee for a part of the State other than a rural fire district or fire district.
- **Section 52** requires each Bush Fire Management Committee to prepare a draft bush fire management plan for their local areas which includes a plan of operations and a bush fire risk management plan.
- **Section 54** of the Act specifies that a draft bush fire risk management plan is to 'set out schemes for the reduction of bush fire hazards in the rural fire district or other part of the State'. A draft bush fire risk management plan may also restrict or prohibit the use of fire or other fire hazard reduction activities in all or specified circumstances or places to which the plan applies.

3.5 Public Authorities & owners/occupiers of land.

The Rural Fires Act, 1997 provides several legislative opportunities to require Public Authorities land owners and occupiers to manage hazardous fuels. These are listed below:

- **Section 63(1)** states that it is the duty of a public authority to take any practicable steps to prevent the occurrence of bushfires on, and to minimise the danger of the spread of a bushfire on or from:
 - (a) any land vested in or under its control or management, or
 - (b) any highway, road, street, land or thoroughfare, the maintenance of which is charged on the authority.
- **Section 63(2)** states that 'it is the duty of the owner or occupier of land to take the notified steps (if any) and any other practicable steps to prevent the occurrence of fires on, and to minimise the danger of the spread of fires on or from that land'.
- **Section 66(1)** states that a local authority of an area may, by notice in writing, require the occupier or owner [not being a public authority] of any land within the area to carry out bushfire hazard reduction work specified in the notice on the land.
- **Section 66(2)** states that the local authority must serve a notice under this section if required to do so by a bushfire risk management land applicable to the land that is in force.

- **Section 87** allows the removal of hazards in the bush fire danger period by the provision of a permit system. The permits are valid for 21 days, excluding TOBAN days. Section 10 permits are not required to adhere to *Part V* provisions of the EPA Act 1979 in the assessment of impact, except for public authorities. An owner/occupier of private land must obtain from the NSW Rural Fire Service, a bushfire hazard reduction certificate before undertaking hazard reduction works on that land (Section 100E of the *Rural Fires Act 1997*).

3.6 Management of the Asset Protection Zones to the Development.

The provision of the Asset Protection Zones to the future residential development will be provided by either the widths of the perimeter roads plus building line setback or the establishment of the Asset Protection Zones within the lots.

Therefore the management of the Asset Protection Zones/landscaping within the proposed residential subdivision will remain the responsibility of the individual landowner whilst the 7A zoned land will be retained in a separate lot and maintained by the present owner under the provisions of a Vegetation Management Plan and Fire Management Plan.

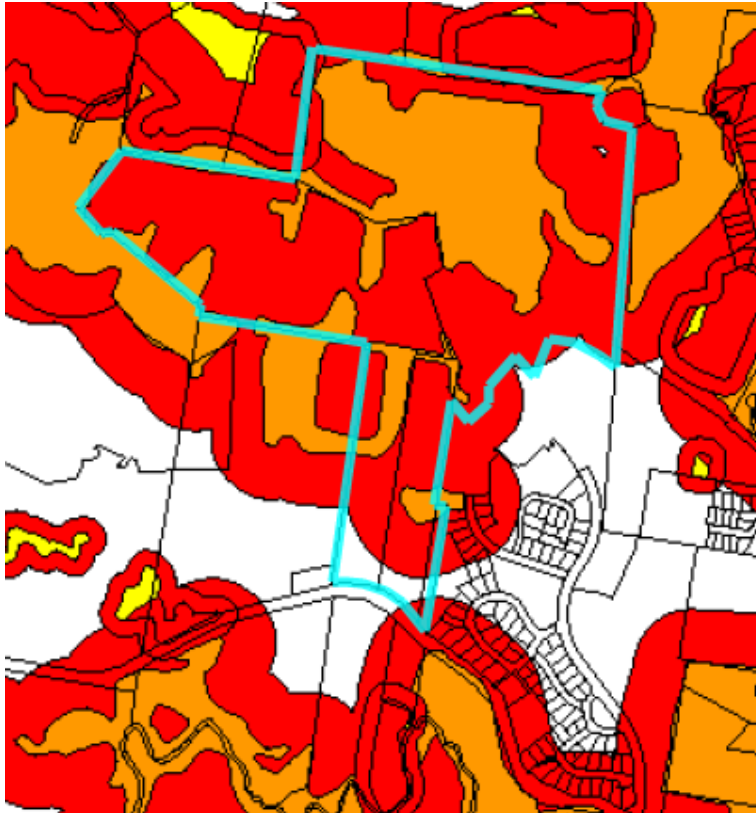
SECTION 4

PRECINCT LEVEL ASSESSMENT

4.1 Certified Bushfire Prone Land Map

The following Figure 7 is a copy of an extract of the Certified Coffs Harbour Council Bushfire Prone Land Map showing the extent of the Category 1 Bushfire Prone Vegetation on the development site and adjoining properties.

Figure 7 – Plan of Bushfire Prone Land.



The site inspection examined the extent of the bushfire prone vegetation located within the development site and on adjoining lands and confirmed the accuracy of the Certified Bushfire Prone Land Map.

SECTION 5

BUSHFIRE PROTECTION ASSESSMENT

5.1 Introduction.

The Department of Planning [DOP] issued Director General's Requirements [DGRs] for the Environmental Assessment of a Concept Plan for the proposed residential subdivision, under Part 3A of the *Environmental Planning & Assessment Act* on the 28th June 2006 and requires, under Part 4 "Natural Hazards & Contamination" that the Environmental Assessment address the requirements of *Planning for Bushfire Protection 2001*. Since the issue of the DGRs, this document has been replaced by *Planning for Bushfire Protection 2006*, therefore, the following bushfire protection assessment will be undertaken to address the requirements of this latter document.

Planning for Bushfire Protection 2006 provides a methodology to determine the Asset Protection Zones and Bushfire Attack / Construction Standards required for habitable buildings in development for residential purposes that are designated as bushfire prone.

Sections 5.2 and 5.3 of this report use the methodology provided by *Planning for Bushfire Protection 2006* to determine the deemed-to-satisfy Asset Protection Zones and construction standards required for the construction of the future residential development on the site.

Planning for Bushfire Protection 2006 also provides deemed-to-satisfy specifications on the provision of access and water supplies for firefighting operations and emergency access/egress and the management protocols for Asset Protection Zones and landscaping. These matters are examined in Sections 5.4 – 5.8 of this report.

5.2 Determination of Asset Protection Zones.

Appendix 2 of *Planning for Bushfire Protection 2006* provides the following procedure for determining setback distances (Asset Protection Zones):

- (a) *Determine vegetation formations as follows:*
 - Identify all vegetation in all directions from the site for a distance of 140 metres;
 - Consult Table A2.1 to determine the predominant vegetation type; and
 - Select the predominant vegetation formation as described in Table A2.1.
- (b) *Determine the effective slope of the land under the predominant vegetation Class.*

- (c) Determine the appropriate fire [weather] area in Table A2.2.
- (d) Consult Table A2.5 and determine the appropriate setback [Asset Protection Zone] for the assessed land use, vegetation formation and slope range.

The following tables [Table 2 – 4] provide a summary of this assessment and the resultant widths of the Asset Protection Zones for the construction of future residential development within the proposed development site. The Fire Danger Index [FDI] for the site is 80.

Table 2. Determination of Asset Protection Zones to the future residential development on proposed Lots 1 – 79 within the southern portion of the development precinct.

Aspect	Vegetation within 140m of the development	Predominant Vegetation Formation	Effective Slope of Land	Width of APZ [Table A2.5 of Pf BFP 2006]	Width of APZ Provided	Compliance with Table A2.5 of Pf BFP 2006
North of Lots 74 & 79	Proposed residential development	Managed curtilage	Level	Nil	None required	Yes
East of Lots 53 – 58, Lot 63, 64, 78 & Northeast of Lots 131, 136	Managed curtilage in existing residential lots	Managed curtilage	< 5 degrees down slope to the east	Nil	None required	Yes
Southeast of Lot 1 & Lots 130, 131	Managed curtilage in existing residential lots	Nil	< 5 degrees down slope to the N.E.	Nil	None required	Yes
South of Lots 1 - 12	Forest to the southeast of Lots 1 - 7; Managed grassland & orchard to the south of Lots 1 – 12	Forest to the southeast of Lots 1 – 7; Nil to the south of Lots 1 – 12	> 5 degrees upslope to the S.E. of Lots 1 – 7; 5 degrees downslope to the S.E. of Lots 1 – 12	20 metre wide APZ required to the S.E. of Lots 1 – 7; Nil APZ required to the south of Lots 1 – 12	> 20 metres provided to Lots 1 – 7 by width of North Boambee Road	Yes
West of Lots 12 – 23 & Lots 67 - 74	Managed grassland within future residential development	Nil	< 5 degrees downslope to the west of Lots 12 – 23; < 5 degrees upslope to Lots 67 - 74	Nil	> 100 metres provided by managed grassland & future residential development	Yes
Habitat corridor between Lots 67 – 74 & Lots 59, 60, 66, 75, 76 & 79	Narrow band [< 50m] of Tall Open Forest	Forest reclassified to "Rainforest" due to corridor width being less than 50m	< 5 degrees downslope to east & west of vegetated corridor	10 metres to the lots on both sides of the vegetated corridor	> 15 metres provided by the width of the edge roads + the building setback distance	Yes

Assessment Results:

The 7A Environmental Protection Habitat zoned land to the southeast of proposed Lot 1, on the southern side of North Boambee Road creates a bushfire hazard to proposed Lots 1 – 7, being those lots within 100 metres of the edge of the Tall Open Forest.

The assessment has determined that a 20 metre wide Asset Protection Zone separation is required, for Level 3 construction, to the future dwellings on these lots. This separation is available in the width of North Boambee Road, increasing as the lots progress to the west.

The habitat corridor within the northern portion of this development precinct contains Tall Open Forest which will be retained as a Habitat [Koala] corridor. The corridor has a width of less than 50 metres and is therefore classified as “Rainforest” bushfire prone vegetation. The lots adjoining this vegetation require the provision of a minimum 10.0 metre wide Asset Protection Zone which is provided by the width of the perimeter roads and the building line setback.

Figure 8 – Asset Protection Zones to Lots 1 – 86

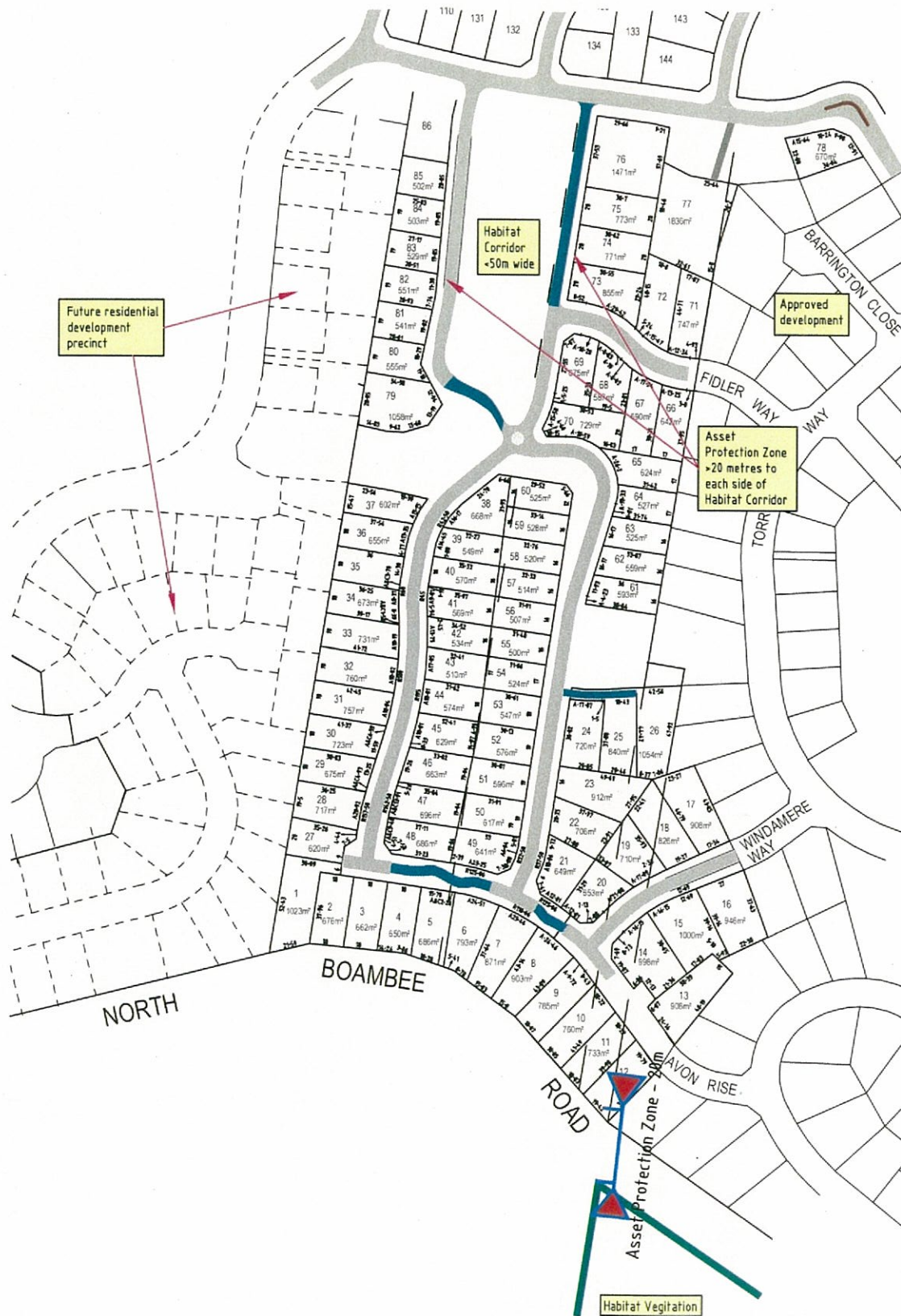


Table 3. Determination of Asset Protection Zones to the future residential development on proposed Lots 80 – 129 & Lots 181 – 199 within the western portion of the development precinct.

Aspect	Vegetation within 140m of the development	Predominant Vegetation Formation	Effective Slope of Land	Width of APZ [Table A2.5 of PfBFP 2006]	Width of APZ Provided	Compliance with Table A2.5 of PfBFP 2006
North of Lots 101 – 102; 128, 129 & Lots 185 & 186	Narrow corridor of Tall Open Forest + regenerating vegetation	Forest	< 5 degrees downslope to the north	20 metres	Minimum 20 metres provided by width of road + building setback	Yes
North of Lots 189 - 192	Tall Open Forest	Forest	> 15 degrees upslope to the north	20 metres	Minimum 20 metres provided by APZ	Yes
Northeast of Lots 81 – 83; Lots 99 - 101	Lowland Rainforest	Rainforest	< 5 degrees downslope to the northeast	10 metres	> 15 metres provided by road width and building setback	Yes
East of Lots 80, 81 & Lots 197 – 199	Managed grassland	Nil	< 2 degrees downslope to the east	Nil	> 15 metres provided by road width and building setback	Yes
South of Lots 88, 91 & 92	Tall Open Forest in Habitat Corridor to the south	Forest [linear length of vegetation in habitat corridor]	Level to the south	10 metres	> 15 metres provided by road width and building setback	Yes
South of Lots 116 – 119 & Lot 181	Tall Open Forest on the adjoining land to the south	Forest	Level to Lots 116 – 119; < 5 degrees downslope to Lot 181	20 metres	> 20 metres provided by road + setback to Lots 116 – 118 & APZ to Lots 119 & 181	Yes
South of Lots 187, 193 - 195	Tall Open Forest	Forest	14 – 15 degrees downslope to the south	40 metres	> 40 metres provided by road + setback to buildings	Yes
West of Lots 195 & 196	Tall Open Forest	Forest	8 degrees downslope to the west	30 metres	30 metres provided by APZ & access road	Yes
Habitat corridor between Lot 89; Lots 103 – 111 & Lots 113 – 116 & 125 - 128	Narrow band [< 50m] of Tall Open Forest	Forest reclassified to "Rainforest" due to corridor width being less than 50m	< 5 degrees downslope to east & west of vegetated corridor	10 metres to the lots on both sides of the vegetated corridor	> 15 metres provided by the width of the edge roads + the building setback distance	Yes

Assessment Results:

The habitat corridor between Lots 89, 103 – 111 [to the east] and Lots 113 – 116 & 126 – 128 [to the west] contains Tall Open Forest which will be retained as a Habitat [Koala] corridor.

The corridor has a width of less than 50 metres and is therefore classified as "Rainforest" bushfire prone vegetation. The lots adjoining this vegetation require the provision of a minimum 10.0 metre wide Asset Protection Zone which is provided by the width of the perimeter roads and the building line setback.

Figure 9 – Asset Protection Zones to Lots 141 - 138, 120 - 123, 111, 112 - 120, 87 - 91, 96 & 97, 106 - 109, 92, 104 & 105.



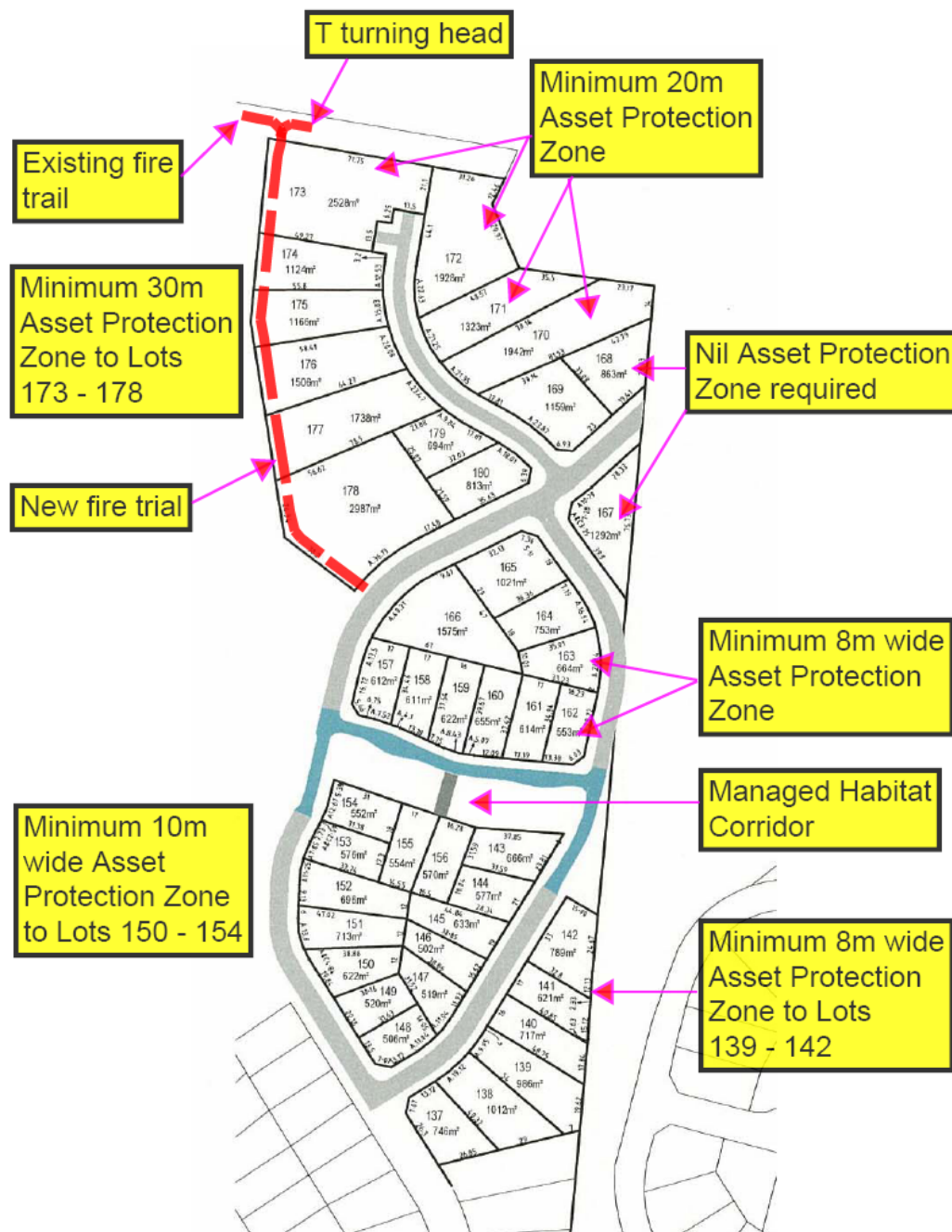
Table 4. Determination of Asset Protection Zones to the future residential development on proposed Lots 137 – 142, 150 – 154, Lot 157, Lots 162 – 164, Lot 166 – 178 within the north-eastern portion of the development precinct.

Aspect	Vegetation within 140m of the development	Predominant Vegetation Formation	Effective Slope of Land	Width of APZ [Table A2.5 of PfBFP 2006]	Width of APZ Provided	Compliance with Table A2.5 of PfBFP 2006
North of Lots 170 - 173	Tall Open Forest	Forest	> 15 degrees upslope to the north	20 metres	Minimum 20 metres provided by APZ on lots	Yes
Northeast of Lot 172	Tall Open Forest	Forest	> 15 degrees upslope to the north	20 metres	Minimum 20 metres provided by APZ on lot	Yes
East of Lots 167 & 168	Managed grassland within future residential development	Nil	< 15 degrees downslope to the east	Nil	None required	Yes
East of Lots 162 – 164	Tall Open Forest in Habitat Corridor to the northeast	Forest [linear length of vegetation in habitat corridor]	15 degrees upslope to the northeast	20 metres [Note – 8 metres by calculation]	> 15 metres provided by road width and building setback	Yes – exceeds calculated width of APZ
East of Lots 139 – 142	Tall Open Forest in narrow finger of Habitat Corridor	Forest	15 degrees upslope to the northeast	20 metres [Note – 8 metres by calculation]	> 8 metres provided by APZ within lots	Yes – complies with calculated width of APZ
West of Lots 150 – 154	Lowland Rainforest	Rain Forest	< 2 degrees downslope to the west	10 metres	> 15 metres provided by road + setback to buildings	Yes
West of Lots 173 - 178	Tall Open Forest	Forest	< 10 degrees downslope to the west	30 metres	30 metres provided by APZ within lots	Yes
Habitat corridor between Lot 143; Lots 154 – 156 & Lots 157 – 162	Narrow band [< 50m] of Tall Open Forest with a managed understorey	Nil – canopy only retained with managed understorey	< 5 degrees upslope from Lots 143, 154 – 156; < 5 degrees downslope from Lots 157 – 162	Nil – managed corridor	None required	Yes

Assessment Results:

The Tall Open Forest vegetation between Lot 143; Lots 154 – 156 and Lots 157 – 162 will be retained to provide a habitat corridor from the vegetation to the west of this development precinct to the Habitat vegetation on the land to the east. This corridor will retain the tree canopy whilst management will be undertaken to minimise understorey vegetation and ground fuels.

Figure 10 – Asset Protection Zones to Lots 137 – 142, 150 – 154, Lot 157, Lots 162 – 164, Lot 166 – 178 within the north-eastern portion of the development precinct.



5.3 Assessment of Bushfire Attack (Construction Standards).

Part 2.3.4 of the Building Code of Australia states that a Class 1 building that is constructed in a *designated bushfire prone area* must be designed and constructed to reduce the risk of ignition from a bushfire while the fire front passes.

Part GF5.1 states that a Class 2 or 3 building constructed in a *designated bushfire prone area* is to provide a resistance to bushfires in order to reduce the danger to life and minimize the risk of the loss of the building.

Australian Standard A.S. 3959 -1999 is the enabling standard that addresses the performance requirements of both Parts 2.3.4 and Part GF5.1 of the Building Code of Australia. Therefore, the future Class 1 buildings within the development shall be constructed to comply with the specifications of this Standard.

Appendix A3.6 of *Planning for Bushfire Protection 2006* provides the following procedure for determining bushfire attack at construction stage for a building within a designated bushfire prone area:

- (a) *Determine vegetation formation types and sub-formation types around the building;*
- (b) *Determine the separation distance between each vegetation formation and the building;*
- (c) *Determine the effective slope of the ground for each vegetation formation;*
- (d) *Determine the relevant FDI for the Council Area;*
- (e) *Match the relevant FDI, appropriate vegetation formation, separation distance and effective slope to determine the category of bushfire attack.*

Five categories of Bushfire Attack are determined. They are:

- Low:

Insignificant ember attack, radiation heat or is greater than 100 metres from all woody vegetation.

- Medium: (Level 1 Construction AS3959-1999).

Significant ember attack with radiation heat no greater than 12.5 KWm².

- High: (Level 2 Construction AS3959-1999).

Significant ember attack and possible flame contact, radiation heat greater than 12.5 KWm² and no greater than 19 KWm².

- Extreme: (Level 3 Construction AS3959-1999).

Significant ember attack and possible flame contact, radiation heat greater than 19 KWm² and no greater than 29 KWm².

- Flame Zone:

Within the Flame Zone and / or greater than 29 KWm² (Construction outside scope of AS3959-1999).

The nominated widths of the Asset Protection Zones provided in Tables 2 – 4, for those lots exposed to the threat from future bushfires that may occur in the Habitat Corridors within an adjoining the development site are predicated on the construction of the future buildings erected on these lots meeting the performance standards of Level 3 in accordance with Australian Standard A.S. 3959 – 1999 – “*Construction of Buildings in Bushfire Prone Areas*”.

For those buildings located within 100 metres of the bushfire hazard interface, the NSW Rural Fire Service requires that these buildings to have a minimum construction standard of Level 1, in accordance with A.S 3959 – 1999.

Formal assessment of the level of construction of the buildings, for bushfire protection, shall be undertaken during the detail design of the subdivision and submitted to Coffs Harbour Council/Private Certifier as part of the approval process for the construction of the future dwellings within the subdivision.

5.4 Water Supplies for Firefighting Operations.

The future residential subdivision of the land will have a reticulated water supply extended from the existing water supply mains. The dwellings in the future subdivision of the land will be connected to this reticulated water supply.

The reticulated water supply in the subdivision shall include the provision of a water supply main with Hydrants installed in accordance with the specifications of Australian Standard A.S 2419.2 and have a minimum flow rate of 10 litres / second.

Fire hydrants shall be accessible and located such that a tanker can park within a maximum distance of 20 metres from the hydrant and the habitable building must be located such that a fire at the furthest extremity can be attacked by fire-fighters using two 30 metre hose lines and a 10 metre water jet. A clear unobstructed path between the hydrant and the most distant point of the building cannot exceed 90 metres.

Hydrant locations shall be delineated by blue markers placed on the hydrant side of the centreline of the road pavement.

5.5 Access for Fire Fighting Operations.

5.5.1 Public Roads:

The public roads within the proposed subdivision shall be constructed to comply with the specifications for public roads as defined by Section 4.1.3(a) of *Planning for Bushfire Protection 2006*.

The Concept Plan prepared by Coomes Consulting provides for the extension of Lakes Drive to service the western development precinct whilst loop roads extend to the west into the southern development precinct and to the north to service the proposed lots within the north-eastern corner of the development site.

The North Boambee Valley Concept Plan shows that the extension of Lakes Drive continues to the west as a loop road that reconnects to North Boambee Road.

Future road connections will also occur with a loop road extending through the future residential precinct to the west of the southern development precinct.

The road network will provide alternate travel routes from the proposed subdivision precincts.

The minimum width of the perimeter roads that adjoin bushfire prone vegetation [except for the narrow Habitat Corridors] will have a formed width of 8.0 metres and the internal road width [including the roads adjoining the narrow Habitat Corridors] will be 6.5 metres with defined parking bays provided clear of the formed road width. Roads adjacent to or crossing the Habitat Corridors [as shown in blue on the Concept Plan, will be designed to slow traffic to safe-guard the Koala population.

- **Specifications for Public Roads.**

Section 4.1.3 [Access] of *Planning for Bushfire Protection 2006* provides advice on the design and construction of Public Roads providing access to and internal roads within a development which is deemed to be bushfire prone.

The specifications for public roads are:

- *Roads shall be designed for two-wheel drive all weather access;*
- *Perimeter roads adjacent to the bushfire hazard interface [except for those roads adjoining the narrow Habitat Corridors] shall be two-way with a minimum carriageway width of 8.0 metres, kerb to kerb, with shoulders on each side to allow traffic to pass in opposite directions;*
- *Roads shall be through roads. Dead ends shall not be more than 200 metres in length and incorporate a 12m outer radius turning circle;*
- *The capacity of road surfaces/bridges in a subdivision with reticulated water supply shall be 15 tonnes;*

- *Curves of roads shall have a minimum inner radius of 6 metres and a minimum outer radius of 12 metres;*
- *Vertical clearance above the road surface shall be 4.0 metres;*
- *All public roads eight metres wide shall locate services outside parking reserves to ensure accessibility to the reticulated water supply;*
- *All public roads between 6.5 & 8 metres in width shall be No Parking on one side with services (hydrants) located opposite the parking side;*
- *Single lane one-way roads shall be no less than 3.5 metres in width with parking bays provided clear of the road formation;*
- *Parking Bays shall be 2.6 metres wide from kerb to the edge of the road formation;*
- *All access roads directly interfacing the bushfire hazard shall provide roll top kerbing to the hazard side of the road.*

5.5.2 Fire Trail Access.

The Concept Plan layout provides for a fire trail access link along the western boundary of proposed Lots 173 – 178, linking to the existing fire trail along the northern boundary of Lot 10 in DP 1111430. This fire trail is located within the Asset Protection Zone to the west of lots within the north-eastern corner of the subdivision precinct and shall be fitted with a fire trail access gate to the new road intersection.

• Specifications for the Fire Trail.

The specifications for the proposed fire trail within a development are:

- *A minimum carriageway width of 4.0 metres with an additional 1.0 metre clearance provided to each side which is kept clear of grasses and shrubs;*
- *The carrying capacity of the fire trail surface shall be 15 tonnes for reticulated areas;*
- *A minimum vertical distance of 4.0 metres shall be provided clear of overhanging branches, trees and shrubs.*

5.5.3 Emergency Response Access / Egress.

The subdivision layout provides emergency response access/egress in the form of a looped road network which extends off the extension of Lakes Drive and provides for alternate access/egress via future roads links through adjoining residential development.

5.6 Adequacy of Bushfire Maintenance Plans and Fire Emergency procedures.

The Coffs Harbour Bushfire Risk Management and Operational Plans adequately address the bushfire maintenance and fire emergency procedures for the management of the bushfire vegetation and the operational procedures during fire events in the local area. A fuel management plan should be prepared for the maintenance of the vegetation within the residual lands within the subdivision.

5.7 Emergency Management for Fire Protection / Evacuation.

Future bushfire events in the vegetated retained in the habitat areas within and adjoining the development precinct is unlikely to create the need for emergency services to consider evacuation of those residents located adjacent to the hazard interface. However, should this occur, emergency management and relocation will be initiated by Police and therefore a site specific emergency evacuation plan will not be necessary with safe evacuation routes available, away from any potential bushfire attack.

5.8 Bushfire Hazard Management.

The intention of bushfire hazard management is to prevent flame contact with a structure, reduce radiant heat to below the ignition thresholds for various elements of a building, to minimize the potential for wind driven embers to cause ignition and to reduce the effects of smoke on residents and fire-fighters.

It is recommended that a Section 88B Instrument, under the provisions of the Conveyancing Act of 1919, be created on the title of the lots impacted by the provision of the Asset Protection Zone so as to ensure ongoing management of the nominated Asset Protection Zones and the combustible fuels within the landscaped gardens.

SECTION 6

RECOMMENDATIONS

Recommendation 1:

Asset Protection shall be provided to the future lots adjacent to the bushfire prone vegetation to the minimum widths as determined in Tables 2 – 4 and as shown diagrammatically on Figure 8 [page 27; Figure 9 [page 29] and Figure 10 [page 31] of this report.

Recommendation 2:

The Asset Protection Zones shall be maintained as an Inner Protection Area in accordance with Appendix 5 of *Planning for Bushfire Protection 2006* and the NSW Rural Fire Service's "*Specifications for Asset Protection Zones*".

Recommendation 3:

An 88B Covenant, in accordance with the provisions of the Conveyancing Act of 1919, shall be created on the title of the future lots burdened by the Asset Protection Zones to ensure the ongoing management of the landscaped gardens/residual vegetation, in accordance with the prescriptions of an Inner Asset Protection Zone.

Recommendation 4:

The minimum construction standard to the future dwellings erected on those lots which are adjacent to the bushfire prone vegetation and which are impacted by the provision of the recommended Asset Protection Zones shall be Level 3 construction standard, in accordance with the specifications of Australian Standard A.S 3959 - Second Edition 1999 and Amendment 1, 2000, "*Construction of Buildings in Bushfire Prone Areas*".

Recommendation 5:

The construction of the future dwellings located within 100 metres of the bushfire hazard interface shall be determined during the preparation of the subdivision documentation.

Recommendation 6:

Future public access roads shall be constructed to comply with the deemed-to-satisfy provisions of Section 4.1.3(a) of *Planning for Bushfire Protection 2006*.

Recommendation 7:

The fire access trail shall be constructed to comply with the deemed-to-satisfy provisions of Section 4.1.3(c) of *Planning for Bushfire Protection 2006*. The formed width shall be 4.0 metres with an additional metre provided to both sides and kept clear of grasses and shrubs. Locked fire trail access gates shall be provided at the intersection with the public road network.

Recommendation 8:

The existing water supply mains shall be extended, to service the future residential development, in accordance with the specifications of Australian Standard A.S 2419.2. Hydrants shall have a flow rate of 10 litres / second with blue pavement marks provided to locate hydrant positions.

Fire hydrants shall be accessible and located such that a tanker can park within a maximum distance of 20 metres from the hydrant and the habitable building must be located such that a fire at the furthest extremity can be attacked by fire-fighters using two 30 metre hose lines and a 10 metre water jet. A clear unobstructed path between the hydrant and the most distant point of the building cannot exceed 90 metres.

Blue hydrant markers shall be provided to locate the positions of the hydrants. The markers shall be positioned on the hydrant side of the centreline of the road pavement.

SECTION 7

CONCLUSION

A Concept Plan approval is being sought, under Part 3A [Major Projects] of the *Environmental Planning & Assessment Act 1979* for the residential subdivision of land within Part Lot 95 in DP 1111430 Lakes Drive and Lot 10 in DP 1071628, Lot 2 in DP 607602 and Lot 1 in DP 1089778 North Boambee Road, North Boambee Road.

The proposed subdivision creates approximately 199 residential lots on land located to the northwest of the existing Lakes Estate which is located to the north of North Boambee Road.

The cleared areas of the development site are zoned for residential development under the Coffs Harbour LEP 2000 whilst the vegetated land within the site and on the adjoining lands to the north, east, south and west is zoned 7A Environmental Protection Habitat and is deemed to contain Koala habitat.

This vegetation has also been mapped on the Certified Coffs Harbour Bushfire Prone Land Map as Category 1 Bushfire Prone Vegetation. Therefore, the Director Generals Environmental Assessment Requirements for the subdivision of the land require that the proposed development comply with the requirements of *Planning for Bushfire Protection 2006*.

This report has therefore reviewed the development against the requirements of *Planning for Bushfire Protection 2006* and the recommendations contained in Section 6 address the deemed-to-comply provisions for the provision of Asset Protection Zones to the future dwellings; access and water supplies for fire fighting operations; construction of the future dwellings and the management of the Asset Protection Zones.

The following table summarises the extent to which the Concept Plan conforms to the deemed-to-satisfy specifications of *Planning for Bushfire Protection 2006*.

Table 5. Compliance with the deemed-to-satisfy provisions of *Planning for Bushfire Protection 2006*.

Bushfire Protection Measure	Compliance with deemed-to-satisfy provisions of <i>Planning for Bushfire Protection 2006</i>.
(I) Asset Protection Zone setbacks	YES – width of Asset Protection Zones complies with, or exceeds the widths provided in Table A2.5 of <i>Planning for Bushfire Protection 2006</i> .
(II) The siting and adequacy of water supplies for fire fighting	YES – Hydrant supply to be installed in accordance with AS 2419.2
(III) Design of Public Roads	YES – Perimeter Public Road provided and roads to comply with the specifications of Section 4.1.3(a) of <i>Planning for Bushfire Protection 2006</i> .
(IV) Design of Fire Trail network	YES – Fire trail provided within APZ to the west of residential lots in the north-eastern corner of subdivision. The fire trail to be constructed to comply with the specifications of Section 4.1.3(c) of <i>Planning for Bushfire Protection 2006</i> .
(V) Adequacy of emergency response access and egress	YES – Road network provides two-way perimeter road plus internal road network that permits egress away from the bushfire hazard interface.
(VI) Adequacy of bushfire maintenance plans and fire emergency procedures	YES – Fire Management Plan should be prepared for vegetation within the Habitat corridors and on the residual lands.
(VII) Building construction standards	YES – Level 3 construction required for buildings located within or adjacent to the Asset Protection Zones. Construction levels of buildings within 100m of hazard interface shall be determined at DA stage.
(VIII) Adequacy of sprinkler systems and other fire protection measures to be incorporated into the development	Not applicable

The proposed development, as represented by the Concept Plan layout prepared by Coomes Consulting, complies with the “Deemed-to-Satisfy” specifications set out in Chapter 4 (Performance Based Control) and the aim and objectives of *Planning for Bushfire Protection 2006*.

REFERENCES:

- N.S.W Rural Fire Service – *Planning for Bushfire Protection 2006*;
- *Environmental Planning & Assessment Act – 1979*;
- *Rural Fires Act – 1997*;
- *Rural Fires Regulation 2002*;
- NSW Rural Fire Service – *Guideline for Bushfire Prone Land Mapping 2002*;
- *Bushfire Environmental Assessment Code 2003*;
- Building Code of Australia;
- Australian Standard A.S 3959-1999 “*Construction of Buildings in Bushfire Prone Areas*”.
- *Coffs Harbour Bushfire Prone Land Map*

SECTION 9

ATTACHMENT A – Concept Plan showing Bushfire Protection Measures.