Common name	Scientific name	Method Observed	
Large Forest Bat	*Vespadelus darlingtoni*	A	
Large-footed Myotis[TS]	*Myotis macropus*	A	
White-striped Mastiff-bat	*Austronomus australis*	A	
Rabbit *	*Oryctolagus cuniculus*	S	
Amphibians			
Spotted Marsh Frog	*Limnodynastes tasmaniensis*	C	

Note: * indicates introduced species
[TS] indicates threatened species

All species listed are identified to a high level of certainty unless otherwise noted as:
[PR] indicates species identified to a 'probable' level of certainty
[PO] indicates species identified to a 'possible' level of certainty

A	-	Anabat II/SD-1	C	-	Call Identification
O	-	Observation	P	-	Call-playback Response
T	-	Trap (Elliott, cage, etc)	H	-	Habitat Search
S	-	Spotlight	I	-	Scat, Track or Sign Identification

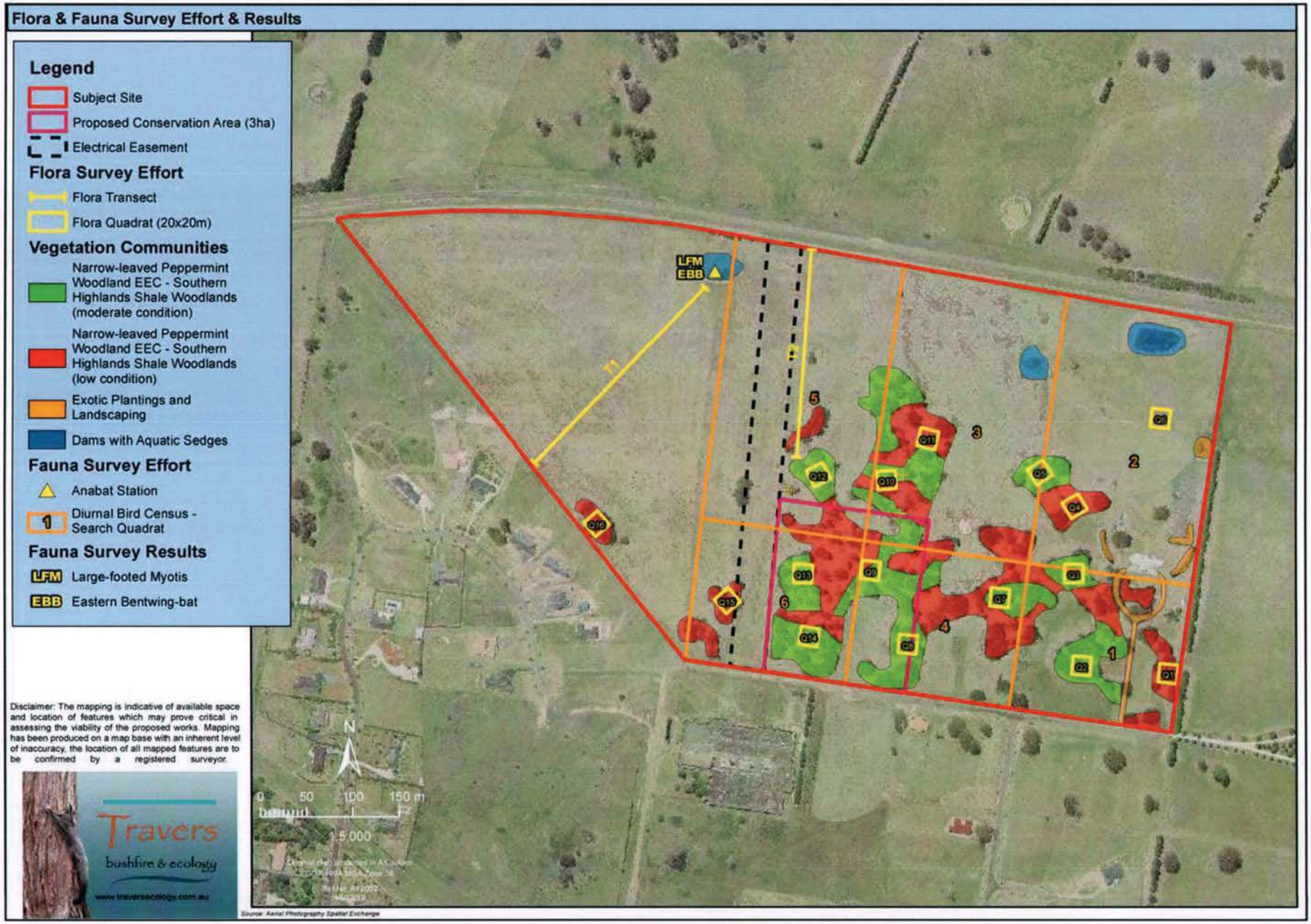


Figure 2 – Flora & fauna survey effort and results

Ecological Assessment 4

4.1 Flora

A number of landscaping species were observed within the eastern portion of the subject site. These were not taken into consideration in preparing the species list. A total of ninety (90) specimens were observed.

No threatened flora species were observed, however there was a lack of fruiting material and juvenile leaves to determine the presence or absence of the threatened eucalypt *Eucalyptus macarthurii*. We recommend undertaking a tree condition assessment report (arboricultural report) when fruiting material is likely to be more readily available. The species flowers between February and April.

All species are listed in Table 3.1.

4.1.1 State legislative flora matters

(a) Threatened flora species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH 2012) database indicated a list of species that have been recorded within a 10 km radius of the study area. Those species are considered for suitable habitat and potential to occur in Table A2.1 (Appendix 2).

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened flora species:

- *Eucalyptus aggregata*
- *Eucalyptus macarthurii*

Note: Full habitat descriptions for these species are provided in Appendix 2

No state listed threatened flora species were observed during the survey undertaken. *Eucalyptus macarthurii* is a state listed threatened species and is potentially onsite. Some trees onsite may be *Eucalyptus macarthurii,* but we were unable to confirm the identification without fruits or flowers. Further target survey for this species should be undertaken when fruiting material is available. This may be undertaken as part of a tree assessment and will influence the retention of significant trees in the landscape.

(b) Endangered flora populations (NSW)

There are no known endangered populations within a 10km radius of the subject site.

(c) Endangered ecological communities (NSW)

One (1) endangered ecological community (EEC) was found to be present within the subject site. The Narrow-leaved Peppermint Woodland is equivalent to the EEC Southern Highlands Shale Woodlands.

A total of sixteen (16) flora quadrats were undertaken across the subject site to help in assessing whether or not the Southern Highlands Shale Woodland EEC was present and to also assist in determining low condition vegetation based upon documented benchmarks.

The vegetation present appears to be closest to the biometric vegetation type HN554 – Mountain Grey Gum – Narrow-leaved Peppermint grassy woodland on shales of the Southern Highlands, southern Sydney Basin. This vegetation unit is considered to be equivalent to the EEC – Southern Highlands Shale Woodland. The overstorey projected foliage cover has a lower benchmark of 24%. For the vegetation to be considered low condition, the overstorey must fall 6% coverage and the understorey must comprise of more than 50% exotic species. Table 4.1 shows the quadrat data observed on site.

Table 4.1 – Flora quadrat data

Quadrat	% EEC	No. Natives	No. Exotics	Canopy Cover	Native Ground Cover	Exotic Ground Cover
1	54	13	11	15	50	30
2	71	7	8	10	19	70
3	33	9	12	8	20	70
4	63	8	9	<5	30	50
5	56	9	7	10	30	60
6	50	4	7	0	80	20
7	56	9	11	<5	43	50
8	57	7	10	15	20	70
9	38	8	9	10	44	40
10	50	6	11	8	22	65
11	63	8	14	<5	17	75
12	50	10	13	10	33	45
13	57	7	13	7	42	45
14	45	11	16	15	37	55
15	40	10	16	15	33	55
16	75	4	14	25	12	65

Whilst the vegetation on site is limited in native species diversity and cover, it is apparent that a significant proportion of those natives are listed on the final determinations for the EEC. As such, it is appropriate to regard the remnant vegetation as EEC.

The understorey vegetation in the far east of the site contains a slightly higher proportion of natives to exotics however the central section and remnants to the west contain much more exotic vegetation than native vegetation, largely due to the current grazing pressures. It was relatively obvious that because the understorey was in a poor condition in the central and western portions, where there was a canopy gap, the remnant may be classed as low condition. Also, patches of vegetation less than 0.25ha in size may be regarded as low condition.

6.43ha of EEC has been mapped, with 3.08ha being classed as moderate condition and 3.35ha being classed as low condition.

The underlying geology of the site being shale is also a prime characteristic in being able to identify this EEC, which has been confirmed from the Moss Vale 1:100,000 Geological Map.

For the purposes of the subdivision, the loss of low condition vegetation onsite is not considered to be significant and does not require offsetting. Based on the location of the subdivision i.e. a semi-rural landscape and the presence of 3.08 ha of medium quality EEC, Travers *bushfire and ecology* considers that a subdivision outcome that results in a 3 ha conservation area of fully restored EEC - Southern Highlands Shale Woodlands would be a balanced ecological outcome.

This community has been assessed in detail within Appendix 2.

4.2.2 Native Vegetation Act (2003)

The *Native Vegetation Act 2003* (NV Act) and the *Native Vegetation Regulation* (NV Regulation.) currently allows the clearing of trees for the minimum extent necessary to erect a single dwelling house issued with development consent. As complying development is included in the definition of development consent, the same requirements under the NV Act and NV Regulation for a single dwelling house apply.

The loss of low condition vegetation is excluded from assessment under the NV Act and the NV Regulation. However the loss of medium or better quality vegetation may need to be offset in accordance with the Act or its Regulation.

The proposed conservation area of 3 ha results in a 2.5:1 offset ratio which in the site context and given the lack of threatened species , it is considered to be a reasonable ecological outcome. Further native trees can be retained or replanted within the subdivision landscape if required.

4.2.3 Matters of national environmental significance - flora

(a) Threatened flora species (National)

A review of the schedules of the *EPBC Act* indicated the potential for a list of threatened flora species to occur within a 10km radius of the site. These species have been considered for habitat presence and potential to occur within Appendix 2.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides no potential habitat for any nationally listed threatened flora species.

(b) Endangered ecological communities (National)

The Southern Highlands Shale Woodlands is not listed nationally.

4.2.4 Flora and EEC assessment conclusions

In accordance with Section 5A of the *EPA Act 1979*, the 7 part test of significance (Appendix 3) concluded that the proposed subdivision will not have a significant impact on any state listed threatened species, populations or EECs. This is provided that the mitigation measures outlined with the recommendations of this report are undertaken. Therefore, a Species Impact Statement should not be required for the proposed subdivision in respect to

flora. Overall, the development must provide a minimum of 3ha of area to be restored to Southern Highlands Shale Woodlands of a moderate-good condition, and be managed under the provisions of a vegetation management plan or equivalent.

The proposed subdivision was not considered to have a significant impact on matters of national environmental significance listed under the *EPBC Act 1999*. As such a referral to Department of Sustainability, Environment, Water, Populations and Communities should not be required.

4.2 Fauna

All fauna species recorded during the survey are listed in Table 3.2.

4.2.1 Fauna Habitat

The fauna habitats present within the site are identified within Table 4.2.

Table 4.2 – Observed fauna habitat

Topography				
Flat ✓	Gentle ✓	Moderate	Steep	Drop-offs
Vegetation structure				
Closed Forest	Open Forest	Woodland ✓	Heath	Grassland
Disturbance History				
Fire	Underscrubbing ✓	Cut & fill works		
Tree clearing ✓	Grazing ✓			
Soil Landscape				
DEPTH:	Deep	Moderate ✓	Shallow ✓	Skeletal
TYPE:	Clay ✓	Loam ✓	Sand	Organic
VALUE:	Foraging ✓	Denning ✓	Roosting	Digging ✓
WATER RETENTION:	Well Drained ✓	Damp / Moist	Water logged	Swamp / Soak ✓
Feed Resources				
FLOWERING TREES:	Eucalypts ✓	Corymbias	Melaleucas	
	Banksias	Acacias		
SEEDING TREES:	Allocasuarinas	Conifers		
WINTER FLOWERING EUCALYPTS:	E. maculata	E. crebra	E. globoidea	E. sideroxylon
	E. squamosa	E. grandis	E. multicaulis	E. scias
	E. robusta	E. tereticornis	E. agglomerata	E. siderophloia
FLOWERING PERIODS:	Autumn ✓	Winter	Spring ✓	Summer ✓
OTHER:	Mistletoe ✓	Figs / Fruit	Sap / Manna	Termites
Foliage Protection				
UPPER STRATA:	Dense	Moderate ✓	Sparse ✓	
MID STRATA:	Dense	Moderate	Sparse ✓	
PLANT / SHRUB LAYER:	Dense	Moderate	Sparse ✓	
GROUNDCOVERS:	Dense	Moderate ✓	Sparse	
Hollows / Logs				
TREE HOLLOWS:	Large	Medium ✓	Small ✓	
GROUND HOLLOWS:	Large	Medium ✓	Small ✓	
Vegetation Debris				
FALLEN TREES:	Large ✓	Medium	Small	
FALLEN BRANCHES:	Large ✓	Medium	Small	
LITTER:	Deep	Moderate	Shallow ✓	
HUMUS:	Deep	Moderate	Shallow ✓	
Drainage Catchment				
WATER BODIES	Soak(s)	Dam(s) ✓	Drainage line(s)	Creek(s)	River(s)
RATE OF FLOW:	Still ✓	Slow	Rapid	
CONSISTENCY:	Permanent ✓	Perennial	Ephemeral	
RUNOFF SOURCE:	Urban / Industrial	Parkland	Grazing ✓	Natural

RIPARIAN HABITAT:	High quality	Moderate quality	Low quality	Poor quality
Artificial Habitat				
STRUCTURES:	Sheds	Infrastructure	Equipment	
SUB-SURFACE	Pipe / Culvert(s)	Tunnel(s)	Shaft(s)	
FORREIGN MATERIALS:	Sheet	Pile / Refuse ✓		

4.2.2 Habitat trees

A complete assessment of the location of habitat trees and the size of hollows within was not conducted as part of surveys undertaken. The available size range and quality of hollows were noted during site visits.

Trees containing hollows were found to occur in high density throughout the site estimated at 2 in every five trees containing hollows. In an attempt to identify trees of importance, locations and data on significant habitat trees were collected during the fauna survey. These are trees containing large hollows suitable for use by owls and/or containing a number of good quality hollows typically consisting of more than one medium (10-30cm) sized hollow. A tree may also be considered significant where evidence of use by select fauna is found.

Despite the high number of hollows present within the site and many of these being good quality, only 3 significant habitat trees were identified, and one of these contained no hollows of value but rather contained a raptor nest. The high number of hollows is attributed to the old age of remnant trees on site. However the reason for a low number of significant habitat trees is attributed to the tree species present. The site is dominated by Brown Barrel (*Eucalyptus fastigata* and Narrow-leaved Peppermint (*E. radiata*) which appear to provide many fissures of cracked bark, bark exfoliations and broken limbs but do not typically result in many open chambered hollows such as in some smooth-barked tree species. Additionally, the two significant habitat trees identified with hollows (SHT1 & SHT 3) whilst fitting the significant category, did not necessarily show features considered of greater value as a priority to retain.

The recording of the hollow-dependent Large-footed Myotis (to a 'possible' level of certainty) does give value to the hollows present. It is however very difficult to determine what trees, if any are being utilised by microbats without exhaustive survey on each individual tree.

A summary of significant habitat tree data for relocating purposes is provided in Table 4.3. Small hollows are identified as being <10cm opening, medium hollows are between 1-30cm and large hollows are >30cm. Figure 1 provides locations of habitat trees.

Table 4.3 – Habitat tree data

Tree No	Name	Hollows & Other Habitat Features Recorded
SHT1	Smooth-barked Eucalypt	2x medium branch hollows 5x small branch hollows
SHT2	Narrow-leaved Peppermint	Raptor Nest
SHT3	stag	4x medium trunk hollows

4.2.3 State legislative fauna matters

(a) Threatened species (NSW)

TSC Act – A search of the *Atlas of NSW Wildlife* (OEH, 2012) database provided a list of threatened fauna species previously recorded within a 10km radius of the subject site. These

species are listed in Table A2.2 (Appendix 2) and are considered for potential habitat within the subject site. Strictly estuarine and oceanic threatened species found within 10km have not been included as no marine / aquatic habitats occur within the subject site.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following state listed threatened fauna species:

- Gang-gang Cockatoo
- Powerful Owl
- Varied Sittella
- Scarlet Robin
- Flame Robin
- Grey-headed Flying-fox
- Eastern Falsistrelle
- Eastern Bentwing-bat
- Large-footed Myotis

Note: Full habitat descriptions for these species are provided in Appendix 2

Two (2) state listed threatened fauna species – Eastern Bentwing-bat (*Miniopterus orianae oceansis*) and Large-footed Myotis (*Myotis macropus*) – were recorded within the subject site during surveys. These species have been assessed in detail within Appendix 3.

FM Act – No habitats suitable for threatened aquatic species were observed within the subject site and as such the provisions of this act do not require any further consideration.

(b) Endangered populations (NSW)

There are no endangered fauna populations within the Wingecarribee LGA.

(c) SEPP 44 Koala Habitat Protection

SEPP 44 Koala Habitat Protection applies to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. In addition, Part 2 of the Policy outlines a three (3) step process to assess the likelihood of the land in question being potential or core koala habitat. Part 2 applies to land which has an area of greater than 1 hectare or has, together with any adjoining land in the same ownership, an area of more than 1 hectare.

The subject site is required to be considered under SEPP 44 as it falls within the Wingercarribee LGA, which is listed on Schedule 1 of this Policy. In addition, the total area of the subject site is greater than 1 hectare, hence Part 2 – Development Control of Koala Habitats, of the Policy applies.

Potential Koala Habitat (PKH) is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the policy.

Core Koala Habitat (CKH) is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

Step 1 – Is the land PKH?

No Koala food tree species were recorded from Schedule 2 of SEPP 44, as such the subject site is not considered to comprise 'potential Koala habitat' as defined under SEPP 44 and no further assessment under this policy is required.

4.2.4 National environmental significance - fauna

(a) Threatened species (National)

EPBC Act – A review of the schedules of the *EPBC Act* identified a list of threatened fauna species or species habitat likely to occur within a 10km radius of the subject site. These species have been listed in Table A2.2 (Appendix 2), and those with potential habitat within the subject site are considered in the seven-part test within Appendix 3.

Based on the habitat assessment within Appendix 2, it is considered that the subject site provides varying levels of potential habitat for the following nationally listed threatened fauna species:

- Grey-headed Flying-fox

No nationally listed threatened fauna species were recorded foraging within the subject site during surveys undertaken.

(b) Protected migratory species (National)

The EPBC Act Protected Matters Report provides additionally listed terrestrial, wetland and marine migratory species of national significance likely to occur, or with habitat for these species likely to occur, within a 10km radius of the subject site. These migratory species are considered in Table A2.3 (Appendix 2). Threatened migratory species are assessed in Table A2.2 (Appendix 2).

4.2.5 Fauna assessment conclusions

In accordance with Section 5A of the *EPA Act 1979*, the 7 part test of significance (Appendix 3) concluded that the proposed subdivision will not have a significant impact on any state listed threatened fauna species or threatened fauna populations. This is provided that the mitigation measures outlined with the recommendations of this report are undertaken. Therefore, a Species Impact Statement should not be required for the proposed subdivision in respect to fauna.

The proposed subdivision was not considered to have a significant impact on threatened or migratory fauna species listed as matters of national environmental significance under the *EPBC Act 1999*. As such a referral to Department of Sustainability, Environment, Water, Populations and Communities should not be required in respect to fauna.

4.3 Vegetation connectivity and wildlife corridors

The vegetation within the subject site forms an odd shaped remnant within the southern and central portions of the subject site with small patches near the south-western boundary less than 0.25ha. Overall, the total amount of remnant EEC vegetation on site amounts to an estimated 6.43ha which includes 3.08ha of moderate condition vegetation and 3.35ha of low condition vegetation.

The remnant within the subject site is not connected in any way to native vegetation outside of the subject site. Almost all vegetation just outside of the subject site are planted conifer windbreaks along fencing boundaries.

Given the existing fragmentation of the vegetation on site, and the presence of grazing activities and exotic vegetation, the value of the remnant for threatened species is low. Its main value is the fact that it forms an EEC.

4.4 Potential ecological impact

The potential ecological impact is largely the loss of EEC vegetation on site. In its current state, it has limited value for threatened species that occur locally, and more likely the more mobile species.

The proposal will not increase the fragmentation but instead aims to restore some portion of the remnant through weed control and revegetation works.

The key impacts to minimise are the loss of the EEC - Southern Highlands Shale Woodlands and associated fauna habitat. For the purposes of the subdivision, the loss of low condition vegetation onsite is not considered to be significant and does not require offsetting. Based on the location of the subdivision i.e. a semi-rural landscape and the presence of 3.08 ha of medium quality EEC, Travers *bushfire and ecology* considers that a subdivision outcome that results in a 3 ha conservation area of fully restored EEC - Southern Highlands Shale Woodlands would be a balanced ecological outcome.

Conclusions & Recommendations 5

5.1 Conclusions

The document forms the basis of assessment required under Section 5A of the *EPA Act*. This assessment determines if future development of the site is likely to have a significant effect on threatened species, populations and / or EECs.

EPA Act and TSC Act

In respect of matters required to be considered under the *EPA Act* and relating to the species / provisions of the *TSC Act.*

- Two (2) state listed threatened fauna species – Eastern Bentwing-bat (*Miniopterus orianae oceansis*) and Large-footed Myotis (*Myotis macropus*) – were recorded within the subject site during surveys
- No threatened flora species were recorded within the subject site
- One (1) EEC – *Southern Highlands Shale Woodlands* – was recorded within the subject site
- No endangered populations have been observed

The 7 part test of significance (Section 5 of this report) has concluded that the proposed subdivision will not have a significant impact on any threatened species, populations or EECs. Therefore, an SIS should not be required for the proposed subdivision.

EPBC Act

In respect of matters required to be considered under the *EPBC Act:*

- No threatened fauna species (including migratory species) were recorded within the subject site
- No threatened flora species were recorded within the subject site
- No endangered populations or EECs listed under the *EPBC Act* were recorded within the subject site

Consideration of these species within Section 4 of this report concluded that the proposed subdivision was not considered to have a significant impact on matters of NES. As such a referral to SEWPAC should not be required.

FM Act

In respect of matters relative to the *FM Act,* no suitable habitat for threatened aquatic species was observed within the subject site, and there are no matters requiring further consideration under this Act.

Conclusion

It is concluded that the proposed rural residential subdivision at Lot 391 DP 737061 off Farnborough Drive, Moss Vale, is unlikely to result in a significant impact on any threatened species, populations or EECs or their habitats. As such no further assessments are considered to be required under the *EPA Act, EPBC Act or FM Act.*

5.2 Recommendations

The key impacts to minimise are the loss of the EEC - Southern Highlands Shale Woodlands and associated fauna habitat. For the purposes of the subdivision, the loss of low condition vegetation onsite is not considered to be significant and does not require offsetting. Based on the location of the subdivision i.e. a semi-rural landscape and the presence of 3.08 ha of medium quality EEC, Travers *bushfire and ecology* considers that a subdivision outcome that results in a 3 ha conservation area of fully restored EEC - Southern Highlands Shale Woodlands would be a balanced ecological outcome.

Therefore the following mitigation measures are recommended:-

- Establishment of a 3 ha conservation area as shown on Figure 1 which will be protected and restored in accordance with an approved Vegetation Management Plan. Post completion of primary restoration works (fencing, revegetation and primary weed control), a minimum 3 year maintenance period is required.

- Remnant trees in good health should be retained throughout the subdivision landscape to promote the retention of arboreal habitat within lots.

- Street-scaping or landscaping works should utilise species that occur frequently within the Southern Highlands Shale Woodlands EEC or as recommended by Council.

- Subject to a condition assessment, retain hollow-bearing trees in situ that have been marked as significant, and utilise any fallen logs or dismantled trees as additional ground habitat within the conservation area.

- Retain existing water bodies or provide new open water areas as foraging habitat for the Large-footed Myotis.

- The removal of hollow bearing trees is to be offset with the installation of artificial nest boxes at a minimum ration of 1:1 for every hollow removed or destroyed. The nest boxes should be installed within the conservation area.

- A Tree Condition assessment and habitat Tree assessment is to be undertaken to assess the no of trees to be removed due to poor condition or civil works and to determine the no of hollows and types being lost. A nest box installation program is to be recommended and incorporated into the preparation of a vegetation management plan for the proposed conservation areas.

- A vegetation management plan is to be prepared for the proposed conservation area identifying as a minimum the revegetation requirements and number of artificial hollows to be installed. Standard protection weed control and maintenance works are to be stipulated as part of the VMP. Any proposed pathways are to be identified.

Note that early intervention by protecting the conservation areas will promote significant regeneration of the EEC – Southern Highlands Shale Woodland and reduce the level of primary restoration effort.

The trees assessment should be undertaken during the flowering or fruiting period of *Eucalyptus macarthurii* to locate the presence or otherwise of this threatened tree species. This in turn will influence the retention of trees within lots and whether any planting of this species is required within the proposed conservation area to offset losses.

Bibliography

Auld, B. A. & Medd, R. W. (1996) *Weeds.* Inkata Press.

Barker, J., Grigg, G. C. & Tyler, M. J. (1995) *A Field Guide to Australian Frogs.* Surrey Beatty & Sons.

Bishop, T. (1996) *Field Guide to the Orchids of New South Wales and Victoria.* UNSW Press.

Briggs, J. D. & Leigh, J. H. (1995) *Rare or Threatened Australian Plants.* CSIRO.

Churchill, S. (2008) *Australian Bats*, 2nd Ed., Jacana Books, Crows Nest, Sydney.

Cogger, H. G. (1996) *Reptiles and Amphibians of Australia.* Reed Books Australia.

DEC (2004) *Threatened Species Survey and Assessment: Guidelines for developments and activities (working draft),* New South Wales Department of Environment and Conservation, Hurstville, NSW

DECC (2008) *Bio-banking Methodology.*

Ehmann, H. (1997) *Threatened Frogs of New South Wales.* FATS Group.

EPBC (1999) Environmental Protection and Biodiversity Conservation Act 1999 - Interactive Map Database Search - http://epbcweb.ea.gov.au/image/otherbatch.html

Griffiths, K. (1997) *Frogs and Reptiles of the Sydney Region.* University NSW Press.

Harden, G. (1993) *Flora of New South Wales.* University NSW Press.

Hoser, R. (1989) *Australian Reptiles and Frogs.* Pierson & Co.

Lamp, C. & Collett, F. (1996) *A Field Guide to Weeds in Australia.* Inkata Press.

Lunney, D., Urquart, C .A. & Reed, P. (1988) *Koala Summit,* NPWS.

Marchant, S., & P. J. Higgins (Eds.) (1990) *Handbook of Australian, New Zealand and Antarctic Birds.* Volumes 1-7 Oxford University Press, Melbourne.

Morrison, R. G. B. (1981) *A Field Guide to the Tracks & Traces of Australian Animals.* Rigby.

OEH (2012) *Atlas of NSW Wildlife* for the relevant 1:100,000 scale map sheet.

Parnaby, H. (1992) *An interim guide to identification of insectivorous bats of south-eastern Australia.* The Australian Museum, Sydney, Technical Report, No. 8.

Pizzey, G. & Knight, F. (1997) *A Field Guide to the Birds of Australia.* Angus & Robertson.

Reader's Digest (1976) *Complete Book of Australian Birds.*

Richardson, F. J., Richardson, R. G. & Shepherd, R. C. H (2007) *Weeds of the South-East: an Identification Guide for Australia.* Everbest Printing Co. Pty. Ltd. China.

Robinson, L. (1994) *Field Guide to the Native Plants of Sydney.* Kangaroo Press.

Robinson, M. (1996) *A Field Guide to Frogs of Australia.* Reed.

Schodde, R. and Tidemann, S. (Eds) (1986) Readers Digest complete book of Australian Birds. Second Edition. Reader's Digest Services Pty Ltd, Sydney.

Simpson & Day (1996) *Field Guide to the Birds of Australia.* Viking.

Specht, R. L., Specht, A., Whelan, M. B. & Hegarty, E. E. (1995) *Conservation Atlas of Plant Communities in Australia.* Southern Cross University Press, Lismore.

Triggs, B. (1996) *Tracks, Scats & Other Traces: A Field Guide to Australian Mammals.* Oxford University Press, Melbourne.

Trounson, Donald & Molly (1998) *Australian Birds Simply Classified.* Murray David Publishing Pty Ltd, NSW.

Van Dyke, S. and Strahan, R. (Eds.) (2008) *The Mammals of Australia* (3rd Edn). Reed New Holland: Sydney.

Wheeler, D. J. B., Jacobs, S. W. L. & Norton, B. E. (1994) *Grasses of New South Wales.* University of New England.

Wilson, K. W. and Knowles, D. G. (1988) *Australia's Reptiles - A Photographic Reference to the Terrestrial Reptiles of Australia.* Cornstalk Publishing.

Standard Survey Methodology

A1

The survey methods outlined within this Appendix are standard techniques employed by *Travers bushfire & ecology.* The fauna survey techniques deployed for each specific site are outlined within the survey effort table in the main body of this report. The techniques selected will depend upon the site characteristics extent of available habitat as well as restrictions such as available survey time and weather conditions.

If any additional or target survey techniques for fauna species are undertaken, beyond the standard methods outline within this Appendix, the details of these will be described within the main body of this report.

1 Standard survey techniques

1.1 Diurnal birds

Diurnal birds are typically identified visually and/or by calls during diurnal surveys. Habitat searches to identify nests, feathers, eggs, or signs of foraging may be utilised more specifically for identifying threatened diurnal bird species.

Visual observations are made more accurate with the use of binoculars and where necessary or practical, with the use of a spotting scope. Binoculars are carried by the fauna surveyor at all times during nocturnal and diurnal fauna surveys. A birding field guide is always available in the field when required for verifications.

Calls are identified in the field by the fauna surveyor. If an unknown call is heard it is cross-matched to comprehensive bird call reference libraries taken into the field. A call library of birds occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

Diurnal bird census points may be undertaken at large sites where the total area may not be effectively covered during the survey period or as a measure to ensure focused bird only survey.

1.2 Nocturnal birds

Searches for evidence of owl roosts, key perches and potential owl roosting / breeding hollows are made during diurnal site searches. Whitewash, feathers or regurgitated pellets give key information. Pellets are sent for analysis of contents to assist in identification where necessary.

The presence of nocturnal birds during the nocturnal period is first determined by quiet listening after dusk for calls by individuals emerging from diurnal roosts. Following this and provided no calls are heard call-playback techniques are employed for threatened species that have suitable habitat present.

Threatened nocturnal birds known to provide response to call-playback techniques include Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*), Sooty Owl (*Tyto tenebricosa*), Grass Owl (*Tyto capensis*), Black Bittern (*Ixobrychus flavicollis*), Australian Bittern (*Botaurus poiciloptilus*) and Bush Stone-curlew (*Burhinus grallarius*).

Each call is typically played for 5-minute periods with 5-minute intervals of quiet listening for a response. This is followed with spotlighting and periods of quiet listening throughout the nocturnal survey.

Separation distances between broadcasting stations during a single night of survey are advised for different species within survey guidelines. These include 1km between owl calls and 3km between Bush Stone-curlew calls. Subsequent to this separate broadcasting stations will be deployed on the same night where sites of significant size are surveyed. Separations for bitterns are not advised and these may be broadcast at a number of stations along suitable habitat areas.

Stag-watching will be undertaken where suitable large hollows for owl nesting/roosting show signs of activity or are located within development areas. Stag-watching of nesting trees should be undertaken during the recognised nesting period for owls with potential to occur.

1.3 Arboreal mammals

Arboreal mammals may be surveyed using Elliott type A, B and/or C traps, small and/or large hair tubes, spotlighting, call-playback techniques, scat searches or searches for other signs of activity.

Baiting and layout for Elliott trapping and hair tubing are typically incorporated into terrestrial trapping and hair tubing effort unless where target survey is undertaken. Standard baiting and layout is therefore described in Section A1.3.2 below within terrestrial survey methods. Where gliders are targeted the standard bait mix may be additionally laced with a nectarivor powder mix used for feeding captive birds. Where Brush-tailed Phascogales are targeted the standard bait mix may be additionally laced with an insectivore powder mix. Where Eastern Pygmy Possum is targeted the bait mix will be more heavily laced with honey.

Elliott traps for arboreal captures are placed onto tree-mounted platforms that are attached to the trunk 2-3 m above the ground at an incline to facilitate drainage during inclement weather. Plastic sleeves are placed around or over traps when there is a possibility of wet weather in the forecast. Arboreal hair tubes are attached to the trunk of trees using rubber bands with the tube entry facing down preventing water entry.

For all arboreal traps and hair tubes a mixture of honey and water is sprayed onto the trunk up to 8 metres above the trap and around the trap as a lure. Where Eastern Pygmy Possum is targeted a high concentrate honey-water mix is also sprayed from the base of trunk up and along connective branches.

Arboreal traps and hair tubes are placed in trees selected to bias target species. These are often flowering or sap flow trees for gliders, rough -barked trees for the Brush-tailed Phascogale and Banksias for the Eastern Pygmy possum.

Where habitat is suitable, the presences of Koala (*Phascolactos cinereus*), Yellow-bellied Glider (*Petaurus australis*) and Squirrel Glider (*Petaurus norfolcensis*) may be targeted by call-playback techniques. Calls are played for 5-minute periods during nocturnal surveys. This is followed by quiet listening and spotlighting.

1.3.1 Koala survey

Koala survey is undertaken where the site is considered to provide potential habitat under the definitions of SEPP 44 - Koala Habitat Protection or in the presence of feed trees listed in Appendix 1 of the Recovery Plan for the Koala. Habitat may also be defined according to locally prepared Koala Plans of Management.

SEPP 44 is applied to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. Part 2 is applied to land which has an area of greater than 1 hectare or has, together with any adjoining land in the same ownership, an area of more than 1 hectare.

To determine Potential Koala Habitat (PKH) under the definitions of SEPP 44 an estimate of the percentage density of each tree species within vegetation communities is determined by averaging the percentage of stems counted. PKH is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the policy.

Where Koala habitat is considered to be present the site will be surveyed on foot, with known Koala food trees being inspected for signs of use. Trees are inspected for characteristic scratch and claw marks on the trunk and scats around the base of each tree. Koalas may also be targeted during nocturnal survey involving call-playback techniques and spotlighting.

For large sites Koala search quadrats may be employed within portions of communities where feed trees are present at suitable densities. All Koala feed trees within quadrats are searched for signs of activity including characteristic claw marks on the trunk and faecal pellets around the base. Pellet searches are undertaken according to the tree base search methods described in *Phillips & Callaghan* (2008). Search quadrats are less labour intensive than the SAT techniques described below but may only be an initial survey effort to determine presence/absence.

Where any Koala activity is recorded the complete Spot Assessment Technique (SAT) described by *Phillips & Callaghan* (2008) may be undertaken as a measure of Koala 'activity'. This technique may also be employed in the first instance as an indicator of presence/absence, particularly where a site has potential Koala activity based on previous records.

For any survey technique the location and density of Koala droppings, if found, are documented.

1.4 Terrestrial mammals

Various traps may be used to survey for the presence of terrestrial mammals. These include Elliot trapping, medium and large cage trapping, small and large hair tubing and pitfall traps. Other survey methods for terrestrial mammals include the use of camera surveillance, spotlighting and activity searches.

Arboreal and terrestrial Elliott traps and hair tubes are placed in grids or more commonly along trap-lines of 5-10 traps separated by distances of 20-50m depending on site size and variation of habitat. Trap or hair tube sizes selected at each trap station may alternate or may have an emphasis on certain sizes according to target species.

Selection of terrestrial Elliott trap, cage trap, hair tube or pitfall trap locations have an emphasis on nearby foliage, runways, shelters and signs of activity.

Standard bait mix for all Elliott traps, medium cage traps and hair tubes is a mixture of rolled oats, honey and peanut butter. Standard bait mix may be supplemented with sardines in large hair tubes or cage traps to simultaneously target Spotted-tailed Quoll. Cage traps may also be baited solely with meat or roadkill to target Spotted-tailed Quoll. Where Potoroos or Bandicoots are targeted, truffle oil may be used to lace the standard bait mix or used on its own.

Where difficult to access, sensitive or extended trapping periods are undertaken surveillance cameras can be used in terrestrial mammal surveys. The surveillance camera is mounted on a tree and directed towards a closed baited cage trap. Surveillance cameras may also be used to detect use or monitor activity at burrows, hollows, nests, etc.

During diurnal site searches assessment is made of 'found' scats, markings, diggings, runways and scratches located. Any scats or pellets not readily identifiable (particularly predator scats) may be collected and sent to Barbara Triggs for identification of contents, hair or bone fragments.

1.5 Bats

Micro-chiropteran bats are surveyed by echolocation using Anabat detectors or trapped using harp (Constantine) traps, mist nets or trip lines. Microchiropteran bats are also surveyed by searches of subterranean habitats such as caves, tunnels or shafts where present, or by searching structures such as under bridges and abandoned buildings or wall/ceiling cavities where entry is possible.

Anabat Mk 2 and SD-1 detectors are used in fixed passive monitoring positions and/or during active nocturnal monitoring. Active monitoring is used in conjunction with spotlighting or during stag-watching for greater accuracy of recorded call identification.

Bat call recordings are interpreted through Anabat V and Anabat CF Storage and Interface Module ZCAIM devices and analysed using Anabat 6 and Analook 3.3q computer software packages.

Harp traps and mist nets are placed along suitable 'flyways' such as along open narrow road/river corridors to maximise the likelihood of captures. Traps may be purpose set to capture bats emerging from roosts by being placed at the entry of tunnels/caves or draped over the edge of bridges. Trip lines are placed over water to trip low flying drinking bats into the water. These bats are collected as they swim to the water's edge.

Harp traps are checked during early nocturnal survey as well as each morning. Mist nets and trip lines require constant monitoring. Captured bats are identified using field identification guides. Bats are released at the point of capture after dusk or placed under trunk bark/splits of nearby trees.

Mega-chiropteran bat species, such as Grey-headed Flying-fox, are surveyed by targeting flowering/fruiting trees during spotlighting activities and by listening to distinctive vocalisations. Suitable roosting habitat is searched for presence of small or large established camps during diurnal survey periods.

1.6 Amphibians

Amphibians are surveyed by vocal call identification, call-playback, spotlighting along the edge of water-bodies, pitfall trapping, funnel trapping, by driving along sealed roads near waterways, habitat searches and collection of tadpoles.

Calls are identified in the field by the fauna surveyor. For similar calling species or if an unknown male call is heard it is cross-matched to frog call reference libraries taken into the field. A call library of frogs occupying the NSW coastal areas is also stored into a mobile phone for a quick reference. This phone is carried into the field at all times and may be used for call-playback methods and recording calls for later analysis.

All threatened frog species may be targeted by use of call-playback techniques where suitable habitat exists, with some species more reliable than others in providing a response. Red-crowned Toadlet may also be targeted by clapping and loud retort along suitable habitat drainages in order to evoke a call response.

Any amphibians found are visually identified and when required to be examined are handled with latex gloves and kept moist until release. Any tadpoles requiring capture are collected with a scoop net and placed within a snap-lock clear plastic bag for analysis of colour and morphological features.

Amphibian survey yields best results during or following wet periods with seasonal breeding and subsequent male calling varying according each species. Targeted survey is thus undertaken in appropriate seasons.

1.7 Reptiles

Reptiles are surveyed opportunistically during diurnal site visit(s), but also by habitat searches, pitfall trapping, funnel trapping, by driving along roads on humid nights and by camera surveillance at burrows.

Habitat searches for reptiles are undertaken in likely localities such as under logs, rocky slabs on rock surfaces, under sheet debris, under bark exfoliations and leaf litter at the base of trees and along the edge of wetlands. Aspect and land surface thermal properties are considered to determine best search locations particularly along rocky escarpments.

During warmer months spotlighting may assist survey effort particularly during humid conditions.

1.8 Invertebrates

Target survey is undertaken for the Cumberland Plain Land Snail (*Meridolum corneovirens*) when in proximity to previous Atlas of NSW Wildlife Database records and particularly where its typical host vegetation community is present. The most appropriate areas of observed habitat are searched. Dense areas of leaf litter with likely moisture retaining properties are scraped using a three pronged rake. Logs, stumps, artificial refuse and rocks are also turned over. In large survey areas searches quadrats are undertaken evenly across highest quality habitat areas to estimate population size.

The top (spiral side), side (showing aperture) and underside (showing umbilicus) of snail specimens found are photographed and sent to Michael Shea of the Australian Museum Malacology Unit for confirmation of identification.

2 Habitat Trees

Hollow-bearing tree surveys use a *Trimble* handheld GPS unit to log both field reference location as well as tree data. Data such as hollow types, hollow size, tree species, diameter at breast height, canopy spread and overall height are documented. A metal tag with the tree number is placed on the trunk for field relocation purposes. Other habitat features such as nests and significant sized mistletoe for foraging are also noted.

3 Survey Effort Table Descriptors:

Target - Where effort is specifically concentrated towards an individual species. Selected target species will be identified within the survey effort table and where necessary described within the report.

Opportunistic - Where birds are identified by observation, call or indirect methods as the opportunity arises.

Habitat search - Where suitable areas of habitat for selected fauna groups such as frogs, reptiles and invertebrates are specifically searched.

Diurnal Bird Census Point(s) - Are bird surveys undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. Size and time will be specified in the survey effort table. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently census points are selected to adequately represent each of the habitat areas present and particularly areas designated for proposed development. Often census points are commenced at locations where bird activity is noticeably high.

Spotting-scope Outlook - A Nikon spotting scope with 16~47 zoom at x60 magnification on a mounted tripod is used for distant inspections of diurnal birds. This is undertaken at wetlands for viewing waterfowl and waders but also other difficult to access areas. It may also be used for inspecting activity at nests, hollows and combined with spotlight for a panoramic search in open areas.

Call-playback - This involves broadcasting recorded calls through a 15 watt Toa 'Faunatech' amplifier to evoke a response from species known to reply. Species selected for call-playback will be indicated in the survey effort table.

Spotlighting - is carried out using a hand held 55 watt spotlight powered by a 12 volt rechargeable battery. This technique involves walking amongst the woodland areas, forest fringes, along roads, trails and fence lines so that a maximum number of trees can be observed. Spotlighting around water-bodies and particularly along the shallow fringes is used for finding frogs. Spotlighting is used in combination with binoculars or spotting scope for closer night inspections.

Stag-watching - involves watching hollows in the dusk period approximately 15 minutes prior to dark until 30 minutes following dark. Placement of the observer on the ground allows for a silhouette of any emerging fauna to be seen against the lighter sky background such that a spotlight is not required, which would likely to disrupt emergence behaviour. Where any movement is observed a spotlight may then be used for identification purposes.

Search Quadrats - are undertaken within a specified area surrounding a point (or in a quadrat) for a specified amount of time. These are more typically undertaken across larger sites where the total area cannot be effectively covered during the survey period. Subsequently quadrats are selected to adequately represent each of the suitable habitat areas present and particularly areas designated for proposed development. The use of this technique simply as an initial time-effective suitable indicator of presence/absence of Koalas has been discussed with Koala expert Stephen Phillips.

Koala Spot Assessment Technique (SAT) - Method outlined by *Phillips & Callaghan* (2008) and accepted by the Australian Koala Foundation to determine Koala activity levels. Activity levels are calculated from the proportion of trees showing signs of Koala use as indicated by the presence of scats as well as site location within the state.

Elliott trapping - using Elliott type A (33x10x10 cm) and Type B (45x15x15 cm), B and/or Type C traps for trapping small sized mammals. Trapping nights' effort will be indicated in the survey effort table. Trapping layout, trap sizes, baiting and trapping period will be outlined within the site specific methodology section.

Medium Cage trapping - using medium sized cage traps (17x17x45 cm foldout cages with tread-plate mechanism or 22x25x58 cm rigid cage with tread-plate mechanism) for trapping up to cat/bandicoot sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Large Cage trapping - using large sized cage traps (25x25x50 cm foldout cages with pull lever (meat) mechanism, 28x28x60 cm foldout cages with tread-plate mechanism or 30x30x70cm rigid cage with tread-plate mechanism) for trapping up to quoll sized mammals. Trapping layout, target species, baiting and trapping period will be outlined within the site specific methodology section.

Hair tubing - using small (40mm diameter x 120mm long) and/or large (90mm diameter x 200mm long) PVC pipe sections for collecting mammal hair samples. At one end of each tube is an enclosed chamber where the bait is placed and capped. Small drill holes in the inside face of the chamber allow the smell of the bait to permeate out through the tube without allowing access to the bait. At the other open entry end, double-sided tape is attached around the inner rim so hair samples of animals entering the tube are collected. Hair samples collected are sent to Barbara Triggs for identification. Trapping layout, tube sizes, baiting and trapping period will be outlined within the site specific methodology section.

Pitfall trapping - is used to survey for small terrestrial mammals, frogs, reptiles and invertebrates. Pitfall trapping involves the use of 15cm diameter and 60 cm long PVC stormwater pipe sections placed vertically into pre dug holes. The pipe is placed and set firm with surrounding soil so that the top rim is level with the ground surface. Drift fences made of damp-proof-course 270mm wide are held tight and upright by wooden and steel pegs and run along the length of each trap-line. Drift fences are run over the middle of each pit in the trap line ensuring at least 5m of fencing is run along each side of each pit. Ground fauna passing beyond the pitfall transect are diverted towards the pits along the fence line.

Funnel trapping - is used to survey mainly for frogs and reptiles. Funnel traps are 18cm x 18cm x 75cm long and constructed of shade cloth with an internal spring and wire frame in a similar design to yabby traps. At each end an inward facing funnel directs fauna through a 4cm hole and into the trap. Herpetofauna search the walls and corners for an exit and discover it difficult to re-find the internal exit hole. As with pitfall traps, funnel traps are used with drift fences that divert fauna towards the trap entry. At least 5m of fencing is run between each funnel trap which may be placed on either side of the fence. Trapping layout, target species, fence lengths and trapping period will be outlined within the site specific methodology section.

Passive Anabat monitoring - involves leaving the bat recorder in a fixed mounted position to record call-sequences of passing bats. Recording locations are determined in order to represent different available foraging structures for various micro-chiropteran bat species. Dams, cleared flyways, high insect activity areas, forest edges and ecotones are particularly targeted.

Active Anabat monitoring - is a method of active microbat recording during stag-watching or during complete nocturnal survey. Active monitoring involves an SD-1 recorder allied with a PDA for viewing call-sequences in real-time. When calls are heard the transducer microphone is actively directed towards the calling animal with the aid of a spotlight, so longer and clearer call sequences may be recorded. When calls of a potential threatened species are observed on the PDA screen a view by spotlight of the bat size and wing morphology is attempted for greater identification accuracy.

Active vehicle Anabat monitoring - is a method of active microbat recording deployed when large distances need to be covered in a nocturnal survey period. A Hi-mic extension cable allows the transducer microphone to be placed on a bracket on the roof of a travelling vehicle so calls may be viewed whilst driving. The vehicle travels at no more than 40km/h to prevent wind interference. When calls of a potential threatened species are observed on the dash mounted PDA screen active spotlighting is undertaken.

Harp trapping - is used to capture microchiropteran bats. Harp traps have an aluminium frame with a two-bank 4.2m^2 area and calico capture bag set along the base area.

Mist netting - is used to capture microchiropteran bats. The mist net capture area is 2.4m high and 9m wide and supported by two 3.5m poles which are braced with ropes and pegs. Design is a 0.08mm ultrafine nylon monofilament thread arranged in a 14x14mm mesh, with four horizontal capture pockets. These features are specific for the use to capture micro-chiropteran bat species and are provided from the only known supplier in Poland.

Trip lining - is used to capture microchiropteran bats. Fishing line is strung tight on pegs in a zig-zag pattern across open water-bodies just above the water surface to trip drinking bats into the water.

Camera surveillance - is used to monitor activity at burrows, hollows, etc. or to survey for species presence at baited stations. A Reconyx Hyperfire digital weatherproof camera is used with a passive infrared motion detector and a night-time infrared illuminator. The camera is mounted on a tree or tripod and takes three consecutive photo frames on the detection of movement up to 30m away or the detection of a heat/cold source different to the ambient temperature.

Weather conditions - Survey effort for each fauna group accounting for methods undertaken, duration, and weather conditions are provided in the survey effort table. Weather details are documented for all survey techniques and include:

- Air temperature;
- Cloud cover
- Rain (eg none, light drizzle, heavy drizzle, heavy rain);
- Recent rain events (where relevant);
- Wind Strength eg calm, light (leaves rustle), moderate (moves branches), strong (moves tree crowns).
- Wind direction
- Moon (where relevant) (eg none, 1/4 moon, 1/2 moon, 3/4 moon, full moon);

Threatened & Migratory Species Habitat Assessment

A2

Table A2.1 below provides an assessment of potential habitat within the subject site for state and nationally listed threatened flora species recorded within 10km on the Atlas of NSW Wildlife Database (OEH) or indicated to have potential habitat present within 10km on the EPBC Protected Matters Tool.

Table A2.1 – Threatened flora habitat assessment

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Acacia bynoeana OEH	E1	V	Erect or spreading shrub to 0.3 m high growing in heath and dry sclerophyll open forest on sandy soils. Often associated with disturbed areas such as roadsides. Distribution limits N-Newcastle S-Berrima.	x	x	-	-	x	x
Asterolasia elegans EPBC	E1	E	Erect shrub 1-3 m high growing in moist sclerophyll forests on Hawkesbury sandstone slopes hillsides. Distribution limits Maroota region.	x	x	-	-	x	x

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Boronia deanei OEH	V	V	Small shrub to 1.5m tall which grows in wet heath, often at the margins of open forest adjoining swamps or along streams. Scattered populations from the Blue Mountains then south-eastern NSW. Most known plants are in in conservation reserves.	x	x	-	-	x	x
Caladenia tessellata EPBC	E1	V	Terrestrial orchid. Clay-loam or sandy soils. Distribution limits N-Swansea S-south of Eden.	x	x	-	-	x	x
Cryptostylis hunteriana OEH EPBC	V	V	Saprophytic orchid. Grows in swamp heath on sandy soils. Distribution limits N-Gibraltar Range S-south of Eden.	x	x	-	-	x	x
Diuris aequalis OEH	E1	V	Terrestrial orchid which occurs in montane Eucalypt forest with grassy-heathy understorey. Very rare apart from Boyd Plateau. Distribution limits N-Blue Mountains S-Braidwood.	x	x	-	-	x	x
Eucalyptus aggregata OEH	V	-	Small or medium sized tree to approximately 18m tall. Grows usually on alluvial soils, on cold, poorly-drained flats and hollows adjacent to creeks and small rivers. Higher altitude species. Distributed near to Blayney, Crookwell, Goulburn, Braidwood and Bungendore.	x	✓ Limited to the flat area along the railway line	x	✓	Low	✓

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Eucalyptus macarthurii OEH	V	-	Tall tree to 40m tall which occurs within grassy woodland vegetation types predominately around Moss Vale district to Kanangra-Boyd NP in the Southern Highlands.	x	✓	✓	✓	✓	✓
Gentiana wingercarribiensis OEH	Crit. E	E	Small herb until 10cm tall which flowers in October and November. An annual herb which grows in bogs in Sphagnum Moss humps. Known from Hanging Rock Swamp and Wingercarribee Swamp.	x	x	-	-	x	x
Grevillea molyneuxii OEH	V	E	A small spreading shrub to 60cm tall which may flower at any time of the year. This species has only been recorded in low heathland on sandstone where it grows in skeletal soil on flat, wet sandstone shelves above dissected valleys. Occurs near/in Morton NP.	x	x	-	-	x	x
Kunzea cambagei EPBC	V	V	A groundcover species which is restricted to damp, sandy soils in wet heath or mallee open scrub at higher altitudes on sandstone outcrops or Silurian group sediments. Flowers September – November. Occurs in the western and southern parts of the Blue Mountains, just west of Berrima, Loombah Plateau, Kanangara-Boyd NP and Nattai NP.	x	x	-	-	x	x
Lysimachia vulgararis var. *davurica* OEH	E1	-	Herb to 80cm tall. Found at Wingercarribee Swamp, Boro and Bega River Valley. In disparate habitat: extensive wetland on peaty soils, riparian vegetation and pasture on a dairy farm.	x	x	-	-	x	x

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Persoonia glaucenscens OEH EPBC	E1	V	An erect shrub with moderately hairy young branchlets. Restricted to small populations in the Southern Highlands between Picton and Berrima.	x	x	-	-	x	x
Pomaderris sericea OEH	E1	V	Small shrub to 2m tall, flowering in October. Only known from 2 locations within NSW, the rest are in VIC. In VIC, the habitat is typically low shrubland on rock within the flood level of the river. The 2 known populations within the NSW occur in Wollemi NP and Moreton NP.	x	x	-	-	x	x
Prasophyllum uroglossum OEH	Critic. E	E	Orchid species to 50cm tall, grows in boggy heath dominated by Tea-trees. Only known from Wingercarribee Swamp in the Southern Highlands.	x	x	-	-	x	x
Pterostylis pulchella OEH EPBC	V	V	Orchid species to 15cm tall, found on cliff faces at Fitzroy Falls, Belmore Falls, upper Bundanoon Creek and Minnamurra Falls. Flowers appear from February to May	x	x	-	-	x	x
Thelymitra sp. 'Kangaloon' OEH EPBC	-	Critic. E	A terrestrial orchid with dark blue flowers, presented in mid-late spring. Only known from the Robertson area in the Southern Highlands. Often in association with the endangered ecological community *Temperate Highland Peat Swamps on Sandstone.*	x	x	-	-	x	x
Thesium australe EPBC	V	V	Erect herb to 0.4 m high. Root parasite. Grassland or woodland often damp. Distribution limits N-Tweed Heads S-south of Eden.	x	x	-	-	x	x
OEH	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database								

Scientific Name DATABASE SOURCE	TSC Act	EPBC Act	GROWTH FORM AND HABITAT REQUIREMENTS	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	

EPBC	- Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	- Denotes vulnerable listed species under the relevant Act
E or E1	- Denotes endangered listed species under the relevant Act
NOTE:	1. This field is not considered if no suitable habitat is present within the subject site 2. 'records' refer to those provided by the *Atlas of NSW Wildlife* database. Updated 1:100,000 database mapsheet requests to OEH are undertaken every 3 months as recommended. 3. 'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

A detailed assessment in accordance with Section 5A of the *EPA Act* will be completed for these species in Appendix 3 of this report.

Table A2.2 below provides an assessment of potential habitat within the subject site for state and nationally listed threatened fauna species recorded within 10km on the Atlas of NSW Wildlife Database (OEH) or indicated to have potential habitat present within 10km on the EPBC Protected Matters Tool.

Table A2.2 – Threatened fauna habitat assessment

COMMON NAME ***Scientific Name*** DATABASE SOURCE	**TSC Act**	**EPBC Act**	**PREFERRED HABITAT** ***Distribution Limit***	**RECORDED ON SITE (✓)**	**IF NOT RECORDED ON-SITE**				**CONSIDERED IN 7 PART TEST (✓)**
					Suitable Habitat Present (✓)	**Nearby and/or high number of record(s) (✓)** *Notes 1,2 & 3*	**Record(s) from recent years (✓)** *Notes 1,2 & 3*	**Potential to occur**	
Giant Burrowing Frog *Heleioporus australiacus* EPBC	V	V	Inhabits open forests and riparian forests along non-perennial streams, digging burrows into sandy creek banks. *Distribution Limit: N-Near Singleton S-South of Eden.*	x	x	-	-	x	x
Stuttering Frog *Mixophyes balbus* EPBC	E	V	Terrestrial inhabitant of rainforest and wet sclerophyll forests. *Distribution Limit: N-near Tenterfield S-South of Bombala.*	x	x	-	-	x	x
Green and Golden Bell Frog *Litoria aurea* EPBC	E	V	Prefers the edges of permanent water, streams, swamps, creeks, lagoons, farm dams and ornamental ponds. Often found under debris. *Distribution Limit: N-Byron Bay S-South of Eden.*	x	x	-	-	x	x
Littlejohn's Tree Frog *Litoria littlejohnii* EPBC	V	V	Found in wet and dry sclerophyll forest associated with sandstone outcrops at altitudes 280-1000m on eastern slopes of Great Dividing Range. Prefers flowing rocky streams. *Distribution Limit: N-Hunter River S-Eden.*	x	x	-	-	x	x

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Malleefowl *Leipoa ocellata* EPBC	E	V	Inhabits cool to warm temperate mallee communities and other semi-arid eucalypt woodlands. *Distribution Limit: N-Near Bourke. S-Wentworth.*	x	x	-	-	x	x
Blue-billed Duck *Oxyura australis* OEH	V	-	A completely aquatic species occurring mainly throughout the Murray-Darling basin in cool to warm temperate deep permanent freshwater lakes, lagoons and swamps with extensive reed-beds. *Distribution Limit: N-Tenterfield. S-Albury.*	x	x	-	-	x	x
Freckled Duck *Stictonetta naevosa* OEH	V	-	Occurs mainly within the Murray-Darling basin and the channel country within large cool temperate to sub-tropical swamps, lakes and floodwaters with cumbungi, lignum or melaleucas. *Distribution Limit: N- Tenterfield. S-Albury.*	x	x	-	-	x	x
Australasian Bittern *Botaurus poiciloptilus* OEH EPBC	V	E	Found in or over water of shallow freshwater or brackish wetlands with tall reedbeds, sedges, rushes, cumbungi, lignum and also in ricefields, drains in tussocky paddocks, occasionally saltmarsh, brackish wetlands. *Distribution Limit: N-North of Lismore. S- Eden.*	x	x	-	-	x	x

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Australian Painted Snipe *Rostratula australis* EPBC	V	V	Most numerous within the Murray-Darling basin and inland Australia within marshes and freshwater wetlands with swampy vegetation. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×
Gang-gang Cockatoo *Callocephalon fimbriatum* OEH	V	-	Prefers wetter forests and woodlands from sea level to > 2000m on Divide, timbered foothills and valleys, timbered watercourses, coastal scrubs, farmlands and suburban gardens. *Distribution Limit: mid north coast of NSW to western Victoria.*	×	marginal	✓	✓	low	✓
Swift Parrot *Lathamus discolour* EPBC	E	E	Inhabits eucalypt forests and woodlands with winter flowering eucalypts. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	×	-	-	×	×
Powerful Owl *Ninox strenua* OEH	V	-	Forests containing mature trees for shelter or breeding & densely vegetated gullies for roosting. *Distribution Limits: N-Border Ranges National Park. S-Eden.*	×	marginal	×	×	low	✓
Eastern Bristlebird *Dasyornis brachypterus* EPBC	E	E	Coastal woodlands, dense scrubs and heathlands, especially where low heathland borders taller woodland or dense tall tea-tree. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Regent Honeyeater *Xanthomyza Phrygia* OEH EPBC	E4A	E	Found in temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts. *Distribution Limit: N-Urbanville. S-Eden.*	×	×	-	-	×	×
Varied Sittella *Daphoenositta chrysoptera* OEH	V	-	Open eucalypt woodlands/forests (except heavier rainforests); mallee, inland acacia, coastal tea-tree scrubs; golfcourses, shelterbelts, orchards, parks, scrubby gardens. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	×	Marginal	×	✓	Low	✓
Scarlet Robin *Petroica boodang* OEH	V	-	Found in foothill forests, woodlands, watercourses; in autumn-winter, more open habitats: river red gum woodlands, golf courses, parks, orchards, gardens. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	×	Marginal	×	✓	Low	✓
Flame Robin *Petroica phoenicea* OEH	V	-	Summer: forests, woodlands, scrubs, from sea-level to *c.* 1800 m. Autumn-winter: open woodlands, plains, paddocks, golf courses, parks, orchards. *Distribution Limit: N northern NSW tablelands. S-South of Eden.*	×	Marginal	×	×	Low	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Spotted-tailed Quoll *Dasyurus maculatus* OEH EPBC	V	E	Dry and moist open forests containing rock caves, hollow logs or trees. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	x	x	-	-	x	x
Southern Brown Bandicoot *Isoodon obesulus* EPBC	E	E	Utilises a range of habitats containing thick ground cover - open forest, woodland, heath, cleared land, urbanised areas and regenerating bushland. *Distribution Limit: N-Kempsey. S-South of Eden.*	x	x	-	-	x	x
Koala *Phascolarctos cinereus* OEH	V	-	Inhabits both wet & dry eucalypt forest on high nutrient soils containing preferred feed trees. *Distribution Limit: N-Tweed Heads. S-South of Eden.*	x	x	-	-	x	x
Eastern Pygmy Possum *Cercatetus nanus* OEH	V	-	Found in a variety of habitats from rainforest through open forest to heath. Feeds on insects but also gathers pollen from banksias, eucalypts and bottlebrushes. Nests in banksias and myrtaceous shrubs. *Distribution Limit: N-Tweed Heads. S-Eden.*	x	x	-	-	x	x

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Squirrel Glider *Petaurus norfolcensis* OEH	V	-	Mixed aged stands of eucalypt forest & woodlands including gum barked & high nectar producing species & hollow bearing trees. *Distribution Limit: N-Tweed Heads. S-Albury.*	×	×	-	-	×	×
Long-nosed Potoroo *Potorous tridactylus* EPBC	V	V	Coastal heath and dry and wet sclerophyll forests with a dense understorey. *Distribution Limit: N-Mt Warning National Park. S-South of Eden.*	×	×	-	-	×	×
Brush-tailed Rock-wallaby *Petrogale penicillata* EPBC	E	V	Found in rocky gorges with a vegetation of rainforest or open forests to isolated rocky outcrops in semi-arid woodland country. *Distribution Limit: N-North of Tenterfield. S-Bombala.*	×	×	-	-	×	×
Grey-headed Flying-fox *Pteropus poliocephalus* EPBC	V	V	Found in a variety of habitats including rainforest, mangroves, paperbark swamp, wet and dry open forest and cultivated areas. Forms camps commonly found in gullies and in vegetation with a dense canopy. *Distribution Limit: N-Tweed Heads. S-Eden.*	×	✓	×	×	✓	✓

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Large-eared Pied Bat *Chalinolobus dwyeri* EPBC	V	V	Warm-temperate to subtropical dry sclerophyll forest and woodland. Roosts in caves, tunnels and tree hollows in colonies of up to 30 animals. *Distribution Limit: N-Border Ranges Nation Park. S-Wollongong.*	×	×	-	-	×	×
Eastern Falsistrelle *Falsistrellus tasmaniensis* OEH	V	-	Recorded roosting in caves, old buildings and tree hollows. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	Marginal	×	✓	Low	✓
Eastern Bentwing-bat *Miniopterus orianae oceansis* OEH	V	-	Prefers areas where there are caves, old mines, old buildings, stormwater drains & well-timbered areas. *Distribution Limit: N-Border Ranges National Park. S-South of Eden.*	✓	✓	×	✓	✓	✓
Large-footed Myotis *Myotis macropus* OEH	V	-	Roosts in caves, mines, tunnels, buildings, tree hollows and under bridges. Forages over open water. *Distribution limits: N-Border Ranges National Park. S-South of Eden.*	✓	✓	×	✓	✓	✓
Greater Broad-nosed Bat *Scoteanax rueppellii* OEH	V	-	Inhabits areas containing moist river & creek systems especially tree lined creeks. *Distribution Limit: N-Border Ranges National Park. S-Pambula.*	×	×	-	-	×	×

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	
Smoky Mouse *Pseudomys fumeus* EPBC	-	E	Although recorded from sub-alpine regions to coastal dunes the animal's dietary requirements appear to be a key aspect of habitat. Epacrids that provide berries and flowers and legumes that provide seeds are typical. Sparse and patchy in dry sclerophyll forest on ridges with heath and tussock grass understorey, coastal heath and sub-alpine heath. *Distribution Limit: N-Act. S-South of Eden.*	x	x	-	-	x	x
Macquarie Perch *Macquaria australasica* EPBC	V	E	Occurs in south east Australia at moderate to high altitudes in rivers and reservoirs. *Historical records show the species was widespread and abundant in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers and their tributaries. Allen (1989) states that introduced populations are present in Nepean River and water supply dams in the Sydney area. Occurs in lakes and flowing streams, usually in deep holes.*	x	x	-	-	x	x
Australian Greyling *Prototroctes maraena* EPBC	Part 2, Section 19 – Protected Fish	V	Clear, moderate to fast flowing water in the upper reaches of rivers (sometimes to altitudes above 1000m). Typically found in gravel bottom pools. Often forming aggregations below barriers to upstream movement (eg weirs, waterfalls).	x	x	-	-	x	x
OEH	- Denotes species listed within 10km of the subject site on the *Atlas of NSW Wildlife* database								

COMMON NAME *Scientific Name* DATABASE SOURCE	TSC Act	EPBC Act	PREFERRED HABITAT *Distribution Limit*	RECORDED ON SITE (✓)	IF NOT RECORDED ON-SITE				CONSIDERED IN 7 PART TEST (✓)
					Suitable Habitat Present (✓)	Nearby and/or high number of record(s) (✓) *Notes 1,2 & 3*	Record(s) from recent years (✓) *Notes 1,2 & 3*	Potential to occur	

EPBC	-	Denotes species listed within 10km of the subject site in the *EPBC Act* habitat search
V	-	Denotes vulnerable listed species under the relevant Act
E	-	Denotes endangered listed species under the relevant Act
NOTE:	1.	This field is not considered if no suitable habitat is present within the subject site
	2.	'records' refer to those provided by the *Atlas of NSW Wildlife* database. Updated 1:100,000 database mapsheet requests to OEH are undertaken every 3 months as recommended.
	3.	'nearby' or 'recent' records are species specific accounting for home range, dispersal ability and life cycle.

A detailed assessment in accordance with Section 5A of the *EPA Act* will be completed for these species in Appendix 3 of this report.

Table A2.3 below provides an assessment of potential habitat within the subject site for nationally *protected* migratory fauna species recorded within 10km on the EPBC Protected Matters Tool. Nationally *threatened* migratory species are considered in Table A2.2 above.

Table A2.3 – Migratory fauna habitat assessment

COMMON NAME ***Scientific Name***	**PREFERRED HABITAT** ***Migratory Breeding***	**Suitable Habitat Present (✓)**	**Recorded on Site (✓)**	**COMMENTS**
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Coasts, islands, estuaries, inlets, large rivers, inland lakes, reservoirs. *Sedentary; dispersive.*	marginal	×	-
White-throated Needletail (*Hirundapus caudacutus*)	Airspace over forests, woodlands, farmlands, plains, lakes, coasts, towns; companies forage often along favoured hilltops and timbered ranges. *Breeds Siberia, Himilayas, east to Japan. Summer migrant to eastern Australia.*	✓	×	-
Rainbow Bee-eater (*Merops ornatus*)	Open woodlands with sandy, loamy soil; sandridges, sandspits, riverbanks, road cuttings, beaches, dunes, cliffs, mangroves, rainforest, woodlands, golf courses. *Breeding resident in northern Australia. Summer breeding migrant to south-east & south-west Australia.*	✓	×	-
Black-faced Monarch (*Monarcha melanopsis*)	Rainforests, eucalypt woodlands; coastal scrubs; damp gullies in rainforest, eucalypt forest; more open woodland when migrating. *Summer breeding migrant to coastal south-east Australia, otherwise uncommon.*	×	-	-
Satin Flycatcher (*Myiagra cyanoleuca*)	Heavily vegetated gullies in forests, taller woodlands, usually above shrub-layer; during migration, coastal forests, woodlands, mangroves, trees in open country, gardens. *Breeds mostly south-east Australia & Tasmania over warmer months, winters in north-east Qld.*	×	-	-
Rufous Fantail (*Rhipidura rufifrons*)	Undergrowth of rainforests/wetter eucalypt forests/gullies; monsoon forests, paperbarks, sub-inland and coastal scrubs; mangroves, watercourses; parks, gardens. On migration, farms, streets buildings. *Breeding migrant to south-east Australia over warmer months. Altitudinal migrant in north-east NSW in mountain forests during warmer months.*	✓	×	-
Great Egret (*Ardea alba*)	Shallows of rivers, estuaries; tidal mudflats, freshwater wetlands; sewerage ponds, irrigation areas, larger dams, etc. *Dispersive; cosmopolitan.*	✓	×	-
Cattle Egret (*Ardea ibis*)	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats, drains. *Breeds in summer in warmer parts of range including NSW.*	✓	×	-

COMMON NAME *Scientific Name*	PREFERRED HABITAT *Migratory Breeding*	Suitable Habitat Present (✓)	Recorded on Site (✓)	COMMENTS
Latham's Snipe (*Gallinago hardwickii*)	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks; seepage below dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2000m; samphire on saltmarshes; mangrove fringes. *Breeds Japan. Regular summer migrant to Australia. Some overwinter.*	✓	×	-
Fork-tailed Swift (*Apus pacificus*)	Aerial: over open country, from semi-arid deserts to coasts, islands; sometimes over forests, cities. *Breeds Siberia, Himilayas, east to Japan south-east Asia. Summer migrant to east Australia. Mass movements associated with late summer low pressure systems into east Australia. Otherwise uncommon.*	✓	×	-

7 Part Test of Significance

A3

Council is required to consider the impact upon threatened species, populations and / or EECs from any development or activity via the process of a 7 part test of significance. The significance of the assessment is then used to determine the need for a more detailed species impact statement (SIS).

The following 7 part test of significance relies on the ecological assessment provided in Sections 3 and 4 of this report and should be read as such.

The 7 part test of significance is as follows.

a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Detailed flora and fauna investigations of the subject site, together with habitat assessments, have resulted in the identification of potential habitat for a variety of threatened species. An assessment of these species is as follows:

Threatened flora

- *Eucalyptus aggregata*
- *Eucalyptus macarthurii*

Endangered ecological communities

- *Southern Highlands Shale Woodlands*

Threatened fauna

- Gang-gang Cockatoo
- Glossy Black-Cockatoo
- Powerful Owl
- Varied Sittella
- Scarlet Robin
- Flame Robin
- Grey-headed Flying-fox
- Eastern Falsistrelle
- Eastern Bentwing-bat*
- Large-footed Myotis*

Endangered populations

- None

Species indicated with a "*" were recorded within the subject site during surveys. Despite the presence of potential habitat, the remaining listed species were not recorded during the flora

and fauna survey. It is considered that the proposal is unlikely to disrupt the life cycle for any of these listed species such that a viable local population would be placed at risk of extinction.

Summary of threatened species recorded

Large-footed Myotis (*Myotis macropus*)
The Large-footed Myotis inhabits rainforests and open forests predominantly foraging along creeklines and over waterbodies where it takes insects and small fish from on and just below the water's surface (Richards 1995). The Large-footed Myotis roosts in tree hollows, caves, mines, under bridges, in tunnels and occasionally buildings (Richards 1995). This species was recorded foraging over Wyee Creek adjacent to the old pistol club area (Figure 1). The subject site provides suitable roosting, breeding and foraging habitat for this species.

It is considered that the subject site provides suitable roosting, foraging and breeding habitat for the Large-footed Myotis. This species was recorded to a 'possible' level of certainty foraging over the north-western dam where the Anabat recorder was placed during survey (see Figure 2). As this species forages over waterbodies, a number of recorded calls are typically encountered when this species is present. However during survey only one or two passes were recorded and the species may be confused with non-threatened species. Other foraging habitat within the site is again present over the slightly larger dam to the north of the existing homestead. Roosting habitat is present within hollows present, however there is no way of identifying exact roosting locations without undertaking exhaustive survey.

In summary, and in respect to the locality, more suitable foraging habitat is located within a large floodplain area surrounding a larger dam located 500m to the north. Furthermore, numerous other similar dams occur in the surrounding rural locality such that it would be expected that if a local population is present, it would in no way be expected to be central to the subject site.

Eastern Bentwing-bat

The Eastern Bentwing-bat forages above and below the canopy within open forests and woodlands, feeding on small flying insects, predominantly moths (Dwyer, 1995). The Eastern Bentwing-bat is known to roost in a range of habitats including stormwater channels, under bridges, occasionally in buildings, old mines and, in particular, caves (Dwyer, 1995). Caves are an important resource for this species, particularly for breeding where maternity caves must have suitable temperature, humidity and physical dimensions to permit breeding (Dwyer, 1995). Roost sites in tree hollows have not been reported within the literature reviewed.

The subject site provides suitable foraging habitat for the Eastern Bentwing-bat throughout the remnant vegetated areas. It was recorded at the Anabat location on the western-most dam near the railway line. There is no suitable natural roosting and subsequent breeding habitat for this species present.

Foraging along this interface of bushland is typical for the species and provided that a remnant is retained and in the future improved, there should be minimum disruption to this species. Given it is a highly mobile species, and there are similar remnants within a 2km radius of the subject site, the future subdivision is unlikely result in a significant impact on a local population of the species.

b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

There are no endangered fauna populations within the Wollondilly LGA.

c) In the case of a critically endangered or endangered ecological community, whether the action proposed:

i. Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

6.43ha of EEC has been mapped, with 3.08ha being classed as moderate condition and 3.35ha being classed as low condition.

The proposed conservation area will be 3.00ha in size which shall be restored through weed control and revegetation works to a good quality remnant.

Within this proposed conservation area, there is currently 1.21ha of moderate condition vegetation and 0.85ha of low condition vegetation.

Given that a portion of land will be set aside and likely managed under a vegetation management plan or equivalent, the proposal is not likely to have an adverse effect on the extent of any ecological community such that its local occurrence is likely to be placed at risk of extinction.

ii. Is likely to substantially and adversely modify the composition such that its local occurrence is likely to be placed at risk of extinction,

The large majority of the existing vegetation on site only meets a medium condition as the over-storey or canopy cover falls within the benchmark figures for the associated biometric vegetation type (or cannot be classed as low condition), however if numbers were based on the mid-storey vegetation and ground layer, it would almost entirely be regarded as low condition.

Taking the cattle off the property will promote the regeneration of grasses and small herbs along with juvenile trees. Currently there are very few regenerating trees on site; many being over-mature and containing significant amounts of dieback.

The proposal is expected to assist in maintaining integrity of the EEC by designating 3ha of land for regeneration and revegetation works within an area containing some of the better vegetation within the site.

Whilst approximately half of the vegetation on site will be removed (individual trees may stay in some instances where safe to), the conservation area aims to return the 3ha of land back to good quality EEC vegetation which will aid in assuring its longevity.

A vegetation management plan or equivalent should be imposed once the subdivision proposal has been approved to assist in the timely and efficient management of the proposed conservation area.

Therefore, it is unlikely that the proposed subdivision will adversely modify the composition of this community such that its local occurrence is likely to be placed at risk of extinction.

d) In relation to the habitat of threatened species, populations or ecological community:

It is considered that the habitat attributes of the subject site provide known or potential habitat for *Eucalyptus aggregata, Eucalyptus macarthurii,* Southern Highands Shale Woodlands, Gang-gang Cockatoo, Powerful Owl, Varied Sittella, Scarlet Robin, Flame Robin, Grey-headed Flying-fox, Eastern Bentwing-bat, Large-footed Myotis and Eastern Falsistrelle.

i. The extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The subject site has an area of 35.15ha, which comprises approximately 6.43ha of remnant disturbed vegetation including 3.08ha of moderate condition and 3.35ha of low condition. This remnant vegetation on site is not connected to any other patches thus is isolated. The proposal will likely see the removal or modification to 4.09ha of vegetation for the aforementioned species. In the longer term, 0.94ha of cleared vegetation will be restored, and 2.06ha of remnant vegetation will be enhanced from low or moderate condition to good condition.

ii. Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

The subject site is currently isolated. The proposal will reduce the area of spread of the remnant vegetation into a smaller pocket of 3ha but will increase the condition of the vegetation significantly. The proposal thus will not increase the pressures of isolation or fragmentation.

iii. The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The proposal will remove EEC vegetation that has been under-scrubbed and grazed over an extensive time period and as such, the native mid-storey is completely absent. The ground layer of vegetation amongst the remnant trees typically contains more than 50% coverage by non-native pasture, annual and perennial weed species. As such, the remnant vegetation is of poor quality generally however only 52% of it has been regarded as low condition under a biometric assessment.

To date, no threatened species have been recorded within the bushland remnant, and those two (2) fauna species which have been recorded are highly mobile microbat species for which there is no breeding habitat present on site.

The proposal will not further fragment nor isolate remaining bushland, but instead consolidate a 3ha portion of land which will be fully vegetation to a good condition remnant of Southern Highlands Shale Woodlands EEC.

In conclusion, the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality is expected to be of low importance.

e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

The site has not been identified as critical habitat within the provisions of the TSC Act. Therefore this matter does not require any further consideration at this time.

f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

Approved state recovery plans have been prepared for the following threatened species with potential habitat within the subject site:

- Large Forest Owls ((Powerful Owl (*Ninox strenua*), Sooty Owl (*Tyto tenebricosa*) and Masked Owl (*Tyto novaehollandiae*)) (DEC 2006).

It is considered that the proposed development is generally consistent with the objectives or actions of the above-mentioned draft and approved recovery plans. There is minimal habitat present for the Powerful Owl and it's likely only to be transient foraging habitat as there are no suitable hollows present for breeding.

g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A key threatening process is defined in the *TSC Act* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities.

The current list of key threatening processes under the *TSC Act*, and whether the proposed activity is recognised as a threatening process, is shown below.

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	**Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?**		
	Likely	**Possible**	**Unlikely**
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic Climate Change			✓
Bushrock removal			✓
Clearing of native vegetation	✓		
Competition and habitat degradation by feral goats			✓
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition from feral honeybees			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners			✓
High frequency fire resulting in the disruption of life-cycle processes in plants and animals and loss of vegetation structure and composition			✓
Herbivory and environmental degradation caused by feral deer			✓

Listed key threatening process (as described in the final determination of the Scientific Committee to list the threatening process)	Is the development or activity proposed of a class of development or activity that is recognised as a threatening process?		
	Likely	Possible	Unlikely
Importation of red imported fire ants into NSW			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of *Lantana camara*			✓
Invasion of native plant communities by bitou bush & boneseed *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of native plant communities by African Olive (*Olea europaea* subsp. *cuspidata*)			✓
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*)			✓
Loss of Hollow-bearing trees	✓		
Loss and/or degradation of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)			✓
Predation by the European Red Fox (*Vulpes vulpes*)			✓
Predation by the Feral Cat (*Felis catus*)			✓
Predation by Plague Minnow or Mosquito Fish (*Gambusia holbrooki*)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition & disease transmission from Feral pigs (*Sus scofa*)			✓
Removal of dead wood and dead trees	✓		

Summary of "likely" or "possible" Key Threatening Processes

Clearing of native vegetation

The proposal is of a class of development recognised as a threatening process. It is generally recommended that all sites should aim to achieve a maintain or improve outcome on the quality and quantity of native vegetation cover through protection and restoration measures. Offsetting the loss of native vegetation including trees is to be considered as part of the proposed works. The removal of native vegetation on the subject site is not likely to significantly affect the biodiversity of the local area due to grazed and degraded nature of the

existing remnant. The conservation of 3ha of land to be rehabilitated will essentially provide a *maintain* outcome for the loss of non-low condition vegetation.

Infection of native plants by Phytophthora cinnamomi

The proposal may temporarily increase the risk of fungal infection on site as it may be spread via vehicular movement and relocation of soil and vegetation. Consequently standard *Phytophthora cinnamomi* protocol applies to the cleaning of all plant, equipment, hand tools and work boots prior to delivery onsite to ensure that there is no loose soil or vegetation material caught under or on the equipment and within the tread of vehicle tyres. Any equipment found to contain soil or vegetation material is to be cleaned in a quarantined work area or wash station and treated with anti-fungal pesticides.

Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae

The 'Myrtle Rust' may be spread via machinery, animals and humans as well as by environmental factors such as wind. The presence of machinery and construction works is likely to slightly increase the potential for spread of this newly listed key threatening process. Similar protocols as to *Phytophthora cinnamomi* should be applied.

Invasion of native plant communities by exotic perennial grasses

The proposal is of a class of development recognised as a threatening process due to possible incursions of grasses such as *Pennisetum clandestinum* (Kikuyu). However the vegetation within the subject site is of a degraded nature and the proposed development is not expected to significantly increase the prevalence of exotic perennial grasses. The conservation of a 3ha parcel of land with a vegetation management plan imposed will likely result in exotic perennial grasses being managed through appropriate weed control practices.

Loss of hollow-bearing trees

The remnant trees on site are mature or over-mature specimens with approximately 40% of them containing some hollows. Only three (3) hollow-bearing trees were regarding as being significant due to size, amount or usage. These occur just to the north of the proposed conservation area. It is unknown at this stage whether or not they will be retained as it would be dependent upon where the adjacent building envelopes would be placed.

Removal of dead wood and dead trees

The proposal will require the removal of dead wood and dead trees and as such is of a class of development recognised as a threatening process. Given the low quality habitat present within the future development areas, the removal of dead wood and dead trees is not considered likely to impact on threatened species or the biodiversity of the local area.

Appendix B

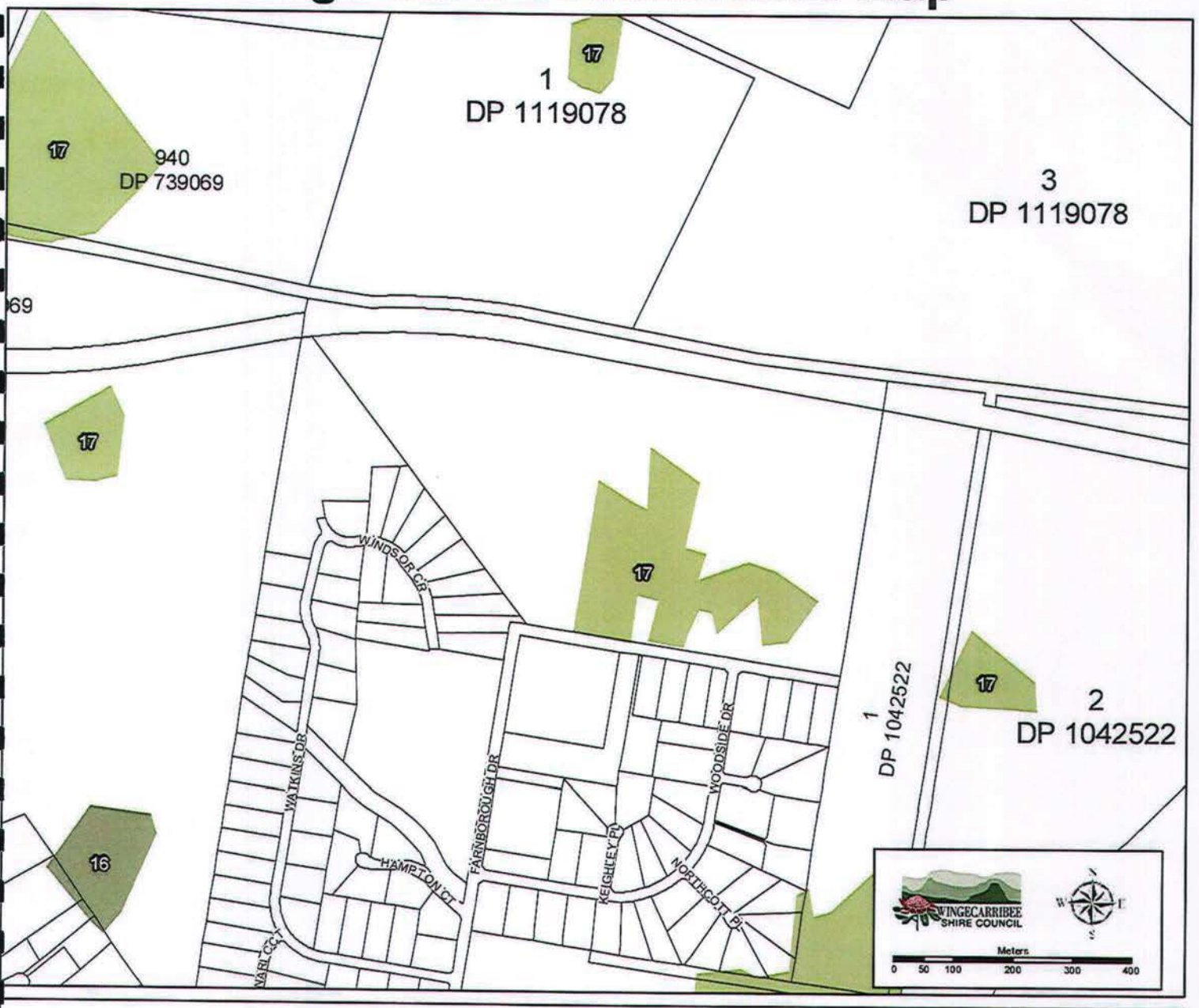

PRELIMINARY
SUBDIVISION PLAN – OP 2
SK 1007
CANDALEPAS ASSOCIATES


PRELIMINARY
CONNECTIVITY DIAGRAM
SK 1008
CANDALEPAS ASSOCIATES

Appendix C

Wingecarribee Shire Council

Vegetation Communities Map

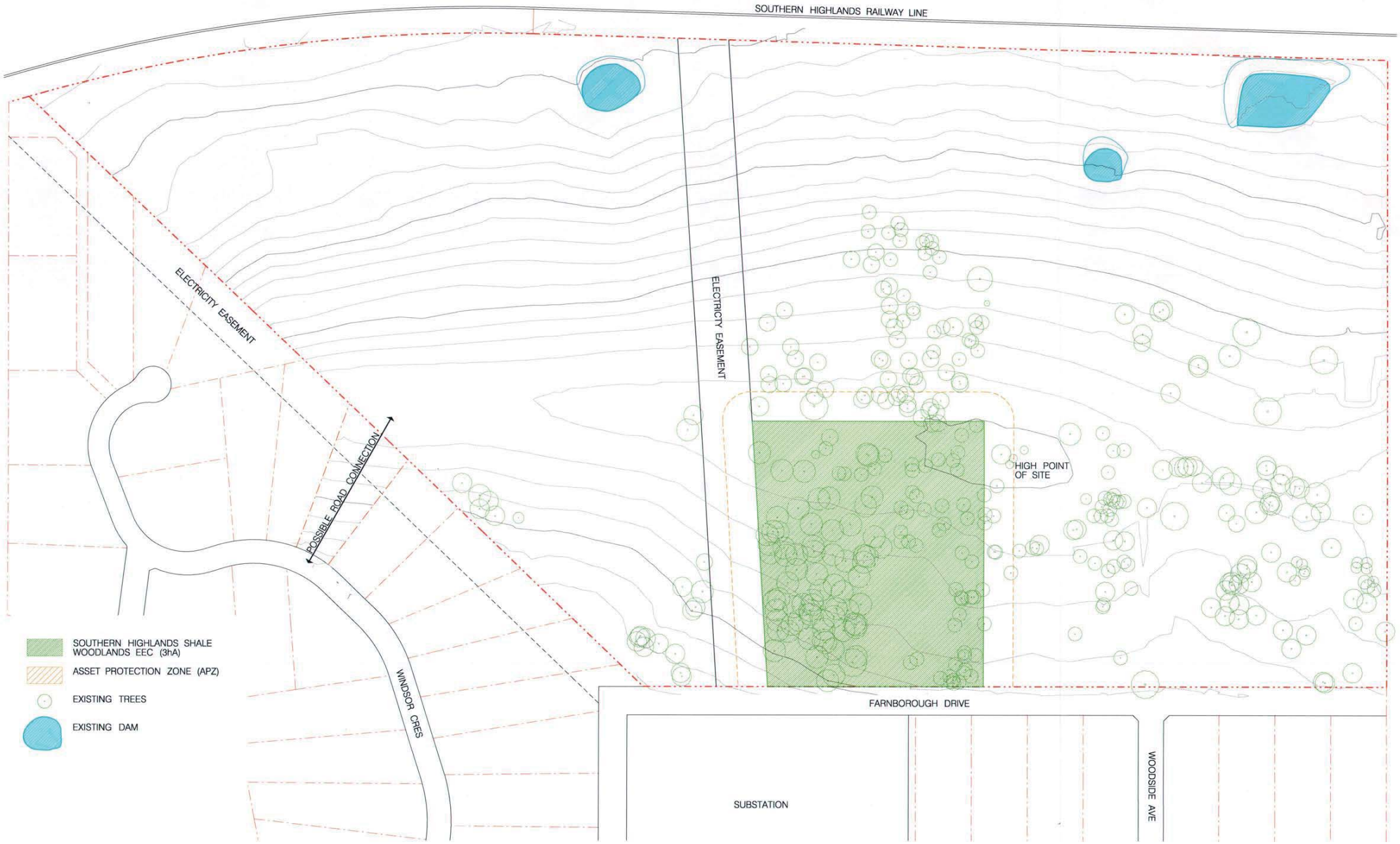


Legend

1 Hawkesbury Sandstone Woodland
2 Bundanoon Sandstone Woodland
3 Sydney Sandstone Gully Forest
4 Mittagong Sandstone Woodland
5 Wingecarribee Mallee
6 Scribbly Gum Open Woodland
7 Sandstone Wet Heath/Sedge
8 Swamp (EEC)
9 Riparian Casuarina Forest
10 Wingecarribee Woodland
11 Burragorang Ironbark Woodland
12 Bindook Porphyry Moist Woodland
13 Bindook Porphyry Dry Woodland
14 Robertson Basalt Rainforest (EEC)
15 Shoalhaven Gorge Tall Open Forest
16 Robertson Basalt Tall Open Forest (EEC)
17 Southern Highlands Shale Woodlands (EEC)
18 Joadja Tall Open Forest (EEC)
19 Upper Shoalhaven Tall Open Forest
20 Mt Gibraltar Forest (EEC)
21 Warm Temperate Rainforest
604 Sandstone Riparian Scrub
608 Moist Gully Gum Forest
609 Nepean Gorge Moist Forest
613 Tall Open Gully Gum Forest
619 Transitional Shale Open Blue Gum Forest
623 Transitional Shale Stringybark Forest (EEC)
627 Nepean Sandstone Gully Forest
629 Exposed Sandstone Scribbly Gum Woodland
630 Nepean Enriched Sandstone Woodland
632 Escarpment Edge Silvertop Ash Forest
635 Upper Georges River Sandstone Woodland
636 Budawang Ash Mallee Scrab
638 Rock Pavement Heath
639 Rock Plate Heath-Mallee
641 Highlands Sandstone Allocasuarina Heath
642 Upland Swamps: Banksia Thicket (EEC)
643 Upland Swamps: Tea Tree Thicket (EEC)
644 Upland Swamps: Sedgeland-Heath Complex (EEC)
645 Upland Swamps: Fringing Eucalypt Woodland (EEC)
646 Upland Swamps: Mallee-Heath (EEC)
647 Highlands Sandstone Swamp Woodland
648 Highlands Swamp Gum-Melaleuca Woodland
650 Regenerating Vegetation
702 Bargo Brush Forest (EEC)
703 Nattai Sandstone Gully Forest
706 Dry Nattai Escapement Complex
707 Moist Nattai Escarpment Complex
821 Shoalhaven Gorge Moist Shrub Forest
853 Shoalhaven Gorge Riparian Shrub Forest
9997 Mined Peat Swamp (EEC)
9998 Weeds/exotics/pine plantations
9999 Water

EEC stands for 'Endangered Ecological Community'

Appendix D



P R E L I M I N A R Y

NORTH

CONSTRAINTS ANALYSIS

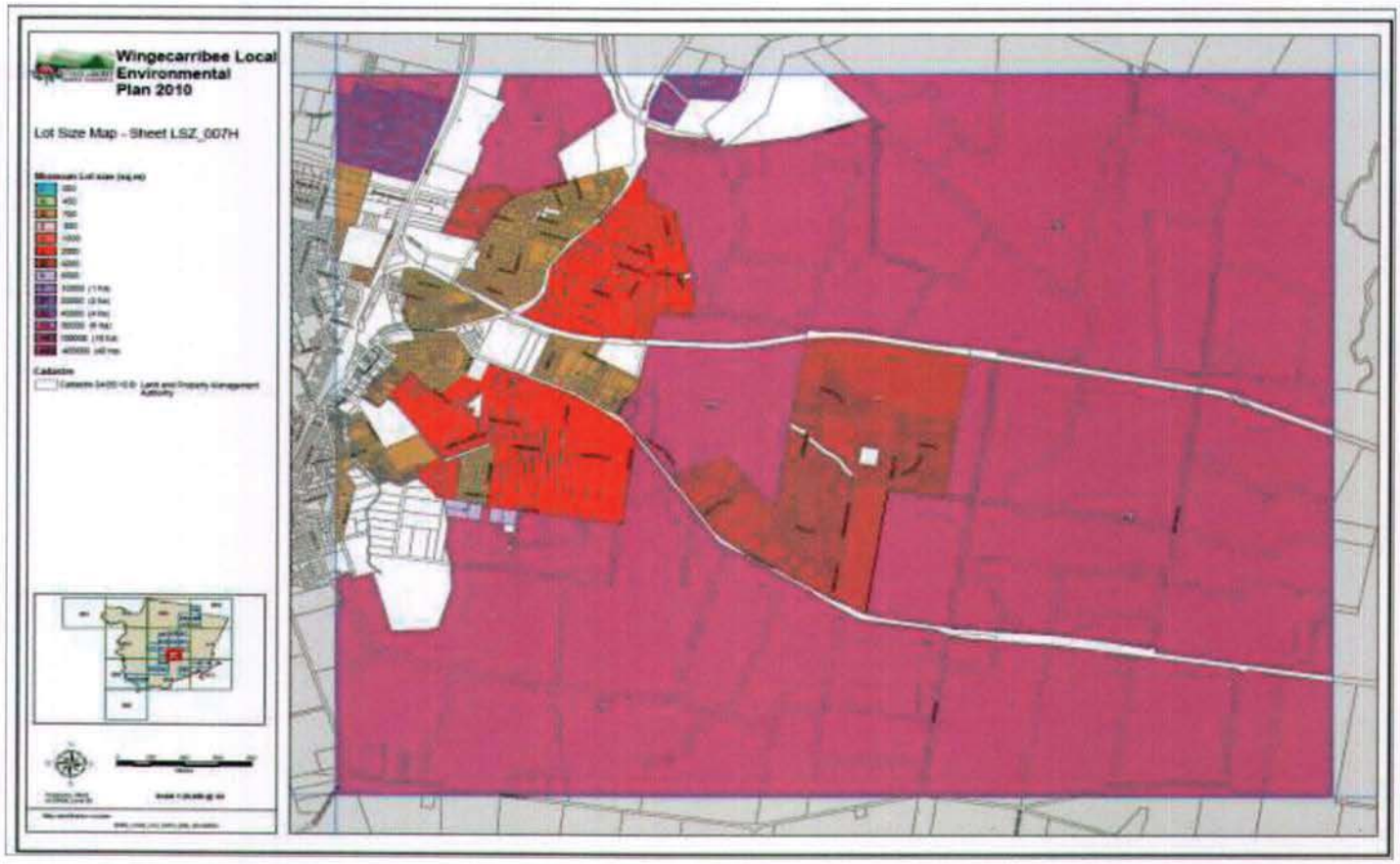
SK 1005

JOB NO: 5613
PROJECT: FARNBOROUGH DRIVE, MOSS VALE
CLIENT: ASSOCIATED PROJECT SERVICES

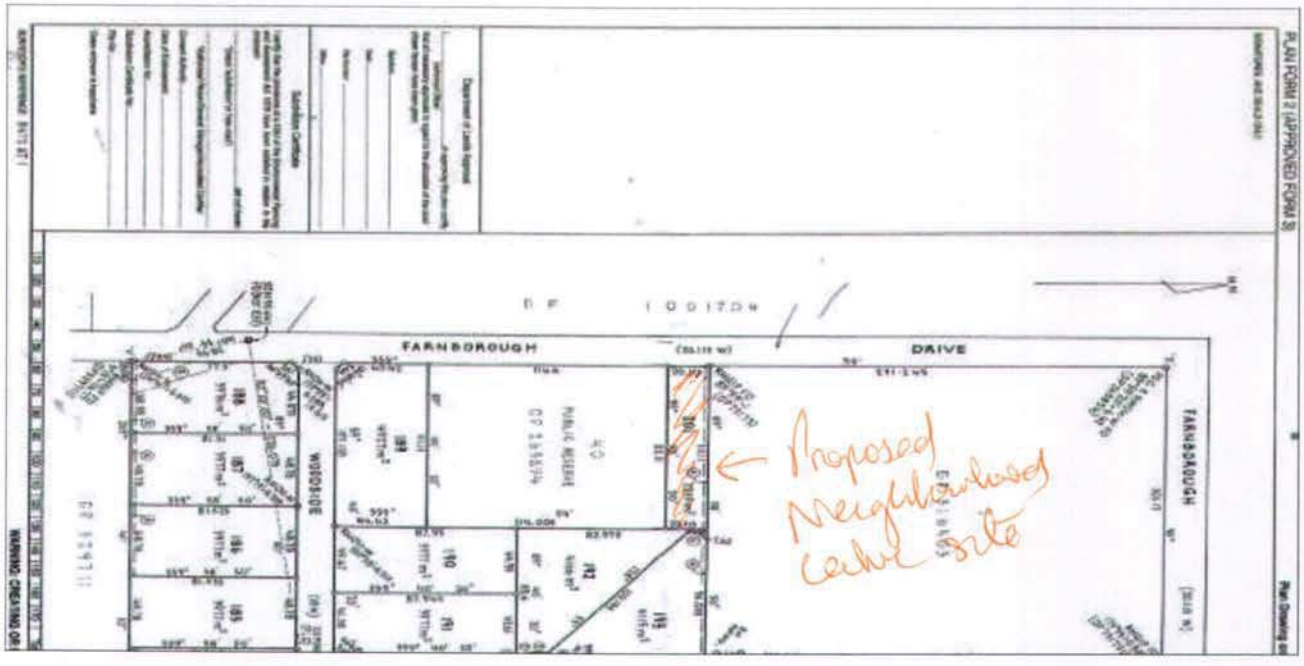
SCALE: 1 : 2500 @ A3
DATE: 21 FEBRUARY 2012
DRAWN BY: JRW

CANDALEPAS ASSOCIATES
LEVEL 9, 219 CASTLEREAGH ST
SYDNEY NSW 2000
T 9283 7755 F 9283 7477

Appendix E



Appendix F



Bushfire Protection Measures

Legend

- Subject Site
- Conservation Area

Vegetation Formation

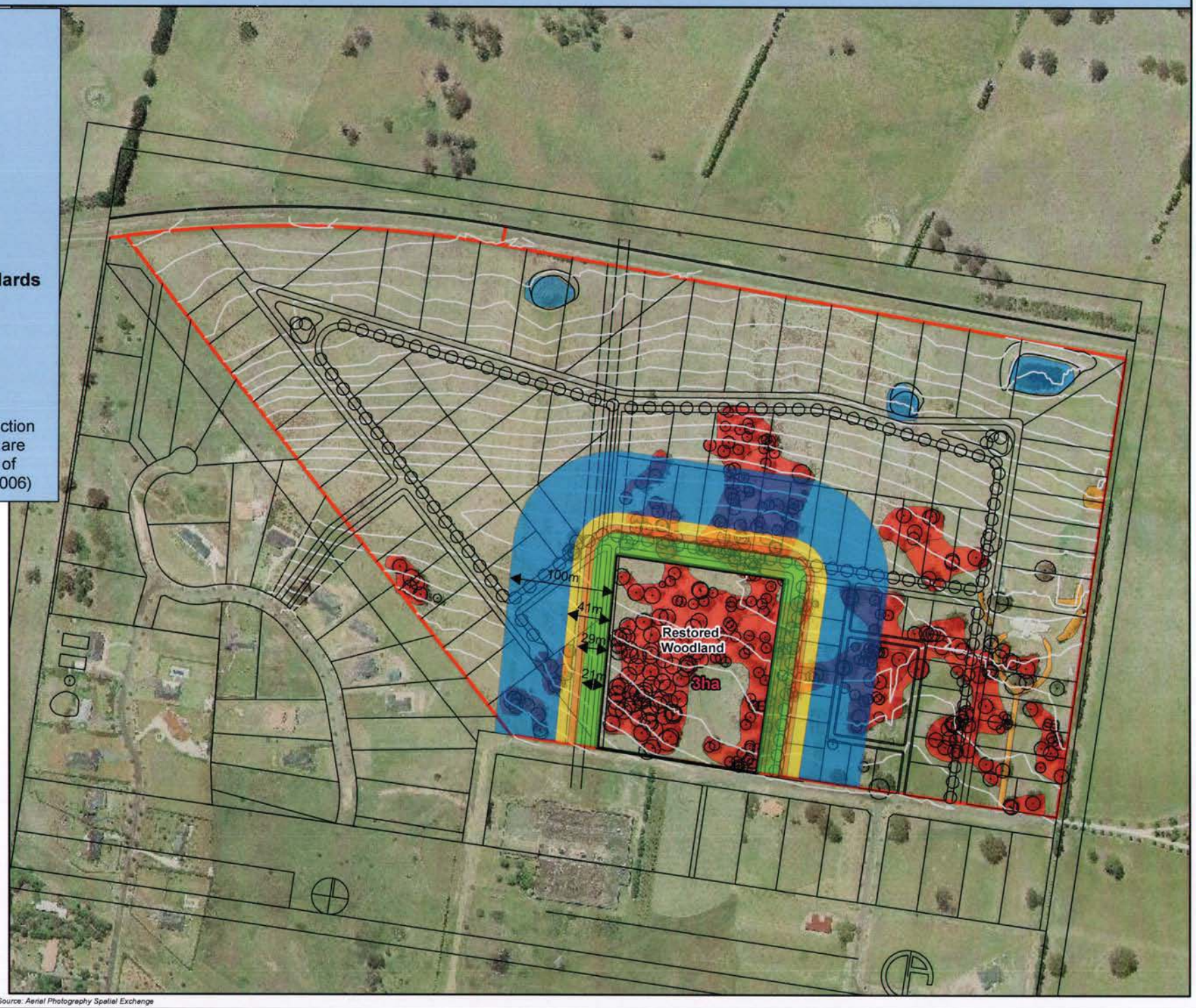
- Woodland (grassy)
- Exotic Plantings and Landscaping
- Dams with Aquatic Sedges
- Asset Protection Zone

Bushfire Construction Standards

AS3959 (2009)*

- BAL 12.5
- BAL 19
- BAL 29

* Please refer to additional construction requirements for BAL levels which are contained in Addendum Apendix 3 of Planning for Bushfire Protection (2006)



N

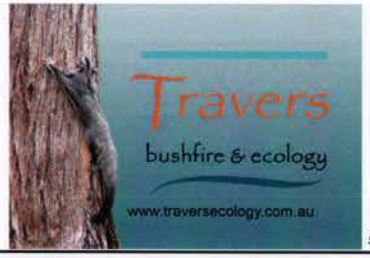
0 50 100 150 m

1:5,000

Original plan produced in A4 colour
GDA 1994 MGA Zone 56

Ref.No. A12002
12/03/12

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.



Source: Aerial Photography Spatial Exchange