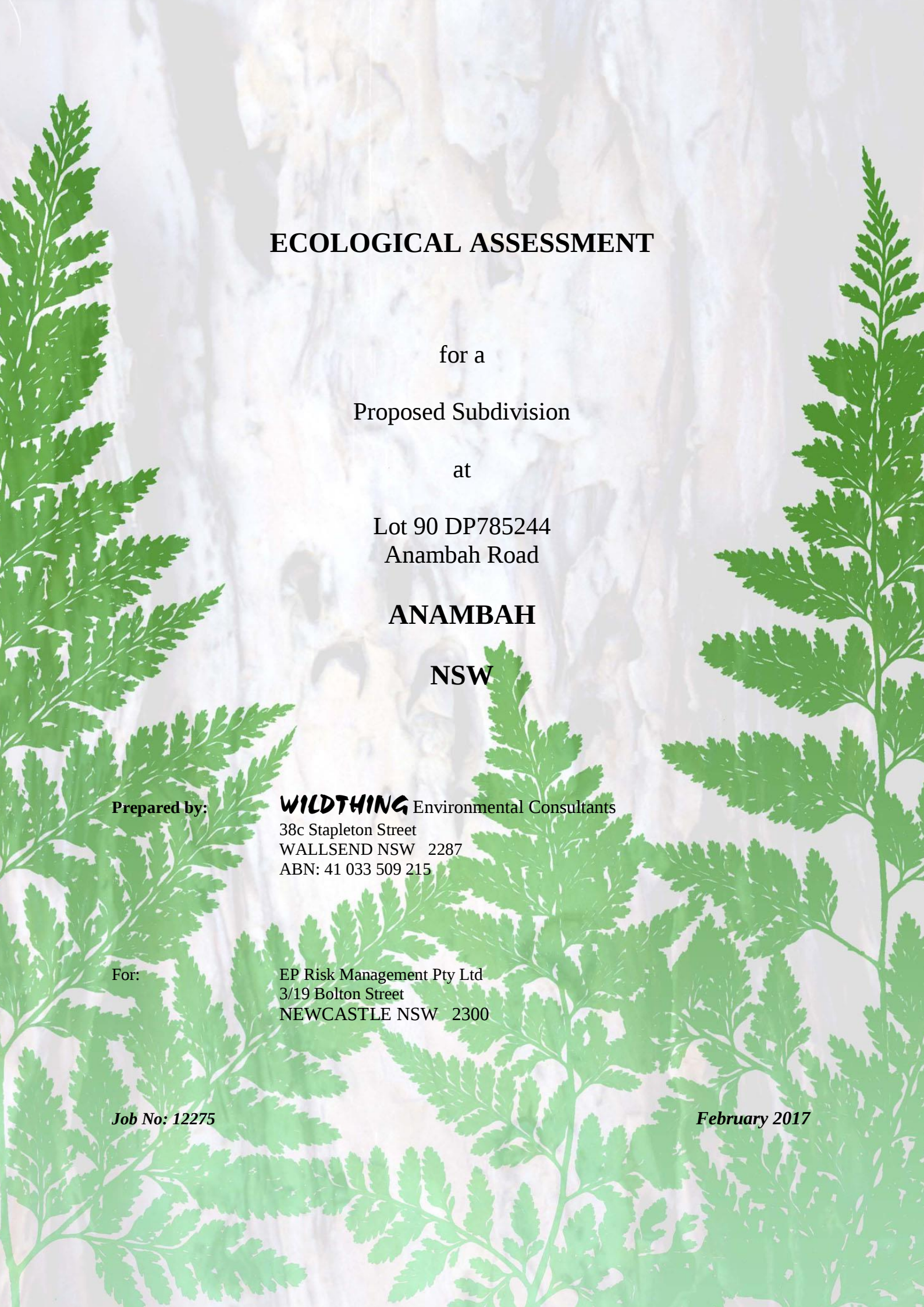




ECOLOGICAL ASSESSMENT

for a

Proposed Subdivision

at

Lot 90 DP785244
Anambah Road

ANAMBAH

NSW

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APPENDIX A - FLORA SPECIES LIST

APPENDIX B – FAUNA SPECIES LIST

1.0 INTRODUCTION

Flora, fauna and habitat studies have been undertaken for a proposed subdivision at Lot 90 DP 785244 Anambah Road, Anambah NSW. Investigations in accordance with the requirements of the Environmental Planning and Assessment Act 1979 (EPA Act) and the Threatened Species Conservation Act 1995 (TSC Act) have been undertaken. The results are presented here in the form of a Seven Part Test report, incorporating an assessment of the site under the provisions of State Environmental Planning Policy No. 44 (SEPP 44) - 'Koala Habitat Protection' and the Commonwealth Environment Protection And Biodiversity Conservation Act 1999 (EPBC Act).

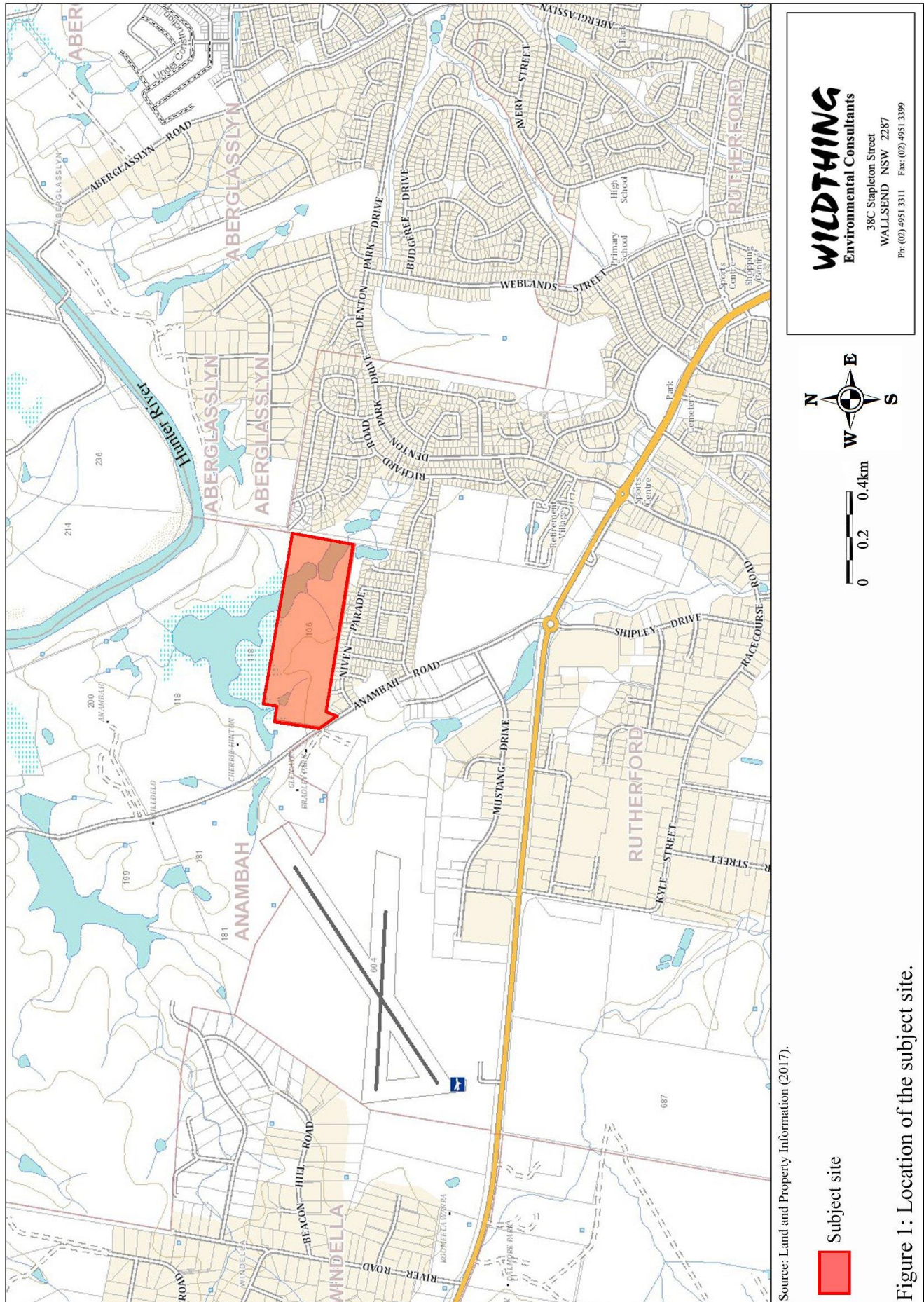
1.1 GENERAL DESCRIPTION OF THE SITE

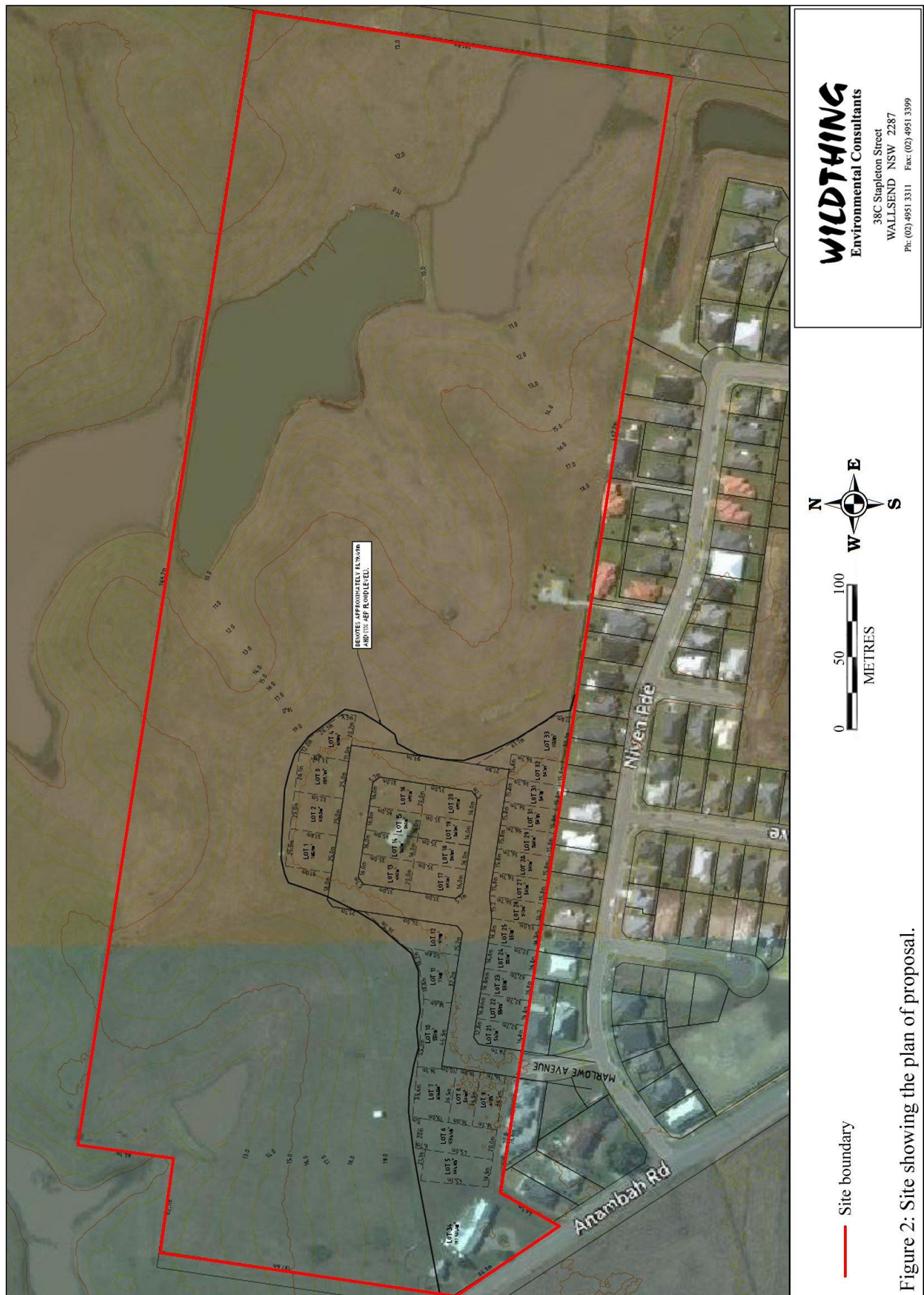
The 22.86ha site (Lot 90 DP 785244) was located on the eastern side of Anambah Road, Anambah (Figures 1 & 2). The site was bounded by relatively recent residential development to the south and east, and farmland to the north and west. Anambah Road adjoined the south-west boundary of the site. The topography of the site consisted of rolling low hills that reached a height of up to just over 20m in the south-west. Two larger waterbodies separated by a narrow man made section of land occupied 2.73ha of the lower ground in the north-eastern portion of the site. These bodies of water were also associated and formed part of a Lagoon (approximately 10ha) to the north of the site. This Lagoon was connected to the Hunter River approximately 500m to the north-east of the site. A residence and associated infrastructure such as sheds were present in the far west of the site adjacent to Anambah Road.

The site has been historically developed for agriculture and has been subject to past and ongoing grazing for a considerable period of time which has resulted in the removal of all of the original native woodland vegetation from within the site. The site consisted of pasture/grassland primarily composed of introduced species. With the exception of a small number of young planted trees around a pumping station in the south of the site and maintained gardens around the residence in the far west, no native trees or shrubs were recorded within the site. A number of native flora species such as sedges and rushes were present around the periphery of the water bodies. A smaller constructed dam was present in the west of the site.

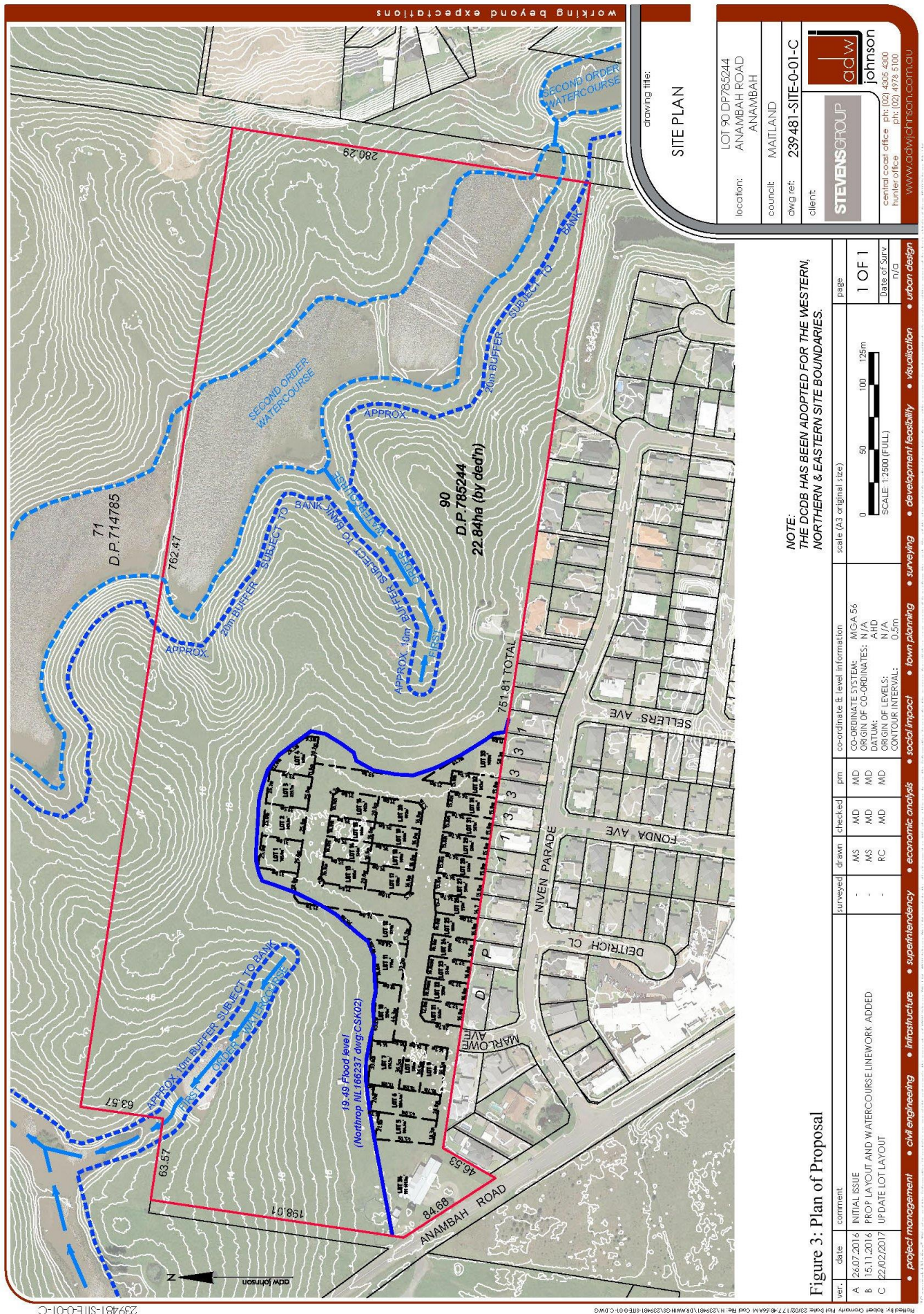
1.2 DESCRIPTION OF THE PROPOSAL

It is proposed that Lot 90 DP 785244 be subdivided into 34 residential lots. The building footprints and associated infrastructure such as roads will impact an area of 3.9ha on the higher ground along the southern boundary in the west of the site within the area of highly disturbed pasture/grassland. Stormwater falling onto the proposed development footprint will be treated in concurrence with Maitland City Council Guidelines. This could include a bio-retention swale.





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2.0 SCOPE OF THE STUDY

This study was designed to address any likely flora and fauna issues of significance, notably the presence of the Green and Golden Bell Frog and waterbirds occurring within the site. This was achieved by appraisal of the vegetation assemblage and structural formation, and identification of representative plant species of the various structural layers. Potential habitat offered by the vegetation present was also assessed. The possibility of this site being significant for any Schedule 1 and 2 (endangered and vulnerable) flora, fauna and ecological communities was paramount in the assessment process. Appraisal has been confined to the site and its immediate surroundings in the Section 5A assessment.

2.1 LEGISLATIVE REQUIREMENTS

This Seven Part Test on Threatened Flora and Fauna has been structured upon the guidelines laid down in Section 5A of the Environmental Planning and Assessment Act (1979) and the Threatened Species Conservation Act (1995), which requires consideration of the impact of the proposed action upon any Schedule 1 and 2 (endangered or vulnerable) species and ecological communities expected or found on the site. Endangered and vulnerable species are collectively referred to as ‘threatened’ species in this report.

Also considered in this report was the Commonwealth Environment Protection and Biodiversity Conservation Act (1999) and State Environmental Planning Policy No. 44 (SEPP 44).

Fieldwork undertaken by Wildthing Environmental Consultants was carried out under the following NPWS Scientific Investigation Licence SL100345 and under Animal Care and Ethics Approval: Animal Research Authority Issue by the Director General of NSW Agriculture (File No. TRIM 13/251) for the Fauna Survey for Biodiversity and Impact Assessment.

3.0 METHODOLOGY

3.1 VEGETATION APPRAISAL METHODOLOGY

The initial determination of the basic vegetation community boundaries was undertaken through the review of an orthophoto covering the site. Following this, a detailed ground survey was conducted in accordance with the Lower Hunter and Central Coast Region – Flora and Fauna Guidelines (Murray, *et al.* 2002). Flora searches for threatened species were undertaken across the site in the manner described by Cropper (1993) as the ‘Random Meander Technique’. This involved walking in a random manner throughout the entire site and visiting the full range of potential habitats and checking every plant species seen. A list of all flora species identified on site during this survey and past surveys has been provided in Appendix A.

3.2 HABITAT APPRAISAL METHODOLOGY

Habitat may be defined as the physical and biological environment required for the survival of a specific population of a species. In modern usage habitat has also come to be regarded as an association of landform and plant life, which provides sustenance and shelter for a particular fauna assemblage.

The methodology of the habitat appraisal used the vegetation community data combined, where relevant, with geomorphological features and the occurrence of particular plant species or forms (i.e. tree hollows) to provide a basis for a subjective habitat assessment aimed at placing the ecological status of the site within a local perspective.

3.2.1 GENERAL HABITAT FOR NATIVE SPECIES

From the vegetation appraisal and a general inspection of the site and surrounding areas, a subjective assessment of the general habitat value of this site was made. Considered in this assessment were:

- occurrence of that habitat type in the general vicinity;
- degree of disturbance and degradation;
- area occupied by that habitat on site;
- continuity with similar habitat adjacent to the site, or connection with similar habitat off site by way of corridors; and
- structural and floral diversity.

3.2.2 HABITAT FOR SIGNIFICANT SPECIES

This site was evaluated as potential habitat for each of the threatened species reported on the Office of Environment and Heritage (OEH) and Department of the Environment (DoE) database from within 10km of the site. This evaluation was based on home range, feeding, roosting, breeding, movement patterns and corridor requirements for fauna and hydrology, soil types, aspect and structural formation for flora species.

3.3 FAUNA APPRAISAL METHODOLOGY

The methodology adopted consisted of an assessment of the potential use of the site by any Schedule 1 and 2 fauna identified on the OEH and DoE Databases. This was undertaken by both appraising the extent of likely habitat upon the site, searches for secondary indications of threatened species utilising the site, and incidental observations of native fauna in general. The location of targeted fauna surveys is shown in Figure 4.

3.3.1 DIURNAL SURVEYS

Opportunistic sightings of species and secondary indications (scats, scratches, diggings, tracks etc.) of resident fauna were noted and included:

- dedicated searches for amphibians targeting the Green and Golden Bell Frog;
- dedicated searches for herpetofauna;
- dedicated searches for avifauna; and
- searches for whitewash, prey remains and regurgitation pellets from Owls;

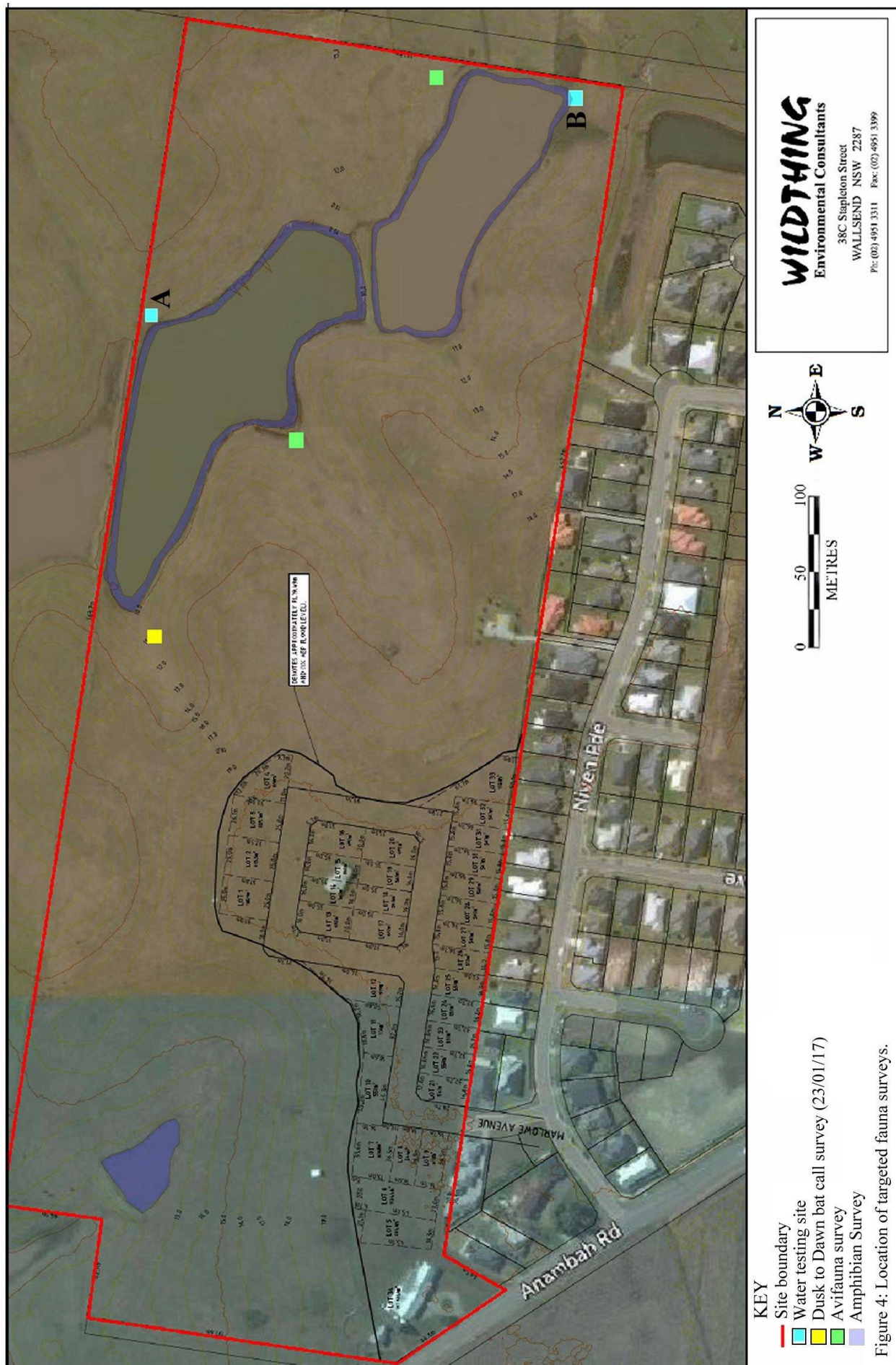
3.3.2 NOCTURNAL SURVEYS

The nocturnal surveys undertaken included:

- amphibian surveys targeting the threatened Green and Golden Bell Frog;
- spotlighting;
- recording of microchiropteran bat calls; and

The amphibian surveys targeting the Green and Golden Bell Frog were undertaken in accordance with the Threatened species survey assessment guidelines: Field Survey Methods for Fauna – Amphibians (DECC, 2009). Surveys were undertaken within the optimal survey time for the Green and Golden Bell Frog (August – February) (Lemckert & Mahony, 2008) and using the appropriate Hygiene protocols for the control of disease in frogs (NSW National Parks and Wildlife Service, 2001). Diurnal surveys included visual searches for basking individuals within vegetation in and around the water bodies. Any tadpoles encountered were also captured for identification using a Tadpole key (Anstis, 2002). Incidental records of other frog species heard or sighted were also recorded.

Nocturnal surveys involved call playback and spotlighting searches. Call playback involved an initial listening period of 10 minutes then playing 5 minutes of Green and Golden Bell Frog calls. Calls were played using an MP3 player and a megaphone using pre-recorded calls (Stewart, 1998). This was followed by 10 minutes of listening. The call playback survey was repeated a number of times within suitable habitat around the entire waterbodies on site. Spotlighting surveys involved walking around the waterbodies and actively looking for frogs and their eye shine within suitable habitat. Any tadpoles present were captured for identification. Incidental records of other frog species heard or sighted were also recorded.



Spotlighting was undertaken on foot using 100watt hand-held spotlights. The spotlighting involved walking at a slow pace around the entire site and stopping every 2 minutes, allowing the observer to hear movements of animals.

Stationary call activated microchiropteran bat detection was undertaken from dawn to dusk for one night. The transformed calls were analysed using an Anabat V Zero Crossing Analysis Interface feeding into a computer and were identified by comparison with sample bat calls. The recorded bat calls were analysed in-house by Mungo Worth.

3.4 AQUATIC ECOLOGY ASSESSMENT

3.4.1 GENERAL HABITAT DESCRIPTION

A subjective assessment of the general habitat value of the aquatic environment within the study area was made. Considered in this assessment were:

- Degree of disturbance;
- Habitat such as woody debris;

3.4.2 PHYSICAL WATER QUALITY PARAMETERS

Water quality was assessed at one point within the two larger waterbodies (Points A & B). Physical water quality measurements were sampled *in-situ* at each site. Water quality was measured using a Horiba U 50 Water Meter. Parameters measured included pH, temperature, Oxidation Reduction Potential (ORP), Dissolved Oxygen (mg/L DO), Dissolved Oxygen (DO%), Conductivity (dS/m), Turbidity TDU, Total Dissolved Solids (TDS) and Salinity. The locations of water quality testing are shown in Figure 4.

3.5 DATE, TIMES, ACTIVITIES & WEATHER CONDITIONS

A summary of the time spent on site during fieldwork and the prevailing weather conditions at the time is contained below in Table 1.

Table 1: Survey Dates, Times and Weather Conditions

DATE	TIME	SURVEY EFFORT (EXPRESSED IN PERSON HOURS)	ACTIVITY	WEATHER
Thursday 19-01-2017	1100-1230	1.5 hours (Three persons)	Vegetation and habitat surveys Avifauna survey Aquatic survey Incidental observations	E 15km/h, 8/8 Cloud, 22°C, Humidity 67%

DATE	TIME	SURVEY EFFORT (EXPRESSED IN PERSON HOURS)	ACTIVITY	WEATHER
Monday 23-01-2017	1845-2045	1 hours (One Person)	Avifauna survey Reptile Survey Amphibian Survey Bat call survey (Anabat left out dawn to dusk)	NE 20km/h, 0/8 Cloud, 34°C, Humidity 36%
Tuesday 24-01-2017	0615-0715	1 hour (One Person)	Retrieval of Anabat Avifauna survey	Calm-NNW 6km/h, 0/8 Cloud, 33 °C, Humidity 67%
Wednesday 25-01-2017	1930-2130	2 hours (Two Person)	Avifauna survey Nocturnal survey (Amphibian Survey)	SE 13km/h, 8/8 Cloud, 23.3 °C, Humidity 75%

3.6 SIGNIFICANT SPECIES, POPULATIONS AND COMMUNITIES

The following threatened species listed in Table 2 have been recorded on the OEH and DoE Databases as occurring within 10km of the study area. Species marked with an asterisk (*) are listed on the DoE Database as having habitat likely to occur within 10km of the study area.

Table 2: Threatened species, endangered populations and ecological communities considered.

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
FLORA			
* <i>Tetratheca juncea</i>	Black-eyed Susan	V	V
* <i>Dichanthium setosum</i>	Bluegrass	V	
* <i>Acacia bynoeana</i>	Bynoe's Wattle	E1	V
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small Flowered Grevillea	V	V
<i>Callistemon linearifolius</i>	Netted Bottlebrush	V	
<i>Eucalyptus glaucina</i>	Slaty Red Gum	V	V
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Earp's Gum	V	V
<i>Syzygium paniculatum</i>	Magenta Lillypilly	E1	V
* <i>Pterostylis gibbosa</i>	Illawarra Greenhood	E1	E
* <i>Euphrasia arguta</i>		E4A	CE
* <i>Asterolasia elegans</i>		E1	E
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V
* <i>Thesium australe</i>	Austral Toadflax	V	V
FAUNA			
Amphibians			
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	V
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V
* <i>Mixophyes balbus</i>	Stuttering Frog	E1	V
Birds			
<i>Oxyura australis</i>	Blue-billed Duck	V	
* <i>Botaurus poeciloptilus</i>	Australasian Bittern	E1	E

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
<i>Rostratula australis</i>	Australian Painted Snipe	E1	E
<i>Gallinago hardwickii</i>	Latham's Snipe,		M
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E1	
<i>Sternula albifrons</i>	Little Tern	E1	M
* <i>Calidris ferruginea</i>	Curlew Sandpiper	E1	CE, M
* <i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1	E
<i>Callocephalon fimbriatum</i>	Gang Gang Cockatoo	V	
<i>Lathamus discolor</i>	Swift Parrot	E1	CE
<i>Neophema pulchella</i>	Turquoise Parrot	V	
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	
<i>Epthianura albifrons</i>	White-fronted Chat	V	
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	V	
<i>Petroica boodang</i>	Scarlet Robin	V	
<i>Anthochaera Phrygia</i>	Regent Honeyeater	E4A	E
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	
* <i>Grantiella picta</i>	Painted Honeyeater	V	V
<i>Pomatostomus temporalis subsp. temporalis</i>	Grey-crowned Babbler	V	
<i>Chthonicola sagittata</i>	Speckled Warbler	V,P	
* <i>Erythrorhynchus radiates</i>	Red Goshawk	CE	V
<i>Circus assimilis</i>	Spotted Harrier	V	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	M
<i>Lophoictinia isura</i>	Square-tailed Kite	V	
<i>Ninox connivens</i>	Barking Owl	V	
<i>Ninox strenua</i>	Powerful Owl	V	
<i>Tyto novaehollandiae</i>	Masked Owl	V	
Migratory Birds			
* <i>Apus pacificus</i>	Fork-tailed Swift		M
* <i>Ardea alba</i>	Great Egret		M
<i>Ardea ibis</i>	Cattle Egret		M
* <i>Gallinago hardwickii</i>	Latham's Snipe		M
<i>Calidris melanotos</i>	Pectoral Sandpiper		M
* <i>Numenius madagascariensis</i>	Eastern Curlew		CE, M
<i>Numenius minutus</i>	Little Curlew		M
* <i>Cuculus optatus</i>	Oriental Cuckoo		M
* <i>Tringa nebularia</i>	Common Greenshank		M
<i>Tringa stagnatilis</i>	Marsh Sandpiper		M
<i>Ardenna pacificus</i>	Wedge-tailed Shearwater		M
<i>Hirundapus caudacutus</i>	White-throated Needletail		M
* <i>Pandion cristatus</i>	Eastern Osprey	V	M
<i>Merops ornatus</i>	Rainbow Bee-eater		M
* <i>Monarcha melanopsis</i>	Black-faced Monarch		M
* <i>Monarcha trivirgatus</i>	Spectacled Monarch		M
* <i>Motacilla flava</i>	Yellow Wagtail		M
* <i>Myiagra cyanoleuca</i>	Satin Flycatcher		M
* <i>Rhipidura rufifrons</i>	Rufous Fantail		M
Mammals			
<i>Dasyurus maculatus maculatus</i>	Tiger Quoll	V	E
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V	
<i>Phascogale cinereus</i>	Koala	V	V
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	
* <i>Petauroides volans</i>	Greater Glider		V
* <i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo	V	V
* <i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E1	V
* <i>Pseudomys novaehollandiae</i>	New Holland Mouse		V
* <i>Pseudomys oralis</i>	Hastings River Mouse	E1	E
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	
<i>Miniopterus australis</i>	Little Bentwing-bat	V	
<i>Miniopterus schreibersii oceanensis</i>	Large Bentwing-bat	V	
<i>Myotis macropus</i>	Southern Myotis	V	
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V	
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V
Endangered Populations (E2)			
<i>Eucalyptus camaldulensis</i> population in the Hunter catchment		E2	
<i>Cymbidium canaliculatum</i> population in the Hunter Catchment		E2	
Wetlands of National Importance (RAMSAR)			
Hunter estuary wetlands		Ramsar	Ramsar
Endangered Ecological Communities (EEC)			
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion.			
Hunter Lowlands Redgum Forest in the Sydney Basin Bioregion			
River Flat Eucalypt Forest on Coastal Floodplains			
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast			
Kurri Sand Swamp Woodland in the Sydney Basin Bioregion			
*Central Hunter Valley Eucalypt Forest and Woodland			
*Hunter Valley Weeping Myall (<i>Acacia pendula</i>) Woodland			
*Lowland Rainforest of Subtropical Australia			
*White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland			
E/E1=Endangered Species V=Vulnerable Species E4A=Critically Endangered M=Migratory Species			

4.0 RESULTS

4.1 FLORA ASSEMBLAGES

The site has been historically developed for agriculture and has been subject to past and ongoing grazing for a long period of time. This has resulted in the removal of native woodland vegetation from within the site and replacement with introduced pasture species. A number of native flora species, largely sedges were found around the waterbodies.

A total of three vegetation communities were found to be present within the site:

- Open Grassland/Pasture (19.96ha)
- Freshwater Wetland (2.73ha)
- Small Constructed Dam – Aquatic Vegetation (0.15ha)

A general description of the flora assemblage identified on site is given below. A full list of the flora species recorded during fieldwork is listed in Appendix A. The distribution of the vegetation communities has been indicated in Figure 5*.

*Note on Vegetation Community Distribution Map. A map of vegetation of any area seeks to describe the distribution of the plant species in that area by defining a number of vegetation units (assemblages or communities), which are relatively internally homogenous. Whilst such mapping is a convenient tool, it greatly oversimplifies the real situation. Plants rarely occur in defined communities with distinct boundaries. Accordingly vegetation units used for the accompanying map should be viewed as indicative of their extent rather than being precise edges of communities.

Open Grassland/Pasture

The majority of the site (19.96ha) was composed of open grassland/pasture (Figures 6-10). This community was highly disturbed due to historic clearing and ongoing grazing and was composed largely of introduced grass species. Common introduced grasses included *Axonopus fissifolius* (Narrow-leaf Carpet Grass), *Pennisetum clandestinum* (Kikuyu) and *Paspalum dilatatum* (Paspalum). *Cynodon dactylon* (Common Couch) may occur naturally within the site was also a common groundcover. Other introduced groundcovers included *Plantago lanceolata* (Plantain), *Centaureum erythraea* (Common Centaury), *Cirsium vulgare* (Black Thistle), and *Senecio madagascariensis* (Fireweed). The few native ground covers included *Bothriochloa macra* (Red-leg Grass).

A small number of young specimens of *Casuarina glauca* (Swamp Oak) were found to have been planted within the fenced area containing the pumping station in the south of the site.



Figure 5: Vegetation map of site.



Figure 6: Open Grassland/Pasture in North-east of site (facing south-west).



Figure 7: Open Grassland/Pasture in North-east of site (facing south).



Figure 8: Open Grassland/Pasture in south-east of site facing north.



Figure 9: Open Grassland/Pasture in south of site.



Figure 10: Planted specimens of *Casuarina glauca* around fenced off pumping station.

Freshwater Wetland

Vegetation adapted to varying amounts of inundation was present around the periphery of the section of Lagoon occurring on site (Figures 11-13). This vegetation community largely consisted of sedges, rushes and semi-aquatic grasses. Common native aquatic flora species included *Paspalum distichum* (Water Couch), *Ludwigia peploides* subsp. *montevidensis* (Water Primrose), *Bolboschoenus caldwellii*, *Eleocharis sphacelata* (Tall Spike-rush), *Schoenoplectus mucronatus*, *Schoenoplectus validus*, *Cyperus difformis* (Dirty Dora), *Cyperus exaltatus*, *Juncus usitatus* (Common Rush) and *Pratia concolor* (Poison Pratia). Common introduced species observed along the water's edge included *Cyperus eragrostis* (Umbrella Sedge), *Paspalum dilatatum* (Paspalum) and *Paspalum urvillei* (Vasey Grass). Few aquatic plants were observed within the water itself. The floating fern species, *Azolla filiculoides* was also recorded.

Similar freshwater vegetation was observed to be present around the remainder of the Lagoon outside the site.



Figure 11: Freshwater Wetland occurring around the southern side of the western waterbody.



Figure 12: Freshwater Wetland occurring around the western side of the western waterbody.



Figure 13: Freshwater Wetland occurring around the western side of the eastern waterbody.



Figure 14: Aquatic Vegetation occurring around the small constructed dam in the west of the site.

Small Constructed Dam

A small constructed dam approximately 0.15ha in area occupied part of the ephemeral drainage line in the north-west of the site (Figure 14). Only a small amount of aquatic vegetation was present within the peripheries of the dam including the native species *Juncus usitatus*, *Paspalum distichum* (Water Couch) and *Ludwigia peploides* subsp. *montevidensis* (Water Primrose). Common introduced species observed along the water's edge included *Cyperus eragrostis* (Umbrella Sedge), *Paspalum dilatatum* (Paspalum) and *Paspalum urvillei* (Vasey Grass).

4.1.1 ENDANGERED ECOLOGICAL COMMUNITIES

Five vegetation communities mapped in the local area are currently listed as Endangered Ecological Communities (EECs) on the NSW Threatened Species Conservation Act 1995. These include:

- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion.
- Hunter Lowlands Redgum Forest in the Sydney Basin Bioregion
- River Flat Eucalypt Forest on Coastal Floodplains
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion

An additional two EEC's listed under national legislation were also present on the protected matters search (DoE, 2015).

- Central Hunter Valley eucalypt forest and woodland
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

The narrow band of freshwater wetland occurring around the section of Lagoon on site were found to be consistent with the broad Endangered Ecological Community Freshwater Wetlands on Coastal Floodplains of the NSW North Coast. The impact of the proposal on this EEC - Lower Hunter Spotted Gum-Ironbark Forest has been addressed in Section 6.0 of this report.

No nationally threatened ecological communities were considered to be present within the site.

4.1.2 ENDANGERED POPULATIONS

Two Endangered populations; *Eucalyptus camaldulensis* (River Red Gum) and *Cymbidium canaliculatum* populations in the Hunter Catchment, have been recorded within 10km of the site according to the OEH database. Neither of these two endangered populations were recorded within the site during fieldwork.

4.1.3 THREATENED AND RARE FLORA SPECIES

Thirteen threatened and two rare flora species were recorded within 10km of the site according to the OEH Wildlife Atlas or have potential habitat within 10km of the site according to the DoE databases (Table 3).

Table 3: Threatened and Rare Flora species recorded within the locality.

FLORA SPECIES	TSC	EPBC	ROTAP
<i>Tetradlea juncea</i> (Black-eyed Susan)	V	V	3VCa
<i>Dichanthium setosum</i> (Bluegrass)	V		
<i>Acacia bynoeana</i> (Bynoe's Wattle)	E1	V	3VC-
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (Small-flowered Grevillea)	V	V	
<i>Grevillea montana</i>			2KC-
<i>Callistemon linearifolius</i> (Netted Bottlebrush)	V		
<i>Eucalyptus glaucina</i> (Slaty Red Gum)	V	V	3VCa
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> (Earp's Gum)	V	V	2V
<i>Syzygium paniculatum</i> (Magenta Lillypilly)	E1	V	3VCi
<i>Pterostylis gibbosa</i> (Illawarra Greenhood)	E1	E	2E (Recom. 3E)
<i>Euphrasia arguta</i>	E4A	CE	3X
<i>Asterolasia elegans</i>	E1	E	2ECa
<i>Rutidosia heterogama</i> (Heath Wrinklewort)	V	V	2VCa
<i>Thesium australe</i> (Austral Toadflax)	V	V	3VCi
<i>Macrozamia flexuosa</i>			2K

^See Appendix B for ROTAP Key

In total 55 plant species were recorded during field work within the site (Appendix A). No threatened flora species were recorded within the site. As a result of the high disturbance to the site no suitable habitat was considered to be present for any of the addressed flora species.

No ROTAP or rare species were found within the site. No suitable habitat was present for the ROTAP listed *Grevillea montana* and *Macrozamia flexuosa*.

A species-specific habitat assessment for the addressed threatened flora species has been provided in Section 4.2.3 of this report.

4.1.4 NOXIOUS WEEDS AND WEEDS OF STATE AND NATIONAL SIGNIFICANCE

Two noxious weed species were found to be present within the site and are shown below in Table 4. The site lies within the Maitland Noxious Plants Advisory Area.

Table 4: Noxious Weed species found on site.

WEED SPECIES	WEED CLASS MAITLAND LGA	ADDITIONAL SIGNIFICANCE
<i>Olea europaea</i> subsp. <i>Cuspidate</i> (African Olive)		T
<i>Senecio madagascariensis</i> (Fireweed)	Class 4	N

N – Weed of National Significance (Listed in the Commonwealth Government's National Weeds Strategy 1997)

T – Listed as a Threatening Process under the NSW TSC Act 1995.

*Control Classes under the Noxious Weeds Act 1993.

- Class 1 & 2 This plant must be eradicated from the land and the land must be kept free of this plant.
- Class 3 This plant must be fully and continuously suppressed and destroyed.
- Class 4 The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the Local Control Authority (LCA). Must also, 'not be sold, propagated or knowingly distributed'.
- Class 5 The requirements of the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

4.2 HABITAT APPRAISAL

4.2.1 HABITAT DESCRIPTION AND DISTRIBUTION IN THE VICINITY

Three broad habitat categories, Grassland/Pasture, Freshwater Waterbody and Constructed Dam were identified within the site.

Grassland/Pasture

The Grassland/Pasture habitat, a result of past clearing and continued grazing, was primarily composed of introduced grasses. Such habitat provides opportunity for a variety of avifauna, including predominantly terrestrial species preferring open spaces such as Pipits, seed eating birds and several birds of prey, which may hunt over this area in search of potential prey species. Macropods may also frequent such areas whilst grazing. Some species of bats may also forage over this cleared area for insects. However, the lack of vegetative cover often limits the value of such areas for many species, particularly some reptiles, small mammals and birds which are vulnerable to predation in open spaces.

Freshwater Waterbody

Two larger waterbodies separated by a narrow man made section of land occupied 2.73ha of the lower ground in the north-eastern portion of the site. These bodies of water were also associated and formed part of a much larger area of water (approximately 10ha) to the north of the site. This larger water body was also connected to the Hunter River approximately 500m to the north-east of the site. During times of flooding additional water from the Hunter Rivers would back up into the site.

The waterbodies would provide suitable aquatic habitat for a range of fish, frog, reptile, waterbird and mammal species. These areas would also act as a water source for other native animals such as macropods and offer potential habitat for bats that prefer to hunt above or around water bodies.

Constructed Dam

The relatively small constructed dam was located in the far west of the site. The dam would offer aquatic habitat for a small variety of frogs and reptiles and provide a source of drinking water for native species such as birds, microchiropteran bats and macropods.

4.2.2 HABITAT FRAGMENTATION & CORRIDORS

As a result of past agricultural activities and residential development the site would not form any significant terrestrial ecological corridors.

Two larger waterbodies separated by a narrow man made section of land occupied 2.73ha of the lower ground in the north-eastern portion of the site. These bodies of water were also associated and formed part of a much larger area of water (approximately 10ha) to the north of the site. This larger water body was also connected to the Hunter River approximately 500m to the north-east of the site. During times of flooding additional water from the Hunter Rivers would back up into the site.

As there are no planned changes to the waterbodies the proposal is unlikely to have any impact on aquatic linkages.

4.2.3 HABITAT FOR SIGNIFICANT SPECIES

An assessment of habitat attributes on site has been undertaken for the significant species listed in Section 3.5. The results of the assessment are displayed in Table 5. Threatened species identified in this assessment as having potential habitat available on site have been considered further under Section 5A of the EPA Act in Section 5.0 of this report.

Table 5: Habitat Assessment for Significant Species

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELIHOOD OF OCCURRENCE ON SITE
<i>Tetratheca juncea</i> Black-eyed Susan	TSC Act-V EPBC Act-V	Heath and Dry Sclerophyll Forests on low nutrient soil with a dense understorey of grasses. Is most commonly found associated with species including, <i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus globoidea</i> (White Stringybark), <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Acacia myrtifolia</i> (Myrtle Wattle).	Unlikely No suitable habitat was present.
<i>Dichanthium setosum</i> Bluegrass	TSC Act – V EPBC Act – V	Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Bluegrass occurs on the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland. It occurs widely on private property, including in the Inverell, Guyra, Armidale and Glen Innes areas.	Unlikely No suitable habitat was present.
<i>Acacia bynoeana</i> Bynoe's Wattle	TSC Act – E1 EPBC Act – V	Found in heath, woodland and dry sclerophyll forests on sandy soils. Commonly associated species include <i>Eucalyptus haemastoma</i> (Scribbly Gum), <i>Corymbia gummifera</i> (Red Bloodwood), <i>Angophora bakeri</i> and <i>Banksia spinulosa</i> (Hairpin Banksia).	Unlikely No suitable habitat was present.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> Small-flowered Grevillea	TSC Act-V EPBC Act-V	This species of <i>Grevillea</i> occurs in light clayey soils in woodlands. This species grows chiefly in south-western Sydney. Disjunct populations occur near Cessnock, Putty and Cooranbong (Fairley, 2004).	Unlikely No suitable habitat was present.
<i>Callistemon linearifolius</i> Netted Bottle Brush	TSC Act - V	Grows in dry sclerophyll forest on the coast and adjacent ranges from the Georges River to the Hawkesbury River in the Sydney area, and north to Nelson Bay.	Unlikely No suitable habitat was present.
<i>Eucalyptus glaucina</i> Slaty Red Gum	TSC Act-V EPBC Act-V	The Slaty Red Gum principally occurs in the Casino area in northern NSW and from Gloucester to Broke, in mid-northern NSW. It grows mostly on gentle slopes near drainage lines in alluvial and clayey soils, in open forest.	Unlikely No suitable habitat was present.
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i> Earp's Gum	TSC Act - V EPBC Act – V ROTAP – 2V	Occurs in woodland on sandy soils in wet sites. In the Port Stephens area, the Drooping Red Gum occurs in open wet sclerophyll woodland on heavy, often waterlogged, inter-barrier depression soils.	Unlikely No suitable habitat was present.
<i>Syzygium paniculatum</i> Magenta Lillypilly	TSC Act-E1 EPBC Act-V	Occurs in coastal rainforests on sandy soils or stabilised coastal dunes from Jervis Bay to Bulahdelah in NSW.	Unlikely No suitable habitat was present.
<i>Pterostylis gibbosa</i> Illawarra Greenhood	TSC Act-E1	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the	Unlikely No suitable habitat was present.

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE
	EPBC Act-E	Shoalhaven region (near Nowra). Occurs in open forest or woodland, on flat or gently sloping land with poor drainage. In the Hunter region, the species grows in open woodland dominated by <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark), <i>E. tereticornis</i> (Forest Red Gum) and <i>Callitris endlicheri</i> (Black Cypress Pine).	
<i>Euphrasia arguta</i>	TSC Act-E4A EPBC Act-CE	Found in sub humid open forest country around Bathurst and in meadows near rivers. Usually within shrub understory amongst mixed grasses.	Unlikely No suitable habitat was present. No local records.
<i>Asterolasia elegans</i>	TSC Act-E1 EPBC Act-E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys. The canopy at known sites includes <i>Syncarpia glomulifera</i> subsp. <i>glomulifera</i> (Turpentine), <i>Angophora costata</i> (Smooth-barked Apple), <i>Eucalyptus piperita</i> (Sydney Peppermint), <i>Allocasuarina torulosa</i> (Forest Oak) and <i>Ceratopetalum gummiferum</i> (Christmas Bush).	Unlikely No suitable habitat was present.
<i>Rutidosia heterogama</i> Wrinklewort	TSC Act – V EPBC Act – V	Dry sclerophyll forest and woodland, as well as heath, sand dunes and in disturbed areas such as roadsides. This species has been found on the Central Coast and Lower Hunter Valley, particularly around Cessnock.	Unlikely No suitable habitat was present.
<i>Thesium australe</i> Austral Toadflax	TSC Act-V EPBC Act-V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland or grassy woodland often found in damp sites in association with Kangaroo Grass (<i>Themeda australis</i>).	Unlikely No suitable habitat was present.
<i>Litoria aurea</i> Green and Golden Bell Frog	TSC Act-E1 EPBC Act-V	This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. <i>L. aurea</i> is thought to be displaced from more established sites by other frog species thus explaining its existence on disturbed sites.	Low-Moderate Suitable habitat was considered to be present within the waterbodies on site.
<i>Litoria littlejohni</i> Littlejohn's Frog	TSC Act-V EPBC Act-V	Habitats include wet and dry sclerophyll forest, coastal woodland and heath. Associated characteristics include rocky streams and sandstone outcrops, semi-permanent dams and slow flowing streams. The water quality required for breeding is usually tannic (pH 6.2) and contains detritus, which is used as anchors for egg clusters.	Unlikely No suitable habitat was present.
<i>Mixophyes balbus</i> Stuttering Frog	TSC Act-E1 EPBC Act-V	Occurs in wet forest regions of south-eastern Queensland, Eastern NSW and Victoria. In late spring, eggs are deposited among leaf litter	Unlikely No suitable habitat was available for this

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE
		on the banks of streams and subsequently are washed into the water during heavy rain.	species due to the lack of wet forest, deep litter and rocky streams.
<i>Oxyura australis</i> Blue-billed Duck	TSC Act-V	This duck is almost wholly aquatic, preferring deepwater in large permanent wetlands or dams where aquatic flora is abundant	Moderate Suitable habitat available within areas fringing the waterbodies.
<i>Botaurus poiciloptilus</i> Australasian Bittern	TSC Act-E1 EPBC Act-E	Favours permanent fresh-waters dominated by sedges, rushes, reeds or cutting grasses (eg. Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea and Gahnia).	Moderate Suitable habitat available within areas fringing the waterbodies.
<i>Rostratula australis</i> Australian Painted Snipe	TSC Act-E1 EPBC Act-E	Margins of swamps and streams, chiefly those covered with low and stunted vegetation.	Moderate Suitable habitat available within areas fringing the waterbodies.
<i>Gallinago hardwickii</i> <i>Latham's Snipe</i>	EPBC Act-M	Soft wet ground or shallow water with tussocks and other green or dead growth; wet parts of paddocks, dams; irrigated areas; scrub or open woodland from sea-level to alpine bogs over 2000m; 'samphire' on saltmarshes; mangrove fringes.	High - Recorded on site Suitable habitat available within vegetated areas fringing the waterbodies.
<i>Ephippiorhynchus asiaticus</i> Black-necked Stork	TSC Act-E1	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	Low Suitable transitory habitat was present within the waterbodies.
<i>Sternula albifrons</i> Little Tern	TSC Act-E1 EPBC Act-M	Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers. In NSW, it arrives from September to November, occurring mainly north of Sydney.	Unlikely No suitable habitat was present.
<i>Calidris ferruginea</i> Curlew Sandpiper	TSC Act-E1 EPBC Act-CE, M	In Australia, Curlew Sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one year old birds remain in Australia rather than migrating north. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms.	Low Marginal habitat was present around the larger waterbodies.
<i>Dasyornis brachypterus</i> Eastern Bristlebird	TSC Act-E1 EPBC Act-E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey.	Unlikely No suitable foraging or roosting habitats was present.
<i>Callocephalon fimbriatum</i> Gang Gang Cockatoo	TSC Act-V	Tall montane forests and woodlands in mature wet sclerophyll forests. Requires hollows in which to breed between October and January.	Unlikely No suitable foraging or roosting habitat was present.

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE
<i>Lathamus discolor</i> Swift Parrot	TSC Act-E1 TSC Act-E	Open Forest to Woodland, also street trees and in parks and gardens, winter flowering eucalypts for feeding. This species nests in Tasmania during the summer months.	Unlikely No suitable foraging habitat was present.
<i>Neophema pulchella</i> Turquoise Parrot	TSC Act - V	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Unlikely No suitable habitat was present.
<i>Glossopsitta pusilla</i> Little Lorikeet	TSC Act-V	Tall Open Forests, woodlands, orchards, parks and street trees.	Unlikely No suitable habitat was present.
<i>Epthianura albifrons</i> White-fronted Chat	TSC Act-V	Occurs mostly in the southern half of NSW, occurring in damp open habitats along the coast, and near waterways in the western part of the state.	Low Suitable habitat was present.
<i>Artamus cyanopterus cyanopterus</i> Dusky Woodswallow	TSC Act-V	The Dusky Woodswallow is found in open forests and woodlands, and may be seen along roadsides and on golf courses.	Low Marginal habitat was present.
<i>Melanodryas cucullata cucullata</i> Hooded Robin (south-eastern form)	TSC Act-V	Widespread across Australia, except in drier deserts and wetter coastal areas. Preferred habitat is lightly wooded country, open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats including mature eucalypts, saplings, small shrubs and a ground layer of tall native grasses.	Unlikely No suitable habitat was present.
<i>Petroica boodang</i> Scarlet Robin	TSC Act-V	Primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. This species lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Habitat usually contains abundant logs and fallen timber and these are important components of its habitat.	Unlikely No suitable habitat was present.
<i>Anthochaera phrygia</i> Regent Honeyeater	TSC Act-E4A EPBC Act-E	Temperate woodlands and open forest, including forest edges, preferring to forage on large-flowered Eucalypts.	Unlikely No suitable habitat was present.
<i>Daphoenositta chrysoptera</i> Varied Sittella	TSC Act-V	Open eucalypt woodland/forest, mallee, inland acacia, coastal tea-tree scrubs, golf courses, orchards and parks.	Unlikely No suitable habitat was present.
<i>Grantiella picta</i> Painted Honeyeater	TSC Act-V EPBC Act-V	Lives almost entirely on the berries of mistletoes thus its movements are regulated by the fruiting of mistletoe plants.	Unlikely No suitable habitat was present.
<i>Pomatostomus temporalis</i> subsp. <i>temporalis</i> Grey-crowned Babbler	TSC Act-V	Open forest, woodland, scrubland, farmland and outer suburbs. Prefers woodlands with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs.	Low Only marginal foraging and nesting/roosting habitat was present.

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE
<i>Chthonicola sagittata</i> Speckled Warbler	TSC Act-V	Lives in a wide range of eucalypt-dominated vegetation that typically includes scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. This species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast.	Unlikely No suitable habitat was present.
<i>*Erythroriorchis radiatus</i> Red Goshawk	TSC Act-CE EPBC Act-V	The species is very rare in NSW, it was at least occasionally reported as far south as Port Stephens. In NSW, preferred habitats include mixed subtropical rainforest, <i>Melaleuca</i> swamp forest and riparian <i>Eucalyptus</i> forest of coastal rivers.	Low Only marginal hunting habitat was present.
<i>Circus assimilis</i> Spotted Harrier	TSC Act-V	Occurs in grassy open woodland including mallee remnants, inland riparian woodland, grassland and shrub steppe. Most commonly inhabits native grassland, but also inhabits agricultural land and forages over open habitats including inland wetlands. Distributed widely throughout mainland Australia, excluding densely forested or wooded habitats of the coast.	Low Only marginal hunting habitat was present.
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	TSC Act-V EPBC Act-M	The White-bellied Sea-Eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. It also extends inland along some of the larger waterways, especially in eastern Australia. Considered to be a migratory species, however any movements are likely to be nomadic rather than migratory, in response to food availability.	Moderate The waterbodies contained suitable hunting habitat.
<i>Lophoictinia isura</i> Square-tailed Kite	TSC Act-V	Inhabits open forests and woodlands, particularly those on fertile soils with abundant passerines.	Low Only marginal hunting habitat was present.
<i>Ninox connivens</i> Barking Owl	TSC Act-V	This species is found in forest and woodland, encountered most commonly in savannah and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding.	Low Marginal hunting habitat was present.
<i>Ninox strenua</i> Powerful Owl	TSC Act-V	Inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the	Unlikely No suitable habitat was present.

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE
		ground.	
<i>Tyto novaehollandiae</i> Masked Owl	TSC Act-V	A range of wooded habitats that contain mature trees with large hollows for roosting and nesting, and more open areas for hunting.	Unlikely No suitable habitat was present.
<i>Apus pacificus</i> Fork-tailed Swift	EPBC Act-M	In NSW, the Fork-tailed Swift is recorded in all regions. Many records occur east of the Great Divide, however, a few populations have been found west of the Great Divide. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes.	Moderate Due to the non-specific habitat requirements of the Fork-tailed Swift habitat was considered to be present.
<i>Ardea alba</i> Great Egret	EPBC Act-M	Inhabits shallows of rivers, larger dams, freshwater wetlands and irrigation areas.	Moderate Foraging habitat present.
<i>Ardea ibis</i> Cattle Egret	EPBC Act-M	Inhabits stock paddocks, pastures, croplands, wetlands and drains.	High - Recorded on site.
<i>Calidris melanotos</i> Pectoral Sandpiper	EPBC Act-M	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Low The waterbodies contained suitable habitat.
<i>Numenius madagascariensis</i> Eastern Curlew	EPBC Act-M	Within Australia, the Eastern Curlew has a primarily coastal distribution. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.	Unlikely No suitable habitat was present.
<i>Numenius minutus</i> Little Curlew	EPBC Act-M	In New South Wales most records are scattered east of the Great Dividing Range, from Casino, south to Greenwell Point with a few scattered records west of the Great Dividing Range. The species prefers pools with bare dry mud (including mudbanks in shallow water) and they do not use pools if they are totally dry, flooded or heavily vegetated.	Low The waterbodies contained suitable habitat.
<i>Cuculus optatus</i> Oriental Cuckoo	EPBC Act-M	Mainly inhabits forests, occurring in coniferous, deciduous and mixed forest. It feeds mainly on insects and their larvae, foraging for them in trees and bushes as well as on the ground.	Unlikely No suitable habitat was present.
<i>Tringa nebularia</i> Common Greenshank	EPBC Act-M	Occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often	Unlikely No suitable habitat was present.

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELIHOOD OF OCCURRENCE ON SITE
		in round tidal pools, rock-flats and rock platforms.	
<i>Tringa stagnatilis</i> Marsh Sandpiper	EPBC Act-M	It is recorded in all regions of NSW but especially the central and south coasts and (inland) on the western slopes of Great Divide and western plains. The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks.	Low The waterbodies contained suitable habitat.
<i>Ardenna pacificus</i> Wedge-tailed Shearwater	EPBC Act-M	The Wedge-tailed Shearwater breeds on the east and west coasts of Australia and on off-shore islands. The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters.	Unlikely No suitable habitat was present
<i>Hirundapus caudacutus</i> White-throated Needletail	EPBC Act-M	Inhabits the airspace above forests, woodlands, farmlands, plains, lakes, coasts and towns.	Low Due to the non-specific habitat requirements of the Fork-tailed Swift habitat was considered to be present.
<i>Pandion cristatus</i> Eastern Osprey	TSC Act-V EPBC Act-M	Open and swamp forest adjacent to the coast or estuaries, fishing mainly in brackish or salt water.	Unlikely No suitable habitat was present.
<i>Merops ornatus</i> Rainbow Bee-eater	EPBC Act-M	Inhabits areas such as open woodlands with sandy soils, sandridges, riverbanks, beaches, dunes, cliffs and rainforests.	Low Suitable foraging habitat was present.
<i>Monarcha melanopsis</i> Black-faced Monarch	EPBC Act-M	Utilises a range of habitats including rainforests, eucalypt woodlands, coastal scrubs (Pizzey & Knight, 2001).	Unlikely No suitable habitat was present.
<i>Monarcha trivirgatus</i> Spectacled Monarch	EPBC Act-M	Wet forests, thickly wooded gullies, waterside vegetation and mangroves.	Unlikely No suitable habitat was present.
<i>*Motacilla flava</i> Yellow Wagtail	EPBC Act-M	An insectivorous bird inhabiting open country near water.	Low Suitable habitat around the watercourses
<i>Myiagra cyanoleuca</i> Satin Flycatcher	EPBC Act-M	Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves, drier woodlands and open forests.	Unlikely No suitable habitat was present.
<i>Rhipidura rufifrons</i> Rufous Fantail	EPBC Act-M	Utilises a range of habitats including rainforests, wet sclerophyll forests, monsoon forests, scrubs, mangroves, watercourses, parks and gardens. During migration this species also utilises farms, street trees and buildings (Pizzey & Knight, 2001).	Unlikely No suitable habitat was present.
<i>Dasyurus maculatus maculatus</i> Tiger Quoll	TSC Act-V EPBC Act-E	Inhabits sclerophyll forests, rainforests and coastal woodlands. Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby.	Unlikely No suitable habitat was present.

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	TSC Act-V	Sparsely distributed outside the semi-arid zone in dry sclerophyll forest and monsoonal forest and woodland.	Unlikely No suitable habitat was present.
<i>Phascolarctos cinereus</i> Koala	TSC Act-V EPBC Act-V	Coastal woodland and open forest containing suitable food trees.	Unlikely No suitable habitat was present.
<i>Petaurus norfolcensis</i> Squirrel Glider	TSC Act-V	Dry sclerophyll forests and woodlands with exudates for foraging and hollows for nesting.	Unlikely No suitable habitat was present.
<i>Petauroides Volans</i> Greater Glider	EPBC Act-V	The Greater Glider occurs in eucalypt forests and woodlands along the east coast of Australia from north-east Queensland to the Central Highlands of Victoria.	Unlikely No suitable habitat was present.
<i>Potorous tridactylus tridactylus</i> Long-nosed Potoroo	TSC Act-V EPBC Act-V	This species is known from a variety of habitats, including Rainforest, Open Forests and Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species.	Unlikely No suitable habitat was present.
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	TSC Act-E1 EPBC Act-V	Found in steep rocky sites in sclerophyll forests with a grassy understorey.	Unlikely No suitable habitat was present on site.
<i>Pseudomys novaehollandiae</i> New Holland Mouse	EPBC Act-V	Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes.	Unlikely No local records were present for this species.
<i>Pseudomys oralis</i> Hastings River Mouse	TSC Act-E1 EPBC Act-E	Lives in a variety of dry open forest and woodland types with dense low ground cover. Ideal ground cover ranges from 10 to 75cm and may consist of grass, sedge, rush or heath. Permanent shelter such as rocky outcrops, are important, as is access to seepage zones, creeks and gullies.	Unlikely No suitable habitat was present.
<i>Pteropus poliocephalus</i> Grey-headed Flying-Fox	TSC Act-V EPBC Act-V	Wet and Dry Sclerophyll Forests, Rainforest, Mangroves and Paperbark swamps and Banksia Woodlands.	Unlikely No suitable habitat was present.
<i>Mormopterus norfolkensis</i> Eastern Freetail-bat	TSC Act-V	This species appears to live in Sclerophyll Forests and Woodland. Roosts in tree hollows or under loose bark.	Moderate Only hunting habitat was present.
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	TSC Act-V	Inhabits sclerophyll forests and has been observed roosting in holes and hollow trunks of Eucalypts.	Moderate Only hunting habitat was present.
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	TSC Act-V	This microchiropteran bat species occupies a range of habitats including eucalypt forests, Mallee or open country. Roosts in tree hollows, animal burrows, dry clay cracks, under rock slabs and in abandoned Sugar Glider nests.	Low- Moderate Hunting habitat present, No preferred roosting habitat present.

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE ON SITE
<i>Miniopterus australis</i> Little Bentwing-bat	TSC Act-V	Tropical Rainforest to warm-temperate Wet and Dry Sclerophyll Forest; caves or similar structures for roosting.	High - Recorded on site. Only hunting habitat was present.
<i>Miniopterus schreibersii oceanensis</i> Large Bentwing-bat	TSC Act-V	Wet and Dry Tall Open Forest, Rainforest, Monsoon Forest, Open Woodland, Paperbark Forests and Open Grasslands; caves or similar structures for roosting. It occasionally uses tree hollows.	High - Recorded on site. Only hunting habitat was present.
<i>Myotis Macropus</i> Southern Myotis	TSC Act-V	Various habitats of the coast and adjacent ranges with suitable waterbodies for hunting; caves or similar structures for roosting. It occasionally uses tree hollows.	Moderate Preferred hunting habitat was present. No roosting habitat was present.
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	TSC Act-V	Tree-lined creeks, woodland/clearing ecotones and rainforest creeks, roosting mainly in tree hollows.	Low- Moderate Hunting habitat present, No preferred roosting habitat present.
<i>Vespadelus troughtoni</i> Eastern Cave Bat	TSC Act-V	The Eastern Cave Bat roosts in caves and occurs in wet/dry sclerophyll forests to the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally buildings.	Low- Moderate Hunting habitat present, No roosting habitat present.
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	TSC Act-V EPBC Act-V	This species has been found occupying Dry Sclerophyll Forest and Woodland. Roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels.	Unlikely No suitable habitat was present.

4.3 FAUNA APPRAISAL RESULTS

4.3.1 DIURNAL SURVEYS

Avifauna

The site was found to contain habitat for a number of avifauna species. Common native species recorded within the area of pasture/grassland included *Cracticus tibicen* (Magpie), *Grallina cyanoleuca* (Magpie-lark), *Cisticola exilis* (Golden-Headed Cisticola) and *Anthus novaseelandiae* (Australasian Pipit). A number of *Cecropis ariel* (Fairy Martin) were observed flying around the site. These Fairy Martins had constructed mud nests under the eaves of a residence over the southern boundary. Introduced birds encountered included *Acridotheres tristis* (Indian Myna) and *Sturnus vulgaris* (Common Starling)

A number of wetland birds were recorded in and around the waterbodies on site. These wetland birds included *Chenonetta jubata* (Australian Wood Duck), *Anas superciliosa* (Pacific Black Duck), *Anas gracilis* (Grey Teal), *Platalea regia* (Royal Spoonbill), *Egretta novaehollandiae* (White-faced Heron), *Pelecanus conspicillatus* (Australian Pelican) and *Gallinula tenebrosa* (Dusky Moorhen). Two wetland birds, *Gallinago hardwickii* (Latham's Snipe) and *Ardea ibis* (Cattle Egret) which are listed as migratory species under the National EPBC Act were also recorded with the site. These Migratory species have been addressed further in Section 9.0 of this report.

None of the species recorded are listed as threatened under state or national legislation.

Reptile Survey

No reptile species were observed on site during the field survey.

Mammal Survey

One native mammal *Macropus giganteus* (Eastern Grey Kangaroo) was observed on site during the site survey. Introduced mammals observed included *Mus musculus* (House Mouse) and *Oryctolagus cuniculus* (European Rabbit). A small number of *Ovis aries* (Sheep) and a *Equus caballus* (Horse) were also present within the site.

None of the mammal species recorded during diurnal surveys are listed as threatened under state or national legislation.

4.3.2 NOCTURNAL SURVEYS

Four species of microchiropteran bat, *Chalinolobus gouldii* (Gould's Wattle Bat), *Miniopterus australis* (Little Bentwing-bat), *Miniopterus schreibersii oceanensis* (Large Bentwing-bat) and *Austronomus australis* (White-striped Freetail Bat) were positively identified during the bat call survey. A number of calls ascribed to *Vespadelus* sp. and *Nyctophilus* sp. could not be identified to

species level due to the similarity between the calls within the genus. Calls attributed to the Genus *Nyctophilus* were likely to be either *Nyctophilus geoffroyi* (Lesser Long-eared Bat) or *Nyctophilus gouldi* (Gould's Long-eared Bat). Calls attributed to the Genus *Vespadelus* were either *Vespadelus darlingtoni* (Large Forest Bat) or *Vespadelus regulus* (Southern Forest Bat).

Two of these microchiropteran bat species; *M. australis* and *M. schreibersii oceanensis* are listed as vulnerable under the TSC Act (1995) and have been further assessed within Section 6.0 of this report.

Amphibian Survey

Three species of amphibian; *Litoria fallax* (Eastern Dwarf Tree Frog), *Litoria latopalmata* (Broad-palmed Frog) and *Litoria peronii* (Peron's Tree Frog) were recorded around the waterbodies on site. *Litoria fallax* was the most common species encountered. An additional species *Litoria caerulea* (Green Tree Frog) was heard calling over the eastern boundary during the survey. Other frog species expected to be on site are *Crinia signifera* (Common Eastern Froglet) and *Limnodynastes tasmaniensis* (Spotted Marsh Frog) which are known to be common within the area.

None of these amphibian species are listed as threatened under the NSW TSC Act 1995 or EPBC Act 1999.

4.3.3 SURVEY LIMITATIONS

As with all reports of this type the main survey limitation is considered to be the very short period of time in which the fieldwork was carried out. Limitations to the likelihood of detecting certain subject species were also encountered during this survey. Such limitations were generally related to the seasonal occurrence of species, be it as a result of known flowering periods for flora or migratory movements by fauna.

These limitations have been overcome by applying the precautionary principle in all cases where the survey methodology may have given a false negative result. This precautionary principle was achieved by recognising that most threatened species are rare and therefore unlikely to be encountered during a survey even if they may utilise the site at other times. These species have been assessed on the basis of the presence of their habitat and the likely significance of that habitat to a viable local population.

5.0 IMPACT ASSESSMENT

5.1 DIRECT IMPACTS

It is proposed that Lot 90 DP 785244 be subdivided into 34 residential lots. The subdivision will be positioned on the higher ground in the south-west of the site within the area of cleared pasture/grassland. No areas of significant vegetation or habitat will be directly impacted. The entire residential development will result in the direct removal of 3.9ha of pasture/grassland. Sediment and stormwater controls may be implemented within an area of pasture/grassland adjacent to the development in concurrence with Maitland City Council Guidelines.

5.2 INDIRECT IMPACTS

The proposal may result in the following indirect and potential impacts:

- Stormwater runoff carrying sediment and runoff into lagoon impacting water quality and Freshwater Wetland Vegetation;
- Increased spread of noxious weeds;

5.3 MITIGATION MEASURES

A number of mitigation measures have been specified to minimise the impact of the proposal. These measures will include:

Stormwater runoff carrying sediment and runoff

- Sediment control during construction - Sediments controls such as silt fences are to be employed during construction;
- Stormwater runoff after construction – Stormwater falling onto the proposed development footprint will be treated in concurrence with Maitland City Council Guidelines. This could include a bio-retention swale.
- It is recommended that all Noxious Weeds within the site be controlled as part of ongoing management.

6.0 CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

Considerations of the effects of the proposed development under the guidelines of Section 5A of the Environmental Planning and Assessment Act (1979) for the concerned threatened species is given below. The species dealt with are those identified during the fieldwork and those identified as having potential habitat available on site in Section 4.2.2 of this report.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on this threatened species, populations or ecological communities, or their habitats:

- 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.*

Threatened Flora

Despite targeted searches, no threatened flora species were recorded on site. As a result of the highly disturbed nature of the site no suitable habitat was considered to be present for any of the addressed threatened flora species, therefore the proposal is not likely to have a significant impact on the life cycle of these addressed flora species such a local population will be placed at risk of extinction.

Threatened Fauna

Two threatened fauna species *Miniopterus australis* (Little Bentwing-bat) and *Miniopterus schreibersii oceanensis* (Large Bentwing Bat) were recorded on site during the bat call survey. Suitable hunting habitat was present over the site for both *M. australis* and *M. schreibersii oceanensis*, however required roosting habitat in the form of caves and similar man-made structures was absent for both these species. Whilst possibly resulting in an incremental reduction in the quality of hunting habitat for *M. australis* and *M. schreibersii oceanensis* it is not likely that the proposal will have a significant impact on these microchiropteran bat species such that a local extinction would occur.

It is considered that foraging/hunting/nesting resources was available for 21 of the 44 remaining threatened species addressed.

<i>Litoria aurea</i>	Green and Golden Bell Frog
<i>Oxyura australis</i>	Blue-billed Duck
<i>Botaurus poiciloptilus</i>	Australasian Bittern
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork
<i>Calidris ferruginea</i>	Curlew Sandpiper
<i>Epthianura albifrons</i>	White-fronted Chat
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow
<i>Pomatostomus temporalis subsp. temporalis</i>	Grey-crowned Babbler

<i>Erythrotriorchis radiatus</i>	Red Goshawk
<i>Circus assimilis</i>	Spotted Harrier
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle
<i>Lophoictinia isura</i>	Squared-tailed Kite
<i>Ninox connivens</i>	Barking Owl
<i>Tyto novaehollandiae</i>	Masked Owl
<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat
<i>Myotis macropus</i>	Southern Myotis
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat
<i>Vespadelus troungtoni</i>	Eastern Cave Bat

Taking the habitat within the site and local records into consideration the most likely of these listed species to utilise the site would be those more mobile species such as a number of the addressed wetland birds and microchiropteran bats. The proposal will result in a small incremental reduction of highly disturbed grassland/pasture habitat for a small number of these fauna species. As the areas of aquatic habitat will remain *in-situ* the proposal is unlikely to disrupt the life cycle of the addressed threatened species such that local extinction would occur.

- 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.*

Two endangered populations are known to be present within the local area:

- *Cymbidium canaliculatum* (Tiger Orchid) – Population in the Hunter Catchment
- *Eucalyptus camaldulensis* (River Red Gum) – in the Hunter Catchment

No listed Endangered Populations were recorded within the site during the survey. No suitable habitat was present for *Cymbidium canaliculatum* due to the lack of suitable host trees. Marginal habitat was present for *Eucalyptus camaldulensis* around the periphery of the larger waterbodies.

The proposal is not likely to have an adverse effect on the life cycle of either *C. canaliculatum* or *E. camaldulensis* such that a viable local population is likely to be placed at risk of extinction.

- c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*
- 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*
 - is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

One Endangered Ecological communities were found to be present within the site, being:

- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast (2.73ha).

Due to the presence of a number of indicative flora species, lack of woody plants and connection to the greater Hunter River Floodplain the Freshwater Wetland Community occurring around the perimeter of the section of lagoon on site was found to be consistent with the Endangered Ecological Community Freshwater Wetlands on Coastal Floodplains of the NSW North Coast. The Endangered Ecological Community on site had been subject to high disturbance from prolonged grazing and trampling by livestock, changes to the natural movement of water (damming of sections of the larger waterbody to retain water) and weed incursion. The nature of the freshwater wetland on site would be dynamic and fluctuate with water level.

Residential development within the subdivision is proposed to be situated on the higher ground in the south of the site will not have any direct impact on lower areas of ground containing the Freshwater Wetland Community. Indirect impacts such as stormwater and nutrient runoff during and after construction have the potential to have some impact on this community. It is recommended that these secondary impacts be avoided wherever possible. Stormwater falling onto the proposed development footprint will be treated in concurrence with Maitland City Council Guidelines. This could include measures such as a bio-retention swale.

Taking the recommendations and the current disturbance of this EEC into consideration the proposal is unlikely substantially and adversely remove and modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

- d) *in relation to the habitat of a threatened species, population or ecological community:*
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*
 - (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*
 - (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.*

It is proposed that Lot 90 DP 785244 be subdivided into 34 residential lots. The subdivision will be positioned on the higher ground in the south-west of the site within the area of cleared pasture/grassland. The entire residential development will result in the direct removal of 3.9ha of pasture/grassland. No areas of significant vegetation or habitat will be directly impacted by the proposal. .

The proposal may result in the following indirect and potential impacts:

- Stormwater runoff carrying sediment and runoff;
- Increased in human presence;
- Increased spread of noxious weeds;

As the areas of the site proposed for development will be located on highly disturbed areas of the site which have been utilised for grazing for many years these indirect impacts are not likely to be significant. However taking into consideration the recommendations and the fact that areas of freshwater wetland habitat will remain *in-situ* on site no area of habitat important to the long-term survival of the species, population or ecological community in the locality is likely to be removed, modified, fragmented or isolated

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan under the TSC Act (1995) has been completed for the Red Goshawk and Large Forest Owls. Draft Recovery Plans have also been completed for the Large Forest Owls, Barking Owl, and Golden Bell Frog.

The objectives of the Green and Golden Bell Frog include:

- To avoid direct impacts and retain habitat;
- Minimise impacts where ever possible;
- Mitigate or ameliorate impacts; and as a last resort;
- Compensate or offset for any unavoidable impacts.

Given the lack of known key populations in the immediate locality and avoidance of suitable habitat areas it is considered that the proposal development will not significantly conflict with this draft recovery plan.

The main objective of the Recovery Plan for the Red Goshawk is to identify and protect any known habitat or nest sites that occur in NSW. The proposal is unlikely to significantly compromise this Recovery Plan.

The Recovery Plan for both the Large Forest Owls (Powerful and Masked Owl) and Barking Owl recommends that developments containing bushland protect nest and roost sites, patches of habitat and prey bases. The proposal is not likely to compromise either of these two Recovery Plans.

No Recovery Plan has been developed for the remaining addressed species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statements identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not conflict with the PAS for any of these species.

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.*

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed below in Table 6.

Table 6: Key Threatening Processes.

Key Threatening Process	Applicability in regards to the site
Clearing of Native Vegetation.	The proposal will not result in the removal of native vegetation from the site.
Loss of hollow-bearing trees	No hollow-bearing were present within the site.
Removal of dead wood and dead trees	No dead wood or trees were present within the site.
Invasion of native plant communities by exotic perennial grasses.	The majority of the site consisted of grassland/pastures largely composed of exotic perennial grasses. The proposal is unlikely to further exacerbate this threatening process.
Invasion, establishment and spread of <i>Lantana camara</i> .	No Lantana was recorded on site.
Invasion of native plant communities by African Olive <i>Olea europaea</i> subsp. <i>cuspidata</i>	Very small isolated, individual occurrences of African Olive were found within the site. It is recommended that African Olive be managed to prevent future infestation particularly if grazing is not continued over the remainder of the site.
Predation by <i>Gambusia holbrooki</i> (Plague Minnow):	This species of fish was found to be abundant within the larger waterbodies on site. The proposal is not likely to have any impact upon numbers of this introduced fish species.

Key Threatening Process	Applicability in regards to the site
Competition and grazing by the feral European Rabbit <i>Oryctolagus cuniculus</i> .	A small number of European Rabbits were found to be present within the site. The proposal is not likely to result in an increase in the number of this introduced species.
Predation by the European Red Fox <i>Vulpes vulpes</i> .	Paw prints consistent with the European Red Fox were observed within the site. The Red Fox would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
Predation by the Feral Cat <i>Felis catus</i> .	No Feral Cats were recorded within the site. This species would be likely to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in feral numbers of this introduced species.
Infection of native plants by <i>phytophthora cinnamomi</i> .	This infection is not known to occur on within the locality.
Infection of Frogs by amphibian chytrid fungus causing the disease chytridiomycosis.	It is possible that this fungus has an impact on frogs in the local area. The proposal is unlikely to increase infection from this fungus.
Forest Eucalypt dieback associated with over-abundant psyllids and bell miners.	No suitable habitat was present for this bird species.
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners <i>Manorina melanocephala</i> .	The Noisy Miner not recorded within the site during the survey. The proposal is unlikely to have any impact of local numbers of Noisy Miners.
Infection by <i>Psittacine circoviral</i> (beak and feather) disease affecting endangered <i>Psittacine</i> species.	No endangered <i>Psittacine</i> species were seen on site. The proposal is unlikely to increase infection by this disease.

7.0 AQUATIC ECOLOGY

7.1 DESCRIPTION OF AQUATIC ENVIRONMENT

Two larger waterbodies separated by a narrow man made section of land occupied 2.73ha of the lower ground in the north-eastern portion of the site. These bodies of water were also associated and formed part of a much larger Lagoon (approximately 10ha) to the north of the site. This lagoon was connected to the Hunter River approximately 500m to the north-east of the site. During times of flooding additional water from the Hunter Rivers flood the lagoon and back up into the site. Under the Water Act 2000 the lagoon is classed as a secondary order watercourse requiring a buffer of 20m (Figure 3). To ephemeral first order watercourses were also present on the site. The eastern most watercourse was largely undefined on the ground and flowed directly into the section of lagoon on site. The western watercourse flowed into a small constructed dam on site. This watercourse flowed north-ward onto an adjacent property before entering the same lagoon offsite.

7.2 AQUATIC SURVEY & ASSESSMENT

7.2.1 WATER QUALITY

Water quality was assessed at two sites, within the Lagoon on site. Physical water quality measurements were sampled in situ at each site. Water quality was measured using a Horiba U 50 Water Meter. Parameters measured included temperature, pH, Oxidation Reduction Potential (ORP), Dissolved Oxygen (mg/L DO), Dissolved Oxygen (DO%), Conductivity (dS/m), Turbidity TDU, Total Dissolved Solids (TDS) and Salinity. The water parameters are shown in Table 7.

Table 7: Water quality measurements

Water parameter	Area A	Area B
Temperature 0C	25.72	24.48
pH	8.83	7.40
Oxidation Reduction Potential (ORP) pHmV	-65	-32
Conductivity (ms/cm)	0.300	0.221
Turbidity TDU	258	270
Dissolved Oxygen (mg/L DO)	7.71	6.27
Dissolved Oxygen (DO%),	96.1	76.4
Total Dissolved Solids g/L TDS	0.197	0.144
Salinity ppt	0.1	0.1

Despite the turbidity being elevated the physical water quality was found to be in relatively good condition.

7.2.2 AQUATIC VERTEBRATE SPECIES

The section of Lagoon on site would suitable habitat for a number of species of fish, amphibians and aquatic reptiles (turtles). No targeted surveys were conducted for aquatic fauna. With the exception of amphibians which are dealt with in Section 4.3.2, species recorded as a result of incidental observations were the native species *Anguilla reinhardtii* (Long-finned Eel) and introduced species *Cyprinus carpio* (Carp) and *Gambusia holbrooki* (Gambusia).

8.0 CONSIDERATIONS UNDER SEPP 44 – ‘KOALA HABITAT PROTECTION’

The principal aim of State Environment Planning Policy 44 - Koala Habitat Protection is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and to reverse the current trend of Koala population decline.

This policy applies to areas of more than one hectare or an area which has together with any adjoining land in the same ownership an area of more than 1 hectare, whether or not the development application applies to the whole, or only part of the land. In addressing SEPP44 there are two questions to be considered regarding the occurrence of ‘Potential’ and ‘Core’ Koala Habitat on site.

8.1 FIRST CONSIDERATION - IS THE LAND ‘POTENTIAL KOALA HABITAT’?

‘Potential Koala Habitat’ is defined in SEPP44 as, “...an area of native vegetation where trees of the type listed in Schedule 2 (Koala feed tree species) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component”.

No preferred Koala tree species were present on site, therefore the site would not constitute ‘Potential Koala Habitat’ and accordingly no further provisions of this policy apply to the site.

9.0 CONSIDERATIONS UNDER THE COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999. Assessments have been made to determine whether or not the proposal or activity has, will have, or is likely to have a significant impact on a matter of National Environmental Significance. The matters of National Environmental Significance and the appropriate responses are listed below:

- *World Heritage properties;*

The site is not affected by World Heritage listing, nor is it likely to impact upon any World Heritage area.

- *wetlands recognised under the Ramsar convention as having international significance;*

The study area occurs within 10km of the Hunter Estuary Wetlands Ramsar site. The proposed project is not likely to have a significant impact on this Ramsar site.

- *listed threatened species and communities;*

Two nationally threatened ecological communities were recorded on the DoE database as occurring or having potential habitat within 10km of the site, these being:

- Central Hunter Valley eucalypt forest and woodland
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Under the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (DEWHA, 2009) an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- reduce the extent of an ecological community;
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- adversely affect habitat critical to the survival of an ecological community;
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting;
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established, or – causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or
- interfere with the recovery of an ecological community.

No nationally listed endangered ecological communities were found to be present within the site.

Thirty-one nationally threatened species were recorded on the OEI database as occurring within 10km of the site or on the DoE database as having potential habitat available within 10km of the site, these being:

<i>Tetratheca juncea</i>	Black-eyed Susan
<i>Acacia bynoeana</i>	Bynoe's Wattle
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small Flowered Grevillea
<i>Eucalyptus glaucina</i>	Slaty Red Gum
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>	Earp's Gum
<i>Syzygium paniculatum</i>	Magenta Lillypilly
<i>Pterostylis gibbosa</i>	Illawarra Greenhood
<i>Euphrasia arguta</i>	
<i>Asterolasia elegans</i>	
<i>Dichanthium setosum</i>	Bluegrass
<i>Thesium australe</i>	Austral Toadflax
<i>Litoria aurea</i>	Green and Golden Bell Frog
<i>Mixophyes balbus</i>	Stuttering Frog
<i>Botaurus poiciloptilus</i>	Australasian Bittern
<i>Rostratula australis</i>	Australian Painted Snipe
<i>Calidris ferruginea</i>	Curlew Sandpiper
<i>Dasyornis brachypterus</i>	Eastern Bristlebird
<i>Lathamus discolor</i>	Swift Parrot
<i>Anthochaera phrygia</i>	Regent Honeyeater
<i>Grantiella picta</i>	Painted Honeyeater
<i>Erythrorhynchus radiatus</i>	Red Goshawk
<i>Numenius madagascariensis</i>	Eastern Curlew
<i>Dasyurus maculatus maculatus</i>	Tiger Quoll
<i>Phascogale cinerea</i>	Koala
<i>Petaurista volans</i>	Greater Glider
<i>Potorous tridactylus tridactylus</i>	Long-nosed Potoroo
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby
<i>Pseudomys novaehollandiae</i>	New Holland Mouse
<i>Pseudomys oralis</i>	Hastings River Mouse
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat

Under the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (DEWHA, 2009) an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

No nationally threatened species were recorded within the site during the survey. Suitable habitat within the site was limited to those species that utilise disturbed open areas and waterbodies/wetlands. All nationally listed species that were considered to have potential habitat on site have been addressed under the provisions of state legislation (ie: Section 5A of the NSW Environmental Planning and Assessment Act 1979). As stated within Section 6.0, the proposal is unlikely to have any significant impact on these nationally listed threatened species.

- *migratory species protected under international agreements;*

Eighteen nationally listed migratory species were recorded on the DoE on-line database as occurring or having potential habitat available within 10km of the study area, these being:

Migratory Terrestrial Species:

- *Cuculus optatus* (Oriental Cuckoo)
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle)
- *Hirundapus caudacutus* (White-throated Needletail)
- *Merops ornatus* (Rainbow Bee-eater)
- *Monarcha melanopsis* (Black-faced Monarch)
- *Monarcha trivirgatus* (Spectacled Monarch)
- *Motacilla flava* (Yellow Wagtail)
- *Myiagra cyanoleuca* (Satin Flycatcher)
- *Rhipidura rufifrons* (Rufous Fantail)

Migratory Wetland Species:

- *Ardea alba* (Great Egret)
- *Ardea ibis* (Cattle Egret)
- *Calidris ferruginea* (Curlew Sandpiper)
- *Gallinago hardwickii* (Latham's Snipe)
- *Rostratula benghalensis* (Painted Snipe)
- *Numenius madagascariensis* (Eastern Curlew)
- *Pandion haliaetus* (Osprey)
- *Tringa nebularia* (Common Greenshank)

Migratory Marine Birds

- *Apus pacificus* (Fork-tailed Swift)

Under the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (Department of the Environment, Water, Heritage and the Arts, 2009) an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or
- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Two listed migratory species, the Cattle Egret and Latham's Snipe were recorded within the site during fieldwork.

Ardea ibis (Cattle Egret)

A small number of specimens of Cattle Egret were observed within the area of pasture/grassland within the site.

Gallinago hardwickii (Latham's Snipe)

Individual specimens of Latham's Snipe were recorded around the larger waterbodies of the site on a number of occasions.

Considering the relative commonality of these two migratory species within local area and the relatively small direct and indirect impact on habitat in the locality it is unlikely that these species or any of the listed migratory species would be significantly impacted by the proposal.

- *nuclear activities;*

The proposal does not involve any type of nuclear activity.

- *the Commonwealth marine environment;*

The proposal does not involve the modification of the Commonwealth marine environment.

10.0 RECOMMENDATIONS

The recommendations given in the report have been listed here along with a brief discussion of their implementation:

Sediment control during construction

Structures such as sediment fences are to be put in place around the proposal during construction to prevent sediment entering sensitive areas of habitat within and outside the site.

Stormwater runoff after construction

Stormwater falling onto the proposed development footprint will be treated in concurrence with Maitland City Council Guidelines. This could include measures such as a bio-retention swale.

Noxious Weeds

It is recommended that all Noxious Weeds within the site be controlled as part of ongoing management.

11.0 CONCLUSION

Flora, fauna and habitat studies have been undertaken for a proposed residential development at Lot 90 DP 785244 Anambah Road, Anambah NSW.

The 22.86ha site (Lot 90 DP 785244) was located on the eastern side of Anambah Road, Anambah. Relatively recent residential development bordered the site to the south and east, and farmland was present to the north and west. The topography of the site consists of rolling low hills. Two larger waterbodies separated by a narrow man made section of land occupied 2.73ha of the lower ground in the north-eastern portion of the site. These bodies of water formed part of a lagoon (approximately 10ha in area) to the north which was connected to the Hunter River. A residence and associated infrastructure such as sheds was present in the far west of the site along Anambah Road.

The site has been historically developed for agriculture and has been subject to past and ongoing grazing for a long period of time. This has resulted in the removal of all native woodland vegetation from within the site. The majority site consisted of pasture/grassland primarily composed of introduced grass species. A number of native flora species such as sedges and rushes were present around the periphery of the section of lagoon on site. A smaller constructed dam present in the west of the site was also fringed by aquatic flora species.

A total of three vegetation communities were found to be present within the site.

- Open Grassland/Pasture (19.96ha)
- Freshwater Wetland (2.73ha)
- Small Constructed Dam – Aquatic Vegetation (0.15ha)

Due to the presence of a number of indicative flora species, lack of woody plants and connection to the greater Hunter River Floodplain the Freshwater Wetland Community occurring around the perimeter of the section of lagoon on site was found to be consistent with the Endangered Ecological Community Freshwater Wetlands on Coastal Floodplains of the NSW North Coast. The Endangered Ecological Community on site had been subject to high disturbance from prolonged grazing and trampling by livestock, weed incursion and changes to the natural movement of water.

The residential development which is proposed to be situated on the higher ground in the south of the site will not have any direct impact on lower areas of ground containing the Freshwater Wetland Community. Indirect impacts such as stormwater and nutrient runoff during and after construction have the potential to have some impact on this community. It is recommended that these secondary impacts be avoided wherever possible.

No threatened flora species were recorded on site. As a result of the highly disturbed nature of the site no suitable habitat was considered to be present for any of the addressed threatened flora species, therefore the proposal is not likely to have a significant impact on the life cycle of these addressed flora species such a local population will be placed at risk of extinction.

Two threatened fauna species *Miniopterus australis* (Little Bentwing-bat) and *Miniopterus schreibersii oceanensis* (Large Bentwing Bat) were recorded on site during the bat call survey. Suitable hunting habitat was present over the site for both *M. australis* and *M. schreibersii oceanensis*, however required roosting habitat in the form of caves and similar man-made structures was absent for both these species. Whilst possibly resulting in an incremental reduction in the quality of hunting habitat for *M. australis* and *M. schreibersii oceanensis* it is not likely that the proposal will have a significant impact on these microchiropteran bat species such that a local extinction would occur.

It is considered that foraging/hunting/nesting resources was available for 21 of the 44 remaining threatened fauna species addressed. Taking the habitat within the site and local records into consideration the most likely of these listed species to utilise the site would be those more mobile species such as a number of the addressed wetland birds and microchiropteran bats. The proposal will result in a small incremental reduction of highly disturbed grassland/pasture habitat for a small number of these fauna species. As the areas of aquatic habitat will remain *in-situ* the proposal is unlikely to disrupt the life cycle of the addressed threatened species such that local extinction would occur.

EPBC Act (1999)

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999). No nationally listed communities or threatened species were recorded on site. Two nationally listed migratory species, the Cattle Egret and Latham's Snipe were recorded within the site during fieldwork. The proposal is unlikely to have a significant impact on either of these two bird species.

In conclusion the proposed subdivision will only result in the direct removal of highly disturbed habitat in the form of pasture/grassland. Provided the recommendations have been implemented to avoid indirect impacts the proposal is unlikely to impact an area of habitat important to the long-term survival of the addressed EECs, endangered populations or threatened flora and fauna in the locality.

12.0 BIBLIOGRAPHY

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APPENDIX A

FLORA LIST

Introduced species are indicated by an asterisk (“*”).

The following standard abbreviations are used to indicate subspecific taxa:

- subsp.** - subspecies
- var.-** variety
- x -** hybrid between the two indicated species

Threatened Species Conservation Act 1995 (TSC Act)

- V** Vulnerable
- E1** Endangered
- E2** Endangered Population
- E4A** Critically Endangered Population

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

- V** Vulnerable
- E** Endangered
- CE** Critically Endangered

ROTAP (Rare or Threatened Australian Plants)

Distribution

- 1.** – Known from only one collection
- 2.** – Geographic range in Australia less than 100km
- 3.** – Geographic range in Australia greater than 100km.
- +** - Also occurs overseas.

Conservation Status

- E.** – Endangered. Species at risk of disappearing from the wild within 20 years.
Includes populations of 100 or less individual plants.
- V.** – Vulnerable. Species not presently endangered, but at risk over 20-50 years.
- R.** – Rare in Australia, but not currently under threat. Includes species within a very restricted area or small populations over a wide range.
- K.** – Poorly known. Accurate knowledge is inadequate.
- C.** – Reserved. The species has at least one population within a national park or other reserve.

Size of Reserved Populations

- a.** – 1000 plants or more known within a conservation reserve.
- i.** – Less than 1000 plants known within a conservation reserve.
- - Reserved population size not accurately known.
- t** - Total known population reserved.

National Parks and Wildlife Act 1974 - Schedule 13 Protected Native Plants

- 1** Group 1
- 2** Group 2
- 3** Group 3
- 4** Group 4
- 5** Group 5

Regional Significance (Hunter Rare Plants Database – Version 1 2003)

- L** endemic to Hunter Region
- DA** disjunct in the Hunter Region, rare or localized (aggregated)
- DB** disjunct in the Hunter Region, widespread and uncommon (broad)
- R** rare but extends beyond the Hunter Region
- U** everywhere uncommon
- N** at northern distributional limit in the Hunter
- E** at eastern distributional limit in the Hunter
- S** at southern distributional limited in the Hunter
- W** at western distributional limited in the Hunter
- T** may be threatened in the Hunter Region
- S** Probably secure in the Hunter Region

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	NPW ACT	REGIONALLY SIGNIFICANT	FLOWERING PERIOD
CLASS FILICOPSIDA (Ferns)							
Salviniaceae							
<i>Azolla filiculoides</i>							
MAGNOLIOPSIDA: Magnoliidae							
LILOPSIDA: (Monocotyledons)							
Cyperaceae							
<i>Bolboschoenus caldwellii</i>							Summer – Spring
<i>Cyperus brevifolius</i>	Mullumbimby Couch						Spring-Summer
<i>Cyperus difformis</i>	Dirty Dora						Summer – Spring
* <i>Cyperus eragrostis</i>	Umbrella Sedge						Spring - Summer
<i>Cyperus exaltatus</i>							Spring – Summer
<i>Cyperus polystachyos</i>							Summer – Spring
<i>Eleocharis sphacelata</i>							
<i>Schoenoplectiella mucronata</i>							Spring – Summer
<i>Schoenoplectus validus</i>							
Iridaceae							
<i>Moraea setifolia</i>	Thread Iris						September-November
<i>Romulea rosea</i> var. <i>australis</i>	Onion Grass						August - November
Juncaceae							
<i>Juncus usitatus</i>							Spring-Summer
Poaceae							
* <i>Axonopus fissifolius</i>	Narrow-Leafed Carpet Grass						
* <i>Bothriochloa macra</i>	Red-Leg Grass						Summer
* <i>Bromus catharticus</i>	Prairie Grass						Spring
* <i>Bromus molliformis</i>	Soft Brome						Spring
* <i>Pennisetum clandestina</i>	Kikuyu Grass						Summer
* <i>Chloris gayana</i>	Rhodes Grass						Summer
<i>Panicum effusum</i>	Hairy Panic						Summer
* <i>Paspalum dilatatum</i>	Paspalum						
* <i>Paspalum distichum</i>	Water Couch						
* <i>Paspalum urvillei</i>	Vasey Grass						
* <i>Setaria pumila</i>	Pale Pigeon Grass						
* <i>Sporobolus creber</i>	Western Rat-tail Grass						

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	NPW ACT	REGIONALLY SIGNIFICANT	FLOWERING PERIOD
<i>*Stenotaphrum secundatum</i>	Buffalo Grass						Summer
MAGNOLIIDAE (Dicotyledons)							
Apiaceae							
<i>Cyclospermum leptophyllum</i>	Slender Celery						
Apocynaceae							
<i>*Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush						
Asteraceae							
<i>*Aster subulatus</i>	Bushy Startwort						Winter
<i>*Carthamus lanatus</i>	Saffron Thistle						November - December
<i>*Centaurea calcitrapa</i>	Star Thistle						
<i>*Cirsium vulgare</i>	Spear Thistle						November - January
<i>*Conyza bilbaoana</i>	Fleabane						
<i>*Gamochaeta americana</i>	Cudweed						October - January
<i>*Hypochaeris glabra</i>	Smooth Catsear						Spring - Autumn
<i>*Hypochaeris radicata</i>	Flatweed						Spring - Autumn
<i>*Taraxacum officinale</i>	Dandelion						
Casuarinaceae							
<i>Casuarina glauca</i>	Swamp Oak						
Fabaceae Subfamily (Caesalpinioideae)							
Fabaceae Subfamily (Faboideae)							
<i>Trifolium campestre</i>	Hop Clover						
<i>Trifolium repens</i>	White Clover						
Gentianaceae							
<i>Centaureum erythraea</i>	Common Centaury						
Lobeliaceae							
<i>Pratia concolor</i>	Poison Pratia						

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	NPW ACT	REGIONALLY SIGNIFICANT	FLOWERING PERIOD
Malvaceae							
<i>Modiola caroliniana</i>	Red-flowered Mallow						
Oleaceae							
* <i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive						
Onagraceae							
<i>Ludwigia peploides</i>	Water Primrose						Summer and Autumn
Oxalidaceae							
* <i>Oxalis corniculata</i>							September - April
Plantaginaceae							
* <i>Plantago lanceolata</i>	Lambs Tongues						
Polygonaceae							
<i>Persicaria decipiens</i>	Slender Knotweed						
* <i>Polygonum aviculare</i>	Wireweed						
* <i>Rumex crispus</i>	Curled Dock						
Ranunculaceae							
<i>Ranunculus inundatus</i>	River Buttercup						Spring - Summer
Solanaceae							
* <i>Solanum nigrum</i>	Black-berry Nightshade						
Verbenaceae							
* <i>Verbena bonariensis</i>	Purpletop						October-January
* <i>Verbena rigida</i>	Veined Verbena						

APPENDIX B

FAUNA LIST

FAUNA LIST

Family sequencing and taxonomy follow for each fauna class:

Herpetofauna

Cogger (2000), Ehmann (Ed) (1997) and Barker, Grigg and Tyler (1995).

Birds

Pizzey and Knight (2012)(9th edn).

Mammals - Van Dyck & Strahan (Ed) (2008) and Churchill (2008).

Churchill, S. (2008). *Australian Bats*. (2nd edn.). Allen & Unwin Australia.

(?) - Indicates a species identified without certainty or to a Genus level only.

* - Indicates an introduced species.

The following symbols are used to indicate species recorded during previous surveys.

@ - Previous record (Wildthing Environmental Consultants, 2008a)

Threatened species addressed within this assessment appear in **bold** font.

Introduced species are indicated by an asterisk (*).

The following standard abbreviations are used to indicate subspecific taxa:

subsp. -subspecies

var.- variety

x - hybrid between the two indicated species

Threatened Species Conservation Act 1995 (TSC Act)

V Vulnerable

E1 **Endangered**

E2 Endangered Population

E4A Critically Endangered Population

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

V **Vulnerable**

E **Endangered**

CE **Critically Endangered Population**

M **Migratory**

Regionally Significant Fauna Species.

+ Region includes Gosford, Wyong, Cessnock, Maitland, Lake Macquarie, Newcastle and Port Stephens LGA's. Produced from Stage 1 of the LHCCREMS – Regional Biodiversity Conservation Strategy.

Observation Type

O - Observed (sighted)

W - Heard call

OW – Observed and heard call

X - In scat

P – Scat

T - Trapped or netted

H – Hair, feathers or skin

A - Stranded/Beached

G – Crushed cones

R – Road Kill

D – Dog Kill

Q – Camera

C – Cat Kill

V – Fox Kill

K – Dead

S – Shot

I – Fossil/subfossil

FB – Burrow

F – Tracks, scratching

Z – In raptor/owl Pellet

U – Ultrasonic recording

M - Miscellaneous

E – Nest/roost

B - Burnt

Y – Bones, teeth or shell

N – Not located

AR – Acoustic Recording

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	REGIONALLY SIGNIFICANT	OBSERVATION TYPE
Phylum - Chordata					
Subphylum - Vertebrata					
Class - Actinopterygii					
Order Anguilliformes					
Family Anguillidae					
<i>Anguilla reinhardtii</i>	Long-finned Eel				
Order Cypriniformes					
Family Cyprinidae					
* <i>Cyprinus carpio</i>	Carp				O
Order Cyprinodontiformes					
Family Poeciliidae					
* <i>Gambusia holbrooki</i>	Mosquitofish				O
Class Amphibia - Amphibians					
Order Salientia – Frogs					
Family Hylidae - Tree Frogs					
<i>Litoria fallax</i>	Eastern Dwarf Tree Frog				O,W
<i>Litoria latopalmata</i>	Broad-palmed Frog				O
<i>Litoria peronii</i>	Peron's Tree Frog				W

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	REGIONALLY SIGNIFICANT	OBSERVATION TYPE
Class Aves –					
Order Ornithurae - Birds					
Family Anatidae - Ducks, Swans and Geese					
<i>Anas castanea</i>	Chestnut Teal				O
<i>Anas gracilis</i>	Grey Teal				O
<i>Anas superciliosa</i>	Pacific Black Duck				
<i>Chenonetta jubata</i>	Australian Wood Duck				O
Family Columbidae - Pigeons, Doves					
* <i>Streptopelia chinensis</i>	Spotted Turtle-Dove				O
Family Pelecanidae - Pelicans					
<i>Pelecanus conspicillatus</i>	Australian Pelican				
Family Ardeidae - Herons, Egrets and Bitterns					
<i>Ardea ibis</i>	Cattle Egret		M		O
<i>Egretta novaehollandiae</i>	White-faced Heron				
Family Phalacrocoracidae – Cormorant					
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant				O
Family Threskiornithidae - Ibises and Spoonbills					
<i>Platalea regia</i>	Royal Spoonbill				O
Family Rallidae					
<i>Gallinula tenebrosa</i>	Dusky Moorhen				
Family Scolopacidae					
<i>Gallinago hardwickii</i>	Latham's Snipe		M	+	O
Family Charadriidae Plover, Dotterels,					

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	REGIONALLY SIGNIFICANT	OBSERVATION TYPE
Lapwings					
<i>Vanellus miles</i>	Masked Lapwing				O
Family Cacatuidae - Cockatoos and Corellas					
<i>Cacatua tenuirostris</i>	Long-billed Corella				O
Motacillidae – Pipits & Wagtails					
<i>Anthus novaeseelandiae</i>	Australasian Pipit				O
Family Monarchidae - Monarchs, Flycatchers and Magpie-Lark					
<i>Grallina cyanoleuca</i>	Magpie-lark				O
Family Rhipiduridae – Fantails					
<i>Rhipidura leucophrys</i>	Willie Wagtail				O
Family Hirundinidae - Swallows and Martins					
<i>Cecropis ariel</i>	Fairy Martin				O
<i>Hirundo neoxena</i>	Welcome Swallow				O
Family Sylviidae - Old World Warblers					
<i>Cisticola exilis</i>	Golden-Headed Cisticola				
Family Artamidae - Wood-swallows, Butcherbirds, Magpie and Currawongs					
<i>Gymnorhina tibicen</i>	Australian Magpie				O
Family Corvidae - Crows, Raven					
<i>Corvus coronoides</i>	Australian Raven				O
Family Sturnidae - Starlings and Mynas					
<i>*Acridotheres tristis</i>	Indian Myna				O
<i>*Sturnus vulgaris</i>	Common Starling				O

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	REGIONALLY SIGNIFICANT	OBSERVATION TYPE
Class Mammalia - Mammals					
Order Dasyuromorphia – Carnivorous Marsupials					
Family Macropodidae - Kangaroos, Wallabies					
<i>Macropus giganteus</i>	Eastern Grey Kangaroo			+	P,F
Subclass Eutheria - Eutherian Mammals					
Order Chiroptera					
Suborder Megachiroptera - Megabats					
Family Molossidae - Freetail-bats					
<i>Austronomus australis</i> syn <i>Nyctinomus australis</i> , <i>Tadarida australis</i>	White-striped Freetail Bat				U
Family Vespertilionidae - Plain-nosed Bats					
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat				U
<i>Miniopterus australis</i>	Little Bentwing-bat	V			U
<i>Miniopterus schreibersii oceanensis</i>	Large Bentwing-bat	V			
<i>Nyctophilus</i> sp.	Gould's Long-eared Bat				
<i>Vespadelus darlingtoni</i> ?	Large Forest Bat				U
<i>Vespadelus regulus</i> ?	Southern Forest Bat			+	U
Order Rodentia					
Family Muridae – Rodents					
* <i>Mus musculus</i>	House Mouse				O
Order Lagomorpha					
Family Leporidae					
* <i>Oryctolagus cuniculus</i>	European Rabbit				O,P

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	REGIONALLY SIGNIFICANT	OBSERVATION TYPE
Order Carnivora					
Family Canidae					
* <i>Vulpes vulpes</i>	Red Fox				F
Order Perissodactyla					
Family Equidae					
* <i>Equus caballus</i>	Horse				O
Order Artiodactyla					
Family					
* <i>Bos Taurus</i>	Cattle				P,F
* <i>Ovis aries</i>	Sheep				O