

15 July 2016

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**PEER REVIEW: SOUTH DURAL VEGETATION MAPPING**

Dear Allison,

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As you requested I have now conducted a peer review of the draft vegetation mapping and constraints analysis of the South Dural land that is being proposed for rezoning. My peer review is provided in **Appendix A**, with figures and data analysis tables provided in **Appendices B** and **C** respectively. I have also supplied a copy of my CV in **Appendix D** to demonstrate my relevant experience for conducting the peer review.

I believe that the draft vegetation mapping of the site provides an accurate and appropriate level of mapping that is suitable for assessing the ecological constraints of the study area. The constraints analysis also appears to be appropriate and correctly recognises that the endangered ecological communities that occur as patches in the study area are potentially high constraints to future rezoning and development.

In preparing this review, I also think that it is important to note that biodiversity legislation in NSW is due to change. The NSW *Threatened Species Conservation Act 1995* is to be repealed and will be replaced by the Biodiversity Conservation Act. When this occurs, and the specific details of the new legislation, are not publically available. However, there is potential for the new legislation to change assessment procedures and arrangements such as biodiversity offsetting for vegetation across NSW, and for South Dural.

Yours sincerely



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*Appendix A*

Peer Review Report: South Dural Vegetation

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## A.1 Purpose & Authorship

The purpose of this document is to provide a peer review of draft vegetation mapping and a vegetation constraints analysis for land known as the South Dural land (“the study area”).

The principal author of this peer review is Dr David Robertson, who has worked extensively with EEC vegetation in Sydney and elsewhere in NSW. Dr Robertson has worked on numerous projects involving all of the major EEC types of relevance to South Dural. He has appeared as an expert witness in the NSW Land and Environment Court to provide evidence about many projects with impacts to these plant communities. He has also worked on numerous projects that entail rezoning of EECs in the Sydney Region. A copy of his CV is provided in the following **Appendix D**.

## A.2 Background

A group of landholders that collectively own an area of land in South Dural (“the study area”) is proposing to have the study area rezoned from rural to largely residential land.

As part of the studies necessary to support the rezoning, vegetation mapping must be prepared in order to consider constraints to future development that could arise from such matters as threatened species and endangered ecological communities listed by the NSW *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Much of South Dural is underlain by Wianamatta shale deposits that give rise to fertile soils that are known to support endangered ecological communities (EECs) listed by both the TSC Act and the EPBC Act. These include the following communities:

- **Blue Gum High Forest:**
  - EPBC name: Blue Gum High Forest of the Sydney Basin Bioregion (critically endangered)
  - TSC Name: Blue Gum High Forest of the Sydney Basin Bioregion (critically endangered)
- **Sydney Turpentine Ironbark Forest:**
  - EPBC name: Turpentine-Ironbark Forest in the Sydney Basin Bioregion (critically endangered)
  - TSC name: Sydney Turpentine-Ironbark Forest (critically endangered)
- **Shale Sandstone Transition Forest:**
  - EPBC name: Shale Sandstone Transition Forest of the Sydney Basin Bioregion (critically endangered)

- TSC name: Shale Sandstone Transition Forest in the Sydney Basin Bioregion (critically endangered)

WSP Parsons Brinckerhoff has prepared draft vegetation mapping (“the PB vegetation map”) of an area of land in South Dural (“the study area”) that is being proposed for rezoning from rural to largely residential land. The PB vegetation map has delineated and named remnant forest vegetation in the study area.

WSP Parsons Brinckerhoff has also prepared a draft constraints map based upon the vegetation map (“the PB constraints map”).

The PB vegetation map replaces earlier mapping prepared by Hayes Environmental (2009) which also delineated and named remnant forest vegetation in the study area.

Cumberland Ecology has been engaged by APP to undertake a peer review of the mapping and to:

- Review the survey findings of WSP Parson Brinckerhoff in light of the requirements of the TSC Act and EPBC Act;
- Conduct a brief site-inspection for the purposes of verifying WSP Parson Brinckerhoff’s survey findings; and
- Prepare a letter report that summarises the key findings and recommendations. The peer review must:
  - Describe the tasks undertaking in reviewing WSP Parson Brinckerhoff’s survey findings;
  - Assess the accuracy of WSP Parson Brinckerhoff’s survey findings and adequacy in addressing the requirements of the TSC Act and EPBC Act;
  - If applicable, recommend any additional tasks that need to be undertaken to fulfil the requirements of the TSC Act and EPBC Act; and
  - Provide comment as to an appropriate pathway for the ongoing management of the site.

## **A.3 Method**

### *i. Tasks*

For the purposes of preparing the review, the following tasks were completed:

Dr David Robertson and Dr Adriana Corona Mothe of Cumberland Ecology met with Mr Alex Cockerill of WSP Parsons Brinckerhoff to obtain a briefing about the work done on the PB vegetation map and the PB constraints map.

Data was acquired from WSP Parsons Brinkerhoff as follows:

- Digital draft mapping including the PB vegetation map and the constraints; and
- Digital spreadsheet data from vegetation quadrats (sample areas) completed in 16 vegetation patches in the study area.

A field investigation was conducted on 23 March 2016 to ground truth a selection of forest patches that have been mapped in the PB vegetation map (e.g. 69, 70, 35 and 3). Notes were made about vegetation composition and condition relative to what had been mapped.

Quadrat data from WSP Parsons Brinkerhoff was analysed and compared with published data from the mapped EECs, including information from the Final Determinations of each EEC. The analyses included:

- Analysis of the composition of each quadrat by determining the numbers of characteristic species from each EEC present in the quadrat.
- Classification and ordination of quadrat data to explore how similar or different each quadrat was to other quadrats.

*ii. Terms Used*

The following terms are used in this peer review:

- BBAM – BioBanking Assessment Methodology
- BCAM – Biocertification Assessment Methodology
- Polygon – an irregular shape of vegetation that designates a vegetation patch in a vegetation map
- Quadrat – a vegetation sampling area (commonly 20 x 20 metres in NSW) and used for sampling and recording plant species present in vegetation
- Classification & Ordination – a statistical means of comparing patterns of vegetation similarities and differences within quadrat data using Bray-Curtis dissimilarity and with dispersion of data shown in a non-parametric multidimensional scaling (nMDS) scaling (Clarke et al. 2014, Clarke and Gorley 2015).

*iii. Limitations of Peer Review*

The peer review was limited to a review of draft vegetation mapping, and a subset of available vegetation data. The fieldwork done to ground truth selected vegetation patches was confined to one day in March.

Whereas a written report was available for the Hayes Environmental (2009) mapping, no written report has yet been produced to support and explain the draft PB vegetation map.

Notwithstanding these limitations, it is the view of the principal author, who has worked on many similar sites, that ample information was available to review the accuracy of the vegetation mapping and the appropriateness of the draft constraints map.

## A.4 Key Findings

### *i. Polygon Mapping and Vegetation Identity*

The PB map has mapped more forest vegetation than was mapped by Hayes Environmental (2009). Where both the Hayes and PB maps have mapped the same vegetation polygons (= mapped vegetation patches), the names used in the PB maps are in many cases different to those assigned by Hayes Environmental (**Figures B.1 and B.2**).

It is important to recognise that expectations and standard methods for vegetation mapping have evolved significantly since 2009. The Hayes Environmental mapping was based upon “ground truthing”, meaning that the patches of vegetation in the study area were visited and notes were taken about each patch visited. No quadrats (vegetation sample areas) were collected in the vegetation. Examination of the aerial photographs indicates that a number of smaller patches of forest have not been mapped by Hayes Environmental.

By contrast, the PB vegetation map was prepared after ground truthing that involved the collection of 16 standard BioBanking quadrats (this data is provided in Table C.1). Additionally, the PB mapping entailed rapid data assessment notes taken in many of the other polygons of vegetation.

BioBanking assessment methods are now commonly used and are considered standard practice in NSW. These methods entail collection of BioBanking quadrat data, which can later be used in by BioBanking software to evaluate the offsetting liability of a proposed development. The use of BioBanking plots is therefore appropriate at South Dural and will facilitate subsequent detailed analysis of any offset liabilities.

Key points to note are:

- Both maps have recognised and shown large areas of EECs across the South Dural area;
- The PB map is more accurate and has recognised more patches of vegetation than were mapped by Hayes Environmental;
- The PB map units have been determined with reference to BioBanking quadrat data, and rapid data assessment plots, which provides a good level of confidence in the identity of the vegetation.

ii. *Comparison of Quadrat Data to EEC Final Determinations*

Cumberland Ecology has examined the quadrat data from the 16 quadrats completed by PB and have noted that these quadrats all contain a high proportion of relevant species from the so called “characteristic plant species” provided in the Final Determinations.

**Table C.1** in **Appendix C** shows the quadrat data in relation to the Final Determinations. Overall, the mapping provided by PB and the quadrat data from mapped polygons shows good agreement with the relevant EECs. As such the mapping of EECs in the study area seems appropriate and sufficiently accurate to inform an assessment of a rezoning proposal.

iii. *Constraints: EECs and Wildlife Corridors*

All of the mapped EEC types in the study area are closely related and, as indicated in the Final Determinations for these communities, they have many species in common. It is also important to note that as closely related and closely located communities, one community often gradually merges with another. For example, Blue Gum High Forest can merge with Sydney Turpentine Ironbark Forest, which in turn can merge with Shale Sandstone Transition Forest. Thus mapping of vegetation, which always shows clear boundaries, is somewhat arbitrary for such vegetation.

As indicated in the background section of this report, the EEC communities are all dually listed under State and Commonwealth legislation as either endangered or critically endangered. They therefore have a high level of protection under existing biodiversity legislation.

The EECs relevant to South Dural have been extensively cleared in the past. Blue Gum High Forest and Sydney Turpentine Ironbark Forest are almost entirely confined to Northern Sydney. They remain largely as small, highly fragmented patches. The TSC Act Final Determinations recognise this and state that the communities can be present and represented as scattered trees. In the NSW Land and Environment Court, scattered trees from these communities are given serious consideration for conservation and retention for many projects. Where patches of such vegetation are to be cleared, there is often a requirement for replanting or offsetting – particularly for larger patches of such vegetation.

The PB constraints mapping (see **Figure B.3**) has recognised most of the larger and more intact patches of EEC vegetation as high constraints, and this is appropriate under current legislation because clearance of such larger patches would be likely to require State and Commonwealth approval. Also, smaller groves of EEC trees are mapped as moderate constraints to development, which is also appropriate given the protection afforded to such patches by, for example, the Land and Environment Court proceedings.

Blackbutt Gully Forest, a major forest type in the south of the study area is not an EEC, but is a large intact patch of forest. It is large enough to be a substantial habitat for fauna and flora species, and occupies approximately 26 ha (**Table 1**). It has been recognised as a significant constraint to future development and the majority of the patch is shown with a high level of constraint by the PB constraints map. This is appropriate given the size of the patch.

**Table 1 Summary of Vegetation Communities and their areas**

Vegetation Community	Condition	Area (ha)
Blue Gum High Forest	Good	4.3
Blue Gum High Forest	Moderate	7.4
	<b>Total</b>	<b>11.7</b>
	<b>Vegetation Communities (%)</b>	<b>16.7</b>
Sydney Turpentine Ironbark Forest	Good	2.1
Sydney Turpentine Ironbark Forest	Moderate	19.8
Sydney Turpentine Ironbark Forest	Poor	4.4
	<b>Total</b>	<b>26.2</b>
	<b>Vegetation Communities (%)</b>	<b>37.4</b>
Shale Sandstone Transition Forest	Moderate	1.4
	<b>Total</b>	<b>1.4</b>
	<b>Vegetation Communities (%)</b>	<b>2.0</b>
Blackbutt Gully Forest	Good	26.0
Blackbutt Gully Forest	Moderate	4.5
Blackbutt Gully Forest	Poor	0.3
	<b>Total</b>	<b>30.8</b>
	<b>Vegetation Communities (%)</b>	<b>0.4</b>
<b>Vegetation Communities Total</b>		<b>70.2</b>
Site Area		238.20

## A.5 Conclusion

### *i. Accuracy of Mapping*

The draft vegetation mapping of the site provides an accurate and appropriate level of mapping that is suitable for assessing the ecological constraints of the study area for the purposes of a proposed rezoning.

The constraints analysis also appears to be appropriate and correctly recognises that the endangered ecological communities that occur as patches in the study area are potentially high constraints to future rezoning and development. It also recognises that the non-EEC forest patch, which is relatively large and intact, is a major constraint as it is considered wildlife habitat. Vegetation communities within the study area might represent habitat for the endangered Dural Land Snail (*Pommerhelix duralensis*) (Threatened Species Scientific Committee 2015) and will need to be incorporated in the constraints and management strategy.



Clearance of vegetation in low and moderate constraints areas of the study area is likely to require some form of offsetting. Offsets can theoretically be available under the NSW BioBanking scheme. However, in practice, under current legislation, offsets (in the form of “biodiversity” or “ecosystem credits”) are not readily available to offset for impacts to larger areas of Blue Gum High Forest or Sydney Turpentine Ironbark Forest. The lack of credits under current legislation is currently a major consideration and constraint when rezoning the land.

ii. *New Biodiversity Legislation*

The Minister of the Environment initiated the Biodiversity Legislation Review (BLR) process in June 2014 by appointing an independent panel to conduct a comprehensive review of the *Native Vegetation Act 2003* (NV Act), TSC Act, *Nature Conservation Trust Act 2001* and Part 4 Divisions 11 through 13, Part 6A (insofar as it relates to native plants and animals), and Part 7 through 9 of the *National Parks and Wildlife Act 1974* (NP&W Act).

The BLR Panel presented its final report on 18 December 2014 (Byron et al 2014). The report included 43 recommendations, among which repealing of the TSC Act and the NV Act, parts of the NP&W Act was proposed, as well as streamline the legislative process for management of biodiversity in the state of NSW by focusing on conserving biodiversity at a bioregional or state scale. The above is to be achieved by creating the Biodiversity Conservation Act.

Currently, the NSW Government has created an Interagency Senior Officers Group to provide a whole-of-government input to the recommendations made by the BLR Panel. The OEH provides secretariat support to the Interagency Senior Officers Group. It is expected the NSW Government via the Interagency Senior Officers Group and the OEH have indicated that they will provide their resolution to the BLR Panel’s recommendations in April 2016.

Procedures for quantifying and securing biodiversity offsets are likely to change as a result of the new Biodiversity Conservation Act. The new Act will require the use of the Biodiversity Assessment Methodology (BAM), a biometric measure similar to BBAM (OEH 2014a), the Framework for Biodiversity Assessment (FBA) (NSW Government, 2014) and BCAM (OEH 2014b) however, the rules of operation of the new system will be different.

The new biodiversity legislation may provide significant changes to the processes of investigating impacts to EECs and for measuring and provision of biodiversity offsetting. Participation in the new biodiversity offsets scheme will be mandatory in certain cases. Developers will need to obtain a ‘biodiversity development assessment report’ (BDAR) from an accredited biodiversity assessor – if the proposed development will ‘exceed the threshold’.

Currently, the proposed legislation does not say what the ‘threshold’ will be. This will only be set out in the regulations to be made under the legislation. Such regulations will not be prepared until after the legislation has been passed by parliament. As such it may have important implications for the South Dural project.

## A.6 References

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Clarke K.R. and Gorley R.N., Somerfield P.J. and Warwick R.M. (2014) Change in marine communities: an approach to statistical analysis and interpretation. 3<sup>rd</sup> edition. PRIMER-E: Plymouth.

Clarke K.R. and Gorley R.N. (2015) PRIMER v7: User Manual/Tutorial, PRIMER-E: Plymouth.

DoE (2005). "Blue Gum High Forest of the Sydney Basin Bioregion." Department of the Environment.

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Threatened Species Scientific Committee (2015) Conservation Advice for *Pomrthelix duralensis* (Dural Land Snail). Conservation Advice approved by the Minister of Environment on 26 March 2015 and Species listed as endangered on 9 April 2015.

Tozer M.G., Turner K., Keith D.A., Tindall D., Pennay C., Simpson C., MacKenzie B., Beukers P. and Cox S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11(3): 359-406 + Appendices 1 to 6.

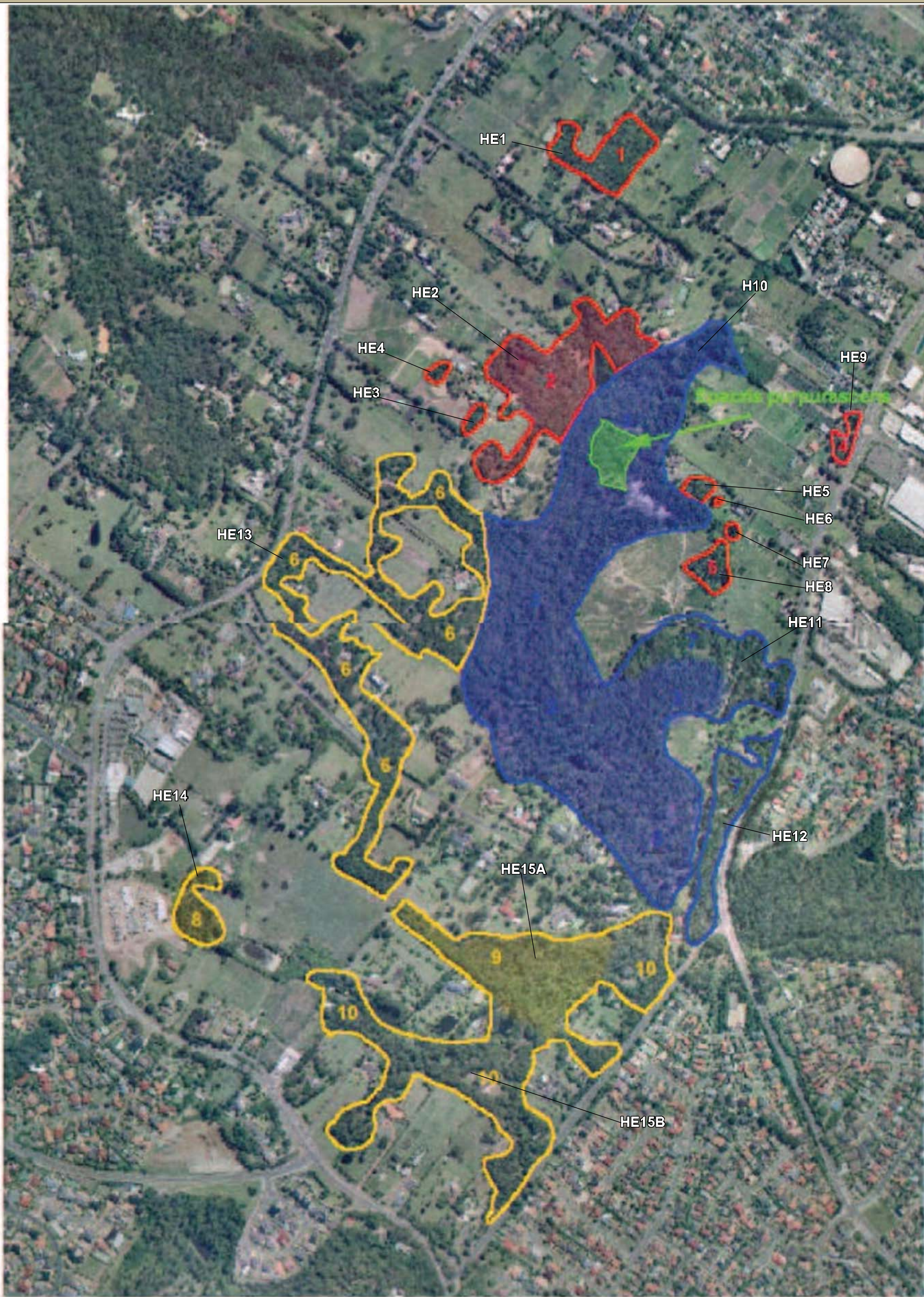
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*Appendix B*

Vegetation Mapping

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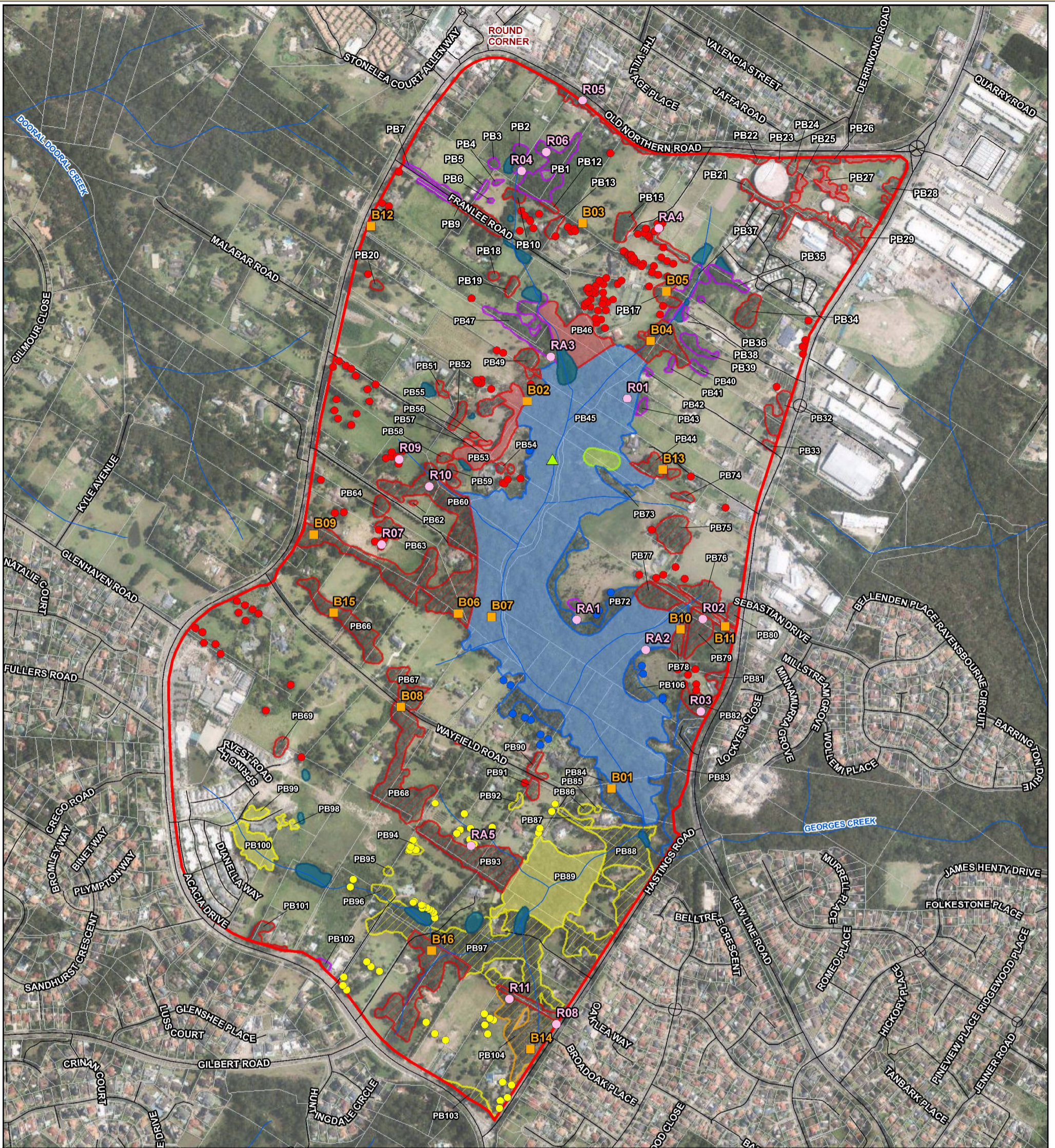
**FIGURE 2B**  
**Ecological communities within the**  
**study area: southern**

	Good condition	Poor condition
<b>Blue Gum High Forest (CEEC)</b>		
<b>Blackbut Gully Forest</b>		
<b>Sydney Turpentine Ironbark Forest (CEEC)</b>		

Image Source: Hayes Environmental (2009). Proposed rezoning of land. Old Northern Road, Hastings Road, and New Line Road, South Dural. Flora and Fauna Investigations. (Figure 2A and 2B).

**Figure B.1. Vegetation Communities mapped by Hayes Environmental in 2009**





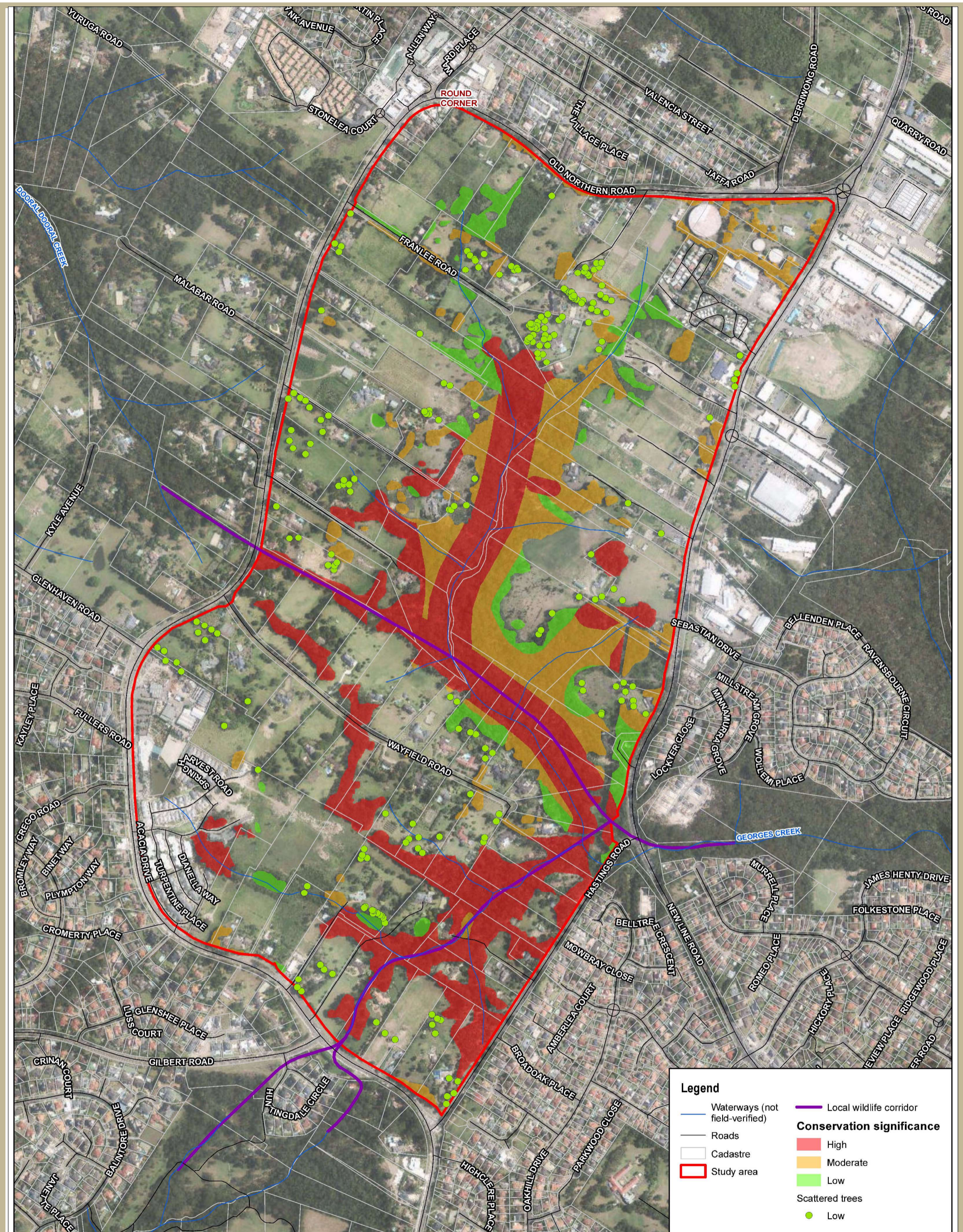
Legend		Threatened species of plant		Vegetation communities		Miscellaneous ecosystems	
	Waterways		<i>Epacris purpurascens</i> var. <i>purpurascens</i>		Acacia regrowth		Water bodies, rivers, lakes, streams (not wetlands)
	Roads		<i>Epacris purpurascens</i> var. <i>purpurascens</i> patch (approximate)		Blackbutt Gully Forest (Good condition)		Highly disturbed areas with no or limited native vegetation
	Cadastre		Scattered trees		Blackbutt Gully Forest (Moderate condition)		
	Study area		Blackbutt Gully Forest (Poor condition)		Blackbutt Gully Forest (Poor condition)		
	Vegetation survey points		Blue Gum High Forest (CEEC) (Poor condition)		Blue Gum High Forest (CEEC) (Good condition)		
	Survey plot		Blue Gum High Forest (CEEC) (Moderate condition)		Blue Gum High Forest (CEEC) (Moderate condition)		
	Rapid assessment point		Sydney Turpentine Ironbark Forest (CEEC) (Poor condition)		Shale Sandstone Transition Forest (CEEC) (Moderate condition)		
			Sydney Turpentine Ironbark Forest (CEEC) (Good condition)		Sydney Turpentine Ironbark Forest (CEEC) (Good condition)		
			Sydney Turpentine Ironbark Forest (CEEC) (Moderate condition)		Sydney Turpentine Ironbark Forest (CEEC) (Moderate condition)		
			Sydney Turpentine Ironbark Forest (CEEC) (Poor condition)		Sydney Turpentine Ironbark Forest (CEEC) (Poor condition)		

Map: 2267036A_GIS_F005_A5	Author: mitchellem			Coordinate system: GDA 1994 MGA Zone 56 Scale ratio correct when printed at A3			South Dural Planning Proposal
Date: 9/06/2016	Approved by: -						
Data source: © Land and Property Information 2015			<p><b>Figure 3.1</b> Vegetation communities and threatened species of plants recorded</p>				

Figure B.2. Vegetation Communities mapped by WSP Parsons Brinckerhoff in 2016

Image Source: Parsons Brinckerhoff (2016). South Dural Planning Proposal - APP Corporation PTY Limited.





**Legend**

- Waterways (not field-verified)
- Roads
- Cadastre
- Study area
- Local wildlife corridor

**Conservation significance**

- High
- Moderate
- Low

Scattered trees

- Low

Map: 2267036A\_GIS\_F006\_A5  
 Date: 10/06/2016  
 Data source: © Land and Property Information 2015

Author: mitchellem  
 Approved by: -

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 Coordinate system: GDA 1994 MGA Zone 56  
 Scale ratio correct when printed at A3



**South Dural Planning Proposal**

**Figure 5.1**  
 Conversation significance

Image Source: Parsons Brinckerhoff (2016). South Dural Planning Proposal - APP Corporation PTY Limited.

**Figure B.3. Conservation Significance Strategy proposed by WSP Parsons Brinckerhoff in 2016**

I:\...16055\Figures\Letter 2\20160715\Figure B.3. Conservation Significance



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*Appendix C*

Data Analysis Tables

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**Table 2** Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle			TRUE#					x		x	x					2			
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle			TRUE#					x	x	x	x	4	1		2	1			
Fabaceae (Mimosoideae)	Acacia linifolia	Flax-leaved Wattle			TRUE				x	x					1						
Fabaceae (Mimosoideae)	Acacia longissima	Narrow-leaved Wattle			TRUE									1					4	2	
Fabaceae (Mimosoideae)	Acacia parramattensis	Parramatta Wattle			TRUE#					x	x	x	x	1	1	3		5			
Fabaceae (Mimosoideae)	Acacia ulicifolia	Prickly Moses			TRUE										1				2		
Polygonaceae	Acetosa sagittata	Rambling Dock			FALSE																
Alliaceae	Agapanthus praecox	Agapanthus			FALSE									2							20
Asteraceae	Ageratina adenophora	Crofton Weed			FALSE																
Poaceae	Agrostis capillaris	Browntop Bent			FALSE																2
Casuarinaceae	Allocasuarina littoralis	Black Sheoak			TRUE#				x			x	x								
Casuarinaceae	Allocasuarina torulosa	Forest Oak			TRUE#	x	x	x	x	x	x	x	x							4	
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed			TRUE																
Primulaceae	Anagallis arvensis	Scarlet/Blue Pimpernel			FALSE													2			
Poaceae	Andropogon virginicus	Whisky Grass			FALSE																
Myrtaceae	Angophora costata	Sydney Red/Rusty Gum			TRUE#	** / *	x	x	x	***	x			2	1		5		2		
Myrtaceae	Angophora floribunda	Rough-barked Apple			TRUE#	** / *		x		***											
Poaceae	Anisopogon avenaceus	Oat Speargrass			TRUE						x								20	1	
Basellaceae	Anredera cordifolia	Madeira Vine			FALSE																
Asclepiadaceae	Araujia sericifera	Moth Vine			FALSE											10					
Poaceae	Aristida vagans	Threeawn Speargrass			TRUE					x	x	x	x								
Anthericaceae	Arthropodium milleflorum	Vanilla Lily			TRUE						x	x	x								1
Asparagaceae	Asparagus aethiopicus	Asparagus Fern			FALSE													1	1		
Asparagaceae	Asparagus asparagoides	Bridal Creeper			FALSE											10	1	1	1		1
Asparagaceae	Asparagus officinalis	Asparagus			FALSE																1
Poaceae	Austrostipa pubescens				TRUE							x	x						7	1	
Poaceae	Austrostipa ramosissima	Stout Bamboo Grass			TRUE											3					
Poaceae	Axonopus fissifolius	Narrow-leaved Carpet Grass			FALSE													1			
Asteraceae	Bidens pilosa	Cobblers Pegs			FALSE																

**Table 2** Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08
Pittosporaceae	Billardiera scandens	Appleberry			TRUE				x	x	x	x	x	4	1				1	4	
Fabaceae (Faboideae)	Bossiaea obcordata	Spiny Bossiaea			TRUE																
Sterculiaceae	Brachychiton acerifolius	Illawarra Flame Tree			TRUE		x														
Euphorbiaceae	Breynia oblongifolia	Coffee Bush			TRUE	x	x			x		x	x	1	1		1		10		
Poaceae	Bromus catharticus	Prairie Grass			FALSE						x										
Goodeniaceae	Brunonia australis	Blue Pincushion			TRUE								x								10
Acanthaceae	Brunoniella australis	Blue Trumpet			TRUE		x				x	x									
Pittosporaceae	Bursaria spinosa	Native Blackthorn			TRUE					x	x	x	x						3		
Cyperaceae	Carex inversa	Knob Sedge			TRUE													1			100
Lauraceae	Cassytha sp.				TRUE															1	
Vitaceae	Cayratia clematidea	Slender Grape			TRUE		x				x										
Ulmaceae	Celtis sinensis	Chinese Nettle Tree			FALSE																
Cunoniaceae	Ceratopetalum gummiferum	Christmas Bush		P13 (NSW)	TRUE#				x					5						1	
Adiantaceae	Cheilanthes sieberi	Mulga Fern			TRUE					x	x	x	x						1		
Anthericaceae	Chlorophytum comosum				FALSE											10					
Asteraceae	Chrysanthemoides monilifera subsp. monilifera	Boneseed			FALSE												1				
Lauraceae	Cinnamomum camphora	Camphor Laurel			FALSE										1						
Asteraceae	Cirsium vulgare	Spear Thistle			FALSE										1						
Ranunculaceae	Clematis aristata	Mountain Clematis			TRUE					x				1					15		
Verbenaceae	Clerodendrum tomentosum				TRUE	x	x			x											
Commelinaceae	Commelina cyanea	Native Wandering Jew			TRUE					x	x						1				
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane			FALSE																
Asteraceae	Conyza sp.				FALSE																2
Asteliaceae	Cordyline stricta	Narrow-leaved Palm Lily			TRUE									1							
Myrtaceae	Corymbia citriodora																	1			
Myrtaceae	Corymbia eximia	Yellow Bloodwood			TRUE#																
Myrtaceae	Corymbia gummifera	Red Bloodwood			TRUE#				x	x		x		5						4	
Asteraceae	Cotula australis	Common Cotula			TRUE																
Orchidaceae	Cryptostylis sp.				TRUE									3						7	

**Table 2** Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08	
Cyperaceae	Cyathochaeta diandra	Sheath Sedge			TRUE									1								
Poaceae	Cynodon dactylon	Common Couch			TRUE																	
Cyperaceae	Cyperus eragrostis	Umbrella Sedge			FALSE																	1
Cyperaceae	Cyperus gracilis	Slender Flat-sedge			TRUE																	100
Cyperaceae	Cyperus sp.				TRUE																	
Cyperaceae	Cyperus tetraphyllus				TRUE													10				
Phormiaceae	Dianella caerulea				TRUE	x	x		x		x	x			2			5				
Phormiaceae	Dianella caerulea var. producta				TRUE									2					10	5		
Phormiaceae	Dianella longifolia				TRUE						x		x									
Poaceae	Dichelachne inaequiglumis	Loose Plume-grass			TRUE						x							1				
Poaceae	Dichelachne sp.				TRUE																	
Convolvulaceae	Dichondra repens	Kidney Weed			TRUE					x	x <sup>9</sup>	x	x <sup>9</sup>						50			100
Iridaceae	Dietes grandiflora				FALSE																	
Poaceae	Digitaria ciliaris				FALSE																	
Poaceae	Digitaria parviflora	Small-flowered Finger Grass			TRUE						x	x	x		4				2			
Sapindaceae	Dodonaea triquetra	Large-leaf Hop-bush			TRUE				x	x	x	x	x	20								
Poaceae	Echinopogon caespitosus				TRUE					x	x <sup>5</sup>	x <sup>5</sup>	x <sup>5</sup>		20		7		20			
Poaceae	Echinopogon ovatus	Forest Hedgehog Grass			TRUE						x	x	x						2			
Poaceae	Ehrharta erecta	Panic Veldtgrass			FALSE												50	2	20	20		50
Chenopodiaceae	Einadia hastata	Berry Saltbush			TRUE						x						2					2
Chenopodiaceae	Einadia polygonoides				TRUE																	
Chenopodiaceae	Einadia trigonos	Fishweed			TRUE																	12
Elaeocarpaceae	Elaeocarpus reticulatus	Blueberry Ash			TRUE <sup>#</sup>	x	x		x	x				1								
Poaceae	Entolasia marginata	Bordered Panic			TRUE	x	x			x	x	x	x		10		7		20			10
Poaceae	Entolasia stricta	Wiry Panic			TRUE	x			x	x	x	x	x	20	200		100		50	100		
Myrtaceae	Eucalyptus acmenioides				TRUE <sup>#</sup>					x	x						3					
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark			TRUE							x	x									
Myrtaceae	Eucalyptus paniculata	Grey Ironbark			TRUE <sup>#</sup>	x		x		***	x <sup>10</sup>				1	11			2			3
Myrtaceae	Eucalyptus pilularis	Blackbutt			TRUE <sup>#</sup>	***	x	x	x		x			2	3		7	2	1	1		

**Table 2** Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08
Myrtaceae	Eucalyptus punctata	Grey Gum			TRUE <sup>#</sup>			x	x		x	x	x						1		1
Myrtaceae	Eucalyptus resinifera	Red Mahogany			TRUE <sup>#</sup>			x	x	***	x <sup>11</sup>		x <sup>11</sup>		1		2		2	1	4
Myrtaceae	Eucalyptus saligna	Sydney Blue Gum			TRUE <sup>#</sup>	***	x <sup>8</sup>	x	x		x <sup>8</sup>							2			
Myrtaceae	Eucalyptus tereticornis	Forest Red Gum			TRUE <sup>#</sup>							x									
Euphorbiaceae	Euphorbia peplus	Petty Spurge			FALSE																
Luzuriagaceae	Eustrephus latifolius	Wombat Berry			TRUE	x	x	x			x			7	20				7	2	
Cyperaceae	Gahnia clarkei	Tall Saw-sedge			TRUE															1	
Rubiaceae	Galium leptogonium				FALSE														1		
Asteraceae	Gamochaeta americana	American Cudweed			FALSE																2
Fabaceae (Faboideae)	Genista monspessulana	Montpellier Broom			FALSE																
Geraniaceae	Geranium homeanum	Rainforest Cranes-bill			TRUE																
Fabaceae (Faboideae)	Glycine clandestina	Twining Glycine		E2 (NSW)	TRUE	x				x	x	x	x						10		
Fabaceae (Faboideae)	Glycine microphylla	Small-leaf Glycine			TRUE						x	x <sup>2</sup>	x	3	1		2	1	10		2
Fabaceae (Faboideae)	Glycine sp.				TRUE																
Fabaceae (Faboideae)	Glycine tabacina				TRUE						x	x	x		7						
Goodeniaceae	Goodenia heterophylla				TRUE					x											2
Proteaceae	Grevillea robusta	Silky Oak			TRUE																
Dilleniaceae	Hibbertia aspera				TRUE						x <sup>3</sup>	x <sup>3</sup>	x <sup>3</sup>				2				
Dilleniaceae	Hibbertia sp.				TRUE																1
Violaceae	Hybanthus monopetalus	Slender Violet-bush			TRUE																1
Apiaceae	Hydrocotyle peduncularis				TRUE						x								50		
Clusiaceae	Hypericum gramineum	Small St Johns Wort			TRUE										8						
Asteraceae	Hypochaeris radicata	Catsear			FALSE										2			1			7
Poaceae	Imperata cylindrica	Bladey Grass			TRUE					x	x <sup>12</sup>						4				
Bignoniaceae	Jacaranda mimosifolia	Jacaranda			FALSE																
Oleaceae	Jasminum polyanthum	White Jasmine			FALSE									4							
Juncaceae	Juncus sp.				TRUE												1	5			7
Fabaceae (Faboideae)	Kennedia rubicunda	Red Kennedy Pea			TRUE					x	x			1							
Asteraceae	Lagenifera stipitata	Blue Bottle-daisy			TRUE														1		
Verbenaceae	Lantana camara	Lantana			FALSE									6	2	10	10	10	2		

**Table 2 Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08
Cyperaceae	Lepidosperma laterale	Variable Sword-sedge			TRUE					x		x	x	3			1		10		
Myrtaceae	Leptospermum sp.				TRUE															2	
Myrtaceae	Leptospermum trinervium	Paperbark Tea-tree			TRUE				x											3	
Epacridaceae	Leucopogon juniperinus	Long-flower Beard-heath			TRUE	x	x	x		x	x	x	x	2	4		2		3	6	
Epacridaceae	Leucopogon lanceolatus	Lance Beard Heath			TRUE															7	
Oleaceae	Ligustrum lucidum	Large-leaved Privet			FALSE			x								20		2	2		
Oleaceae	Ligustrum sinense	Small-leaved Privet			FALSE			x						2	1	20	10	6	15		
Lindsaeaceae	Lindsaea microphylla	Lacy Wedge Fern			TRUE						x									1	
Altingiaceae	Liquidambar styraciflua	Liquidambar			FALSE																
Lomandraceae	Lomandra filiformis	Wattle Matt-rush			TRUE						x <sup>13</sup>	x <sup>4</sup>	x <sup>4</sup>	1							
Lomandraceae	Lomandra longifolia	Spiny-headed Mat-rush			TRUE	x	x	x	x	x	x	x		1			2		3	5	
Lomandraceae	Lomandra multiflora				TRUE							x <sup>6</sup>	x <sup>6</sup>	1					1		
Lomandraceae	Lomandra obliqua				TRUE									10					12	20	
Lomandraceae	Lomandra sp.				TRUE														1		
Proteaceae	Lomatia silaifolia	Crinkle Bush		P13 (NSW)	TRUE									6						2	
Caprifoliaceae	Lonicera japonica	Japanese Honeysuckle			FALSE																
Fabaceae (Faboideae)	Lotus sp.				TRUE														1		
Bignoniaceae	Macfadyena unguis-cati	Cats Claw Creeper			FALSE																
Celastraceae	Maytenus silvestris	Narrow-leaved Orangebark			TRUE	x	x				x								1	1	
Meliaceae	Melia azedarach	White Cedar			TRUE										1						
Poaceae	Microlaena stipoides				TRUE				x	x	x	x	x	20	50		20	20	3	15	15
Malvaceae	Modiola caroliniana	Red-flowered Mallow			FALSE																2
Rutaceae	Murraya paniculata				FALSE																
Davalliaceae	Nephrolepis cordifolia	Fishbone Fern			TRUE									15							
Ochnaceae	Ochna serrulata	Mickey Mouse Plant			FALSE			x							1					1	
Oleaceae	Olea europaea subsp. cuspidata				FALSE														1		
Rubiaceae	Opercularia aspera	Coarse Stinkweed			TRUE															10	

**Table 2** Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08	
Rubiaceae	Opercularia varia	Variable Stinkweed			TRUE														1			
Poaceae	Oplismenus aemulus				TRUE	x	x	x		x	x						20	5	20			10
Poaceae	Oplismenus imbecillis	Creeping Beard Grass			TRUE	x					x			4	10				20			
Oxalidaceae	Oxalis corniculata	Creeping Oxalis			FALSE																	
Oxalidaceae	Oxalis latifolia	Large-leaf Wood-sorrel			FALSE																	
Oxalidaceae	Oxalis perennans	Grassland Wood-sorrel			TRUE	x						x	x				1	1	10			
Oxalidaceae	Oxalis pes-caprae	Soursob			FALSE																	
Oxalidaceae	Oxalis sp.				TRUE										1			2				10
Asteraceae	Ozothamnus diosmifolius	White Dogwood			TRUE		x	x		x	x	x	x		1		12					
Bignoniaceae	Pandorea pandorana	Wonga Wonga Vine			TRUE	x	x			x	x						3	1			2	
Poaceae	Panicum simile	Two-colour Panic			TRUE					x	x	x	x		20				10			
Caryophyllaceae	Paronychia brasiliiana	Chilean Whitlow Wort			FALSE																	2
Apocynaceae	Parsonsia straminea	Common Silkpod			TRUE																	
Poaceae	Paspalidium distans	Spreading Panic-grass			TRUE						x	x	x						20			50
Poaceae	Paspalum dilatatum	Paspalum			FALSE													5				
Passifloraceae	Passiflora edulis	Common Passionfruit			FALSE										1		1					
Passifloraceae	Passiflora suberosa	Cork Passionfruit			FALSE																	
Iridaceae	Patersonia glabrata	Leafy Purple-flag			TRUE																	10
Poaceae	Pennisetum clandestinum	Kikuyu Grass			FALSE											100		200				20
Proteaceae	Persoonia levis	Broad-leaved Geebung			TRUE																	
Proteaceae	Persoonia linearis	Narrow-leaved Geebung			TRUE				x		x	x	x	2								3
Proteaceae	Persoonia pinifolia	Pine-leaved Geebung		P13 (NSW)	TRUE																	
Euphorbiaceae	Phyllanthus hirtellus	Thyme Spurge			TRUE							x	x									10
Phytolaccaceae	Phytolacca octandra	Inkweed			FALSE										1	4						
Thymelaeaceae	Pimelea linifolia	Slender Rice-flower			TRUE							x <sup>7</sup>	x <sup>7</sup>		1				2			
Pinaceae	Pinus sp.				FALSE																	
Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum			TRUE <sup>#</sup>	x	x	x	x	x	x				20	7	20	9	17	4		

**Table 2 Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08
Plantaginaceae	Plantago gaudichaudii	Narrow Plantain			TRUE														1		1
Plantaginaceae	Plantago lanceolata	Lambs Tongues			FALSE																
Fabaceae (Faboideae)	Platylobium formosum	Handsome Flat-pea			TRUE	x	x							1	1						2
Poaceae	Poa affinis				TRUE	x	x	x		x	x			3			2		20	10	
Caryophyllaceae	Polycarpon tetraphyllum	Four-leaved Allseed			FALSE																2
Araliaceae	Polyscias sambucifolia	Elderberry Panax			TRUE	x <sup>1</sup>	x			x				7	3		7				2
Rubiaceae	Pomax umbellata	Pomax			TRUE					x		x	x		1					7	
Euphorbiaceae	Poranthera microphylla				TRUE					x		x	x							1	
Portulacaceae	Portulaca oleracea	Pigweed			TRUE																
Lobeliaceae	Pratia purpurascens	Whiteroot			TRUE	x	x		x	x	x	x	x	10	20		10	1	20		15
Acanthaceae	Pseuderanthemum variable	Pastel Flower			TRUE	x	x	x		x	x			1	20		20		20	20	
Dennstaedtiaceae	Pteridium esculentum	Bracken			TRUE	x		x	x					20							5
Fabaceae (Faboideae)	Pultenaea flexilis				TRUE				x					7							
Rubiaceae	Richardia stellaris				FALSE																13
Iridaceae	Romulea rosea	Onion Grass			FALSE																
Rosaceae	Rubus fruticosus	Blackberry complex			FALSE			x						1							
Polygonaceae	Rumex brownii	Swamp Dock			TRUE																
Poaceae	Rytidosperma sp.				TRUE														1		1
Cyperaceae	Schoenus melanostachys	Black Bog-sedge			TRUE																1
Asteraceae	Senecio madagascariensis	Fireweed			FALSE														1		
Poaceae	Setaria gracilis	Slender Pigeon Grass			FALSE										3					1	
Malvaceae	Sida rhombifolia	Paddys Lucerne			FALSE											20		1			3
Asteraceae	Sigesbeckia orientalis				TRUE						x										
Smilacaceae	Smilax glycyphylla	Sweet Sarsparilla			TRUE	x	x	x	x	x				1	1						1
Solanaceae	Solanum chenopodioides	Whitewip Nightshade			FALSE																
Solanaceae	Solanum mauritianum	Wild Tobacco Bush			FALSE											4					
Solanaceae	Solanum nigrum	Black-berry Nightshade			FALSE																
Solanaceae	Solanum prinophyllum	Forest Nightshade			TRUE						x	x	x		2						
Solanaceae	Solanum pseudocapsicum	Madeira Winter Cherry			FALSE											3			1		

**Table 2** Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B01 – B08

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B01	B02	B03	B04	B05	B06	B07	B08	
Asteraceae	Solenogyne bellioides				TRUE									1								
Asteraceae	Soliva sessilis	Bindyi			FALSE																	20
Caryophyllaceae	Stellaria media	Common Chickweed			FALSE													2				
Menispermaceae	Stephania japonica				TRUE									5								
Myrtaceae	Syncarpia glomulifera	Turpentine			TRUE <sup>#</sup>			x	x	***	x <sup>14</sup>	x		4	7				6	3		
Asteraceae	Taraxacum officinale	Dandelion			FALSE																	
Elaeocarpaceae	Tetradlea thymifolia	Black-eyed Susan			TRUE																2	
Poaceae	Themeda triandra <sup>a</sup>	Kangaroo Grass			TRUE					x	x	x	x						100	10		
Commelinaceae	Tradescantia fluminensis	Wandering Jew			FALSE											100						
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily			TRUE								x						1			
Fabaceae (Faboideae)	Trifolium repens	White Clover			FALSE																	
Fabaceae (Faboideae)	Trifolium sp.				FALSE																	
Verbenaceae	Verbena bonariensis	Purpletop			FALSE																	1
Verbenaceae	Verbena officinalis	Common Verbena			FALSE											1						
Scrophulariaceae	Veronica arvensis	Wall Speedwell			FALSE																	
Scrophulariaceae	Veronica plebeia	Trailing Speedwell			TRUE					x	x	x	x				20		1			20
Fabaceae (Faboideae)	Vicia sp.				FALSE																	
Apiaceae	Xanthosia pilosa	Woolly Xanthosia			TRUE				x					1							15	
Rutaceae	Zieria smithii	Sandfly Zieria		E2 (NSW)	TRUE					x	x			2							10	

Notes:

- BGHF - Blue Gum High Forest
- BGSF - Blue Gum Shale Forest
- STIF - Sydney Turpentine Ironbark Forest
- SSTF - Shale Sandstone Transition Forest
- BGF - Blackbutt Gully Forest
- CSSTF - Cumberland Shale Sandstone Transition Forest
- FD - Final Determination Date
- 1 - Polyscias sambucifolia subsp. A
- 2 - Glycine microphyllus
- 3 - Hibbertia aspera subsp. aspera
- 4 - Lomandra filiformis subsp. coriacea
- 5 - Echinopogon caespitosus var. caespitosus
- 6 - Lomandra multiflora subsp. multiflora
- 7 - Pimelea linifolia subsp. linifolia

- 8 - Eucalyptus saligna X botryoides
  - 9 - Dichondra spp.
  - 10 - Eucalyptus paniculata subsp. paniculata
  - 11 - Eucalyptus resinifera subsp. resinifera
  - 12 - Imperata cylindrica var. major
  - 13 - Lomandra filiformis subsp. Filiformis
  - 14 - Syncarpia glomulifera subsp. glomulifera
  - a - Themeda australis synonymia with Themeda triandra
  - \*\*\* Dominant species or Characteristic
  - \*\* Frequent species
  - \* Infrequent
  - x Species part of the community
  - # - Protected tree species indigenous to Hornsby Shire (HSC 2013a and HELP 2013)
- Vegetation condition: G = good, M = Moderate, P = Poor



**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16	
Fabaceae (Mimosoideae)	Acacia decurrens	Black Wattle			TRUE <sup>#</sup>					x		x	x			2						
Fabaceae (Mimosoideae)	Acacia implexa	Hickory Wattle			TRUE <sup>#</sup>					x	x	x	x			2	2	3	2			1
Fabaceae (Mimosoideae)	Acacia linifolia	Flax-leaved Wattle			TRUE				x	x												
Fabaceae (Mimosoideae)	Acacia longissima	Narrow-leaved Wattle			TRUE																	
Fabaceae (Mimosoideae)	Acacia parramattensis	Parramatta Wattle			TRUE <sup>#</sup>					x	x	x	x				16	3	1			
Fabaceae (Mimosoideae)	Acacia ulicifolia	Prickly Moses			TRUE																	
Polygonaceae	Acetosa sagittata	Rambling Dock			FALSE															2		
Alliaceae	Agapanthus praecox	Agapanthus			FALSE														1			
Asteraceae	Ageratina adenophora	Crofton Weed			FALSE												10					
Poaceae	Agrostis capillaris	Browntop Bent			FALSE																	
Casuarinaceae	Allocasuarina littoralis	Black Sheoak			TRUE <sup>#</sup>				x			x	x		5							
Casuarinaceae	Allocasuarina torulosa	Forest Oak			TRUE <sup>#</sup>	x	x	x	x	x	x	x	x									
Amaranthaceae	Alternanthera denticulata	Lesser Joyweed			TRUE									7						1	10	
Primulaceae	Anagallis arvensis	Scarlet/Blue Pimpernel			FALSE														20	10		
Poaceae	Andropogon virginicus	Whisky Grass			FALSE												2					
Myrtaceae	Angophora costata	Sydney Red/Rusty Gum			TRUE <sup>#</sup>	** / *	x	x	x	***	x				2			1				
Myrtaceae	Angophora floribunda	Rough-barked Apple			TRUE <sup>#</sup>	** / *		x		***									1	1	1	
Poaceae	Anisopogon avenaceus	Oat Speargrass			TRUE						x											
Basellaceae	Anredera cordifolia	Madeira Vine			FALSE														1			
Asclepiadaceae	Araujia sericifera	Moth Vine			FALSE									1		1	2	1	2	1	1	
Poaceae	Aristida vagans	Threeawn Speargrass			TRUE					x	x	x	x			10						
Anthericaceae	Arthropodium milleflorum	Vanilla Lily			TRUE						x	x	x									
Asparagaceae	Asparagus aethiopicus	Asparagus Fern			FALSE									1				1	1			1
Asparagaceae	Asparagus asparagoides	Bridal Creeper			FALSE												2	2	3			1
Asparagaceae	Asparagus officinalis	Asparagus			FALSE																	
Poaceae	Austrostipa pubescens				TRUE							x	x		2							
Poaceae	Austrostipa ramosissima	Stout Bamboo Grass			TRUE																	
Poaceae	Axonopus fissifolius	Narrow-leaved Carpet Grass			FALSE												10					
Asteraceae	Bidens pilosa	Cobblers Pegs			FALSE												2					

**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16	
Pittosporaceae	Billardiera scandens	Appleberry			TRUE				x	x	x	x	x		2							
Fabaceae (Faboideae)	Bossiaea obcordata	Spiny Bossiaea			TRUE										1							
Sterculiaceae	Brachychiton acerifolius	Illawarra Flame Tree			TRUE		x															1
Euphorbiaceae	Breynia oblongifolia	Coffee Bush			TRUE	x	x			x		x	x		1	2						
Poaceae	Bromus catharticus	Prairie Grass			FALSE						x			1						10		1
Goodeniaceae	Brunonia australis	Blue Pincushion			TRUE								x	1								
Acanthaceae	Brunoniella australis	Blue Trumpet			TRUE		x				x	x										1
Pittosporaceae	Bursaria spinosa	Native Blackthorn			TRUE					x	x	x	x		1	4				1		
Cyperaceae	Carex inversa	Knob Sedge			TRUE									100			10				50	
Lauraceae	Cassytha sp.				TRUE																	
Vitaceae	Cayratia clematidea	Slender Grape			TRUE		x				x									4		
Ulmaceae	Celtis sinensis	Chinese Nettle Tree			FALSE									2								1
Cunoniaceae	Ceratopetalum gummiferum	Christmas Bush		P13 (NSW)	TRUE <sup>#</sup>				x													
Adiantaceae	Cheilanthes sieberi	Mulga Fern			TRUE					x	x	x	x									
Anthericaceae	Chlorophytum comosum				FALSE																	
Asteraceae	Chrysanthemoides monilifera subsp. monilifera	Boneseed			FALSE																	
Lauraceae	Cinnamomum camphora	Camphor Laurel			FALSE									1			1					
Asteraceae	Cirsium vulgare	Spear Thistle			FALSE									1				2		1		1
Ranunculaceae	Clematis aristata	Mountain Clematis			TRUE					x												
Verbenaceae	Clerodendrum tomentosum				TRUE	x	x			x				1								
Commelinaceae	Commelina cyanea	Native Wandering Jew			TRUE					x	x			20			15	7				1
Asteraceae	Conyza bonariensis	Flaxleaf Fleabane			FALSE															2		
Asteraceae	Conyza sp.				FALSE																2	
Asteliaceae	Cordyline stricta	Narrow-leaved Palm Lily			TRUE																	
Myrtaceae	Corymbia citriodora																2					
Myrtaceae	Corymbia eximia	Yellow Bloodwood			TRUE <sup>#</sup>										8	3						
Myrtaceae	Corymbia gummifera	Red Bloodwood			TRUE <sup>#</sup>				x	x		x						1				
Asteraceae	Cotula australis	Common Cotula			TRUE									2								
Orchidaceae	Cryptostylis sp.				TRUE																	

**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16	
Cyperaceae	Cyathochaeta diandra	Sheath Sedge			TRUE																	
Poaceae	Cynodon dactylon	Common Couch			TRUE												10			1	1	
Cyperaceae	Cyperus eragrostis	Umbrella Sedge			FALSE																	1
Cyperaceae	Cyperus gracilis	Slender Flat-sedge			TRUE									100								
Cyperaceae	Cyperus sp.				TRUE														1	200		
Cyperaceae	Cyperus tetraphyllus				TRUE									1								
Phormiaceae	Dianella caerulea				TRUE	x	x		x		x	x			2	12						
Phormiaceae	Dianella caerulea var. producta				TRUE													3				
Phormiaceae	Dianella longifolia				TRUE						x		x		2							
Poaceae	Dichelachne inaequiglumis	Loose Plume-grass			TRUE						x											
Poaceae	Dichelachne sp.				TRUE												1					
Convolvulaceae	Dichondra repens	Kidney Weed			TRUE					x	x <sup>9</sup>	x	x <sup>9</sup>	50					200	400	1	
Iridaceae	Dietes grandiflora				FALSE														2			
Poaceae	Digitaria ciliaris				FALSE									2								
Poaceae	Digitaria parviflora	Small-flowered Finger Grass			TRUE						x	x	x									
Sapindaceae	Dodonaea triquetra	Large-leaf Hop-bush			TRUE				x	x	x	x	x									
Poaceae	Echinopogon caespitosus				TRUE					x	x <sup>5</sup>	x <sup>5</sup>	x <sup>5</sup>									
Poaceae	Echinopogon ovatus	Forest Hedgehog Grass			TRUE						x	x	x	2		2						1
Poaceae	Ehrharta erecta	Panic Veldtgrass			FALSE									50			50	50	200	1000		
Chenopodiaceae	Einadia hastata	Berry Saltbush			TRUE						x						1			2		
Chenopodiaceae	Einadia polygonoides				TRUE																	1
Chenopodiaceae	Einadia trigonos	Fishweed			TRUE									10						50		
Elaeocarpaceae	Elaeocarpus reticulatus	Blueberry Ash			TRUE <sup>#</sup>	x	x		x	x												
Poaceae	Entolasia marginata	Bordered Panic			TRUE	x	x			x	x	x	x		20	20				100		
Poaceae	Entolasia stricta	Wiry Panic			TRUE	x			x	x	x	x	x		10	50						
Myrtaceae	Eucalyptus acmenioides				TRUE <sup>#</sup>					x	x										5	
Myrtaceae	Eucalyptus crebra	Narrow-leaved Ironbark			TRUE							x	x						1			
Myrtaceae	Eucalyptus paniculata	Grey Ironbark			TRUE <sup>#</sup>	x		x		***	x <sup>10</sup>			2					1	1	1	
Myrtaceae	Eucalyptus pilularis	Blackbutt			TRUE <sup>#</sup>	***	x	x	x		x				1	1		7				

**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16
Myrtaceae	<i>Eucalyptus punctata</i>	Grey Gum			TRUE <sup>#</sup>			x	x		x	x	x	1					1	1	
Myrtaceae	<i>Eucalyptus resinifera</i>	Red Mahogany			TRUE <sup>#</sup>			x	x	***	x <sup>11</sup>		x <sup>11</sup>	3		3		2			
Myrtaceae	<i>Eucalyptus saligna</i>	Sydney Blue Gum			TRUE <sup>#</sup>	***	x <sup>8</sup>	x	x		x <sup>8</sup>						6				3
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum			TRUE <sup>#</sup>							x							8		
Euphorbiaceae	<i>Euphorbia peplus</i>	Petty Spurge			FALSE									3				2	100	100	1
Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat Berry			TRUE	x	x	x			x								1		
Cyperaceae	<i>Gahnia clarkei</i>	Tall Saw-sedge			TRUE																
Rubiaceae	<i>Galium leptogonium</i>				FALSE																
Asteraceae	<i>Gamochaeta americana</i>	American Cudweed			FALSE																
Fabaceae (Faboideae)	<i>Genista monspessulana</i>	Montpellier Broom			FALSE												20				
Geraniaceae	<i>Geranium homeanum</i>	Rainforest Cranes-bill			TRUE													15	50	100	1
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	Twining Glycine		E2 (NSW)	TRUE	x				x	x	x	x								
Fabaceae (Faboideae)	<i>Glycine microphylla</i>	Small-leaf Glycine			TRUE						x	x <sup>2</sup>	x	20		10	2	20			
Fabaceae (Faboideae)	<i>Glycine sp.</i>				TRUE														100		
Fabaceae (Faboideae)	<i>Glycine tabacina</i>				TRUE						x	x	x								1
Goodeniaceae	<i>Goodenia heterophylla</i>				TRUE					x											
Proteaceae	<i>Grevillea robusta</i>	Silky Oak			TRUE									4							
Dilleniaceae	<i>Hibbertia aspera</i>				TRUE						x <sup>3</sup>	x <sup>3</sup>	x <sup>3</sup>		6	2					
Dilleniaceae	<i>Hibbertia sp.</i>				TRUE																
Violaceae	<i>Hybanthus monopetalus</i>	Slender Violet-bush			TRUE																
Apiaceae	<i>Hydrocotyle peduncularis</i>				TRUE						x										
Clusiaceae	<i>Hypericum gramineum</i>	Small St Johns Wort			TRUE																
Asteraceae	<i>Hypochaeris radicata</i>	Catsear			FALSE									7		20	7	2	50		
Poaceae	<i>Imperata cylindrica</i>	Bladey Grass			TRUE					x	x <sup>12</sup>				1						
Bignoniaceae	<i>Jacaranda mimosifolia</i>	Jacaranda			FALSE									1							
Oleaceae	<i>Jasminum polyanthum</i>	White Jasmine			FALSE																
Juncaceae	<i>Juncus sp.</i>				TRUE													2			
Fabaceae (Faboideae)	<i>Kennedia rubicunda</i>	Red Kennedy Pea			TRUE					x	x										
Asteraceae	<i>Lagenifera stipitata</i>	Blue Bottle-daisy			TRUE									7							
Verbenaceae	<i>Lantana camara</i>	Lantana			FALSE										3	10	20	50			

**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16	
Cyperaceae	Lepidosperma laterale	Variable Sword-sedge			TRUE					x		x	x		3	1						
Myrtaceae	Leptospermum sp.				TRUE																	
Myrtaceae	Leptospermum trinervium	Paperbark Tea-tree			TRUE				x						3							
Epacridaceae	Leucopogon juniperinus	Long-flower Beard-heath			TRUE	x	x	x		x	x	x	x		2	2		1				
Epacridaceae	Leucopogon lanceolatus	Lance Beard Heath			TRUE																	
Oleaceae	Ligustrum lucidum	Large-leaved Privet			FALSE			x									1	2			1	
Oleaceae	Ligustrum sinense	Small-leaved Privet			FALSE			x							7	18	10	2				
Lindsaeaceae	Lindsaea microphylla	Lacy Wedge Fern			TRUE						x											
Altingiaceae	Liquidambar styraciflua	Liquidambar			FALSE												1					
Lomandraceae	Lomandra filiformis	Wattle Matt-rush			TRUE						x <sup>13</sup>	x <sup>4</sup>	x <sup>4</sup>									
Lomandraceae	Lomandra longifolia	Spiny-headed Mat-rush			TRUE	x	x	x	x	x	x	x			2							
Lomandraceae	Lomandra multiflora				TRUE							x <sup>6</sup>	x <sup>6</sup>		1	1						
Lomandraceae	Lomandra obliqua				TRUE										10							
Lomandraceae	Lomandra sp.				TRUE										1	1						
Proteaceae	Lomatia silaifolia	Crinkle Bush		P13 (NSW)	TRUE										9							
Caprifoliaceae	Lonicera japonica	Japanese Honeysuckle			FALSE											7	1		5			
Fabaceae (Faboideae)	Lotus sp.				TRUE												1					
Bignoniaceae	Macfadyena unguis-cati	Cats Claw Creeper			FALSE									1								
Celastraceae	Maytenus silvestris	Narrow-leaved Orangebark			TRUE	x	x				x											
Meliaceae	Melia azedarach	White Cedar			TRUE																	
Poaceae	Microlaena stipoides				TRUE				x	x	x	x	x	100	10	15	100	100	100	2000		
Malvaceae	Modiola caroliniana	Red-flowered Mallow			FALSE									20				2		2		
Rutaceae	Murraya paniculata				FALSE													1				
Davalliaceae	Nephrolepis cordifolia	Fishbone Fern			TRUE																	
Ochnaceae	Ochna serrulata	Mickey Mouse Plant			FALSE			x							2	1						
Oleaceae	Olea europaea subsp. cuspidata				FALSE														1			
Rubiaceae	Opercularia aspera	Coarse Stinkweed			TRUE																	

**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16	
Rubiaceae	Opercularia varia	Variable Stinkweed			TRUE																	
Poaceae	Oplismenus aemulus				TRUE	x	x	x		x	x			50			10	20		10		
Poaceae	Oplismenus imbecillis	Creeping Beard Grass			TRUE	x					x				20	15				400	400	1
Oxalidaceae	Oxalis corniculata	Creeping Oxalis			FALSE									10								
Oxalidaceae	Oxalis latifolia	Large-leaf Wood-sorrel			FALSE									50								
Oxalidaceae	Oxalis perennans	Grassland Wood-sorrel			TRUE	x						x	x	10		2						
Oxalidaceae	Oxalis pes-caprae	Soursob			FALSE															1		
Oxalidaceae	Oxalis sp.				TRUE															100	50	1
Asteraceae	Ozothamnus diosmifolius	White Dogwood			TRUE		x	x		x	x	x	x			50						
Bignoniaceae	Pandorea pandorana	Wonga Wonga Vine			TRUE	x	x			x	x				2							
Poaceae	Panicum simile	Two-colour Panic			TRUE					x	x	x	x									
Caryophyllaceae	Paronychia brasiliiana	Chilean Whitlow Wort			FALSE									50						10		
Apocynaceae	Parsonsia straminea	Common Silkpod			TRUE															1		
Poaceae	Paspalidium distans	Spreading Panic-grass			TRUE						x	x	x									
Poaceae	Paspalum dilatatum	Paspalum			FALSE											20	50	10	400	1	1	
Passifloraceae	Passiflora edulis	Common Passionfruit			FALSE																	
Passifloraceae	Passiflora suberosa	Cork Passionfruit			FALSE									1								
Iridaceae	Patersonia glabrata	Leafy Purple-flag			TRUE																	
Poaceae	Pennisetum clandestinum	Kikuyu Grass			FALSE									20							2	
Proteaceae	Persoonia levis	Broad-leaved Geebung			TRUE										1							
Proteaceae	Persoonia linearis	Narrow-leaved Geebung			TRUE				x		x	x	x		3							
Proteaceae	Persoonia pinifolia	Pine-leaved Geebung		P13 (NSW)	TRUE											1						
Euphorbiaceae	Phyllanthus hirtellus	Thyme Spurge			TRUE							x	x		10							
Phytolaccaceae	Phytolacca octandra	Inkweed			FALSE																1	1
Thymelaeaceae	Pimelea linifolia	Slender Rice-flower			TRUE							x <sup>7</sup>	x <sup>7</sup>		1	1						
Pinaceae	Pinus sp.				FALSE											1						
Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum			TRUE <sup>#</sup>	x	x	x	x	x	x			2	7	7	4	20				1

**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16	
Plantaginaceae	<i>Plantago gaudichaudii</i>	Narrow Plantain			TRUE																1	
Plantaginaceae	<i>Plantago lanceolata</i>	Lambs Tongues			FALSE											10	5				2	
Fabaceae (Faboideae)	<i>Platylobium formosum</i>	Handsome Flat-pea			TRUE	x	x															
Poaceae	<i>Poa affinis</i>				TRUE	x	x	x		x	x											
Caryophyllaceae	<i>Polycarpon tetraphyllum</i>	Four-leaved Allseed			FALSE																	
Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry Panax			TRUE	x <sup>1</sup>	x			x					3	15						
Rubiaceae	<i>Pomax umbellata</i>	Pomax			TRUE					x		x	x									
Euphorbiaceae	<i>Poranthera microphylla</i>				TRUE					x		x	x									
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed			TRUE									2								
Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot			TRUE	x	x		x	x	x	x	x		12	12		50	400			
Acanthaceae	<i>Pseuderanthemum variable</i>	Pastel Flower			TRUE	x	x	x		x	x				10							1
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken			TRUE	x		x	x													
Fabaceae (Faboideae)	<i>Pultenaea flexilis</i>				TRUE				x													
Rubiaceae	<i>Richardia stellaris</i>				FALSE																	
Iridaceae	<i>Romulea rosea</i>	Onion Grass			FALSE																5	
Rosaceae	<i>Rubus fruticosus</i>	Blackberry complex			FALSE			x														1
Polygonaceae	<i>Rumex brownii</i>	Swamp Dock			TRUE									7								
Poaceae	<i>Rytidosperma</i> sp.				TRUE																	
Cyperaceae	<i>Schoenus melanostachys</i>	Black Bog-sedge			TRUE										12							
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed			FALSE												2		2			
Poaceae	<i>Setaria gracilis</i>	Slender Pigeon Grass			FALSE													2	10			
Malvaceae	<i>Sida rhombifolia</i>	Paddys Lucerne			FALSE									20		20	20	10	200			1
Asteraceae	<i>Sigesbeckia orientalis</i>				TRUE						x											1
Smilacaceae	<i>Smilax glyciphylla</i>	Sweet Sarsparilla			TRUE	x	x	x	x	x												
Solanaceae	<i>Solanum chenopodioides</i>	Whitewip Nightshade			FALSE									1			2				5	1
Solanaceae	<i>Solanum mauritianum</i>	Wild Tobacco Bush			FALSE																1	
Solanaceae	<i>Solanum nigrum</i>	Black-berry Nightshade			FALSE																	1
Solanaceae	<i>Solanum prinophyllum</i>	Forest Nightshade			TRUE						x	x	x	1								
Solanaceae	<i>Solanum pseudocapsicum</i>	Madeira Winter Cherry			FALSE																	

**Table 2 (cont) Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural – B09 – B16**

Family Name	Scientific Name	Common Name	EPBC Stat	Threat-Listing	Native	BGHF (FD 2007)	BGHF (Tozer et al 2010)	BGSF (Smith & Smith 2008)	BGF (Smith & Smith 2008)	STIF (FD 1998)	STIF (Tozer et al 2010)	SSTF (FD 2014)	CSSTF (Tozer et al 2010)	B09	B10	B11	B12	B13	B14	B15	B16	
Asteraceae	Solenogyne bellioides				TRUE																	
Asteraceae	Soliva sessilis	Bindyi			FALSE																	
Caryophyllaceae	Stellaria media	Common Chickweed			FALSE																	1
Menispermaceae	Stephania japonica				TRUE																	
Myrtaceae	Syncarpia glomulifera	Turpentine			TRUE <sup>#</sup>			x	x	***	x <sup>14</sup>	x			17	14		6				
Asteraceae	Taraxacum officinale	Dandelion			FALSE													2				
Elaeocarpaceae	Tetradlea thymifolia	Black-eyed Susan			TRUE												3					
Poaceae	Themeda triandra <sup>a</sup>	Kangaroo Grass			TRUE					x	x	x	x			50						
Commelinaceae	Tradescantia fluminensis	Wandering Jew			FALSE									10			10					1
Anthericaceae	Tricoryne elatior	Yellow Autumn-lily			TRUE								x									
Fabaceae (Faboideae)	Trifolium repens	White Clover			FALSE													20				
Fabaceae (Faboideae)	Trifolium sp.				FALSE														10			
Verbenaceae	Verbena bonariensis	Purpletop			FALSE																	
Verbenaceae	Verbena officinalis	Common Verbena			FALSE																	
Scrophulariaceae	Veronica arvensis	Wall Speedwell			FALSE									2								
Scrophulariaceae	Veronica plebeia	Trailing Speedwell			TRUE					x	x	x	x	20		4						
Fabaceae (Faboideae)	Vicia sp.				FALSE													2				
Apiaceae	Xanthosia pilosa	Woolly Xanthosia			TRUE				x						2							
Rutaceae	Zieria smithii	Sandfly Zieria		E2 (NSW)	TRUE					x	x				5							

Notes:

- BGHF - Blue Gum High Forest
- BGSF - Blue Gum Shale Forest
- STIF - Sydney Turpentine Ironbark Forest
- SSTF - Shale Sandstone Transition Forest
- BGF - Blackbutt Gully Forest
- CSSTF - Cumberland Shale Sandstone Transition Forest
- FD - Final Determination Date
- 1 - Polyscias sambucifolia subsp. A
- 2 - Glycine microphyllus
- 3 - Hibbertia aspera subsp. aspera
- 4 - Lomandra filiformis subsp. coriacea
- 5 - Echinopogon caespitosus var. caespitosus
- 6 - Lomandra multiflora subsp. multiflora
- 7 - Pimelea linifolia subsp. linifolia

- 8 - Eucalyptus saligna X botryoides
  - 9 - Dichondra spp.
  - 10 - Eucalyptus paniculata subsp. paniculata
  - 11 - Eucalyptus resinifera subsp. resinifera
  - 12 - Imperata cylindrica var. major
  - 13 - Lomandra filiformis subsp. Filiformis
  - 14 - Syncarpia glomulifera subsp. glomulifera
  - a - Themeda australis synonymia with Themeda triandra
  - \*\*\* Dominant species or Characteristic
  - \*\* Frequent species
  - \* Infrequent
  - x Species part of the community
  - # - Protected tree species indigenous to Hornsby Shire (HSC 2013a and HELP 2013)
- Vegetation condition: G = good, M = Moderate, P = Poor



**Table 3 Summary of species Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural**

WSP Parsons Brinckerhoff's Vegetation Classification and condition as mapped									B01	B02	B03	B04	B05	B06	B07	B08	B09	B10	B11	B12	B13	B14	B15	B16
									G	G	P	G	M	M	G	M	M	M	M		M	M	M	M
<b>Part I: Counts of the number of species</b>																								
No spp	29	26	23	26	48	62	49	47	49	45	20	36	31	63	49	36	47	41	40	36	37	40	32	35
BGHF	53								16	16	3	16	7	18	15	4	5	14	11	3	6	5	5	6
BGHF (Tozer)		41							13	14	1	15	6	13	13	3	3	12	9	3	6	3	2	5
BGSF			26						12	13	4	11	6	15	13	4	5	9	8	5	9	4	4	7
BGF				32					9	5	1	9	5	11	16	4	4	14	8	3	8	3	2	2
STIF					70				22	22	4	22	8	28	18	8	9	18	18	6	12	8	7	6
STIF (Tozer)						93			13	21	1	16	7	30	13	8	8	20	23	4	8	10	5	6
SSTF							88		17	20	1	16	7	29	13	8	8	19	19	4	8	10	4	6
CSSTF (Tozer)								103	14	19	1	15	7	19	11	9	8	17	21	4	7	8	4	4
<b>Part II: Percentage of the number of species</b>																								
No spp	54.717	63.415	88.462	81.25	68.571	66.667	55.682	45.631	49	45	20	36	31	63	49	36	47	41	40	36	37	40	32	35
BGHF	53								33	36	15	44	23	29	31	11	11	34	28	8	16	13	16	17
BGHF (Tozer)		41							27	31	5	42	19	21	27	8	6	29	23	8	16	8	6	14
BGSF			26						24	29	20	31	19	24	27	11	11	22	20	14	24	10	13	20
BGF				32					18	11	5	25	16	17	33	11	9	34	20	8	22	8	6	6
STIF					70				45	49	20	61	26	44	37	22	19	44	45	17	32	20	22	17
STIF (Tozer)						93			27	47	5	44	23	48	27	22	17	49	58	11	22	25	16	17
SSTF							88		35	44	5	44	23	46	27	22	17	46	48	11	22	25	13	17
CSSTF (Tozer)								103	29	42	5	42	23	30	22	25	17	41	53	11	19	20	13	11
<b>Part III: Summary of multivariate analysis in PRIMER 7</b>																								
Part IIIa: Summary of results of mutivariate non-parametric multidimensional analysis (nMDS) for the 16 quadrats and all records of species																								
Groupg	1	2	3	4					4	4	3	4	3	4	4	3	3	4	4	3	3	2	2	1

**Table 3 Summary of species Vegetation Communities in Quadrats Surveyed by WSP Parsons Brinckerhoff (2016), South Dural**

WSP Parsons Brinckerhoff's Vegetation Classification and condition as mapped		B01	B02	B03	B04	B05	B06	B07	B08	B09	B10	B11	B12	B13	B14	B15	B16							
		G	G	P	G	M	M	G	M	M	M	M		M	M	M	M							
Part IIIb: Summary of results of multivariate non-parametric multidimensional analysis (nMDS) for the 16 quadrats and for all native species ('TRUE') and few non-native ('False' records only included if part of a final determination)																								
Group	1	2	3A	3B	4				4	4	3A	4	3B	4	4	3B	3B	4	4	3B	3B	2	2	1

- Notes:
- BGHF** BGHF - Blue Gum High Forest (TSSC Final Determination 2007, CEEC)
  - STIF** STIF - Sydney Turpentine Ironbark Forest (TSSC Final Determination in 1998 as CEEC)
  - SSTF** SSTF - Shale Sandstone Transition Forest (TSSC Final Determination in 2014 as CEEC)
  - BGF** BGF - Blackbutt Gully Forest (Smith & Smith 2008)
- Vegetation condition: G = good, M = moderate, P = poor
- Bold** Number of Characteristic/Diagnostic species in the vegetation community
  - # Total number of Characteristic/Diagnostic species recorded in the 16 quadrats
  - # Total number of Characteristic/Diagnostic species recorded in each quadrat
  - # Percentage of the total number of Characteristic/Diagnostic species recorded in the 16 quadrats
  - # Percentage of the total number of Characteristic/Diagnostic species recorded in each quadrat

**Table 4 Assessment of Congruence in Vegetation Type Classification of Patches Mapped by Hayes Environmental (2009) and WSP Parsons**

Hayes Environmental			WSP PB					Congruence		Assessment of Congruence	Comments	
Patch No	Vegetation Type <sup>1</sup>		Patch No	Vegetation Type <sup>1</sup>					Size			Vegetation Type
	BGHF	BGF		STIF	Ar	BGF	BGHF	SSTF				
HE1	P		PB1, PB2	x					No	No	HE1 occupies a larger are than PB1 and PB2 combined. HE1 is mapped as STIF, whereas PB1 and PB2 are mapped as <i>Acacia</i> regrowth	It is noted that no quadrat data corresponding to patch PB1 and PB2 were provided for assessment
-			PB3, PB4, PB5, PB6, PB7, PB35, PB38, PB39, PB40, PB41, PB42, PB43,	x					-	-	These patches are mapped as <i>Acacia</i> regrowth by PB and have no corresponding patches mapped by HE	No quadrat flora survey data for these patches were provided for assessment.

**Table 4 Assessment of Congruence in Vegetation Type Classification of Patches Mapped by Hayes Environmental (2009) and WSP Parsons**

Hayes Environmental				WSP PB						Congruence		Assessment of Congruence	Comments
Patch No	Vegetation Type <sup>1</sup>			Patch No	Vegetation Type <sup>1</sup>					Size	Vegetation Type		
	BGHF	BGF	STIF		Ar	BGF	BGHF	SSTF	STIF				
				PB102									
-				PB9, PB10, PB12, PB13, PB15, PB18, PB20, PB21, PB22, PB23, PB24, PB25, PB26, PB27, PB28, PB32, PB33, PB101					P	-	-	These patches are mapped as STIFF (Poor condition) by WSP PB and have not corresponding patches in maps by HE	WSP PB's survey quadrat B03 corresponds to patch PB14. Assessment of flora species listed in PB14 as part of this Peer Review agrees with WSP PB's classification of PB14 as STIF (Poor condition).
-				PB17, PB19, PB29, PB34, PB44, PB51, PB52, PB54, PB58, PB59, PB62, PB67 to PB70, PB74 to PB82, PB90, PB91, PB93, PB105					M	-	-	These patches are mapped as STIFF (Moderate condition) by WSP PB and have not corresponding patches in maps by HE	The following survey quadrats are classified as STIFF (Moderate condition) in map prepared by WSP PB: B05, B06, B08, B09, B10, B11, B13 and B15. Assessment of flora species listed in the above survey quadrats and as part of this Peer Review agrees with WSP PB's classification of the 8 quadrats as STIF (Moderate condition).
HE2			G	PB46, PB53					G	No	Yes	HE2 was mapped as STIF (Good condition) and occupied a large area including patches PB46 and PB53 (mapped as STIF - Good condition), PB47 (mapped as Acacia growth) and PB48-PB50 (mapped as STIF moderate).	Comparison of the aerial images used by Hayes Environmental (2009) with that used by WSP Parsons Brinckerhoff (2016) shows that a large portion of forest from HE2 has been cleared. Woodland clearance appear to be the reason in change of vegetation community.
			G	PB47	X					No	No	PB47 occupies a portion of HE2 in addition to land to the west.	No quadrat flora survey data for these patches were provided for assessment
			G	PB49					M	No	No	This patch was part of HE2 mapped as STIF (Good condition). Reduction in woodland area and possibly edge effects might be the reason for the decrease in condition of this remnant patch.	No quadrat flora survey data for these patches were provided for assessment. WSP PB's map shows that rapid assessment point RA3 was undertaken in patch PB49. The flora list or photographs collected from RA3 were not provided for this Peer Review assessment.
			G	PB45		G				No	No	A portion of HE2 has been mapped as BGF (Good condition) part of PB45.	Quadrat B02 is located in the current margin between STIF and BGF (patch PB53 and PB45). Assessment of floristic list in quadrat B02 is congruent with STIFF vegetation. It is noted that BGF in WSP PB mapping has been extended towards the west compared to patch HE10. Floristic survey data recorded in this portion of PB45 was not supplied for analysis. Therefore, assessment of data with regards of modification of BGF was not undertaken.
HE3			P	PB52					M	Yes	Yes	Patch HE3 corresponds to PB52, both classified as STIF by both consultants. The size of patch HE3 is approximately the same as PB52.	No survey quadrat was sampled within patch PB52.
HE4			P	-						-	-	Patch HE4 does not have a corresponding patch in WSP PB's map.	No survey data available for assessment of the classification of patch HE4.

**Table 4 Assessment of Congruence in Vegetation Type Classification of Patches Mapped by Hayes Environmental (2009) and WSP Parsons**

Hayes Environmental				WSP PB					Congruence		Assessment of Congruence	Comments	
Patch No	Vegetation Type <sup>1</sup>			Patch No	Vegetation Type <sup>1</sup>					Size			Vegetation Type
	BGHF	BGF	STIF		Ar	BGF	BGHF	SSTF	STIF				
HE5, HE6			P	PB44					M	Yes	Yes	Patch HE5 and HE6 corresponds to PB44, the three patches were classified as STIF by both consultants, HE5 and HE6 as in poor condition and PB44 as moderate condition. The combined size of patches HE5 and HE is approximately the same as PB44.	Survey quadrat B13 was collected in patch PB44. Peer Review assessment of quadrats suggest their classification as STIF (moderate condition) is congruent with the positive diagnostic species for STIF. Rapid assessment point.
HE7			P	PB74					M	Yes	Yes	HE7 corresponds to PB74. PB74 appears to be slightly larger in area than HE7.	No quadrat data were available to assess classification of this patch a STIF.
HE8			P	PB75					M	Yes	Yes	HE8 corresponds to PB75. PB75 appears to be slightly larger in area than HE8.	No quadrat data were available to assess classification of this patch a STIF.
HE9			P	PB32					P	Yes	Yes	HE9 corresponds to PB32. PB32 appears to be similar in area than HE9.	No quadrat data were available to assess classification of this patch a STIF.
HE10		G		PB45		G				Mostly	Partially	A very high level of congruence exists between HE10 and PB45. There are some portions along the edge of HE10, which have changed and more accurately mapped in PB45. In both maps, a nested patch of <i>Epacris purpurascens</i> var. <i>purpurascens</i> is present.	Quadrat B04, B07 and B01 were surveyed by PB in this area. Peer reviewer agrees with WSP PB's mapping outcome.
		G		PB71, PB72, PB84, PB106		P				No	Partially	The three patches in WSP PB's map are still mapped as Blue Gum Forest, the condition has changed from Good (HE10) to Poor condition.	No quadrat data were available for these patches. Peer reviewer agrees with WSP PB's mapping outcome.
		G		PB43	X					No	No	A portion of HE2 (mapped as Blue Gum Forest) has now been re-classified as <i>Acacia</i> regrowth.	No quadrat data were available to assess PB43. Based on Peer Reviewer's knowledge of the area, it is agreed the mapping outcome by WSP PB.
HE11		P		PB76, PB77, PB78, PB79, PB80					M	No	No	Patch HE2 was mapped as Blue Gum Forest (Poor condition) by HE, these area has now been re-classified as five fragments of Sydney Turpentine Ironbark Forest (Moderate condition).	Quadrat data B10 (in patch PB78), B11 (in patch PB80) were provided for review. Peer Reviewer's opinion is that the latest and more accurate mapping outcome done by WSP PB is correct.
HE12		P		PB81, PB82					M	No	Yes	Most of patch HE12 is still classified as Blackbutt Gully Forest, the condition of this patch changed from Poor condition (HE12), to Moderate condition in the latest mapping.	No quadrat survey within these two patches was available for review. Based on Peer Reviewer's knowledge of the area, it is considered the latest mapping outcome is accurate.
				PB83		M						The northernmost portion of patch HE12 originally mapped as BGF, has now been re-classified as STIF (Moderate condition).	No quadrat data were provided for these patches. However based on experience by the Peer Reviewer in the area, it is considered WSP PB's mapping outcome to be accurate.
HE13	P			PB60, PB63, PB64, PB66, PB67, PB68					M	No	No	The area mapped as patch HE3 (BGHF - Poor condition) was mapped as five patches of STIF (Moderate condition).	Survey quadrats B06 and B09 were collected in patch PB60 and quadrat B15 was collected in patch PB66. Peer Review assessment of quadrats suggest their classification as STIF is congruent with the positive diagnostic species for STIF. Rapid assessment points RA07, RA09 and RA10 were undertaken in PB63, PB61 and PB60, respectively. Their flora list or photographs were not provided for Peer Review assessment. Quadrat B06 had similar number of positive diagnostic species for STIF and SSTF.

**Table 4 Assessment of Congruence in Vegetation Type Classification of Patches Mapped by Hayes Environmental (2009) and WSP Parsons**

Hayes Environmental			WSP PB					Congruence		Assessment of Congruence	Comments		
Patch No	Vegetation Type <sup>1</sup>			Patch No	Vegetation Type <sup>1</sup>							Size	Vegetation Type
	BGHF	BGF	STIF		Ar	BGF	BGHF	SSTF	STIF				
HE14	G			PB99, PB100			G			Mostly	Yes	PB99 and PB100 correspond to HE14 and their overall area is similar in spite of the HE14 patch now been splitted into two patches. Type of vegetation is consistent in maps produced by both consultants.	No quadrat data within these patches was provided. Based on the peer reviewer's knowledge of the area and the community, it is considered the mapping is accurate.
HE15A	G			PB89			G			No	Yes	The eastern portion of HE15A is still mapped as BGHF (Good condition) in WSP PB's mapping.	No quadrat data for this patch area was provided for review. Based on experience by the Peer Reviewer, it is considered WSP PB's mapping is correct, more accurate and updated.
	G			PB93					M	No	No	The western portion of HE15A has been re-classified to STIF (Moderate condition).	
HE15B	P			PB96, PB97			M			No	Yes	The majority of the area mapped as BGHF (Poor condition) in HE15B, continues to classify as BGHF but has changed its condition to Moderate condition.	Survey quadrat B16 is mapped in BGHF (Moderate condition). Survey quadrat B14 was collected in area classified as SSTF. Based on experience of the Peer Reviewer I this vegetation community and in the Dural area, it is cosidered WSP BP mapping to be accurate and up to date.
				PB104					M	No	No	A portion of patch HE15B mapped as BGHF (Poor condition) has been re-classified as SSTF (Moderate condition) by WSP PB.	
				PB105						M	No	No	
-				PB98			G			-	-	No corresponding patch was mapped by Hayes Enviornmental (2009).	
-				PB84, PB87, PB94, PB103	PB86, PB92, PB95,		M			-	-	No corresponding patches were mapped by Hayes Enviornmental (2009).	Based on the Peer Reviewer's experience studying the BGHF community in the Dural area, it is considered the presence of patches of BGHF (Moderate codition) is consistent with the locality.

Notes:

- |      |   |   |                                   |
|------|---|---|-----------------------------------|
| -    | Not Applicable                                      | SSTF  | Shale Sandstone Transition Forest |
| HE#  | Hayes Environmental (2009) mapped patch number      | STIF  | Sydney Turpentine Ironbark Forest |
| PB#  | WSP Parsons Brinckerhoff (2016) mapped patch number | 1 - Vegetation Condition marked as follows: |                                   |
| Ar   | Acacia regrowth                                     | G   | Good condition                    |
| BGF  | Blackbutt Gully Forest                              | M   | Moderate condition                |
| BGHF | Blue Gum High Forest                                | P   | Poor condition                    |

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*Appendix D*

**Dr David Robertson - CV**

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# David Robertson

*Director*



**Dr David Robertson** is a senior ecologist with more than 30 years experience in ecological survey and research. David has been the director of Cumberland Ecology since 2003. He has a bachelor of science with majors in botany and zoology and a PhD in ecology.

Examples of consultancy work has included:

- Participation as senior ecological consultant for Department of Planning on the South Coast Environmental Panel;
- Provision of expert testimony, acting as a Court appointed expert for the Land and Environment Court;
- Management of high level flora and fauna investigations for Environmental Impact Assessments;
- Development of ecological management plans;
- Habitat reconstruction;
- Development of packages for compensatory habitats; and
- Management of negotiations about the level of mitigation measures required for flora and fauna impacts.

David is also very experienced at public speaking and has regularly provided expert testimony in court concerning ecological issues.

In previous work David was employed as the senior ecologist in charge of the Ecological Services Practice for ERM Australia. He also lectured in ecology and aquatic biology at Charles Sturt University, and was employed as a senior ecologist with the Australian Museum.

David has skills that allow him to work in both aquatic and terrestrial fields, management of threatened species, ecological risk assessment, wetland rehabilitation and management, and ecological research for environmental impact assessment.

## Key Industry Sectors

- Mining and Rural Assessments;
- Linear Infrastructure (power, water, transport);
- Urban Development and Infrastructure.

## Education

- Bachelor of Science (Honours), Ecology, University of Melbourne, 1980.
- Doctor of Philosophy, Ecology, University of Melbourne, 1986.

## Professional Affiliations

- Ecological Society of Australia
- CEnvP
- EIANZ

## International Experience

David has International experience in threatened species assessments have been completed in Hong Kong, China and Sri Lanka.

Work on threatened species has included preliminary survey and impact assessment, detailed impact assessment and mitigation, monitoring and plans of management.

His experience includes working for the KCRC Habitat Creation and Management Plan, assessments of impacts of construction on rare fishes for the West Rail project, development of mapping units for mapping Hong Kong flora and fauna habitats for the SUSDEV project and for the Green Island Ecological assessments.

Dr Robertson is familiar with the West Rail project and has helped write the Habitat Creation and Management Plan. He has visited the sites proposed for the wetland creation project and understands the habitat requirements of the target species such as the Painted Snipe and the Narrow-mouthed Frog.

David also has mangrove and tropical rainforest management experience in western Sri Lanka.



## Key Competencies

### ***Ecological Impact Assessment***

David has directed numerous large ecological impact assessments for major projects in a variety of service sectors. These include the power industry, water supply, road construction and mining. Experience in ecological impact assessment for the power industry includes work done for Pacific Power, Transgrid, Powercoal, NorthPower and Powerlink.

### ***Threatened Species Assessment***

David has directed or managed numerous threatened species assessments in Australia and overseas on threatened species.

Across Australia, he has completed numerous projects on threatened species in response to state and commonwealth threatened species legislation. Such legislation includes the NSW *Threatened Species Conservation Act 1995*, Queensland *Nature Conservation Act 1994* and the Victorian *Flora and Fauna Conservation Guarantee 1998* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### ***Provision of Strategic Ecological Advice***

Strategic ecological advice has been provided to aid the selection of potential development sites in Australia, Hong Kong, Sri Lanka and China. Examples include: a model to help minimise problems with threatened species issues developed for use by Landcom.

### ***Bushfire Assessments***

A range of bushfire assessments have been prepared for sites ranging from small allotments for single dwellings to bushfire management plans for large sites (eg the ADI site at St Marys and Majura Field Firing Range in the ACT).

### ***EPBC Experience***

David has extensive experience with assessments under the EPBC Act. He has also worked many times with the Department of the Environment (DoE) in Canberra and has an extensive amount of experience in communicating with that organisation.

David has prepared numerous referrals for a wide range of projects since the gazettal of the EPBC Act. These have included referrals for projects in Victoria, ACT, NSW and Queensland and have entailed such diverse projects as coal mines, highways, transmission lines, residential and tourist developments and water supply projects.

David has also worked on complex ongoing assessments that are required for controlled actions to obtain approvals. He has done this for open cut coal mines, transmission lines, tourist developments, golf courses and water supply projects.

David is an excellent negotiator and presenter – and is adept at giving effective presentations to DoE and other organisations when required. Previously, for a number of projects he has also given direct presentations to Ministers. David has a thorough understanding of the EPBC process and can manage the passage of difficult projects in order to gain approvals.

He has also worked on several Brush-tailed Rock Wallaby projects including impact assessments and management plans for Rock Wallabies on the Timbarra Plateau, Shannon Creek and Chambigne Nature Reserve. As part of his work at Shannon Creek, David is working on an eight year monitoring project for Brush-tailed Rock-wallaby and foxes (which are a major threat to the wallaby).

Recent consultancy work has included:

- Work for the Land and Environment Court as an expert witness;
- Work for Department of Defence as expert on kangaroo management;
- Management of high level flora and fauna investigations for Environmental Impact Assessments;
- Threatened species investigations;
- Development of management plans;
- Development of packages for compensatory habitats;
- Ecological risk assessment.



### **Aquatic Assessments**

David has been the senior ecological adviser for many environmental impact assessment and management projects that have entailed mangroves and saltmarsh. Examples of such projects have included:

- An independent review of the impacts of the proposed Tillegra Dam upon the Hunter Ramsar wetlands, which are listed as wetlands of international importance and matters of national environmental significance;
- Groote Eylandt Eastern Leases: baseline aquatic surveys in ephemeral waterways of a proposed manganese mine expansion on Groote Eylandt, Northern Territory;
- Project Stone: baseline aquatic survey in streams and wetlands of proposed open cut coal site, Galilee Basin;
- Project Katrina: baseline aquatic survey in streams and wetlands of proposed open cut coal site, Bowen Basin;
- James Ruse Drive Camellia – Parramatta Riverbank Management Plan to rehabilitate mangrove area from asbestos contamination from adjacent James Hardie site;
- Mt Thorley aquatic pollution Land and Environment Court case: Assessment of swamp and creek area following sediment contamination from mine;
- Tweed Land and Environment Court Case: Requirement for additional assessment of impacts of proposed development on aquatic flora/fauna;
- Morton St. Parramatta: Impacts of residential development on adjacent mangrove/ saltmarsh along Parramatta River; and
- Saltmarsh and mangrove assessments along Duck River.

### **Key Court Proceedings**

David Robertson has extensive court experience as an expert witness. He is recognised as highly qualified due to a combination of his knowledge, skill and experience, and has been called as an

expert witness in a variety of court cases, panels and tribunals.

#### **Class 1 Proceedings**

Project Venture Management Pty Limited v Warringah Shire Council & Anor [2006] NSWLEC 754

B T Goldsmith Planning Services Pty Limited v Blacktown City Council [2007] NSWLEC 229

Hanson South Coast Pty Limited v Eurobodalla Shire Council [2007] NSWLEC 493

Maybrook Manor Pty Limited v Warringah Council [2008] NSWLEC 1160

Mohamad El Dana v Bankstown City Council [2008] NSWLEC 1484

Champions Quarry Pty Limited v Lismore City Council [2011] NSWLEC 1071

Eco-Villages Australia Pty Ltd v Pittwater Council [2012] NSWLEC 49

Blakeney v Mosman Council [2013] NSWLEC 37

Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited [2013] NSWLEC 48

SHCAG Pty Ltd v Minister for Planning and Infrastructure and Boral Cement Limited [2013] NSWLEC 1032

Anglican Retirement Villages, Diocese of Sydney v Wollongong City Council [2013] NSWLEC 1181

Baclon Pty Ltd v Tweed Shire Council [2013] NSWLEC 1239

Penrith Lakes Development Corporation Ltd v Penrith City Council [2015] NSWLEC 9

Rocla Materials Pty Ltd & Anor ats The Trustee for the Gerald and Catherine Barnard Family Trust t/a Australian Walkabout Wildlife Park Pty Ltd. NSW Land and Environment Court Proceedings No. 10024 of 2014 (Decision Pending)

#### **Class 3 Proceedings**

Kalambaka Pty Limited v Minister Administering the Environmental Planning and Assessment Act 1979 [2009] NSWLEC 57

Maloney v Minister Administering the Environmental Planning and Assessment Act 1979 [2011] NSWLEC 121

#### **Class 4 Proceedings**

Hoxton Park Residents Action Group v Liverpool City Council (No 4) [2012] NSWLEC 67

#### **Class 5 Proceedings**

Director-General of the Department of Environment, Climate Change and Water v Walker Corporation Pty Ltd (No 2) [2011] NSWLEC 229

Chief Executive of the Office of Environment and Heritage v Rinaldo (Nino) Lani [2012] NSWLEC 115

Environment Protection Authority v Coal and Allied Operations Pty Ltd. [2013] NSWLEC 134

Environment Protection Authority v Riverina (Australia) Pty Ltd. [2014] NSWLEC 191.

#### **Peer Reviews**

Cumberland Ecology (2010). Review of Response to Submissions Relating to Continued Operations at Ulan Coal. Prepared for Department of Planning. Carlingford Court, NSW.

Cumberland Ecology (2010). Re: Review of Revised Statement of Commitments and Offset Strategy - Moolarben Coal Project. Prepared for Department of Planning. Carlingford Court, NSW.

Cumberland Ecology (2011). Peer Review of Wallarah Underground Coal Project. Prepared for Hansen Bailey. Carlingford Court, NSW.

Cumberland Ecology (2011). Peer Review of EcoLogical Report: "Proposed Framework for Assessing the Cumulative Risk of Mining on Natural Resource Assets in the Namoi Catchment". Prepared for Aston Resources. Carlingford Court, NSW.

Cumberland Ecology (2012). Peer Review of State and Commonwealth Ecological Impact Assessment Reports for the Proposed Mount Penny Coal Mine, Bylong. Prepared for Wells Environmental Services. Carlingford Court, NSW.

## **Significant Experience**

### **Macropod Management - General**

David has extensive experience working with macropods including kangaroos, wallabies, rock wallabies and species such as potoroos. He has prepared and implemented kangaroo management plans for a number of Department of Defence sites.

At St Marys (ADI), David prepared and implemented kangaroo management that entailed sterilisation of 4,000 animals, the largest project of this kind in Australia.

During 2008 at the former Belconnen Naval Transmitter Station, under constant media and public scrutiny, his team of ecologists successfully completed a sensitive and highly scrutinised kangaroo population management project. The project was undertaken to alleviate the extreme kangaroo grazing pressure on the Natural Temperate Grasslands which occur throughout the site. David managed a team of 24 staff under to achieve a major reduction in the kangaroo population. The threat of macropod starvation has receded and the Natural Temperate Grasslands have shown signs of recovery.

In addition, he has provided assessments and / or management plans for Department of Defence sites at Singleton, Majura, Gingin, Kapooka/Latchford Barracks, Orchard Hills and Puckapunyal.

David has also been involved in several Brush-tailed Rock Wallaby projects including impact assessments and management plans for Rock Wallabies on the Timbarra Plateau, Shannon Creek and Chambigne Nature Reserve. As part of the work at Shannon Creek, we are working on an eight year monitoring project for the Brush-tailed Rock-wallaby.

### **Macropod Management - Shannon Creek Monitoring Program**

The Clarence Valley and Coffs Harbour Regional Water Supply Project includes construction of a 30,000 megalitre storage at Shannon Creek,

southwest of Grafton. The storage development involves the construction of the storage facility and associated infrastructure within the Shannon Creek valley as well as the construction of a new access road and pipeline into the valley and upgrading of the existing connecting local roads.

Under the approval conditions for the construction and operation of the Regional Water Supply, many of the threatened species, communities, vertebrate pests and weeds must be monitored throughout the area. The monitoring program commenced a number of years prior to the start of construction to enable collection of baseline data regarding population levels and distribution of the various species and communities. This includes monitoring in adjacent conservation reserves. The monitoring program is to continue throughout construction of the Regional Water Supply and into its operation. Monitoring of the Brush-tailed Rock wallaby at Shannon Creek has been undertaken during each of these sessions. The Brush-tailed Rock wallaby was monitored at Chambigne Nature Reserve during the first four monitoring sessions and at Koukandowie Nature

The monitoring program assesses a range of impacts which may be associated with the Regional Water Supply, including:

- The impact on macropod populations;
- Clearing of vegetation;
- Infection of native plants by the root-rot fungus *Phytophthora cinnamomi*;
- The invasion of native plant communities by exotic and perennial grasses; and
- Invasion of vertebrate pests along construction corridors.

The monitoring programme has yielded a large amount of data on most subject species/communities with the majority of the results indicating continuing occurrence of threatened species and communities at known locations. The environmental impact statement for the Water Supply Project predicted that the Brush-tailed Rock wallaby populations would remain largely unaffected by the construction of the storage. The

management measures which will be implemented for the project have the following objectives in regards to the Brush-tailed Rock wallaby:

- Maintain, protecting and/or enhancing habitat; and
- Maintenance of movement corridors.

To achieve the above objectives various management measures have been proposed within the Threatened Species Management Plan including the creation of a movement corridor between escarpments downstream of the dam wall to encourage the movement of Brush-tailed Rock wallaby between the escarpments and nature reserves. The corridor will include grassland, riparian habitat and woodland.

Additional monitoring of this habitat will remain in progress for some years to come, to establish whether control actions are required.

#### ***Urban Development - ADI site at St Marys***

Dr David Robertson, the Principal, has worked on the site since 1997. It has almost certainly entailed the most intensive kangaroo herding and fertility control work yet conducted on a captive population.

The 1,500 ha ADI site has over 800 hectares of endangered Cumberland Plain Woodland and affiliated vegetation. It also supports a suite of threatened and regionally significant species that were threatened by overgrazing by Eastern Grey Kangaroos and Red Kangaroos, both of which had been introduced to this fenced property.

Ecological work by Dr Robertson at the ADI site has included ecological assessments and planning work for the rezoning of the 1,500 ha property, ecological impact assessment for Precincts within the ADI, ecological impact assessment for individual Development Applications, preparation of management plans (for weeds, feral animals, threatened species and kangaroos) and implementation of management plans.

Dr Robertson prepared a detailed Kangaroo Management Plan for the ADI Site, which entailed



herding, darting, fertility control and long term management and monitoring of kangaroos to reduce the population. A management plan was then implemented, hiring and managing veterinary surgeons, veterinary nurses, animal handling people and ecologists. This work entailed numerous herds of kangaroos over areas that were as large as 800 ha. During the course of the project he hired and managed over 100 staff (including casual herders).

#### ***Urban Development - Cooks Cove Development Area***

This is a staged development application that Dr Robertson has been working on with team of other consultants including planning, engineering and land contamination specialists. The project involves the construction of a trade and technology park and associated infrastructure adjacent to Sydney Airport as well as the relocation of a golf course to an area that contains endangered ecological communities and threatened species that are protected under the Threatened Species Conservation Act and for some species, commonwealth and international law.

Dr Robertson's role in the project has been to assess the options for offsets and management of land for threatened species and to manage the negotiation and consultation process between the developer, state and federal governments and the public. His team has prepared detailed plans and related costs for the rehabilitation of wetlands on the site and the management of threatened species, which have been subject to public exhibition.

The development application has now been approved by both State and Federal governments and ongoing work concerning the detailed design is underway.

#### ***Urban Development - South Coast Sensitive Urban Lands Review – Experts Panel***

This project involved independent review (for the Department of Planning in 2006) of planning and ecological issues concerning 17 sites zoned for

urban development in the South Coast region (within Shoalhaven, Eurobodalla and Bega Valley LGAs) identified as being environmentally sensitive in the Draft South Coast Regional Strategy.

Following the release of the draft Strategy in May 2006, the Minister for Planning appointed an independent Expert Panel to investigate and report on the sensitive sites outlined in the strategy. Dr David Robertson was selected as a member of the Expert Panel.

Specifically, the Panel was required to determine the suitability and scale of any release for urban development within the sensitive sites. This involved review of written submissions, attendance at public hearings and provision of recommendations for each of the sites according to best planning and ecological outcomes. It also required intensive workshopping with local councils and other agencies such as National Parks and Wildlife and the Department of the Environment and Conservation.

#### ***Urban Development - Growth Centres, Kellyville - Biodiversity Assessment Program***

North Kellyville forms part of the north-west Growth Centres land release area. The purpose of this project was to contribute towards the creation of a precinct plan for North Kellyville. The precinct plan was informed by baseline technical studies that included: flora and fauna habitat; bushfire protection; land capability; areas of indigenous and non indigenous significance; flood analysis; and yield analysis.

Key objectives of this project included:

- The provision of a biodiversity assessment that included: a flora and fauna review; an analysis of ecological values and mapping of areas of high, moderate or low ecological value;
- Consideration of the statutory requirements for the protection, restoration and enhancement of threatened species, populations, ecological communities and their habitats;

- Recommended management frameworks for vegetation issues which enable long term conservation and management of these issues while facilitating the development outcomes for the precincts identified in the structure plan;
- Recommended measures to protect biodiversity values within areas identified by the Growth Centres SEPP; and
- Recommendations to ensure that precinct planning is consistent with the terms of any biodiversity certification granted to the SEPP.

***Urban Development - SAN Hospital Wahroonga - Biodiversity Assessment and Biodiversity Management Plan***

Dr Robertson has carried out numerous surveys in the Wahroonga area in the past, and he was requested to investigate the ecological values of the subject land for a Part 3A Application.

The bushland on the subject site contains significant ecological development constraints. The vegetation contains the endangered ecological communities Turpentine Ironbark Forest and Blue Gum High Forest, as well as a suspected nesting location of the Powerful Owl. Additionally, the bushland on the site forms part of wildlife corridors with significant links to other habitat in the locality, particularly Land Cove National Park.

As a result of the sensitivity of the area, it was necessary to conduct up-to-date surveys, and assess the findings of numerous past reports in the light of this current survey data. After lengthy consultation with local council and government departments, it was decided that a Biodiversity Management Plan was required to ensure the progress of the development, as well the preservation of the site's sensitive ecological issues.

***Rural Assessment - Emirates Hotels – Wolgan Valley Resort***

Dr Robertson was commissioned by Emirates Hotels to submit a Public Environment Report to fully assess the impacts of the proposed construction and operation of the Emirates Wolgan Valley Resort upon matters protected under the

Commonwealth Environment Protection and Biodiversity Conservation Act.

This involved assessing a wealth of available information concerning studies that had already been undertaken of the site (both ecological and otherwise) as well as conducting on-site field investigations to gather further information. Finally, a full assessment of the impacts of the project was produced, including consideration of alternative options, mitigation techniques and long-term management requirements. The report underwent public exhibition and Dr Robertson managed the consultation and review process for this. The project was approved by the Commonwealth government in early 2007.

Dr Robertson's team was also commissioned to prepare a Vegetation Management Plan for the 1,000+ ha site to address the ecological rehabilitation of the site and its enhancement for biodiversity. This included assessing the rehabilitation and regeneration requirements of an 8 km stretch of riparian corridor, as well as assessing the potential for reconstructing wildlife corridors across the site for a range of threatened fauna species.

***Linear Infrastructure – General***

David Robertson has trained and lead a team that have acted as lead ecological consultants and fauna rescue personnel on a number of major infrastructure projects over the past 5 years including the M2, M4 and M7 Upgrade Projects, the Epping to Thornleigh Third Track (ETTT) Project, the Seventh Avenue Airport Extension and the North West Growth Centre Package 2 Project for Sydney Water. .

***Linear Infrastructure - Cooranbong Haul Road***

This project entailed the provision of fauna survey and management services that were required to support the construction of a haul road linking Mandalong Mine to Newstan Rail Loading Facility.

The client required a Fauna Habitat and Movement Requirements Report assessing the likely impacts of the haul road on fauna and habitat connectivity. The report was prepared

prior to construction of the haul road as a condition of consent for the approval of the road. After the survey, Dr Robertson was able to recommend mitigation measures, such as:

- Realignment of proposed routes to avoid significant habitat features
- Pre-clearance surveys to relocate fauna prior to construction
- Road signage and fauna fencing to reduce roadkill
- Erosion control measures
- Fauna underpass and over pass locations
- Revegetation of selected areas and
- Ongoing monitoring.

This project called for extensive communication with the client and local council. Dr Robertson also assisted in the preparation of an EPBC Referral of Proposed Action due to the presence of threatened flora along the road alignment.

#### ***Mining Assessments – General***

David Robertson has provided legal advice, baseline studies and management plans for a number of mining companies both here and overseas. These include the Tampakan Gold and Copper Mine in the Philippines, the Project Stone and Katrina mines in Queensland and a range of mines for BHP Billiton, Glencore, Xstrata and Shenhua across NSW.

#### ***Mining Assessment - Maules Creek***

David Robertson and his team conducted a large-scale flora and fauna baseline study of 2,700 hectares of forest and woodland in the locality of Narrabri, New South Wales. The purpose of the study, which has been ongoing since 2008, was to assess the potential impacts of proposed open cut mining on biodiversity. Key biodiversity values of the Project Area include a number of threatened bird and bat species as well as threatened ecological communities such as the critically endangered Box Gum Woodland.

As part of the Project scope, David prepared a management plan to facilitate the ongoing management of flora and fauna on the future mine

site and the adjacent land. The Flora and Fauna Management Plan prescribes land disturbance protocols such as pre-clearance surveys and timber salvage; ongoing weed and feral management and key performance indicators; and a comprehensive monitoring program to track management outcomes and inform reviews and audits.

David has also prepared a Biodiversity Offset Management Plan for the Project's offsite biodiversity offset properties. This plan makes provisions for the strategic management of the biodiversity offsets, including habitat and vegetation restoration and rehabilitation, weed and feral management, strategic grazing, bushfire management and comprehensive monitoring to track management outcomes..

#### ***Mining Assessment - Bengalla Continuation Project***

David Robertson has acted as Project Director in the preparation of an Ecological Impact Assessment to support an State Significant Development application for the Bengalla Continuation of Mining Project (the Project). The Project impacts include clearing of Box Gum Woodland and Derived Native Grassland, a community listed under the TSC Act and EPBC Act, as well the removal of habitat for a range of threatened species and an endangered population.

David has led negotiations with State and Federal Government Authorities to develop appropriate offsets for the Project impacts. This includes the proponent participating in the Upper Hunter Strategic Assessment; an offsets fund being established by OEH that allows for upfront monetary contributions to satisfy project offsetting requirements for mining projects in the Upper Hunter, now and into the future. Cumberland Ecology is currently preparing an Assessment Report for submission as part of the UHSA, including summary of the results of extensive flora and fauna survey and calculations using the Biodiversity Certification Assessment Methodology (BCAM).



### **Mining Assessment - Mount Pleasant Mine**

David Robertson was required to carry out a survey and analysis of the presence and condition of Box Gum Woodland in the area of the proposed development of a mine at Mt Pleasant. This highly degraded site existed largely as derived grassland, and as patches of remnant canopy trees with large areas of the study area considered to be the State and Commonwealth listed Endangered Ecological Community.

Further fauna surveys of the study area revealed that despite the degraded nature of the vegetation, the site provided habitat for a suite of threatened woodland birds and arboreal mammals. Provision of results and advice to the client will allow them to make an informed decision about the future of the proposed mining project.

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