Appendix H

Ecology Assessment

FLORA AND FAUNA IMPACT ASSESSMENT

PROPOSED RECYCLING FACILITY AT 80 THE WEIR ROAD, TERALBA

Prepared for
EDAW AECOM
(on behalf of Lake Macquarie City Council)

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1.0 INTRODUCTION

1.1 Background and Scope

This Flora and Fauna Impact Assessment Report has been prepared at the request of Natasha Mavlian of EDAW AECOM on behalf of the Lake Macquarie City Council. As part of the preparation of a development application to be assessed under Part 3A Major Projects for the development of a recycling facility at 80 The Weir Road Teralba, this report provides a specialist flora and fauna assessment of the potential ecological impacts of the proposed development. The proposal involves the construction of a recycling facility to be known as the Sustainability Resource Centre for the processing of construction and demolition waste. The proposed facility will process hard waste for resale and will include stockpile areas, an administration building, storage sheds, parking bays, surface water storage areas and a landscaped earth mound surrounding the facility.

These activities are hereafter referred to as the Proposal.

The general aims of this assessment are to:

- describe the existing biological environment of the study area in relation to flora and fauna;
- discuss the potential impacts of the proposal for any threatened species that occur or could be likely to occur in the subject site;
- provide discussion on measures to mitigate impacts.

The environmental studies have been conducted in three stages:

(a) the first stage being a review of available literature pertaining to the site and surrounding locality and preliminary habitat assessment of the study area;

(b) the second stage being the completion field surveys and habitat assessment for threatened species regarded as potential subject species, and surveys to investigate the inherent biological attributes of the study area; and

(c) the third stage being the assessment of impact of the proposal on flora and fauna in accordance with the relevant NSW and Commonwealth legislation and planning instruments.

Within this report, reference is given to the relevant sections of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); NSW *Threatened Species Conservation Act 1995* (TSC Act); *National Parks and Wildlife Act 1974* (NP&W Act); *Environmental Planning and Assessment Act 1979* (EP&A Act); and subsequent amendments to these. Specific consideration is given to Part 3A of the *EP&A Act* and the guidelines provided for threatened species assessment (former NSW Department of Environment and Conservation (DEC) (now Department of Environment, Climate Change and Water (DECCW)).

For this report,

- the *subject site* is defined as the land area potentially directly affected by the proposed development, and is shown as the area bounded by the yellow line in Figure 2 within Lots 42, 43, 54 and 53 DP16062;
- the *study area* consists of the subject site plus a 30m buffer zone beyond the defined boundary of the subject site; and
- the *study locality* is the area of land within a ten (10) kilometre radius of the centre of the subject site.

1.2 General Description of the Study Area and Study Locality

A broad description of the prominent natural and developed features of the study area and study locality is provided in **Table 1** below. The location of the study area within the study locality is shown in **Figure 1**.

Table 1. Description of the Study Area and Locality

Client	EDAW AECOM (on behalf of Lake Macquarie City Council)
Location	80 The Weir Road, Teralba Subject Site: within Lots 42, 43, 53 & 54 DP16062 Zone 56 371000E 6355000N (AGD66) Newcastle 1:100 000 9232 mapsheet
LGA	Lake Macquarie City Council
Zoning	9 - Natural Resources with small areas of 7(1) - Environmental Protection
Site Area	Approximately 7 ha
Bioregion	Sydney Basin
Botanical Subregion	North Coast
CMA	Hunter – Central Rivers
Study Locality Description	The study locality encompasses the outer suburbs of Newcastle and numerous urban residential areas at the northern end of Lake Macquarie including Teralba, Boolaroo, Argenton, Edgeworth, Fennell Bay, Fassifern and Warners Bay. Extractive industries (predominantly collieries and quarries) operate within the locality and large tracts of bushland occur in state forests and other public and private lands within the locality. Cockle Creek to the north of the study area drains most of the area.
Geology	The geology of the site is predominantly Cainozoic quaternary period gravel, sand, silt and clay (NSW Department of Mines 1995).
Elevation	Approx. 2m ASL
Subject Site Description	The site occurs on the floodplain of Cockle Creek to the north and is flat and low-lying. A major powerline easement passes east-west through the centre of the subject site. The subject site is cleared of native vegetation with the exception of a few isolated native trees in the north-western corner.
Current landuse and general condition	Grazing, mostly open and cleared for pasture, weedy.
Significant features	SEPP 14 wetland along eastern boundary of site Drainage channel surrounding the subject site and associated ponds/pools Electricity Easement through centre of site
Surrounding landuse	Surrounding landuse is mixed, comprising urban residential areas, quarries, collieries and associated infrastructure and works areas. A worm farm is situated to the east of the site. Bushland areas occur on private and public lands that are in the catchment for Cockle Creek which flows into Lake Macquarie.

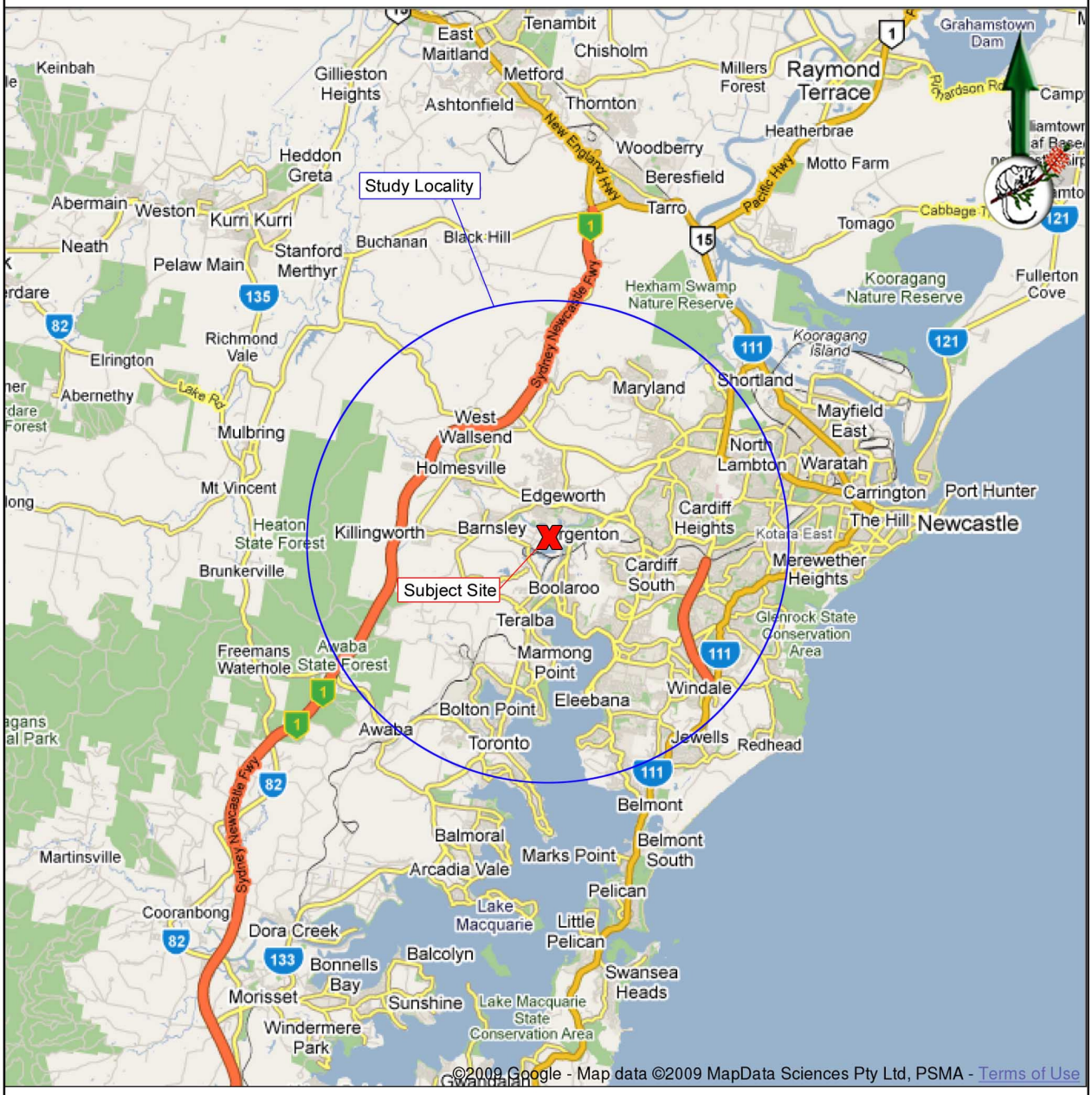
1.3 Description of the Proposal

The proposed recycling facility will be a crushing, grinding and separating operation for hard waste/ construction and demolition materials. The site will reprocess up to 200,000 tonnes per annum of hard waste material for resale. Materials including (but not limited to) concrete, asphalt, recycled asphalt pavement (RAP), road base, green waste, bricks, tiles and soil (from internal CiviLake sources only) will be received over a weigh bridge. Once on site, materials will be deposited into respective stockpiles to await reprocessing. Processing will vary for different feedstock, outputs and market availability.

Design features of the site include:

- A stock fence around the entire perimeter of the property, enclosing protected habitat areas as well as the proposed facility.
- A 1.5 m high bund wall surrounding the proposed facility to be planted with native vegetation. The bund wall will prevent water flows from entering or leaving the site, and the vegetation will assist in minimising airborne dust leaving the site. Retaining walls will be provided where practicable at the edge of the bund to protect a few threatened *Angophora inopina* trees along the western boundary of the site. The exact nature of these retaining walls will be confirmed in the detail design. A security fence will be constructed along the top of the bund wall.
- Stormwater from the site is treated to manage sediment, nutrients and other pollutants to meet best practice targets.
- The main storage pond is located at the northern end of the site, and has a normal water depth of approximately 1m. Following storm events, water is attenuated in the pond to a maximum depth of 3m. Discharge can occur from an outlet pipe when the pond water level rises and via a spillway when the pond capacity is exceeded. Water discharged from the main storage pond will follow an existing drainage pathway (man-made channels) through the downstream swamp forest and freshwater wetland communities and conveys flows into a SEPP14 wetland.
- Stormwater from the stockpile areas on site will be treated and stored in the main storage pond for reuse during operations with an estimated resultant 80% of operational water sourced from on site water ponds.
- Double story gatehouse to allow for visual screening of incoming loads.
- Incoming and outgoing weighbridge located approx 70m from the road verge to allow for truck queuing.
- Site offices and plant storage facilities with rain water tanks and truck wash bay.
- Entry off The Weir Road accessing the weighbridge.
- Product storage bays away from processing areas to avoid operational risks.

These features are shown in a plan of the proposed development in **Figure 2**



Base Map Source: Google Maps http://maps.google.com.au

0 5 10km

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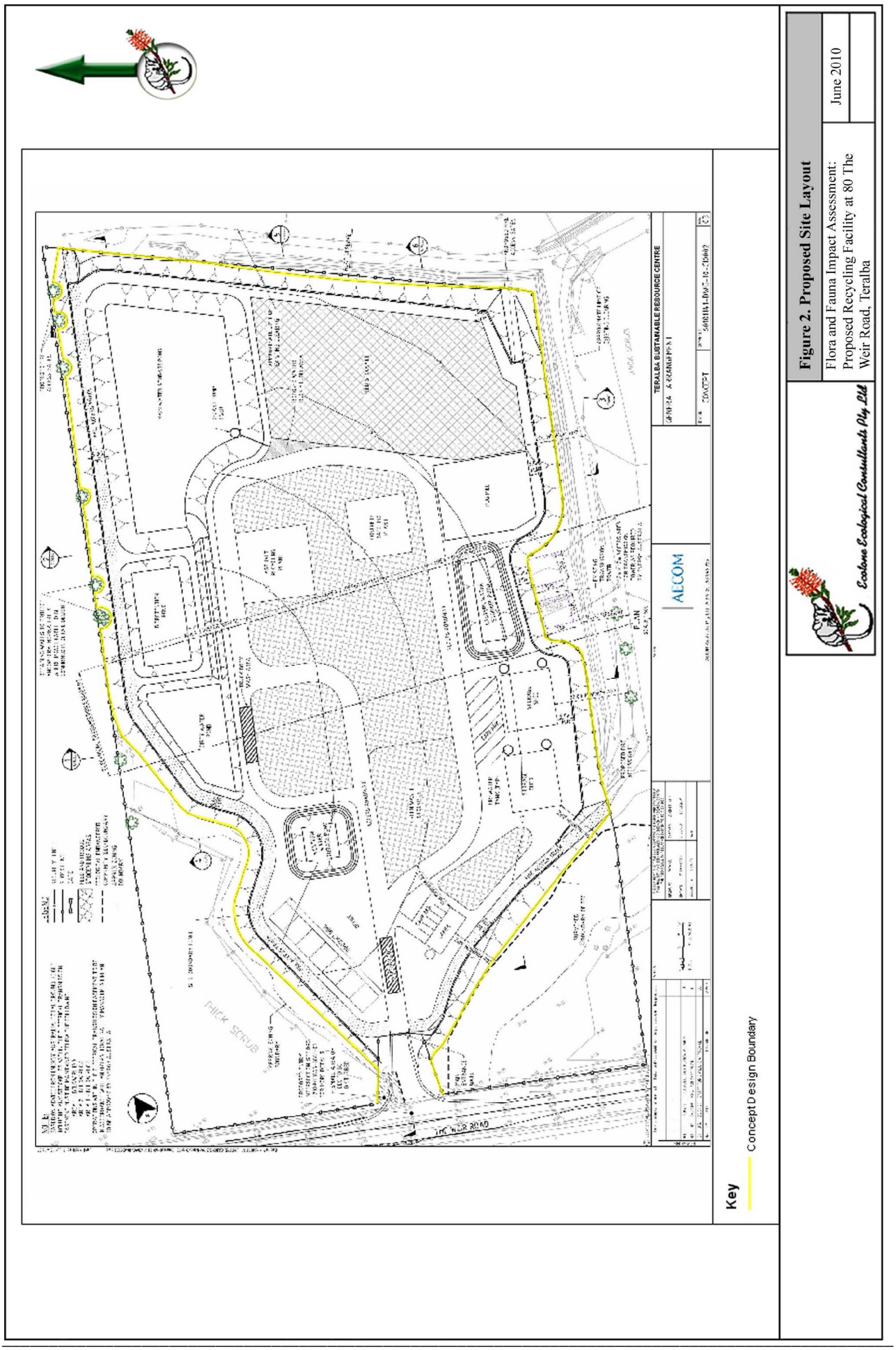
Figure 1. Study Locality

Flora and Fauna Impact Assessment: Proposed Recycling Facility at 80 The Weir Road, Teralba	June 2010


Key
Concept Design Boundary
THICK SCRUB
THE WEIR ROAD
TERALBA SUSTAINABLE RESOURCE CENTRE
AECOM
Figure 2. Proposed Site Layout
Flora and Fauna Impact Assessment:
Proposed Recycling Facility at 80 The Weir Road, Teralba
June 2010
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2.0 FIRST STAGE ECOLOGICAL INVESTIGATION – PRELIMINARY ASSESSMENT

2.1 Review of Local Threatened Species and Other Records

A review of the documented records of the locations of threatened flora and fauna species within the study locality has been undertaken. Threatened species records were accessed from the Department of Environment, Climate Change and Water (DECCW) Atlas of NSW Wildlife Database for the Newcastle (9232) and Lake Macquarie (9231) 1: 100 000 map sheets (updated to July 2009).

2.1.1 Flora

2.1.1.1Rare or Threatened Flora

From the review, a total of 16 rare or threatened flora species have previously been recorded within the study locality. These are listed in **Table 2** below. Ten of these are listed as vulnerable species by the NSW TSC Act, of which all but two (*Callistemon linearifolius* and *Epacris purpurascens* var. *purpurascens*) are also listed as vulnerable in the Commonwealth EPBC Act. Four additional species are not protected under State or Commonwealth legislation but are listed under the national database known as ROTAP *Rare or Threatened Australian Plants* (Briggs & Leigh 1996).

Table 2. Rare or Threatened Flora Previously Recorded Within the Study Locality

Scientific Name	Common Name	Status (TSC)	Status (EPBC)	ROTAP Risk Code	Earliest / latest record	Number of records within 10km of site	Number of records within 2.5km of site
THREATENED SPECIES							
Angophora inopina	Charmhaven apple/ scrub apple	V	V	-	1999-2007	19	15
Callistemon linearifolius	netted bottle brush	V	-	2RCi	2004-2006	3	1
Cynanchum elegans	white-flowered wax plant	E1	E	3ECi	1995-2001	1	0
Diuris praecox	rough doubletail	V	V	2VC-	2007-2008	8	0
Epacris purpurascens var. *purpurascens*	-	V	-	2KC-	2006	1	0
Eucalyptus camfieldii	heart-leaved stringybark	V	V	2VCi	1998	1	0
Grevillea parviflora subsp. *parviflora*	small-flower grevillea	V	V	-	2002-2008	16	0
Melaleuca biconvexa	biconvex paperbark	V	V		2007	2	0
Rutidosis heterogama	heath wrinklewort	V	V	2VCa	2006	1	0
Syzygium paniculatum	magenta lilly pilly	V	V	3RCi	1998-2007	3	0
Tetratheca juncea	black-eyed Susan	V	V	3VCi	1899-2008	484	3
Zannichellia palustris	-	E1	-	3R	1971-2006	4	0
ROTAP ONLY SPECIES							
Arthrochilus prolixus	-	P13	-	2K	2002	1	0
Eucalyptus fergusonii subsp. *dorsiventralis*	-	U	-	2RC-	2005	1	0
Eucalyptus fergusonii subsp. *fergusonii*	-	U	-	3KC-	1997-2000	2	0
Macrozamia flexuosa	-	P13	-	2K	1997-2005	11	1

Notes on Table 2:
371000 E and 6355000 N are the closest rounded coordinates to the study area centre (Newcastle 9232 and Lake Macquarie 9231 1:100 000 mapsheets Grid 56 AGD66). Nomenclature follows Harden (1990-1993), Harden & Murray (2000) and subsequent updates as obtained from PlantNET.

Status (TSC): refers to the NSW *Threatened Species Conservation Act* 1995 (TSC)
- E1 Schedule 1: Endangered Species
- V Schedule 2: Vulnerable Species
- P13 Protected under Schedule 13 of the *National Parks and Wildlife Act* 1974
- U Unprotected (not listed in Schedule 13 of the NPW Act 1974 or in the TSC Act 1995)

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC)
- E Endangered Species
- V Vulnerable Species

ROTAP Risk Code (Briggs and Leigh 1996)
- 2 Geographic range in Australia less than 100km
- 3 Geographic range in Australia greater than 100km
- V Vulnerable Species: not presently endangered, but possibly at risk in future due to continuing depletion or land-use change
- R Rare Species: rare in Australia, but currently without any identifiable threat
- K Poorly Known: taxon that is suspected, but not definitely known, to belong to one of the above categories. At present, accurate field information is inadequate
- C Reserved: indicates taxon has at least one population within a national park, or other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora
- a 1000 plants or more are known to occur within a conservation reserve(s)
- i less than 1000 plants are known to occur within a conservation reserve(s)
- - reserved population size is not accurately known

Please note: These records are based on information supplied by the Department of Environment, Climate Change & Water and other sources, and may contain errors or omissions.

2.1.1.2 Endangered Populations of Plants

The following endangered populations of flora as listed by the *TSC Act 1995* could occur within the study locality:

- *Acacia pendula* in the Hunter catchment
- *Eucalyptus camaldulensis* population in the Hunter catchment
- *Eucalyptus parramattensis* C. Hall. subsp. *parramattensis* in Wyong and Lake Macquarie local government areas
- *Cymbidium canaliculatum* in the Hunter catchment
- *Leionema lamprophyllum* (F. Muell.) Paul G. Wilson subsp. *obovatum* F.M. Anderson in the Hunter catchment

An assessment as to whether any of these flora populations occur or could occur within the study area will be undertaken later in the report.

2.1.1.3 Threatened Ecological Communities and Critical Habitat

The following endangered ecological communities as listed by the *TSC Act 1995* could occur within the study locality, and possibly in the study area if suitable habitat is available:

- Hunter lowland redgum forest in the Sydney basin and NSW north coast bioregions

- Swamp oak floodplain forest of the NSW north coast, Sydney basin and south east corner bioregions
- Swamp sclerophyll forest on coastal floodplains of the NSW north coast, Sydney basin and south east corner bioregions
- River-flat eucalypt forest on coastal floodplains of the NSW north coast, Sydney basin and south east corner bioregions
- Freshwater wetlands on coastal floodplains of the NSW north coast, Sydney basin and south east corner bioregions
- Sydney Freshwater Wetlands in the Sydney Basin Bioregion
- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
- *Melaleuca armillaris* Tall Shrubland in the Sydney Basin Bioregion
- Lower Hunter spotted gum - ironbark forest in the Sydney basin bioregion
- Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions

An assessment of the likely presence of any of these ecological communities in the subject site will be undertaken later in the report.

No threatened ecological communities listed by the Commonwealth EPBC Act are considered to have potential to occur within the study locality.

No critical habitat declared to date occurs within the study locality.

2.1.2 Fauna

2.1.2.1 Threatened Species

A total of 54 threatened terrestrial fauna species (including 4 preliminary determinations) have previously been recorded within the study locality (listed on the Atlas of NSW Wildlife), comprising 36 bird, 14 mammal, 1 reptile and 3 frog species. Of these, five species (black-necked stork, swift parrot, regent honeyeater, wandering albatross and green and golden bell frog) are currently listed as endangered on Schedule 1, Part 1 of the *TSC Act 1995* and the remainder as vulnerable on Schedule 2 of the Act. Ten species are also listed in the Commonwealth EPBC Act (1999), four as endangered (swift parrot, regent honeyeater, wandering albatross and spotted-tailed quoll) and six as vulnerable (painted snipe, black-browed albatross, large-eared pied bat, grey-headed flying-fox, green turtle and green and golden bell frog). The painted snipe and regent honeyeater are also listed as a migratory species in the EPBC Act as are a further six species listed as vulnerable on the TSC Act only. The threatened fauna species previously recorded in the locality are listed in **Table 3.** Oceanic birds (wandering albatross, black-browed albatross, sooty tern and providence petrel), marine reptiles (green turtle) and marine mammals (southern right whale) have been excluded from **Table 3** as habitat is obviously not available within the subject site.

Table 3. Threatened Fauna Previously Recorded Within the Study Locality.

Scientific Name	Common Name	Status (TSC)	Status (EPBC)	Earliest / latest record	Number of records within 10km of site	Number of records within 2.5km of site
BIRDS						
Anseranas semipalmata	Magpie Goose	V	-	1986-2000	55	0
Artamus superciliosus	White-browed Woodswallow	PD (V)	-	1991-2000	11	1
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	1992-2006	7	0
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	1983-2008	9	0
Charadrius leschenaultii	Greater Sand-plover	V	Mi	1977-1978	3	0
Charadrius mongolus	Lesser Sand-plover	V	Mi	1973-1996	14	1
Climacteris picumnus	Brown Treecreeper	V	-	1986-2008	37	0
Daphoenositta chrysoptera	Varied Sittella	PD (V)	-	1978-2008	14	0
Ephippiorhynchus asiaticus	Black-necked Stork	E1	-	1972-2005	90	0
Glossopsitta pusilla	Little Lorikeet	V	-	1991-2008	48	0
Haematopus longirostris	Pied Oystercatcher	V, PD (E)		2001-2007	4	0
Hieraaetus morphnoides	Little Eagle	PD (V)	-	1986-1998	6	0
Irediparra gallinacea	Comb-crested Jacana	V	-	1984-1990	7	0
Ixobrychus flavicollis	Black Bittern	V	-	1983-1999	5	0
Lathamus discolor	Swift Parrot	E1	E	1983-2003	10	0
Limicola falcinellus	Broad-billed Sandpiper	V	Mi	1978-1979	4	0
Limosa limosa	Black-tailed Godwit	V	Mi	2004	1	0
Melanodryas cucullata	Hooded Robin	V	-	1986	1	0
Melithreptus gularis gularis	Black-chinned Honeyeater (E. subsp.)	V	-	1991-2008	11	0
Neophema pulchella	Turquoise Parrot	V	-	1989-1991	2	0
Ninox connivens	Barking Owl	V	-	1985-2008	5	0
Ninox strenua	Powerful Owl	V	-	1982-2008	64	4
Oxyura australis	Blue-billed Duck	V	-	1983-2003	2	0
Pandion haliaetus	Osprey	V	Mi	1981-2007	15	2
Petroica boodang	Scarlet Robin	PD (V)	-	1986-2006	7	0
Ptilinopus magnificus	Wompoo Fruit-Dove	V	-	1985-1989	4	0
Ptilinopus regina	Rose-crowned Fruit-Dove	V	-	1981-2000	3	0
Ptilinopus superbus	Superb Fruit-Dove	V	-	1990-1991	2	0
Pyrrholaemus saggitatus	Speckled Warbler	V	-	1971-1991	3	0
Rostratula benghalensis australis	Painted Snipe (Australian subsp.)	E1	V, Mi	1984-1997	2	0
Sterna fuscata	Sooty Tern	V	Mi	1984	1	0
Stictonetta naevosa	Freckled Duck	V	-	1982-1986	4	0
Tyto novaehollandiae	Masked Owl	V	-	1994-2008	57	4
Tyto tenebricosa	Sooty Owl	V	-	1989-2008	10	0
Xanthomyza phrygia	Regent Honeyeater	E1	E, Mi	1983-1987	3	0

Table 3 - continued

Scientific Name	Common Name	Status (TSC)	Status (EPBC)	Earliest / latest record	Number of records within 10km of site	Number of records within 2.5km of site
FLYING MAMMALS						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	1998-2008	8	1
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	1998-2006	2	0
Miniopterus australis	Little Bentwing-bat	V	-	1993-2008	84	5
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	1993-2008	79	7
Mormopterus norfolkensis	Eastern Freetail-bat	V	-	1997-2008	26	4
Myotis macropus	Southern Myotis	V	-	2001-2008	8	1
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	1995-2008	75	5
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	1993	1	0
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	1993-2008	19	2
Vespadelus troughtoni	Eastern Cave Bat	V	-	2001-2006	6	1
NON_FLYING MAMMALS						
Dasyurus maculatus	Spotted-tailed Quoll	V	E	1980-2008	5	0
Petaurus australis	Yellow-bellied Glider	V	-	1996-2008	8	0
Petaurus norfolcensis	Squirrel Glider	V	-	1977-2008	98	12
Phascolarctos cinereus	Koala	V	-	1952-2008	16	0
FROGS						
Litoria aurea	Green and Golden Bell Frog	E1	V	1984-2006	533	0
Crinia tinnula	Wallum Froglet	V	-	1997-2007	7	0
Pseudophryne australis	Red-crowned Toadlet	V	-	1999	1	0

Notes:
371000 E and 6355000 N are the closest rounded coordinates to the study area centre (Newcastle 9232 and Lake Macquarie 9231 1:100 000 mapsheets Grid 56 AGD66).
Status (TSC): refers to the NSW *Threatened Species Conservation Act* 1995 (TSC)
E1 Schedule 1, Part 1: Endangered species
V Schedule 2: Vulnerable species
PD A preliminary determination has been made by the scientific committee

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC)
E Endangered Species
V Vulnerable Species
Mi Migratory Species

Please note: These records are based on information supplied by the Department of Environment, Climate Change & Water and other sources, and may contain errors or omissions.

2.1.2.2 Endangered Fauna Populations

No listed endangered populations of fauna occur within the study locality.

2.1.3 EPBC Act Protected Matters Report

The EPBC Act Protected Matters Search Tool was accessed on 30th August 2009 to identify the Protected Matters under the Commonwealth EPBC Act that occur or may occur within the study locality. This review yielded a report listing the matters that could potentially be relevant under the EPBC Act for activities within the study area. The report below (**Table 4**) identifies matters that could potentially be relevant in any part of the study locality of 10 km radius around the subject site. The species or matters listed below may not necessarily be relevant to the study area or subject site itself.

Table 4. Summary of Potentially Relevant Matters under the Commonwealth EPBC Act 1999

Protected Matter	Details
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Significance (Ramsar sites)	One: Hunter Estuary Wetlands
Commonwealth Marine Areas	-
Threatened Ecological Communities	Two: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (**CE**) Littoral Rainforest and Coastal Vine Thickets of Eastern Australia (**CE**)
Threatened Species - Flora	Nine species: **Species or species habitat may occur within area according to EPBC modeling.** *Cryptostylis hunteriana* Leafless tongue-orchid (**V**) *Rhizanthella slateri* (**E**) **Species or species habitat likely to occur within area according to EPBC modeling.** *Acacia bynoeana* Bynoe's wattle (**V**) *Angophora inopina* (**V**) *Eucalyptus camfieldii* Camfield's stringybark (**V**) *Grevillea parviflora* subsp. *parviflora* (**V**) *Syzygium paniculatum* Magenta lilly pilly (**V**) *Tetratheca juncea* (**V**) **Species or species habitat known to occur within area according to EPBC modeling.** *Melaleuca biconvexa* Biconvex paperbark **(V)** The likelihood of any of these species occurring in the study area on the basis of available habitat is assessed in **Table 5** (Section 2.2.1).
Threatened Species – Fauna (Terrestrial Species only)	Thirteen species: **Species or species habitat may occur within area according to EPBC modeling.** Australian painted snipe *Rostratula australis* (**V**) Brush-tailed rock-wallaby *Petrogale penicillata* (**V**) Large-eared pied bat *Chalinolobus dwyeri* (**V**) Littlejohns tree Frog *Litoria littlejohni* (**V**) Long-nosed potoroo *Potorous tridactylus tridactylus* (**V**) Spotted-tail quoll *Dasyurus maculatus maculatus* (SE mainland population) (**E**)

	Species or species habitat likely to occur within area according to EPBC modeling. Broad-headed snake *Hoplocephalus bungaroides* (**V**) Green and golden bell frog *Litoria aurea* (**V**) Regent honeyeater *Xanthomyza Phrygia* (**E**) Swift parrot *Lathamus discolor* (**E**) Southern barred frog *Mixophyes iteratus* (**E**) Stuttering frog *Mixophyes balbus* (**V**) **Roosting known to occur within area according to EPBC modeling.** Grey-headed flying-fox *Pteropus poliocephalus* (**V**) The likelihood of any of these species occurring in the study area on the basis of available habitat is assessed in **Table 6** (Section 2.2.2).
Migratory Species (Terrestrial Species Only)	Thirty species : **Species or species habitat likely to occur within area according to EPBC modeling.** White-bellied sea eagle *Haliaeetus leucogaster* (**Mi**) Regent honeyeater *Xanthomyza Phrygia* (**Mi, E**) **Species or species habitat may occur within area according to EPBC modeling.** White-throated needletail *Hirundapus caudacutus* (**Mi**) Rainbow bee-eater *Merops ornatus* (**Mi**) **Breeding may occur within area according to EPBC modeling.** Black-faced monarch *Monarcha melanopsis* (**Mi**) Rufous fantail *Rhipidura rufifrons* (**Mi**) **Breeding likely to occur within area according to EPBC modeling.** Satin flycatcher *Myiagra cyanoleuca* (**Mi**) Wetlands Species **Species or species habitat may occur within are according to EPBC modeling.** Latham's snipe *Gallinago hardwickii* (**Mi**) Painted snipe *Rostratula benghalensis s. lat.* (**Mi**) **Species or species habitat known to occur within area according to EPBC modeling.** Common Sandpiper *Actitis hypoleucos* (**Mi**) Ruddy turnstone *Arenaria interpres* (**Mi**) Sharp-tailed sandpiper *Calidris acuminata* (**Mi**) Red Knot *Calidris canutus* (**Mi**) Curlew sandpiper *Calidris ferruginea* (**Mi**) Red-necked Stint *Calidris ruficollis* (**Mi**) Great Knot *Calidris tenuirostris* (**Mi**) Double-banded Plover *Charadrius bicinctus* (**Mi**) Greater Sand Plover *Charadrius leschenaultia* (**Mi**) Lesser Sand Plover *Charadrius mongolos* (**Mi**) Grey-tailed Tattler *Heteroscelus brevipes* (**Mi**) Broad-billed sandpiper *limicola falcinellus* (**Mi**) Black-tailed godwit *Limosa limosa* (**Mi**) Eastern curlew *Numenius madagascariensis* (**Mi**) Whimbrel *Numenius phaeopus* (**Mi**) Pacific golden plover *pluvialis fulva* (**Mi**) Common greenshank *Tringa nebularia* (**Mi**) Marsh sandpiper *Tringa stagnatilis* (**Mi**) Terek sandpiper *Xenus cinereus* **(Mi)**

	Breeding likely to occur within area according to EPBC modeling. Cattle egret *Ardea ibis* (**Mi**) Great egret *Ardea alba* (**Mi**) The likelihood of any of these species occurring in the study area on the basis of available habitat is assessed in **Table 6** (Section 2.2.2).
Commonwealth Lands	Four - Commonwealth Lands identified within the study locality do not occur in the vicinity of the study area.
Commonwealth Heritage Places	-
Places on the Register of the National Estate	Three: Fennell Bay Reserve (Public Reserve R 38237) NSW Hunter Estuary Wetlands NSW Reserve R 81914 Tingira Heights Fossil Insect Beds NSW
Listed Marine Species	N/A
Whales and Other Cetaceans	N/A
Critical Habitats	None
Commonwealth Reserves	None
State and Territory Reserves	Three: Hexham Swamp Nature Reserve, NSW Pambalong Nature Reserve, NSW Tingira Heights Nature Reserve NSW
Other Commonwealth Reserves	None
Regional Forest Agreements	Lower North East NSW RFA, New South Wales

Notes:
V Species listed as **Vulnerable** under the Commonwealth *EPBC Act*.
E Species listed as **Endangered** under the Commonwealth *EPBC Act*.
CE Species listed as **Critically Endangered** under the Commonwealth *EPBC Act*.
Ex Species listed as **Extinct** under the Commonwealth *EPBC Act.*
Mi Species listed as **Migratory** under the Commonwealth *EPBC Act*.

The information compiled in relation to the flora and fauna habitats of the study area has been used in the determination of a list of threatened flora and fauna species that may be regarded as potential inhabitants of the site (i.e. potential subject species). This has been undertaken in **Section 2.2** below.

2.2 Determination of Local Threatened Flora and Fauna as Potential Subject Species

A list of potential subject species has been compiled. Subject species are defined as those threatened species considered likely to occur in the habitats present within the subject site according to the criteria for determining the list of such species given by DECC (2007). Therefore, such species could be potentially impacted by the proposal and would require formal assessment of impact unless their presence can be conclusively ruled out by appropriate field surveys. Some species are known to occur within or near the study area based on surveys conducted in 2007 for a Local Environment Study (Ecotone 2008).

2.2.1 Threatened Flora

An assessment of the relative likelihood of the threatened flora species previously recorded in the study locality occurring within the study area is provided below in **Table 5**. Species not recorded, but predicted to occur within the locality in the EPBC Act Protected Matters Report (**Section 2.1.3**), have also been included for consideration.

In this report, potential subject flora species are regarded as locally-occurring species listed on the TSC Act and/or EPBC Act that are rated as having at least a moderate likelihood of occurring in the subject site in Table 5 below. On this basis, four of the locally occurring threatened flora species (*Angophora inopina, Callistemon linearifolius, Melaleuca biconvexa* and *Tetratheca juncea*) are

considered to be potential subject species based on the available habitat and presence of previous records in the locality. In the case of *Angophora inopina*, this is certain to occur since it was recorded within the study area including confirmation of a specimen collected during the surveys for the LES (Ecotone Ecological Consultants 2008). Regarding species not listed by legislation, none are considered to have greater than a low likelihood of occurring in the study area.

Table 5. Assessment of the Potential for Local Rare or Threatened Flora Species to Occur Within the Study Area

Scientific Name	Latest Record	Records Within		Preferred Habitat and Comments*	Habitat Available on Site?	Potential to Occur Within Subject Site	Subject Species[a]
		10 km	2.5 km				
Species **Likely** to Occur							
Angophora inopina (scrub apple)	2007	19	15	Occurs most frequently in four main vegetation communities: (i) *Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest; (ii) *Hakea teretifolia–Banksia oblongifolia* wet heath; (iii) *Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata–Corymbia gummifera–Angophora inopina* woodland/forest.	Yes	**Certain** confirmed to occur during previous surveys (2008)	√
Species that **May** Occur							
Threatened Species							
Callistemon linearifolius (netted bottlebrush)	2006	3	1	Grows in damper parts of dry sclerophyll forest in sandy to clayey soils on sandstone on the coast and adjacent ranges. Usually in damp areas such as floodplains and banks of creeks and watercourses.	Possibly	**Moderate**	√
Melaleuca biconvexa (biconvex paperbark)	2007	2	0	Generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Yes	**Moderate**	√

Scientific Name	Latest Record	Records Within		Preferred Habitat and Comments*	Habitat Available on Site?	Potential to Occur Within Subject Site	Subject Species[a]
		10 km	2.5 km				
Tetratheca juncea (black-eyed Susan)	2008	484	3	Usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. Also in heathland and moist forest. Typically in scribbly gum communities. Mostly on low nutrient soils associated with the Awaba Soil Landscape. While the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites and occurs on ridges, although it has also been found on upper slopes, mid-slopes and occasionally in gullies.	Possibly in drier, more elevated parts of the study area where scribbly gums occur.	**Moderate** Previously recorded a little distance to the west of the study area.	√
Species **Unlikely** to Occur							
Threatened Species							
Acacia bynoeana (Bynoe's wattle)	No records – DEWHA habitat modelling only			Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include red bloodwood, scribbly gum, Parramatta red gum, saw banksia and narrow-leafed apple.	Unlikely	**Low**	-
Cynanchum elegans	2001	1	0	Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; coastal tea-tree *Leptospermum laevigatum* – coastal banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; forest red gum *Eucalyptus tereticornis* aligned open forest and woodland; spotted gum *Eucalyptus maculata* aligned open forest and woodland; and bracelet honeymyrtle *Melaleuca armillaris* scrub to open scrub.	No	**Low**	-
Diuris praecox (rough doubletail)	2008	8	0	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey.	Unlikely – habitat is too flat and swampy	**Low**	-

Scientific Name	Latest Record	Records Within		Preferred Habitat and Comments*	Habitat Available on Site?	Potential to Occur Within Subject Site	Subject Species[a]
		10 km	2.5 km				
Epacris purpurascens var. *purpurascens*	2006	1	0	Found in a range of habitat types; particularly sclerophyll forest, scrubs and swamps on sandstone mostly with a strong shale soil influence.	Unlikely – unsuitable soil type	**Low**	-
Cryptostylis hunteriana (Leafless tongue-orchid)	No records – DEWHA habitat modelling only			Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by scribbly gum (*Eucalyptus sclerophylla*), silvertop ash (*E. sieberi*), red bloodwood (*Corymbia gummifera*) and black sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the large tongue orchid (*C. subulata*) and the tartan tongue orchid (*C. erecta*).	Possibly, but unlikely	**Low**	-
Eucalyptus camfieldii (Heart-leaved stringybark)	1998	1	0	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of *E. oblonga* narrow-leaved stringybark, *E. capitellata* brown stringybark and *E. haemastoma* scribbly gum.	Unlikely	**Low**	-
Grevillea parviflora subsp. *parviflora* (Small-flower grevillea)	2008	16	0	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks. Plants are capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, particularly after disturbance such as fire.	Unlikely	**Low**	-

Scientific Name	Latest Record	Records Within		Preferred Habitat and Comments*	Habitat Available on Site?	Potential to Occur Within Subject Site	Subject Species[a]
		10 km	2.5 km				
Rhizanthella slateri (Eastern Australian underground orchid)	No records – DEWHA habitat modelling only			Habitat requirements are poorly understood and no particular vegetation type has been associated with the species. Known to occur in sclerophyll forest on shallow to deep loams. Highly cryptic - grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed.	Unlikely	**Low**	-
Rutidosis heterogama (heath wrinklewort)	2006	1	0	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	No	**Low**	-
Syzygium paniculatum (magenta lilly-pilly)	2007	3	0	Occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Unlikely	**Low**	-
Zannichellia palustris	2006	4	0	Grows in fresh or slightly saline stationary or slowly flowing water.	Possibly in the drainage channels, but unlikely.	**Low**	-
ROTAP Only Species							
Arthrochilus prolixus	2002	1	0	Grows on forested slopes and ridges between grassy tufts or shrubs in sandy and clay loams, also on rotting sawdust heaps near old sawmills.	No	**Low**	
Eucalyptus fergusonii subsp. *dorsiventralis*	2005	1	0	Dry sclerophyll forest on sandstone ridges.	No	**Minimal**	
Eucalyptus fergusonii subsp. *fergusonii*	2000	2	0	Scattered and sporadic, in wet sclerophyll forest or woodland on sandy soils.	Unlikely	**Low**	
Macrozamia flexuosa	2006	11	1	Scattered in sclerophyll forests on siliceous soils.	Unlikely	**Low**	

Notes for Table 5
*compiled primarily from DECC threatened species profiles http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx and/or Harden (1990-2002), Harden & Murray (2000) and
[a]Note - Species rated as having a moderate or better likelihood of occurring are regarded as potential subject species if listed by legislation. Species listed exclusively by ROTAP are not eligible to be subject species.

2.2.2 Threatened Fauna

Tables 3 and **4** (above) identified the threatened and migratory fauna species that have been recorded (TSC Act 1995 – **Table 3**) or are predicted to occur (EPBC Act 1999 – **Table 4**) within a 10 km radius of the subject site. Following is an assessment of the likelihood of occurrence of those threatened and migratory fauna species on the subject site (**Table 6**). Note that threatened marine mammals (1 species), marine reptiles (1 species), oceanic and shore birds (4 species) as well as threatened and migratory wading birds (19 species) have been excluded from this assessment as suitable habitat does not occur within the subject site.

Although much of the subject site consists of an area previously used for landfill and is primarily cleared of natural vegetation, the buffer zone is naturally vegetated and parts may be modified for the construction of a bund wall. Therefore, as the subject site may provide habitat for several listed threatened species at least on an occasional basis, some impacts on any identified threatened or migratory species may occur (**Table 6** – Species **most likely** or that **may** occur). Threatened species requiring large or well connected remnants, or structurally diverse habitats are unlikely to occur on the subject site even though marginal habitats are available on the subject site (**Table 6** – Species unlikely to occur).

Table 6. An Assessment of the Likelihood of Threatened and Migratory Fauna Species Occurring Within the Subject Site

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Species Most Likely to Occur							
Masked Owl	2008	57	4	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Recorded within adjoining habitats in 2007 so could forage within the subject site.	N	Y*	Y
Large-eared Pied Bat (*Chalinolobus dwyeri*)	2008	8	1	Range of well-wooded habitats, including dry sclerophyll forests and woodlands of coastal and semi-arid areas. Occasionally in sub-alpine woodlands and at the edge of rainforest and semi-arid areas. Reliant on suitable roosting habitat including caves and mine tunnels (though may use other structures, eg. abandoned Fairy Martin nests). Recorded within adjoining habitats in 2007 so could forage over the subject site.	N	N	Y
Little Bentwing-bat (*Miniopterus australis*)	2008	84	5	Forages in a range of habitats, including forest, woodland, heath, coastal swamps and rainforest. A nightly foraging range of 20km from roost sites has been reported. Reliant on suitable roosting habitat in caves and mine tunnels, though has been recorded roosting in hollowed out tree bases and dense foliage. Recorded within adjoining habitats in 2007 so could forage over the subject site.	N	N	Y

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Eastern Bentwing-bat (*Miniopterus schreibersii*)	2008	79	7	Forages within a variety of habitat types including moist and dry eucalypt forest, woodland, rainforest, heath and open environments, including urban areas. Reliant on suitable roosting/breeding habitat in caves and mine tunnels, though will also roost in stormwater channels, road culverts and other comparable structures (including buildings). Estimated nightly foraging range of 20 kilometres. Recorded within adjoining habitats in 2007 so could forage over the subject site.	N	N	Y
East-coast Freetail-bat (*Mormopterus norfolkensis*)	2008	26	4	The habitat preference of this species is unclear. It has been predominantly recorded in dry eucalypt forest and woodland, but has been recorded in moist and edge environments. The wing morphology indicates that this species is adapted to the more open habitats. This species primarily roosts in tree hollows, although the roofs of buildings are also used. Recorded within adjoining habitats in 2007 so could forage over the subject site.	Y*	Y*	Y
Grey-headed flying-fox (*Pteropus poliocephalus*)	2008	75	5	Found within 200km of the eastern coast of Australia. Regularly occurs along the eastern coastal plain through NSW. Roosts in camps, usually in dense riparian habitats. At dusk disperses in search of the preferred food source, mainly eucalypt nectar and pollen, and rainforest fruits. Occurs in subtropical and temperate rainforest, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and planted fruit crops. May travel up to 50 km each night in search of food. Known to forage within the local area (Ecotone 2008). No suitable camp or roosting habitat exists on the subject site. Due to the highly mobile nature of the species the buffer zone of the subject site provides potential foraging habitat during periods of eucalypt and paperbark flowering.	N	N	Y*
Squirrel glider (*Petaurus norfolcensis*)	2008	98	12	Usually inhabits dry open sclerophyll forest and woodlands, but has also been observed in moist regenerating forest and moist gullies. Forages on acacia gum, eucalypt sap, nectar, honeydew and manna, invertebrates and pollen, utilising areas with an abundance of flowering eucalypts and tall shrubs (eg. banksias). Acacia species are the preferred sap feeding trees. This species requires an abundance of suitably sized hollow-bearing trees for den sites. This species was recorded within forest/woodland surrounding the subject site in 2007 (Ecotone 2008) and therefore could at least forage within the buffer zone. There is some potential for den sites to occur within tree hollows in the buffer zone.	Y*	Y*	Y*
Cattle egret (*Ardea ibis*)	EPBC modelling – likely to occur. Migratory Species			Shallow open wetlands and mudflats. Moist pastures with tall grass. Often associated with grazing cattle. Recorded within adjoining areas in 2007 and given the presence of grassland and cattle this species is expected to occur	N	N	Y

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Satin flycatcher (*Myiagra cyanoleuca*)	EPBC modelling – breeding likely occur. Migratory Species			Forests and woodlands, mangroves and coastal heath scrubs. This species was recorded in the local area during the 2007 survey for the LEP (Ecotone 2008) however suitable habitat is only available within the proposed buffer zone for the project.	Y*	Y*	Y*
Rufous fantail (*Rhipidura rufifrons*)	EPBC modelling – breeding may occur. Migratory Species			Rainforest, wet eucalypt forest, paperbark and mangrove swamps, also riverside vegetation. Will use more open habitats when migrating. This species was recorded in the local area during the 2007 survey for the LEP (Ecotone 2008) however suitable habitat is only available within the proposed buffer zone for the project.	Y*	Y*	Y*
White-bellied sea-eagle (*Haliaeetus leucogaster*)	EPBC modelling – likely to occur. Migratory Species			Inhabit areas near large bodies of water. Known to occur in the local area and may fly over the subject site however although it may occasionally land in the taller trees in the buffer zone, it is unlikely to breed or forage there.	N	Y*	N
Species That **May** Occur							
White-browed woodswallow (*Artamus superciliosus*) (Preliminary listing only)	2000	11	1	Inhabits mostly eucalypt, sheoak and *Acacia* woodland, including mallee, and adjacent open areas including grassland with scattered trees or shrubs. In agricultural landscapes it prefers healthy woodland patches with low disturbance and little grazing (Higgins *et al.* 2006). It eats arthropods, including insects that swarm above vegetation, plus some nectar and small native fruits. The woodswallow builds a cup-shaped nest of twigs and plant fibres in a fork, crevice or foliage in a tree or shrub (live or dead), vine, creeper, stump or artificial structure. One record was found from within 2.5km of the subject site therefore there is some potential for the species to occur.	Y*	Y*	Y*
Varied sittella (*Daphoenositta chrysoptera*) (Preliminary listing only)	2008	14	0	Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years. Although no nearby records could be found there are several records from the locality therefore this species could occur within the buffer zone.	Y*	Y*	Y*
Little Lorikeet (*Glossopsitta pusilla*)	2008	48	0	Dry open eucalypt forests and woodlands form the coast to the western slopes of the Great Dividing Range. Generally considered nomadic, resulting from food availability. Feed primarily of nectar and pollen. Require tree hollows for breeding, using hollows with very small openings. Most breeding records come from the western slopes. Little lorikeets may visit any flowering eucalypts and melaleucas within the buffer zone during any season in any year.	N	Y*	Y*

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Little eagle (*Hieraaetus morphnoides*) (Preliminary listing only)	1998	6	0	The little eagle forages over woodland and forested lands and open country, extending into the arid zone. It tends to avoid rainforest and heavy forest. This species is unlikely to nest and roost within the study area as larger trees are preferred however individuals may fly over or forage within the local area.	N	N	Y
Swift parrot (*Lathamus discolor*)	2003	10	0	The migratory nature of this species makes them difficult to assess. Known to frequent sclerophyll forest and woodlands with winter flowering trees (eg. spotted gum, red ironbark, *Eucalyptus crebra*, *E. siderophloia*, forest red gum and swamp mahogany) on an opportunistic basis along the coast and ranges of NSW. Although no records could be found within 2.5 km of the subject site, swift parrots may occasionally visit any flowering eucalypt or melaleuca trees between March and October in any year.	N	Y*	Y*
Black-chinned honeyeater (*Melithreptus gularis gularis*)	2008	11	0	Dry eucalypt savannah woodland and forest with an annual rainfall range of 400-700mm, particularly with box-ironbark associations and river red gums. Considered to be locally nomadic requiring remnants of greater than 200ha in area. Forages within foliage and bark of eucalypt trees on spiders, insects, lerp and nectar. The black-chinned honeyeater may occasionally visit any flowering eucalypts and melaleucas within the buffer zone during any season in any year but is unlikely to breed in the local area.	N	Y*	Y*
Scarlet robin (*Petroica boodang*) (Preliminary listing only)	2006	7	0	The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground. This species has the potential to seasonally occur within the subject site however no nearby records were found.	Y*	Y*	Y
Osprey	2007	15	2	Highly specialised fish catcher inhabiting coastal areas. Nests in trees, rocky outcrops, on the ground or in artificial towers (eg. electricity towers). Known to occur in the local area and may fly over the subject site however it is unlikely to use the available habitat attributes.	N	N	N

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Powerful owl (*Ninox strenua*)	2008	64	4	The powerful owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The powerful owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as turpentine *Syncarpia glomulifera*, black she-oak *Allocasuarina littoralis*, blackwood *Acacia melanoxylon*, rough-barked apple *Angorphora floribunda*, cherry ballart *Exocarpus cupressiformis* and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the greater glider, common ringtail possum and sugar glider. There may be marked regional differences in the prey taken by powerful owls. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Powerful owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. Known to occur within the local area and therefore may seasonally forage within the buffer zone, primarily on the common ringtail possum however it is not expected to roost or breed within the subject site.	N	N	Y*
Regent honeyeater (*Xanthomyza phrygia*)	1987	3	0	Inhabits dry open forest and woodland along the coast and ranges of NSW, particularly box-ironbark woodlands, and riparian forests of river oak. Feeds on nectar from a wide range of eucalypts and mistletoe. When nectar is scarce feeds on lerp, honeydew and insects. Regent honeyeaters undertake large-scale nomadic movements most likely in search of flowering areas, or other unknown resource requirements. Every few years regent honeyeaters are found foraging coastal swamp mahogany and spotted gum forests, particularly on the Central Coast of NSW when food is scarce in the preferred western ranges. As a nomadic species that may appear in any area with flowering eucalypt and melaleuca trees, the regent honeyeater may find occasional foraging habitat in the buffer zone of the subject site although the chance of visitation to the site is considered to be extremely low.	N	N	Y*
Eastern false pipistrelle (*Falsistrellus tasmaniensis*)	2006	2	0	Tall forest, woodland or heath/ grassland edges. Roosts in hollow trunk of the largest trees and sometimes buildings. Hunts flying insects above or just below the canopy. Although not recorded within the local area (Ecotone 2008) the habitat within the subject site may provide foraging habitat for the eastern false pipistrelle. Breeding or shelter habitat is limited by the low number of hollow bearing trees within the buffer area.	Y*	Y*	Y

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Greater broad-nosed bat (*Scoteanax rueppellii*)	2008	19	2	Forages for insects over a range of natural and altered habitats, including tall forest, woodland or heath/grassland edges, often along the tree line boundary. Prefers tree hollows in large, often isolated, mature trees for roosting. Usually associated with tall moist open forest. Recorded within 2.5km of the subject site therefore the habitat within the subject site may provide foraging habitat for greater broad-nosed bat. Breeding or shelter habitat is limited by the low number of hollow bearing trees within the buffer area.	Y*	Y*	Y
Southern myotis (*Myotis macropus*)	2008	8	1	Habitats adjacent to large bodies of water for hunting aquatic insects. Usually forages over streams or pools, catching insects and small fish by raking its feet across the water surface. Roosts in caves, mines, tunnels, bridges, culverts and dense foliage. This species was probably recorded by ultrasonic call identification within the local area (Ecotone 2008). As this species generally forages over open water the habitat available on the subject site may be suboptimal as open water habitat is limited to small pools in a drain. Suitable structures for breeding and roosting are absent.	N	N	Y
Wallum Froglet	2006	6	0	Mainly confined to acid paperbark swamps and sedge swamps of the coastal 'wallum' country. The species is a late winter breeder although calls can be heard at any time of the year following rain. Potential habitat occurs in the swampy parts of the subject site and surrounding vegetation although it was not recorded during previous surveys (Ecotone 2008).	Y	Y	Y
Great egret (*Ardea alba*)	EPBC modelling - may occur – Migratory species			Wetlands, flooded pastures, estuarine mudflats, dams, mangroves and reefs. Given the wet nature of parts of the subject site and open water in drains it is possible that this species would forage in the area.	N	N	Y
Rainbow bee-eater (*Meraps ornatus*)	EPBC modelling – likely to occur. Migratory Species			Migrate throughout mainland from northern Australia in September to April. Occurring in woodland, open forest, semi-arid scrub, grasslands and timbered plains, avoiding dense forest. Pursue flying insects. Nest in ground tunnels. The woodland areas within the subject site provide potential foraging and shelter habitat. However the small size and disturbed nature of the subject site suggests that the subject site is unlikely to be suitable for extended use by the rainbow bee-eater.	N	Y*	Y*
Black-faced monarch (*Monarcha melanopsis*)	EPBC modelling – breeding may occur. Migratory Species			Rainforests, mangroves and adjacent eucalypt woodlands. As a summer visitor to the locality this species may breed and forage within the habitats surrounding the subject site, including the buffer zone.	Y*	Y*	Y*
White-throated needletail (*Hirundapus caudacutus*)	EPBC modelling – likely to occur. Migratory Species			High open spaces of sky above all habitat types. Foraging habitat occurs well above the subject site therefore the white-throated needletail may fly above the subject site.	N	N	Y

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Species Unlikely to Occur							
Magpie Goose (*Anseranas semipalmata*	2000	55	0	Tropical wetlands, floodplains, dams, irrigated crops. Grazes in shallow water, usually in large flocks. Also grazes in pasture and crops. Creates a large floating nest on the water amongst emerging rushes or grasses. A colony of magpie geese has been established at Shortland Wetland Centre and some birds visit wetlands in the region. Vagrant visitor to the south of NSW. Available habitat within the subject site is generally unsuitable	N	N	N
Black bittern (*Ixobrychus flavicollis*)	1999	5	0	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds. Generally solitary, but occurs in pairs during the breeding season, from December to March. Like other bitterns, but unlike most herons, nesting is solitary. Nests, built in spring are located on a branch overhanging water and consist of a bed of sticks and reeds on a base of larger sticks. No suitable habitat is present on the subject site for the black bittern.	N	N	N
Gang-gang cockatoo (*Callocephalon fimbriatum*)	2006	7	0	Tall montane forests and woodlands in summer, moving to lower altitudes in winter, preferring more open eucalypt forest and woodland, including coastal areas. Nest during the summer in trunk and limb hollows in large mature trees, often in live trees close to water. Marginal foraging habitat is limited to the buffer zone on the subject site and given that this species is rare in the locality it is considered unlikely to occur.	N	N	Y*
Glossy black-cockatoo (*Calyptorhynchus lathami*)	2008	9	0	Coastal woodlands and dry eucalypt forests to open inland woodlands and forested watercourses. Requires particular food trees (she-oaks, particularly *Allocasuarina torulosa*) and large tree hollows for nesting. No suitable habitat is present on the subject site for the glossy black cockatoo.	N	N	N
Australian painted snipe (*Rostratula australis*)	1997	2	0	Permanent and temporary shallow inland and coastal wetlands (can be freshwater or brackish), particularly where there is a cover of vegetation. Individuals have been known to use artificial wetlands (such as sewage ponds, dams and water-logged grasslands. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. The nest consists of a scrape in the ground, lined with grasses and leaves. Breeding is often in response to local conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter. No suitable habitat is present on the subject site.	N	N	N

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Black-necked Stork (*Ephippiorhynchus asiaticus*)	2005	90	0	Inhabits permanent freshwater wetlands including margins of billabongs, swamps, shallow floodwaters, and adjacent grasslands and savannah woodlands; can also be found occasionally on inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water on a variety of prey including fish, frogs, eels, turtles, crabs and snakes. Breeds in late summer in the north, and early summer further south. A large nest, up to 2 m in diameter, is made in a live or dead tree, in or near a freshwater swamp. This species could occasionally forage in adjacent wetlands and grasslands however the use of the subject site is considered to be extremely low.	N	N	Y
Comb-crested Jacana (*Irediparra gallinacea*)	1990	7	0	Inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies. Pairs and family groups forage across floating vegetation. They feed primarily on insects and other invertebrates, as well as some seeds and other vegetation. Breeds in spring and summer in NSW, in a nest of floating vegetation. No suitable habitat is present on the subject site for this species.	N	N	N
Blue-billed Duck (*Oxyura australis*)	2003	2	0	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. No suitable habitat is present on the subject site for this species.	N	N	N
Freckled Duck (*Strictonetta naevosa*)	1986	4	0	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. No suitable habitat is present on the subject site for this species.	N	N	N
Hooded robin (*Melanodryas cucullata cucullata*)	1986	1	0	Prefers open areas adjacent to large blocks of woodland, particularly with areas of dead timber and sparse shrub cover. Also recorded in open forests and acacia shrublands. Home range areas range from 10 ha during the breeding season to 30 ha during the non-breeding season. Prefers structurally diverse habitats comprising mature trees, regenerating trees, shrubs and tall grasses. Only marginal habitat occurs for this species on the subject site. Given the apparent rarity of this species within the locality it is considered unlikely to occur.	N	Y*	Y
Brown treecreeper (*Climacteris picumnus victoriae*)	2008	8	0	Eucalypt forests, woodlands and scrubs of the drier areas, river-edge trees, timbered paddocks. Occasionally coastal plains and ranges, though predominantly found on inland plains and inland slopes of the Great Dividing Range. Hollows in dead standing timber (trees/stumps) and live trees are essential for breeding. Sedentary, occurring in groups at sites in all seasons and year-round. Average home range size is 4.4 ha, ranging up to 10.7 ha. No suitable habitat for this species occurs on the subject site.	N	N	N

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Speckled warbler (*Pyrrholaemus sagittatus*)	2008	10	0	The speckled warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include 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. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside. No suitable habitat for this species occurs on the subject site.	N	N	N
Turquoise parrot (*Neophema pulchella*)	1991	2	0	Open eucalypt woodland or forest with a grassy or sparsely shrubby understorey. Favours grasslands on the edge of these habitat types, particularly timbered grassland on mountain slopes and ridges. Feeds on seeds of native and introduced grasses and other herbs. Requires suitable hollows in tree limbs, logs or fence posts for breeding. Usually seen in pairs or small, possibly family groups and have also been reported in flocks of up to thirty individuals. This species is rare in the locality and given the limited number of potential nesting hollows in the buffer zone and disturbed nature of the pastureland it is considered unlikely to occur.	N	Y*	Y
Wompoo Fruit-Dove (*Ptilinopus magnificus*)	1989	4	0	Lowland rainforest, moist eucalypt forest and brush box forest that provides fleshy fruit resources. Rare south of Coffs Harbour. No suitable habitat for this species occurs on the subject site.	N	N	N
Rose-crowned Fruit-Dove (*Ptilinopus regina*)	2000	3	0	This Fruit-dove mainly utilises sub-tropical and dry rainforest, and occasionally moist eucalypt, swamp forest or mangroves if food is abundant. A fruit specialist, foraging from vines, shrubs, trees and palms. It appears that this species is nomadic / migratory to some degree following fruit availability. The Rose-crowned Fruit-dove will also forage from introduced flora species (e.g. Camphor Laurel). This dove nests on a small twig platform in a bush or low tree, with a single egg. No suitable habitat for this species occurs on the subject site.	N	N	N
Superb Fruit-Dove (*Ptilinopus superbus*	1991	2	0	Rainforest or closed forest with fleshy fruit resources. Also may forage in eucalypt or acacia woodland where fruit-bearing trees occur. No suitable habitat for this species occurs on the subject site.	N	N	N
Sooty owl (*Tyto tenebricosa*)	2008	10	0	Large areas of tall open forest and woodland particularly in and around dense creek and gully areas. Nests in large hollows in rainforest trees and eucalypts. No suitable habitat for this species occurs on the subject site.	N	N	N

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Barking owl (*Ninox connivens*)	2008	5	0	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as acacia and casuarina species, or the dense clumps of canopy leaves in large eucalypts. Feeds on a variety of prey, with invertebrates predominant for most of the year, and birds and mammals such as smaller gliders, possums, rodents and rabbits becoming important during breeding. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year. Three eggs are laid in nests in hollows of large, old eucalypts. The barking owl is unlikely to breed on the subject site due to lack of suitable hollows within the buffer zone, however on rare occasions individuals may forage within the study area while moving through the landscape.	N	N	Y*
Spotted-tailed quoll (*Dasyurus maculatus*)	2008	5	0	Inhabits a variety of habitat types from moist and wet sclerophyll through to dry forests and woodlands on the edge of open grasslands. Individuals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky cliff faces as den sites. Use latrine sites, often on rocks or boulders. Feed on a wide variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, insects, domestic fowls. Also eats carrion. Female home ranges range up to 750 ha, males 3500 ha. Although there is some connectivity to large areas of bushland further to the west, no records could be found within 2.5km of the study area and given the disturbed nature of the subject site it is considered unlikely that the spotted-tailed quoll occurs.	N	N	Y*
Yellow-bellied glider (*Petaurus australis*)	2008	8	0	Occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Den, often in family groups, in hollows of large trees. Very mobile and occupy large home ranges between 20 and 85 ha to encompass dispersed and seasonally variable food resources. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. The lack of tall mature eucalypt forest, limited availability of tree hollows and disturbed nature of the subject site suggests that the yellow-bellied glider is unlikely to occur.	N	N	N
Koala (*Phascolarctos cinereus*)	2008	16	0	Forest and woodland habitats that contain suitable regional eucalypt feed trees. Known to feed on more than 70 eucalypt and 30 non-eucalypt species. Home range size depends on habitat quality and ranges from a single hectare to several hundred hectares. Spend most of their time in trees but will descend to the ground to move across open	Y*	Y*	Y*

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
				ground between trees. Whilst recorded within the locality, no records of the koala could be found within 2.5 km of the subject site. The assessment for the LES (Ecotone 2008) identified that the forest/woodlands in the local area represented potential koala habitat however it was determined that it did not represent 'core koala habitat' as defined in SEPP 44. Therefore, although habitat is available, it is considered unlikely that the koala occurs within the study area.			
Yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*)	1993	1	0	Wide range of habitats, including open forest. Forages above the canopy in wooded areas and lower down in more open areas or along creeklines. Reliant on suitable trees with hollows for roosting. Breeds from mid-December to March. Although this species can be locally common in the Lower Hunter area records within the locality are few. Although the habitat within the subject site may provide foraging areas, breeding or shelter habitat is limited by the low number of hollow bearing trees within the buffer area. It is therefore considered that this species is unlikely to occur.	Y*	Y*	Y
Eastern cave bat (*Vespadelus troughtoni*)	2006	6	1	The eastern cave bat inhabits tropical mixed woodland and wet sclerophyll forest on the coasts and drier forests on the western slopes and inland. This species is a cave dweller, using shallow sandstone caves, boulder piles, buildings and sites near the entrance of mine tunnels. Little is known about the diet and breeding of the eastern cave bat. Habitats within the subject site may provide foraging habitat for the eastern cave bat. However the lack of caves or tunnels indicates that the subject site is unsuitable breeding or shelter habitat and the species is considered unlikely to occur.	N	N	Y
Green and golden bell frog (*Litoria aurea*)	2006	533	0	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as plague minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs. Preyed upon by various wading birds and snakes. No suitable habitat occurs on the subject site.	N	N	N
Red-crowned Toadlet	1999	1	0	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Eggs are laid in moist leaf	N	N	N

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
				litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter. No suitable habitat occurs on the subject site.			
Latham's snipe (*Gallinago hardwickii*)	EPBC modelling - may occur – migratory species			Wetlands with low vegetation in shallows. A partially flooded drain exists on the site and may provide a small area of opportunistic foraging habitat on a rare basis. Due to the small area of possible habitat and the disturbed nature of the site it is unlikely that Latham's snipe would occur on the subject site.	N	N	Y
Brush-tailed rock-wallaby (*Petrogale penicillata*	EPBC modelling - may occur			Inhabits rocky escarpments and adjoining habitats. No suitable habitat occurs on the subject site. No records could be found for the locality.	N	N	N
Long-nosed potoroo (*Potorous tridactylus*)	EPBC modelling - may occur			Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet as well as roots, tubers, insects and their larvae and other soft-bodied animals in the soil. The habitat within the subject site is marginal for this species as it is too open and is not the preferred soil type. No records could be found for the locality.	N	N	N
Littlejohn's tree frog (*Litoria littlejohni*)	EPBC modelling – may occur			It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It hunts either in shrubs or on the ground. Breeding is triggered by heavy rain and can occur from late winter to autumn, but is most likely to occur in spring when conditions are favourable. Males call from low vegetation close to slow flowing pools. Eggs are laid in loose gelatinous masses attached to small submerged twigs. Eggs and tadpoles are mostly found in slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools. No permanent streams occur on the subject site, no suitable habitat is present.	N	N	N
Giant (southern) barred frog (*Mixophyes iteratus*)	EPBC modelling – likely to occur			Giant barred frogs forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams from late spring to summer. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. Tadpoles grow to a length of 80 mm and take up to 14 months before changing into frogs. When not breeding the frogs disperse hundreds of metres away from streams. They feed primarily on large insects and spiders. No suitable habitat such as flowing streams in rainforest habitat is present.	N	N	N

Common Name	Most Recent Record	Record Within		Preferred Habitat* and Comments	Habitat Available on Site (* Buffer only)		
		10 km	2 km		Breeding	Shelter	Foraging
Stuttering barred frog (*Mixophyes balbus*)	EPBC modelling – likely to occur			Terrestrial inhabitants of rainforest, Antarctic beech or wet sclerophyll forest along permanent streams. No suitable habitat is present.	N	N	N
Broad-headed snake (*Hoplocephalus bungaroides*)	EPBC modelling – likely to occur			Broad-headed snakes are restricted to sandstone outcrops and escarpments, where they shelter in caves or under rock slabs on rock and in nearby tree hollows during summer. These snakes forage on lizards, skinks and geckos. No sandstone outcrops or escarpments are present on the subject site. No suitable habitat is present.	N	N	N

*Compiled from: Australian Museum Fact Sheets; Barrett et al. 2003; Churchill, 2008; Cogger, 1995; DECC threatened species information (website); Garnett & Crowley, 2000; Morcombe, 2004; Strahan, 2002.

Of the 61 threatened and migratory fauna species assessed in the above table, 29 have some potential to occur on the subject site, although not all are likely to occur. Of these, twelve species (7 threatened and 5 migratory) are known or highly likely to occur within or near the subject site. The 29 threatened and migratory fauna species are listed in **Section 2.2.3** below.

2.2.3 Potential Threatened Species, Endangered Populations and Endangered Ecological Communities to be Assessed

The following statutory-listed species and ecological communities that were either confirmed to occur in the study area or considered to have at least a moderate likelihood of occurrence in **Section 2.2.1** and **2.2.2** above are considered to be potential subject species in this assessment. Species that were rated as having a "low to moderate" or lower likelihood of occurring are not included. Migratory species are discussed under the EPBC Act in **Section 4.3**.

2.2.3.1 Flora

- *Angophora inopina* – slaty red gum (Vulnerable – TSC and EPBC Acts)
- *Callistemon linearifolius* – netted bottlebrush (Vulnerable – TSC and EPBC Acts)
- *Melaleuca biconvexa* – biconvex paperbark (Vulnerable – TSC and EPBC Acts)
- *Tetratheca juncea* – black-eyed Susan (Vulnerable – TSC and EPBC Acts)

Endangered Ecological Communities

- Swamp Sclerophyll Forest on Coastal Floodplains

2.2.3.2 Fauna

The following threatened fauna species have been recorded near the subject site and have the potential to at least forage within the study area;

- Masked Owl (*Tyto novaehollandiae*) - (Vulnerable – TSC Act)
- Squirrel glider (*Petaurus norfolcensis*) - (Vulnerable – TSC Act)
- Grey-headed flying-fox (*Pteropus poliocephalus*) – (Vulnerable – TSC and EPBC Act)

- East-coast freetail-bat (*Mormopterus norfolkensis*) – (Vulnerable – TSC Act)
- Eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) – (Vulnerable – TSC Act)
- Little bentwing-bat (*Miniopterus australis*) – (Vulnerable – TSC Act)
- Large-eared pied bat (*Chalinolobus dwyeri*) – (Vulnerable – TSC and EPBC Act)

The following species have some potential to occur as suitable habitat may be available;

- White-browed woodswallow (*Artamus superciliosus*) – (Prelim. determination TSC Act)
- Varied sittella (*Daphoenositta chrysoptera*) – (Prelim. determination TSC Act)
- Little lorikeet (*Glossopsitta pusilla*) – (Vulnerable – TSC Act)
- Swift parrot (*Lathamus discolor*) – (Endangered – TSC and EPBC Act)
- Black-chinned honeyeater (*Melithreptus gularis gularis* – (Vulnerable – TSC Act)
- Scarlet robin (*Petroica boodang*) – (Prelim. determination TSC Act)
- Osprey (*Pandion haliaetus*) (Vulnerable – TSC Act; Migratory – EPBC Act)
- Little eagle (*Heiraaetus morphnoides*) – (Prelim. determination TSC Act)
- Powerful owl (*Ninox strenua*) – (Vulnerable – TSC Act)
- Regent honeyeater (*Xanthomyza phrygia*) – (Endangered – TSC and EPBC Act; Migratory – EPBC Act)
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*) – (Vulnerable – TSC Act)
- Greater broad-nosed bat (*Scoteanax rueppellii*) – (Vulnerable – TSC Act)
- Southern myotis (*Myotis macropus*) – (Vulnerable – TSC Act)
- Wallum froglet (*Crinia tinnula*) – (Vulnerable – TSC Act)

In addition to those listed above, the following migratory species listed under the EPBC Act are known to occur within or near the study area (Ecotone 2008 – in bold) or may fly over or forage within the subject site including the buffer zone.

- **Cattle egret (*Ardea ibis*)**
- Great egret (*Ardea alba*)
- Black-faced monarch *Monarcha melanopsis*
- **Rufous fantail *Rhipidura rufifrons***
- Rainbow bee-eater (*Meraps ornatus*)
- **Satin flycatcher (*Myiagra cyanoleuca*)**
- **White-bellied sea eagle *Haliaeetus leucogaster***
- White-throated needletail (*Hirundapus caudacutus*)

Field survey techniques used in the 2007 and 2009 surveys were designed to adequately target these subject species, populations and ecological communities and are discussed in **Section 3**. The potential impacts on these subject species and communities as a result of the proposal are formally assessed in **Section 4** of this report.

3.0 SECOND STAGE ECOLOGICAL INVESTIGATION – FIELD SURVEYS

3.1 Floral Investigations

3.1.1 Methodology

Following field surveys within a wider area for an earlier LES in 2008 (Ecotone Ecological Consultants 2008) a more site-specific field survey was undertaken on the 19th August 2009 to document the flora and vegetation communities within the study area. The survey methodology complied with current best practice flora survey guidelines for a full impact assessment, such as those endorsed by local councils in the Lower Hunter area (LHCCREMS 2002) or DECCW's Draft Threatened Biodiversity Survey and Assessment Guidelines (DEC 2004). It involved three components:

- Traverses on foot involving a random meander throughout the study area to assess the range of floristic variation, vegetation structure (strata, heights and cover), extent of modification, disturbance, weed invasion and condition of the vegetation generally. All vascular flora species encountered were recorded and the vegetation communities were mapped;
- Three 20x20m flora quadrats covering different community types within the naturally vegetated areas in the 30m buffer zone from the proposal boundary. Additional quadrats were also examined in the surrounding bushland during the flora surveys for the LES (Ecotone Ecological Consultants 2008). Physical and vegetation structural data recorded within the quadrats included vegetation structure (strata, heights and cover), soil type, topography, extent of modification, disturbance, signs of fire, weed invasion and condition of the vegetation generally. All vascular flora species were listed within each quadrat and its location was recorded using a hand-held GPS to an accuracy of ±10 m;
- A targeted survey for any threatened flora species considered to have potential to occur in the study area. It was already known and confirmed from the earlier flora surveys for the LES (Ecotone Ecological Consultants 2008) that the vulnerable species *Angophora inopina* occurred within the buffer zone. The locations of all trees of this species within the buffer zone were recorded with a GPS.

Small samples of any other plant species that could not be identified in the field were obtained for further examination and identification.

A supplementary survey was carried out on 30th March 2010 by Ecotone Ecological Consultants and Lake Macquarie Council surveyors to accurately plot the locations of the *Angophora inopina* trees in the vicinity of the site boundary, and the boundary of the swamp community at the southern end of the site.

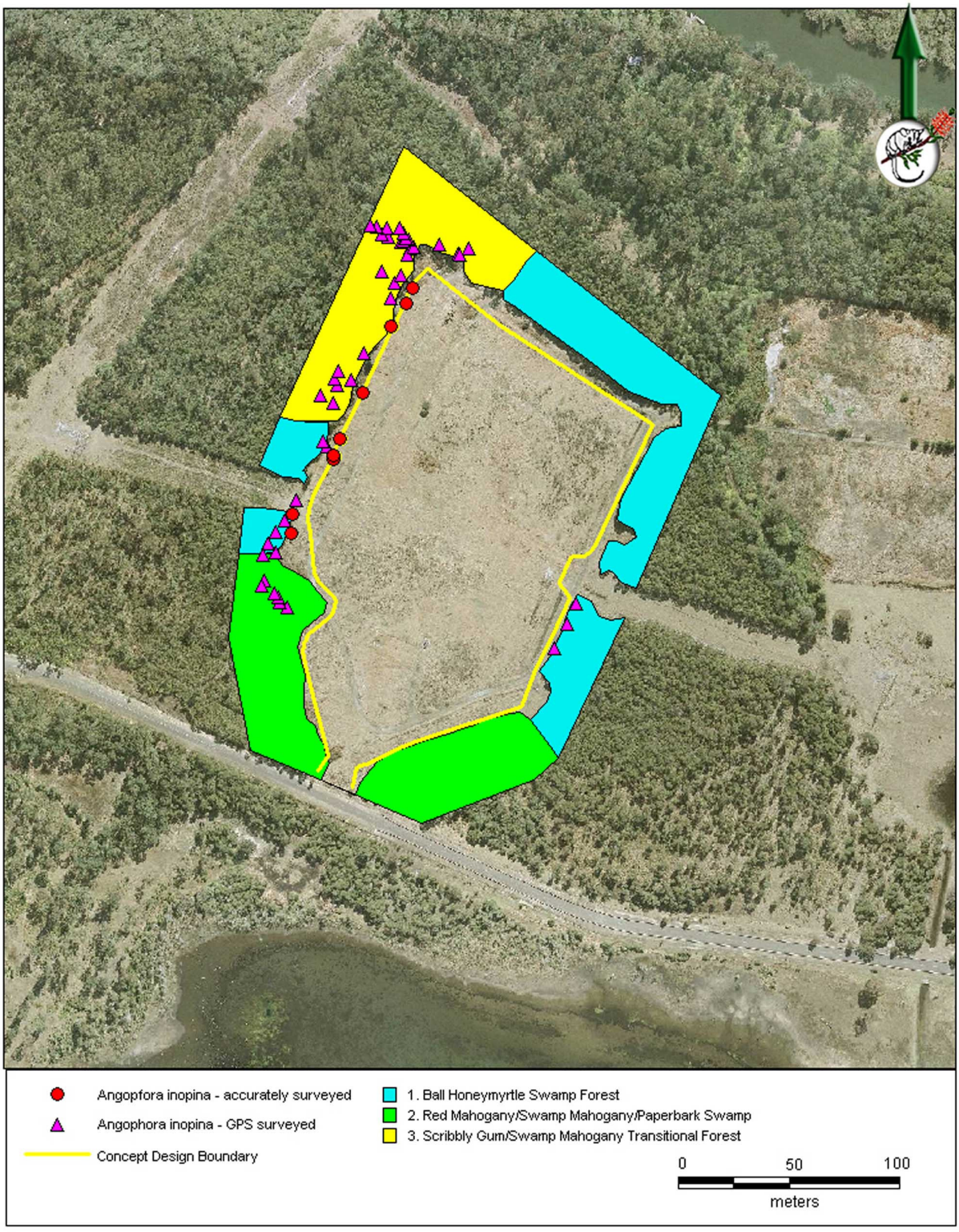
3.1.2 Results

3.1.2.1 Vegetation Communities

Four broad vegetation community types occur within the study area, three of which are natural communities and are restricted to the 30m buffer zone:

1. Ball Honeymyrtle Swamp Forest
2. Red Mahogany / Swamp Mahogany / Paperbark Swamp
3. Scribbly Gum / Swamp Mahogany / Paperbark Transitional Forest
4. Cleared open pasture, with occasional isolated trees

The fourth community is essentially cleared pasture, and is largely restricted to the proposal area (the subject site). Distributions of the vegetation communities are shown in **Figure 3** and descriptions of the structure and floristics of the natural communities within the site are given in **Table 7**.



Map Source: NSW Department of Lands http://imagery.maps.nsw.gov.au/

Ecotone Ecological Consultants Pty Ltd

Figure 3. Vegetation Communities and Threatened Flora

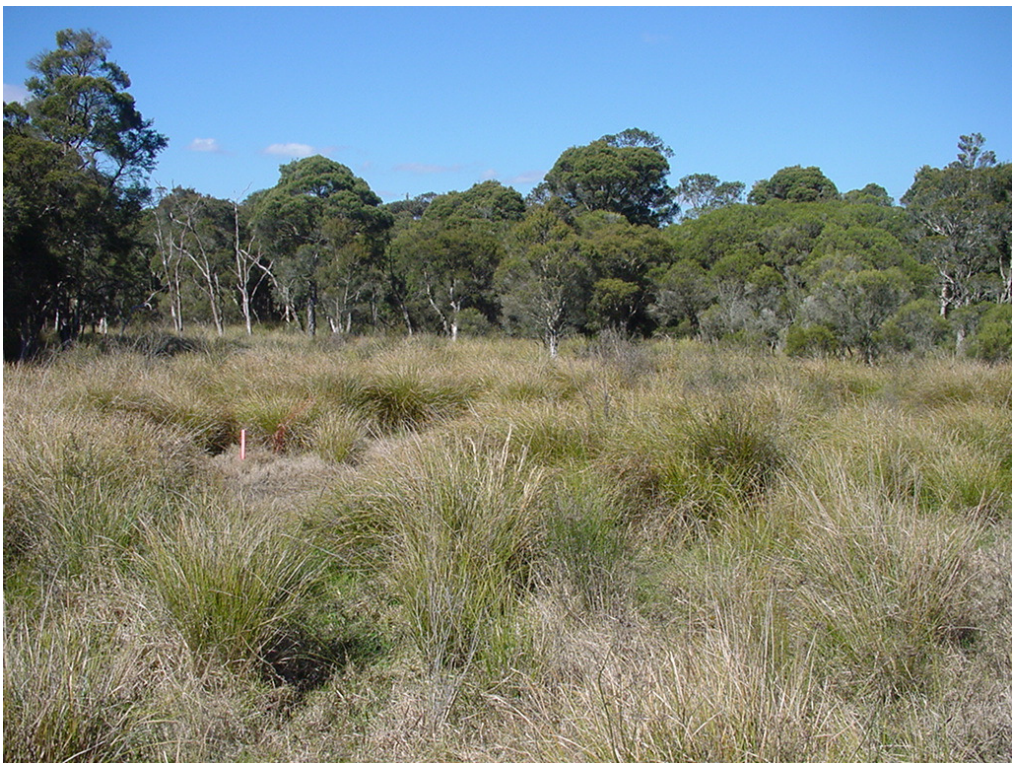
Flora and Fauna Impact Assessment: Proposed Recycling Facility at 80 The Weir Road, Teralba	June 2010

Table 7. Descriptions of the Vegetation Communities within the Study Area

Stratum	Height	% cover*	Dominant species	Comments
Community 1: SWAMP FOREST: Ball Honeymyrtle				
Tree layer	10 - 14 m	50 - 60	*Melalueca nodosa* *Angophora inopina*	Habitat: Low-lying and often swampy land, but a little more elevated and drier than the related Community 2 with swamp mahoganies and standing water during wetter conditions. Structure/Characteristics: Low, dense forest dominated almost exclusively by *Melaleuca nodosa*, with a very sparse shrub layer and sparse to moderate ground layer. Includes occasional emergent tall eucalypts, such as forest red gums, smooth-barked apples and scribbly gums. Distribution within Study Area: Confined to the 30m buffer zone, mainly along the northern and eastern boundaries of the subject site. Condition & Presence of Weeds: Most patches of the community are regrowth from past clearing and subject to continued cattle grazing. Presence of weeds is minor. Conservation Status: Contains the threatened species *Angophora inopina*. The community would qualify as an intergrade form of the EEC 'Swamp Sclerophyll Forest on Coastal Floodplains' (NSW Scientific Committee 2004).
Shrub layer	1 – 2 m	0 – 10	*Bursaria spinosa* *Gahnia clarkei* *Polyscias sambucifolia*	
Ground layer	To 1 m	40 – 50	*Oplismenus aemulus* *Ehrharta erecta* *Microlaena stipoides* *Entolasia marginata* *Imperata cylindrica* *Pratia purpurascens* *Pellaea falcata* *Cheilanthes sieberi* *Adiantum aethiopicum* *Dianella caerulea* *Dichondra repens* *Leucopogon juniperinus* *Pteridium esculentum* *Lomandra longifolia* *Vernonia cinerea*	

*Projective foliage canopy cover

Stratum	Height	% cover*	Dominant species	Comments
Community 2: SWAMP FOREST: Red Mahogany/Swamp Mahogany/Paperbarks				
Tree layer	18 - 22 m	40 - 50	*Eucalyptus resinifera* *E. robusta* *E. tereticornis* *Angophora costata*	Habitat: Low-lying wet depressions often with standing water. Structure/Characteristics: Open forest dominated by paperbarks or red mahogany, with a minor presence of swamp mahogany. The small tree layer of paperbark species is often dense, with a dense ground layer. The community occurs in two distinct forms, a drier form dominated by red mahogany and paperbarks that occurs in the south-western corner of the study area and a more swampy form dominated by sedges and paperbarks in the south-eastern corner. Distribution within Study Area: Occurs in the 30m buffer zone, in two separated locations as described above. Condition & Presence of Weeds: The community shows signs of past disturbance and continued cattle grazing. Presence of weeds is minor. Conservation Status: Contains the threatened species *Angophora inopina*. The community would qualify as the EEC 'Swamp Sclerophyll Forest on Coastal Floodplains' (NSW Scientific Committee 2004). The eastern occurrence of the community is also mapped and listed as a SEPP 14 wetland.
Small tree layer	10 - 12	20 - 40	*Melalueca linariifolia* *M. sieberi* *M. nodosa* *Angophora inopina*	
Shrub layer	1 – 4 m	10 – 30	*Melaleuca sieberi* *M. ericifolia* *Leptospermum polygalifolium* *Callistemon rigidus* *Gahnia clarkei* *Breynia oblongifolia*	
Ground layer	To 1 m	70 – 90	*Carex appressa* *Gahnia sieberiana* *Hypolepis muelleri* *Adiantum aethiopicum* *Melaleuca thymifolia* *Ranunculus inundatus* *Oplismenus aemulus* *Microlaena stipoides* *Entolasia marginata* *Imperata cylindrica* *Hydrocotyle peduncularis* *Pratia purpurascens* *Viola hederacea* *Dichondra repens* *Pteridium esculentum*	



*Projective foliage canopy cover

Stratum	Height	% cover*	Dominant species	Comments
Community 3: TRANSITIONAL FOREST: Scribbly Gum /Swamp Mahogany/Scrub Apple/Paperbarks				
Tree layer	18 - 20 m	30 - 40	*Eucalyptus haemastoma* *E. robusta*	Habitat: Slightly elevated areas with swamp influence. Structure/Characteristics: Open forest dominated by scribbly gums with some swamp mahogany, paperbarks, and an understorey characterised by a mixture of dryland and swamp adapted shrubs. *Angophora inopina* is common. Distribution within Study Area: Restricted to the 30m buffer beyond the western boundary of the subject site, along the central to northern section of this boundary. Condition & Presence of Weeds: The community shows no signs of recent disturbance, but may be regrowth from past clearing. Minor herbaceous weeds are present. Conservation Status: Contains the threatened species *Angophora inopina*. The community is transitional between an unlisted dryland community and the EEC 'Swamp Sclerophyll Forest on Coastal Floodplains' (NSW Scientific Committee 2004).
Small tree layer	8 - 12	20 - 30	*Angophora inopina* *Melalueca nodosa* *M. linariifolia*	
Shrub layer	1 – 3 m	10 – 20	*Melaleuca sieberi* *Leptospermum polygalifolium* *L. juniperinum* *Banksia oblongifolia* *Lantana camara*	
Ground layer	To 1 m	80 – 90	*Gahnia sieberiana* *Adiantum aethiopicum* *Melaleuca thymifolia* *Hardenbergia violacea* *Oplismenus aemulus* *Microlaena stipoides* *Entolasia stricta* *Imperata cylindrica* *Hydrocotyle peduncularis* *Pratia purpurascens* *Viola hederacea* *Caladenia catenata* *Dichondra repens* *Pteridium esculentum*	

*Projective foliage canopy cover

Community 4: Cleared Open Exotic Pasture / Grassland with Occasional Isolated Trees	
This community occupies the bulk of the study area in area. It consists of the central rectangular area that constitutes the subject site, excluding the 30m buffer zone of the study area. It occurs on flat, low-lying land currently surrounded by a drainage channel. It consists almost entirely of cleared, weedy pasture composed of mainly introduced pasture grass species and is currently grazed. The community is normally dry but could be prone to inundation and flooding following heavy rain. Clumps of weeds occur within the community, particulary around its edges. Scattered clumps of *Juncus* occur within the community indicating the wet nature of the site. Old piles of felled timber occur in the north-western corner of the subject site. Apart from one remnant isloated swamp mahogany tree, the community has no conservation significance.	

3.1.2.2 Comparison of Identified Communities with Regional Vegetation Mapping

The regional mapping of vegetation in the Lower Hunter and Central Coast (LHCCREMS 2003) shows the remnant vegetation within the study area as comprising three map units:

- MU5: Alluvial Tall Moist Forest
- MU37: Swamp Mahogany - Paperbark Forest
- MU40: Swamp Oak Rushland Forest

The regional mapping is only partly correct as confirmed by ground-truthing during the current and previous field investigations (Ecotone Ecological Consultants 2008). MU5 is considered to be absent from the site, since no blue gums or turpentines are present. Although small areas of MU40 occur in the larger study area examined for the LES (Ecotone Ecological Consultants 2008), none of this map unit occurs in the study area for the current study. The appropriate LHCCREMS map units that are considered to correspond to the vegetation communities recorded from this study, together with the statewide vegetation classifications of Keith (2004) are shown in **Table 8**.

Table 8. Statewide and Regional Vegetation Classifications that Correspond to the Vegetation Communities of the Study Area.

Vegetation Formation (Keith 2004)	Vegetation Class (Keith 2004)	LHCCREMS (2003) Map Unit	Equivalent Vegetation Communities (this study)
Forested Wetlands	Coastal Swamp Forests	MU37: Swamp Mahogany – Paperbark Forest	Communities 1 & 2
Dry sclerophyll forests (shrubby subformation)	Sydney Coastal Dry Sclerophyll Forests	MU31: Coastal Plains Scribbly Gum Woodland	Community 3

3.1.2.3 Floral Diversity

Overall flora species diversity was low within the subject site itself, but considerably higher in the surrounding 30m buffer of the study area. A total of 92 flora species from 37 families were identified including four ferns, 64 dicotyledons and 24 monocotyledons. Native species richness was moderate with 33 species of introduced or planted flora being identified, representing approximately 36% of the total species.

A list of all flora species recorded and identified from within the subject site is included as **Appendix 1**.

3.1.2.4 Condition of the Vegetation and Presence of Weeds

The vegetation within the subject site is almost totally cleared and highly disturbed, in poor floristic condition and some parts, particularly around the edges, are weedy. The natural vegetation within the remainder of the study area, comprising the 30m buffer zone around the subject site, is generally in moderate to good condition. Parts of it are subject to ongoing disturbances due to cattle grazing, and most appears to be in an advanced state of regrowth from past clearing. Patches of noxious and environmental weeds (e.g. lantana, crofton weed) occur within the natural communities making up the buffer zone, but not at high density. Most weeds are minor and herbaceous.

Five of the species recorded in the study area are declared Noxious Weeds in the Lake Macquarie City Council control area, pursuant to the *Noxious Weeds Act 1993*. These, together with their relevant control classes, are:

- Annual ragweed (*Ambrosia artemisiifolia*) – Class 5
- Blackberry (*Rubus fruticosus* sp. aggr.) – Class 4
- Crofton weed (*Ageratina adenophora*) – Class 4
- Lantana (*Lantana camara*) – Class 5
- Pampas grass (*Cortaderia selloana*) – Class 4

Explanations of the relevant control categories are as follows:

Class 4: Locally Controlled Weeds: 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. Local Control Plans for Class 4 weeds in Lake Macquarie City Council control area are available at: http://www.lakemac.com.au/downloads/noxious_weed_control_plans.pdf

Class 5: Restricted Plants: The requirements in the *Noxious Weeds Act 1993* for a notifiable weed must be complied with. See **Appendix 3** for further details.

Most of the noxious weeds identified occurred within the buffer zone of the study area, and with the exception of annual ragweed, were generally not present within the subject site.

Apart from declared noxious species, common or established environmental weed species within the subject site include fire weed (*Senecio madagascariensis*), kikuyu (*Pennisetum clandestinum*), paspalum (*Paspalum dilatatum*), whisky grass (*Andropogon virginicus*), panic veltgrass (*Ehrharta erecta*), pigeon grass (*Setaria gracilis*), spear thistle (*Cirsium vulgare*), common sowthistle (*Sonchus oleraceus*), redflower mallow (*Modiola caroliana*), and inkweed (*Phytolacca octandra*).

Some of these weed species occurred at locally high densities, but most were generally restricted in their distribution throughout the study area or occurred at low density. Professional control or management of any of these species within the buffer zone would be desirable.

3.1.2.5 Threatened or Significant Flora Species

One threatened flora species listed under both the NSW TSC Act and Commonwealth EPBC Act (*Angophora inopina* or scrub apple) was already known to occur within the buffer zone part of the study area from the earlier LES investigations (Ecotone Ecological Consultants 2008). The species occurs in patches in the drier (less swampy) parts of Communities 1, 2 and 3. The full distribution of this species within the study area is shown in **Figure 3**). Following accurate surveying of a number of *Angophora inopina* trees in the vicinity of the site boundary, it was found that seven individuals occurred at the foot of the proposed bund wall around the perimeter of the site, on the western boundary of or just within the project site. The accurate locations of these trees are shown in **Figures 2 and 3**.

No exclusively-ROTAP species were found within the subject site or study area, and none are expected to occur within the habitats available within the study area.

3.1.2.6 Endangered Ecological Communities

One Endangered Ecological Community (EEC) listed under the NSW TSC Act is considered to occur within the study area, as confirmed by the field investigation. Community 2 qualifies as the EEC *Swamp Sclerophyll Forest on Coastal Floodplains* according to the soil type, habitat and species assemblage as outlined in the Final Determination (NSW Scientific Committee 2004). The EEC is in moderately good condition. Community 2 qualifies as the same EEC in intergrade form, but ball honyemyrtle (*Melaleuca nodosa*) is not a characteristic species of the EEC according to the Final Determination. Some elements of the EEC also occur in Community 3, as represented by the occasional swamp mahoganies, paperbarks and sedge/rush species within the community.

The distribution of the EEC is shown in **Figure 3**. The current proposal has been specifically designed to avoid the EEC, except for a small patch on the western side of the proposed entrance from The Weir Road amounting to an area of approximately 80 m^2. The EEC at this location is in very poor condition compared to other parts of the EEC on the site due to impacts by edge effects as a result of runoff from The Weir Road. As a consequence, it is very weedy with small shrubs only (mainly paperbarks - no substantial trees) and has very low native species diversity in the understorey.

No endangered ecological communities listed under the Commonwealth EPBC Act 1999 are considered to occur in the subject site.

3.1.3 Overall Significance of the Vegetation

The major significance of the natural vegetation within the buffer zone of the study area is that part of it is a mapped SEPP 14 wetland (along the eastern boundary) and most of it also qualifies as the Endangered Ecological Community *Swamp Sclerophyll Forest on Coastal Floodplains*, at least in intergrade form or as embedded elements only. One threatened flora species listed by both the NSW and Commonwealth legislation is common and abundant within the natural buffer zone vegetation.

Apart from habitat for threatened flora species and EECs, the main ecological function of the buffer vegetation within the study area is as part of a wider corridor that provides connectivity both for

movement of fauna and for exchange of genetic material between native flora species locally. It also provides a refuge for flora and fauna that would tend to reduce the risk of local populations becoming locally extinct.

Most of the vegetation within the cleared subject site has little significance for flora or flora populations.

3.2 Faunal Investigations

3.2.1 Methodology

Fauna field surveys were undertaken within the study area in March 2007 for the LES (Ecotone 2008). The survey methodologies used are in general accordance with the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) flora & fauna survey guidelines. A table detailing the survey effort in 2007 has been prepared and included as **Appendix 6**. The field survey methodologies used in the 2007 surveys are as follows:

- Tree trapping
- Ground trapping
- Spotlight survey
- Stag watch
- Nocturnal call playback
- Ultrasonic bat call detection
- Harp trapping for insectivorous bats
- Koala scat survey
- Diurnal bird survey
- Diurnal reptile survey
- Opportunistic observations

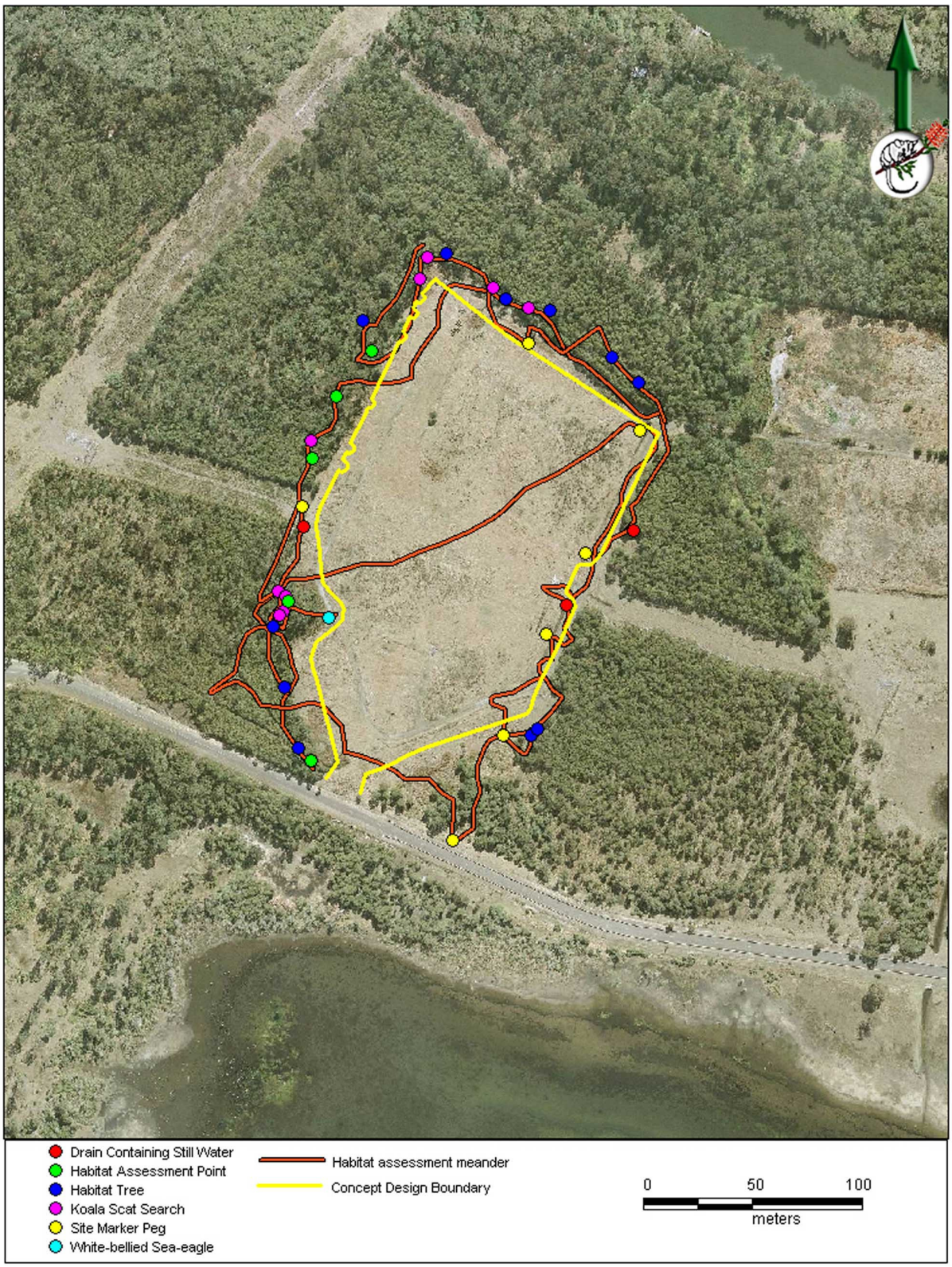
Additional surveys targeting the subject site were carried out in August 2009 in order to compliment the 2007 survey results. This primarily consisted of a habitat assessment, koala scat searches and opportunistic fauna observations (**Figure 4**).

3.2.1.1 Habitat Assessment

During the field survey on the 19th August 2009, the type and condition of potential habitats for fauna species was investigated and recorded across the subject site onto a proforma. Habitat features investigated on the subject site included;

- Topographic features (such as slope, aspect & landscape position),
- Dominant vegetation community composition, structure and condition at all strata levels (i.e. from ground to canopy cover),
- Ground cover type and percentage cover,
- Form, quality and location of water sources,
- Location, type and size of tree hollows,
- The presence, number and condition of unique habitat features (such as caves, crevices, loose tree bark, rocks on rock and mistletoe), and
- The level of disturbance.

During the habitat assessment all opportunistic observations of fauna or faunal activity were recorded, including visual and auditory recognition of fauna species and recognition of evidence of faunal activity (eg. nests, diggings, scratch marks, droppings).



Map Source: NSW Department of Lands http://imagery.maps.nsw.gov.au/

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Figure 4. Fauna Survey Effort and Habitat Assessment Results

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3.2.1.2 Koala Scat Searches

A search for koala scats was conducted under potential food trees identified within the buffer zone (ten largest eucalypt trees shown on **Figure 4**). An area of approximately 1 metre in circumference around the base of each tree was searched for the presence of scats and the trunks were checked for scratch marks.

3.2.3 Fauna Survey Results

A total of 98 fauna species were recorded within the study area during the 2007 field surveys, including seventy birds, twenty mammals, two reptile and six frog species (see **Appendix 5**). Of the 98 species, three were introduced species and the remainder native.

During the 2009 surveys thirty-five fauna species were recorded, including thirty-one birds, two mammal and two frog species. No threatened species were recorded however two migratory species listed under the EPBC Act were identified (cattle egret and white-bellied sea-eagle). Three bird species not recorded in 2007 were identified (white-naped honeyeater, brown warbler and striated pardalote). Species recorded in 2009 are listed in **Appendix 4.**

3.2.3.1 Threatened Fauna Species

Eight threatened fauna species (squirrel glider *Petaurus norfolcensis*, grey-headed flying-fox *Pteropus poliocephalus*, east-coast freetail-bat *Mormopterus norfolkensis*, eastern bent-wing bat *Miniopterus schreibersii oceanensis*, little bent-wing bat *Miniopterus australis*, large-eared pied bat *Chalinolobus dwyeri*, osprey *Pandion haliaetus* and masked owl *Tyto novaehollandiae*) were recorded within the local area during the 2007 surveys for the LES. In addition, a probable identification of a southern myotis *Myotis macropus* call was made using ultrasonic call analysis. All of these threatened species are listed as Vulnerable in Schedule 2 of the NSW TSC Act. The large-eared pied bat is also listed as Vulnerable and the osprey as Migratory on the EPBC Act. Four additional listed migratory species, the cattle egret, rufous fantail satin flycatcher and white-bellied sea-eagle, were also recorded within the LES study area. The locations of all threatened fauna species recorded within the LES study area in 2007 are shown in **Figure 5**.

No threatened species were recorded during the 2009 surveys and habitat assessment of the subject site however the squirrel glider was recorded in 2007 in adjoining habitat and therefore could occur within the proposed vegetated buffer zone. The threatened bat species mentioned above could forage within the subject site particularly along the edge of the buffer zone and the east-coast freetail-bat has the potential to roost within tree hollows in the buffer zone. The masked owl could forage within the subject site for terrestrial rodent such as the introduced house mouse and black rat however it is not expected to nest or roost within the buffer zone of the subject site as only one large tree hollows was identified. The osprey may fly over the subject site however it would not use the habitats available for foraging, nesting or roosting.

The potential impacts on these threatened fauna species and on other identified subject species as a result of potential future development within the study area will be considered in the impact assessment part of this report (refer to **Section 4** below).

3.2.3.2 Fauna Habitat Features

Four main types of fauna habitat were recorded within the study area. They were:

- Paperbark woodland
- Paperbark woodland with scattered eucalypts
- Open grassland (most of the subject site)
- Water filled drains

Paperbark Woodland

Paperbark woodland occurred along the north and eastern boundaries and in the south-western corner boundary behind a mixed stand of eucalypts and paperbarks. The vegetation of the paperbark woodland areas was comprised of a short closed paperbark woodland habitat area (**Plate A**). The canopy was dominated by a stand of regenerating (100 – 200 mm DBH) paperbark trees reaching eight metres in height. Regenerating (100 – 200 mm DBH) paperbark trees and middle aged (201 – 400 mm DBH) eucalypt trees also occurred but at lower frequencies within the canopy. No saplings (< 100 mm diameter stems), or regenerating (100 – 200 mm DBH), mature (400 – 600 mm DBH) and old growth eucalypt trees (600+ mm DBH) trees were recorded. Stags (dead standing trees) were rare reaching up to 15 metres in height. The canopies of individual trees were typically affected by slight levels of dieback and appeared to be free of mistletoe infestation and insect attack during the time of the field survey.

Tree hollows were only recorded in scattered middle-aged trees. Tiny (<25 mm) and small (26 – 50 mm) tree hollows were present but uncommon and no medium (51 – 100 mm), large (101 – 300 mm), extra large (> 301 mm) tree hollows were recorded. Naturally formed tree stumps (> 100 mm diameter; not cut by humans) were scattered and typically solid in nature.

No shrub layer was present. Ground cover was dominated by grass cover. Areas of soil and litter cover also occurred. Log cover (fallen trees and branches) was scattered and dominated by small (< 100 mm diameter), medium (101 – 300 mm diameter), large (> 100 mm diameter) logs. Log cover was predominately comprised of solid logs however some solid (without bark) logs were also recorded.

Species specific habitat areas of loose tree bark were abundant amongst the paperbark trees present. No areas of rock on rock, rock overhangs, caves or litter at the base of trees were recorded. One of the ten koala food tree species listed on Schedule Two of SEPP 44, *Eucalyptus robusta* was recorded as less than one percent of the canopy cover. No potential food trees of the glossy-black cockatoo were recorded in the subject site.

The study area was disturbed by; a historic (> 10 yrs ago) fire event, moderate grazing pressure from cattle and a slight level of weed infestation dominated by wild tobacco tree. No evidence of erosion or rubbish dumping was recorded.

Paperbark woodland with scattered eucalypts

Paperbark woodland with scattered eucalypts occurred along the western boundary and in the south western corner of the subject site. The vegetation was comprised of an open woodland habitat area with a mixed paperbark and eucalypt mid-storey, and a eucalypt over-storey (**Plate B**). The canopy was dominated by a stand of middle aged (201 – 400 mm DBH) eucalypt trees reaching 18 metres in height. Regenerating (100 – 200 mm DBH) trees and saplings (< 100 mm diameter stems) of both paperbarks and eucalypts occurred but at lower frequencies within the mid-canopy. No mature (400 – 600 mm DBH) or old growth trees (600+ mm DBH) trees were recorded. Stags (dead standing trees) were absent. The canopies of individual trees were typically affected by slight levels

of dieback, slight levels of mistletoe infestation and slight levels of insect attack during the time of the field surveys.

Tree hollows were only recorded in middle-aged trees. Tiny (<25 mm) and small (26 – 50 mm), tree hollows were uncommon. No medium (51 – 100 mm) or extra large (> 301 mm) tree hollows were recorded and only a single large (101 – 300 mm) hollow was sighted. Naturally formed tree stumps (> 100 mm diameter; not cut by humans) were absent.

A moderately dense shrub layer ranged between one and six metres in height and was comprised of a relatively small number of species. Ground cover was dominated by grass cover. Small areas of litter cover also occurred. Log cover (fallen trees and branches) was scattered and comprised small (< 100 mm diameter), medium (101 – 300 mm diameter) and large (> 100 mm diameter) logs. Log cover was predominately comprised of solid (with bark) logs.

Species specific habitat areas of loose tree bark were recorded at low density. No areas of rock on rock, rock overhangs, caves or litter at the base of trees were recorded. One of the ten koala food tree species listed on Schedule Two of SEPP 44, *Eucalyptus robusta* was recorded as less than one percent of the canopy cover. No potential food trees of the glossy-black cockatoo were recorded in the subject site.

The study area was disturbed by a past (4 – 10 years ago) fire event and moderate grazing pressure from cattle. No evidence of erosion, rubbish dumping or weed infestation was recorded.

Grassland Areas

Grassland areas comprised the major habitat area of the subject site and were dominated by a mixed stand of grasses reaching 0.2 metres in height with scattered thistles and tussocks reaching 0.6 metres in height (**Plate C**).

Water Holding Drains

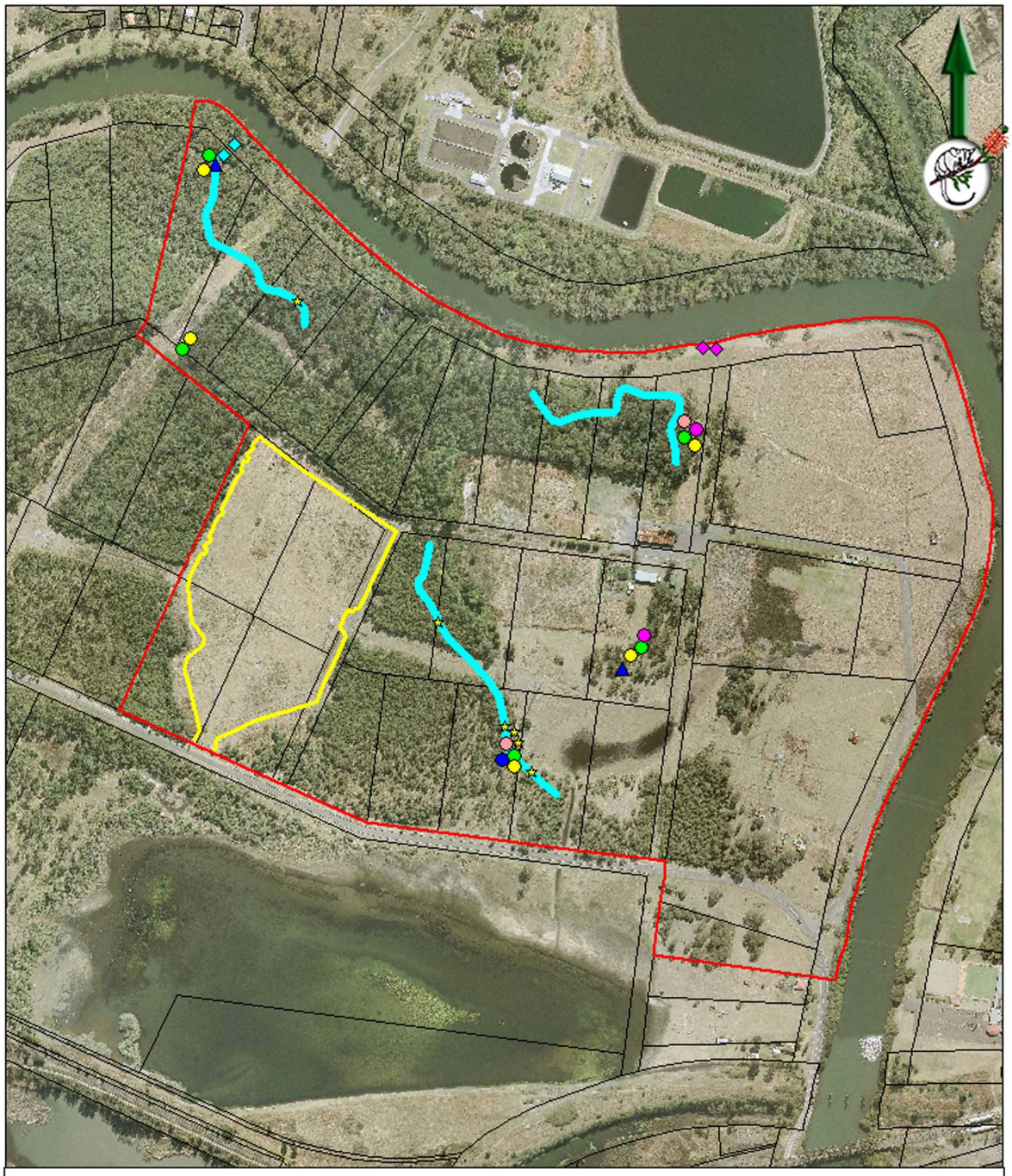
The central area of the subject site is partially bounded by drains which in areas held still bodies of water. While no aquatic flora species were present the clumping of several reedy and tussocky species along the drains suggests that they more often than not hold water (**Plate D**). Water depth at the time of the survey was estimated to be less than 0.4 metres and two frog species were recorded during the daylight hours (**Appendix 4**). The area of water held in the drains at the time of the survey ranged between two to three metres wide and between 10 and 50 metres in length.

Plate A: Paperbark Woodland Habitat Area

Plate B: Paperbark Woodland with Eucalypt Over-storey

Plate C: Grassland Habitat Area

Plate D: Water Holding Drain Habitat Area



Map Source: NSW Department of Lands http://imagery.maps.nsw.gov.au/

Figure 5. Locations of Traplines and Threatened Fauna recorded during the Ecotone 2007 survey

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June 2010

4.0 ASSESSMENT OF THE PROPOSAL

4.1 Overview of Potential Impacts Associated With the Proposal

Following comments from DECCW, the layout of the proposed facility has been revised to mimimise impacts on the EEC *Swamp Sclerophyll Forest on Coastal Floodplains* (Community 2) in the southern part of the site. The boundary of the EEC was accurately surveyed in the field to guide appropriate amendments to the proposed layout. As a result, the EEC will no longer be impacted in the south east corner of the site, and only a small area (approximately 80 m^2) will be disturbed at the western side of the main entrance to the site from The Weir Road.

The proposal may remove or modify a few native trees or remnant native vegetation from Communities 1 and 3 for construction of the fire access track and boundary fence along the western boundary of the site. Seven trees of the vulnerable *Angophora inopina* occur along this boundary, and are at risk of disturbance due to the outer bund wall. However, retaining walls will be provided where practicable to protect the trunks of these trees from disturbance by the earth bund (see Figures 2 and 3). The exact nature of these retaining walls will be confirmed in the detail design. Two small swamp mahogany trees would also be removed from the weedy pasture area (Community 4) in the interior of the subject site. The vast majority of vegetation removal would be of weedy open pasture with no trees.

In terms of water management, treated excess runoff from the site would be discharged from an outlet pipe when the pond water level rises and via a spillway when the pond capacity is exceeded. Water discharged from the main storage pond will follow an existing drainage pathway (man-made channels) through the downstream swamp forest and freshwater wetland communities and conveys flows into a SEPP14 wetland.

Other impacts identified as a result of the operating of the recycling facility are increased traffic movements, noise, dust and, if operated after dark, lighting. The construction of a security fence and infrastructure would also prevent terrestrial species, particularly macropods, from moving across the subject site however forested land to the north provides connectivity between habitat remnants in the locality.

The potential for impact on threatened species and ecological communities as a result of the proposal has been formally addressed below under the provisions of Part 3A of the *Environmental Planning and Assessment Act 1979* (with reference to various planning instruments and policies) and the *Environment Protection and Biodiversity Conservation Act 1999*.

4.2 NSW State Legislative Requirements

4.2.1 Part 3A of the Environmental Planning & Assessment Act 1979 (EP&A Act)

This proposal will be assessed under Part 3A of the Environmental Planning & Assessment Act 1979. Part 3A was introduced by the NSW government in July, 2005. This allows the Minister for Planning to call in 'major projects' or anything deemed as 'critical infrastructure'. A new *State Environmental Planning Policy (Major Projects) 2005* defines what projects are subject to Part 3A and require ministerial approval. The proposed Recycling Facility at Teralba has been declared by the government as a Major Project.

Under Part 3A, The Department of Planning prepares the matters that the proponent must address in the environmental assessment for the Proposal, known as the Director-General's requirements for

environmental assessment. The requirements are developed in consultation with State agencies such as the Department of the Environment, Climate Change & Water and other relevant authorities including local councils. Under Part 3A, the proponent would be required to include a written impact assessment including a statement of commitments to demonstrate how the project's likely environmental impacts will be minimised or managed. If the project is approved, the proponent will be required to honour these commitments as part of the conditions of approval. Following preparation of the impact assessment, the Director-General prepares a statement to the Minister as to whether the assessment is considered to have met the Director-General's requirements. The Minister must take this statement into account when deciding whether to approve the proposed development, but is not obliged to be bound by it.

The Director-General's requirements for environmental assessment of the proposal (Section 75F of the EP&A Act) that are relevant to flora and fauna include consideration of the following key issues:

- Any threatened species, populations and ecological communities;
- The aquatic ecosystems, especially in the surrounding wetlands; and
- Any native vegetation.

Reference to *The NSW Wetlands Management Policy* (DWLC 1996) is also required.

The steps to follow in the assessment process for a Part 3A assessment as recommended in the *Draft Guidelines for Threatened Species Assessment* (DECC 2004) are listed below, with each step addressed in relation to the proposed development.

Step 1. Preliminary Assessment

The main purpose of the preliminary assessment is to determine the likelihood of the subject site supporting threatened species.

This has been addressed by **Section 2** of this report, in which the likelihood of threatened species, endangered populations or threatened ecological communities occurring within the subject site has been assessed on the basis of the nature and quality of habitats available and the presence of previous records in the study locality

Step 2. Field Survey and Assessment

Field surveys should be conducted by suitably qualified and experienced investigators using currently accepted survey methodologies.

The methodology and results of the field surveys have been fully documented in **Section 3** of this report and also in the report for the LES (Ecotone 2008).

Step 3. Evaluation of Impacts

An assessment of the impact on the EEC and any threatened flora or fauna species that actually or could potentially occur within the subject site is presented below. This section addresses the heads of consideration given in Appendix 3 of the *Draft Guidelines for Threatened Species Assessment* under Part 3A of the *Environmental Planning and Assessment Act 1979* (DEC & DPI 2005), with reference to the relevant sub-headings within each head. It should be noted that at this stage this

checklist is part of a draft document which is yet to be finalised. Therefore, the questions currently have no legal standing and are used here for guidance only.

4.2.1.1 Assessment of Impact on Threatened Flora Species and EECs

a) How is the proposal likely to affect the lifecycle of a threatened species and/or population?

Threatened flora species
One listed threatened flora species, *Angophora inopina* (Vulnerable - TSC Act) was confirmed to occur within the study area. Numerous individuals of the species were recorded within the 30m buffer zone around the edge of the subject site (see Figure 3). A number of individuals were found to occur at the edge of or near the boundary of the project site, particularly along the western boundary. Following accurate surveying of their locations, it was found that seven of these trees occurred slightly within the project site or on its boundary. These trees will be protected where practicable by provision of retaining walls to protect the tree trunks from the earth bund wall within a radius from the trunk equal to the dripline of the tree canopies (see Figures 2 and 3). If individual trees need to be removed this would not significantly affect the lifecycle of the local population. Additionally, a total of 52 individuals of *A. inopina* were recorded within the 30m buffer zone surrounding the subject site and none of these would be affected by the proposal. It is also known from the earlier flora surveys for the LES (Ecotone Ecological Consultants 2008) that the species occurs beyond the limits of the current study area, and the population was noted to be dense and abundant to the west of the study area, particularly beyond the north-western corner. Given the protective measures that will be applied to the few trees of *Angophora inopina* that are on or slightly within the site boundary, it is not expected that the lifecycle of the species in the local population would be significantly affected.

Threatened Populations
No endangered populations of flora were recorded within the study area during the field survey, and none are expected to occur given the nature of the habitat available. The proposal is expected to have no affect on the lifecycle of any currently listed endangered populations of flora.

b) How is the proposal likely to affect the habitat of a threatened species, population or ecological community?

Threatened flora species
The habitat for *Angophora inopina* within the 30m buffer zone surrounding the subject site would not be directly or indirectly affected by the proposal. The Landscape Management Plan will ensure that weed invasion into the buffer zone will be prevented and managed. Weeds and habitat will be managed professionally within the retained areas of bushland in the south-western corner of the site, where a patch of habitat for *A. inopina* occurs. Therefore, in this area of the site the quality of the habitat is likely to improve.

Threatened Populations
No endangered flora populations were recorded within the study area during the field survey, and none are expected to occur given the nature of the habitat available. The proposal would have no affect on the habitat of any currently listed endangered populations of flora.

Endangered Ecological Communities

The proposal would remove or modify a small rectangular patch of habitat that qualifies as the EEC *Swamp Sclerophyll Forest on Coastal Floodplains.* This occurs at the southern end of the subject site on the western edge of the site entrance at The Weir Road (see Figures 2 and 3), but the patch is in a poor and degraded condition as explained in section 3.1.2.6. The total area to be removed or modified amounts to approximately 80m^2.

The loss or modification of this small area of habitat would be offset within the site by weed control/ management of retained patches of the EEC in the south-western and south-eastern corners of the property which are both outside the subject site. The available offset area consists of 0.83 ha. of existing habitat for the EEC which would be retained and managed, representing an offset ratio of 104:1.

The habitat for the EEC within the 30m buffer zone surrounding the subject site and beyond would not be directly or indirectly affected by the proposal due to the treatment and appropriate discharge of stormwater runoff from the site. Therefore, the retained areas of habitat for the EEC are unlikely to be affected by edge effects or hydrological changes. The Landscape Management Plan will ensure that weed invasion into the surrounding retained areas of habitat will be prevented and managed. Weeds and habitat will be managed professionally within the retained areas of bushland in the south-western and south-eastern corners of the site, which consist entirely of habitat for the EEC. Therefore, in these areas of the site the quality of the habitat is likely to improve.

Given the extensive area of this EEC that was documented in the surveys for the LES (Ecotone Ecological Consultants 2008), together with the offsetting and management of habitat for the EEC within the study area, the removal or modification of a small area of habitat would have an insignificant effect on the extent and continued health of the EEC in the wider area.

c) Does the proposal affect any threatened species or populations that are at the limit of its known distribution?

The proposal will not affect any listed threatened flora species or populations at the limit of their known distributions.

d) How is the proposal likely to affect current disturbance regimes?

The entire subject site is currently highly disturbed and modified by past land clearing and filling for grazing, dumping of rubbish and timber stockpiles, creation of drainage channels and invasion of weeds.

The disturbances within the subject site due to the proposal would change from the current rural to industrial in nature. With the exception of the loss of two immature swamp mahogany trees, the current situation of a general absence of native vegetation within the subject site would continue. Due to the landscaped mound or bund wall surrounding the subject site and the water management strategy within the site, no indirect additional disturbances should occur to the natural vegetation surrounding the site. Management of the retained vegetation within the site as part of the Landscape Plan will offset the small area of habitat lost and reverse the effects of disturbances due to past and current land management practices, including invasions of weeds.

e) How is the proposal likely to affect habitat connectivity?

The proposal would be almost entirely confined to cleared, open and weedy pasture and would only involve incremental losses of transitional habitat at edges of natural vegetation in the south-western corner and possibly along the western boundary of the subject site. Consequently, habitat connectivity would be practically unaffected by the proposal.

f) How is the proposal likely to affect critical habitat?

No areas of critical habitat proclaimed under the TSC Act to date occur in the vicinity of the study area. Critical habitat will not be affected by the proposal.

Conclusion to Part 3A Assessment for Threatened Flora and EECs
The proposal will result in the loss of an incremental area of degraded habitat for the EEC *Swamp Sclerophyll Forest on Coastal Floodplains* which will be offset by restoration and management of a much larger total area of appropriate habitat containing the EEC within the same property. Seven individuals of one listed threatened flora species (*Angophora inopina*) are at risk of disturbance due to the bund wall, but this risk will be minimised as far as practicable by the construction of retaining walls to protect the trees.

The proposal would not result in impacts of the magnitude that would cause the local occurrence of the EEC or *Angophora inopina* to be placed at risk of local or regional extinction.

4.2.1.2 Assessment of Impact on Threatened Fauna

This assessment addresses the potential effects of the Proposal on threatened fauna species or their habitats according to Appendix 3 of the *Draft Guidelines for Threatened Species Assessment* under Part 3A of the Environmental Planning and Assessment Act 1979 (DECC 2004). Threatened fauna species known or with potential to occur within the subject site are listed below.

Threatened fauna recorded within close proximity to the subject site and most likely to occur;

- Masked owl (*Tyto novaeholladiae*) - (Vulnerable – TSC Act)
- Squirrel glider (*Petaurus norfolcensis*) - (Vulnerable – TSC Act)
- Grey-headed flying-fox (*Pteropus poliocephalus*) – (Vulnerable – TSC and EPBC Act)
- East-coast freetail-bat (*Mormopterus norfolkensis*) – (Vulnerable – TSC Act)
- Eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) – (Vulnerable – TSC Act)
- Little bentwing-bat (*Miniopterus australis*) – (Vulnerable – TSC Act)
- Large-eared pied bat (*Chalinolobus dwyeri*) – (Vulnerable – TSC and EPBC Act)

Threatened fauna species that may occur as suitable habitat could be available;

- White-browed woodswallow (*Artamus supercilliosus*) – (Prelim. determination TSC Act)
- Varied sittella (*Daphoenositta chrysoptera*) – (Prelim. determination TSC Act)
- Little lorikeet (*Glossopsitta pusilla*) – (Vulnerable – TSC Act)
- Swift parrot (*Lathamus discolor*) – (Endangered – TSC and EPBC Act)
- Black-chinned honeyeater (*Melithreptus gularis gularis* – (Vulnerable – TSC Act)
- Scarlet robin (*Petroica boodang*) – (Prelim. determination TSC Act)
- Osprey (*Pandion haliaetus*) (Vulnerable – TSC Act; Migratory – EPBC Act)
- Little eagle (*Heiraaetus morphnoides*) – (Prelim. determination TSC Act)

- Powerful owl (*Ninox strenua*) – (Vulnerable – TSC Act)
- Regent honeyeater (*Xanthomyza phrygia*) – (Endangered – TSC and EPBC Act; Migratory – EPBC Act)
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*) – (Vulnerable – TSC Act)
- Greater broad-nosed bat (*Scoteanax rueppellii*) – (Vulnerable – TSC Act)
- Southern myotis (*Myotis macropus*) – (Vulnerable – TSC Act)
- Wallum froglet (*Crinia tinnula*) – (Vulnerable – TSC Act)

a) How is the proposal likely to affect the lifecycle of a threatened species and/or endangered population?

White-browed woodswallow (*Artamus supercilliosus*) – Preliminary Determination under TSC Act

This species was not recorded during the 2007 (Ecotone 2008) or the current 2009 surveys for this proposal. However there is one record from within 2.5 km of the subject site (DECCW Wildlife Atlas). The open grassland of the subject site may provide potential foraging habitat although nest sites are more likely to occur in adjacent woodland. Although this will be minimised, a very narrow strip of vegetation may be removed along the western boundary of the subject site and some displacement from the buffer zone may occur as a result of expected increased noise and dust levels. Since these impacts are very minor, it is unlikely that the proposal will significantly affect the lifecycle of this species.

Varied sittella (*Daphoenositta chrysoptera*) – Preliminary determination under TSC Act

This species was not recorded during the 2007 (Ecotone 2008) or the current 2009 surveys for this proposal. However there are several (14) records from the locality (within 10 km of the subject site) (DECCW Wildlife Atlas). The open grassland of the subject site is unlikely to provide potential foraging habitat. Foraging and nest sites are more likely to occur in the adjacent forests/woodland. Although this will be minimised, a very narrow strip of vegetation may be removed along the western boundary of the subject site and some displacement from the buffer zone may occur as a result of expected increased noise and dust levels. Since these impacts are very minor, it is unlikely that the proposal will significantly affect the lifecycle of this species.

Little Lorikeet (*Glossopsitta pusilla*) – Vulnerable under the TSC Act

The little lorikeet was not recorded on the subject site or within the subject area during the survey period. Potential foraging habitat occurs in the form of eucalypt trees during flowering periods. The little lorikeet is a nomadic species, moving in response to food availability. Given the nomadic nature of the little lorikeet, the possible removal of a very narrow strip of vegetation along the western boundary of the subject site is unlikely to affect the lifecycle of this species.

Swift Parrot (*Lathamus discolor*) – Endangered under the TSC and EPBC Acts

The swift parrot was not recorded on the subject site or within the subject area during the survey period. Potential foraging habitat occurs in the form of eucalypt trees during winter flowering periods. The swift parrot is a migratory species arriving in NSW from Tasmania during the winter months. Given the large foraging range of the swift parrot during its winter migration, the possible removal of a very narrow strip of vegetation along the western boundary of the subject site is unlikely to affect the lifecycle of this species.

Black-chinned honeyeater (*Melithreptus gularis gularis*) – Vulnerable under the NSW TSC Act

The black-chinned honeyeater was not recorded on the subject site during the survey period. However there are eleven records from the locality (within 10 km of the subject site) (DECCW Wildlife Atlas). Potential foraging habitat occurs in the form of winter flowering eucalypt and melaleuca trees within the buffer zone for the project. The black-chinned honeyeater is a nomadic species with small numbers arriving in the Lower Hunter usually during the winter months. Given the large foraging range of the regent honeyeater during its winter migration, the possible removal of a very narrow strip of vegetation along the western boundary of the subject site is unlikely to affect the lifecycle of this species.

Scarlet robin (*Petroica boodang*) – Preliminary determination under TSC Act

This species was not recorded during the 2007 (Ecotone 2008) or the current 2009 surveys for this proposal. However there are seven records from the locality (within 10 km of the subject site) (DECCW Wildlife Atlas). The open grassland of the subject site may provide potential seasonal foraging habitat as the scarlet robin is known to move to more open areas during winter. As nest sites are generally in drier undulating open forests and woodland this species may not breed in the local area. Foraging is more likely to occur in the adjacent open forests/woodland. Although this will be minimised, a very narrow strip of vegetation may be removed along the western boundary of the subject site and some displacement from the buffer zone may occur as a result of expected increased noise and dust levels. Since these impacts are very minor, it is unlikely that the proposal will significantly affect the lifecycle of this species.

Osprey (*Pandion haliaetus*) – Vulnerable under the NSW TSC Act; Migratory under EPBC Act

The osprey was observed flying along Cockle Creek on two consecutive days during the 2007 survey (Ecotone 2008). It is likely that a nest site occurs within the locality and possibly not far from the subject site. Although the osprey may fly over the site it is unlikely to nest in the vegetation surrounding the proposal. Nest sites are typically in exposed locations, often in the top of large solitary or emergent dead trees. No such nest sites were observed during the habitat assessment for the proposal. As this species is a fish eater it would not forage on the site. Therefore it is considered highly unlikely that the proposal would significantly affect the lifecycle of this species.

Little eagle (*Heiraaetus morphnoides*) – Preliminary determination under TSC Act

This species was not recorded during the 2007 (Ecotone 2008) or the current 2009 surveys for this proposal. However there are six records from the locality (within 10 km of the subject site) (DECCW Wildlife Atlas). This species could forage over the site and could potentially nest within the larger trees in the surrounding forest/woodland however the trees within the immediate buffer zone are probably too small. Therefore it is highly unlikely that the proposal will significantly affect the lifecycle of this species although some displacement from the buffer zone could occur as a result of expected increased noise and dust levels.

Masked owl (*Tyto novaehollandiae*) – Vulnerable under the NSW TSC Act

The masked owl was recorded in the north-west corner of LES area in 2007 (Ecotone 2008). As this species has a large home range and hunts terrestrial mammals on the edge of forest/woodland it could potentially forage within the subject site. The introduced house mouse and black rat are

known food items and are also known to occur within the study area. This species is unlikely to breed in close proximity to the subject site as only one large tree hollow was recorded during the habitat assessment. Therefore, although there will be a minor loss of foraging habitat, it is considered unlikely that the proposal will significantly affect the lifecycle of this species however some displacement from the buffer zone to adjoining bushland may occur as a result of expected increased noise and dust levels.

Powerful Owl (*Ninox strenua*) - vulnerable under the NSW TSC Act

Although the powerful owl was not recorded in the study area during the surveys, DECCW Wildlife Atlas records occur from within 2.5 km of the subject site. This large forest owl is known to occupy a large territory, particularly in fragmented areas, reflecting their high mobility and the diversity of prey species upon which they feed. The powerful owl is reliant upon mature trees containing large hollows for breeding purposes and to roost in dense foliage often within riparian habitats. The subject site itself provides no habitat value due to the lack of trees however the vegetated buffer zone provides a potential foraging area. Although this will be minimised, a very narrow strip of vegetation may be removed along the western boundary of the subject site and some displacement from the buffer zone may occur as a result of expected increased noise and dust levels. Since these impacts are very minor, it is unlikely that the proposal will significantly affect the lifecycle of this species.

Regent Honeyeater (*Xanthomyza phrygia*) – Endangered under the NSW TSC Act and Commonwealth EPBC Act.

The regent honeyeater was not recorded on the subject site during the survey period. Potential foraging habitat occurs in the form of winter flowering eucalypt and melaleuca trees within the buffer zone for the project. The regent honeyeater is a migratory species with small numbers arriving in the Lower Hunter usually during the winter months. Given the large foraging range of the regent honeyeater during its winter migration, the possible removal of a very narrow strip of vegetation along the western boundary of the subject site is unlikely to affect the lifecycle of this species.

Squirrel Glider (*Petaurus norfolcensis*) – Vulnerable under the NSW TSC Act

The squirrel glider was recorded in vegetated areas adjoining the subject site during the 2007 survey period. Although this will be minimised, a very narrow strip of vegetation may be removed along the western boundary of the subject site and some displacement from the buffer zone may occur as a result of expected increased noise and dust levels. Since these impacts are very minor, it is unlikely that the proposal will significantly affect the lifecycle of this species.

Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable under the NSW TSC Act and Commonwealth EPBC Act

The grey-headed flying-fox was recorded foraging within forest remnants adjoining the subject site during the 2007 surveys (Ecotone 2008). Due to the small number of trees that may need to be removed along the western edge of the subject site and the large area over which the grey-headed flying fox forages, the proposal is highly unlikely to displace the grey-headed flying-fox. While the area of habitat to be removed is small and unlikely to affect the grey-headed flying-fox negatively, the removal of any habitat for this species will contribute to the cumulative loss of habitat for the species. As no known flying-fox camps were identified or would be disturbed, it is considered

highly unlikely that the Proposal would disrupt the breeding cycle or roosting behaviour of the grey-headed flying-fox.

Cave-roosting Bats – Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*), Little Bent-wing Bat (*Miniopterus australis*) and Large-eared Pied-bat (*Chalinolobus dwyeri*) – All vulnerable under the NSW TSC Act

All of the above cave-roosting bats were recorded foraging in the local area during the 2007 survey period (Ecotone 2008). No breeding habitat in the form of caves or tunnels occurs on the subject site. Potential foraging habitat occurs for each species within the subject site as well as above surrounding open areas, forested areas and scattered trees. The development of the subject site will result in minor reduction or modification of the total area of potential foraging habitat within the local area. However, as these species forage over a large area and the area to be lost/modified is small (approx 7ha. comprising mostly cleared and highly modified habitat), it is unlikely to significantly affect the lifecycle of any threatened cave-roosting bat.

Hollow-roosting Bats – Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), East-coast Freetail-bat (*Mormopterus norfolkensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and – All vulnerable under the NSW TSC Act

The east-coast freetail-bat was recorded foraging within forest remnants adjoining the subject site during the 2007 surveys (Ecotone 2008). The greater broad-nosed bat has been recorded within 2.5km of the subject site and the eastern false pipistrelle within the locality (DECCW Wildlife Atlas). Potential foraging habitat occurs in the cleared subject site, particularly along the edge of the adjoining forest/woodland. None of the identified tree hollows in the surrounding buffer zone will be lost and therefore there will be no loss of potential roost sites. The proposal will result in the loss/modification of a relatively small area of foraging habitat however, given the mobility and expected large foraging range of these species, this loss is not considered to be significant. Therefore, the proposal is unlikely to significantly affect the lifecycle of these species although other factors such as noise and dust may result in some movement to adjoining habitat.

Southern Myotis (*Myotis macropus*) – Vulnerable under the NSW TSC Act

The southern myotis was tentatively recorded from a probable ultrasonic call on the edge of the wetland to the east of the subject site (Ecotone 2008). This species is not expected to roost in or near the subject site however individuals may occasionally forage over the cleared land. Foraging by this species is more likely to occur over open water along Cockle Creek and over the wetlands, particularly when inundated. Therefore, the proposal is unlikely to significantly affect the lifecycle of this species

Wallum froglet (*Crinia tinnula*) – Vulnerable under the NSW TSC Act

The wallum froglet was not recorded during the surveys conducted for the LES (Ecotone 2008). However potential habitat occurs within the freshwater wetland immediately to the east of the subject site and other wet areas, particularly paperbark swamps. Wetter areas in the south of the subject site may provide marginal habitat for the wallum froglet although extensive areas of better quality habitat occur outside of the development area. Changes to water quality and hydrology as a result of the proposal could be an issue for this species. However if the water quality and flows from the site are controlled as planned it is unlikely that the lifecycle of this species will be significantly affected.

b) How is the proposal likely to affect the habitat of a threatened species, endangered population or endangered ecological community?

Although this will be minimised, a very narrow strip of vegetation may be removed along the western boundary of the subject site. Some displacement of foraging habitat for the squirrel glider, powerful owl and nectar feeding birds from the buffer zone may also occur as a result of expected increased noise and dust levels. Since these impacts are very minor, it is unlikely that the proposal will significantly affect the lifecycle of this species. Potential foraging habitat for the grey-headed flying-fox may also be minimally reduced. The construction of the recycling plant would minimally reduce the foraging capabilities of insectivorous bats in general and possibly the masked owl within the subject site. Nearby swamp habitats could be affected by changes to water quality and flow regimes if not managed properly.

c) Does the proposal affect any threatened species or endangered population that are at the limit of its known distribution?

The subject site is not at or near the limit of the distribution of any threatened species listed in **Section 4.2.1.2** (this section).

d) How is the proposal likely to affect current disturbance regimes?

Current disturbance regimes within the subject site include:

- clearing of natural vegetation,
- the subject site has been filled and vegetated with introduced grassland
- minor rubbish dumping
- grazing by cattle,
- feral animals.

The proposal will see an increase in human presence resulting in increased traffic movements (mainly HGVs), machinery noise (crushers, grinders and separators), dust, if not suppressed adequately and possibly lighting during night operations.

e) How is the proposal likely to affect habitat connectivity?

The subject site is already cleared of natural vegetation so there will be no change to habitat connectivity apart from the construction of the entry road at The Weir Road. The security fence around the recycling facility and infrastructure of the project would prevent or hamper movement across the site by terrestrial fauna species however connectivity around the site to the north would still be maintained.

f) How is the proposal likely to affect critical habitat?

No critical habitat is currently listed in the NSW TSC Act or Commonwealth EPBC Act for the subject species within the study area.

Conclusion to Part 3A Assessment for Threatened Fauna

Although impacts from noise, dust and lighting may result in fauna moving further away from the proposed recycling facility it is considered unlikely that the proposal would result in any significant negative impacts on the threatened fauna species assessed. Reasons for this assumption are:

- the subject site is primarily devoid of natural habitats;
- no identified hollow bearing habitat trees will need to be removed;
- large areas of better quality habitat occur on adjoining land;
- most of the species assessed are highly mobile and either have a large home range and/or are nomadic; and
- vegetated corridors for terrestrial and arboreal species, such as the squirrel glider, will still remain in their current state.

Step 4. Avoid, Mitigate and then Offset

The proposal has been specifically located and designed to avoid, as far as possible, the local occurrence of EECs and threatened species that were already known to occur within the LEP area. It will only remove or modify a small patch of degraded habitat at the outer edge of the EEC, a couple of individual, isolated native trees and may place a few individuals of the vulnerable scrub apple (*Angophora inopina*) at risk at the edge of the population. The potential impacts are so minimal that avoidance by further modifying, downsizing or relocating the proposal is considered unnecessary.

Mitigation of potential impacts would involve the management of invasion and spread of noxious and environmental weeds in the retained areas of natural vegetation within the property, and the maintenance of systems to ensure the proper functioning of the water management strategy for the site to control runoff. Full details are given in the Recommendations (**Section 6.0**).

To compensate for the small area of EEC habitat cleared or modified, appropriate offsets will be provided on-site in two areas of retained natural vegetation in the south-western and south-eastern corners of the site. Soil will be removed from a bare, weedy part of this area which had previously been filled. The area will be restored to the same level as the adjoining natural vegetation and reinstated with local provenance plantings of the same species as the adjoining remnant. Appropriate species to use are given and the Landscape Plan, and could also include those designated by an 'R' in the flora list (**Appendix 1**). The planting list will include the threatened *Angophora inopina*. Professional bush regeneration including removal and management of weeds will be applied in the existing vegetation remnants.

Step 5. Key Thresholds

The development application needs to contain a justification of the preferred option based on:

- *whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.*

  The net effect of the proposal is to at least maintain and probably slightly improve the biodiversity values within the site. The removal or modification of a small area of transitional EEC and the possible removal of a few isolated or scattered native trees will be offset by the provision of suitable compensatory habitat in the areas of retained or restored habitat in the two

southern corners of the site. Control and management of weeds would result in an improvement of habitat, particularly of the retained understorey.

- *whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.*

  No endangered populations are relevant to the site. Since the proposal largely involves impacts on cleared and weedy habitat only, with minimal impacts on habitat for one EEC and possibly one threatened flora species at the edges only, it is highly unlikely to reduce the long-term viability of any local populations of species or ecological communities.

- *whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction*

  The proposal will not accelerate the extinction of or place any species, population or ecological community at risk of extinction.

- *whether or not the proposal will adversely affect critical habitat.*

  The proposal will not affect any areas of identified critical habitat.

4.2.2 Coastal Wetlands – SEPP 14

A wetland listed under State Environmental Planning Policy No. 14 (SEPP 14) occurs along the southern half of the eastern boundary of the land in which the subject site occurs (Wetland No. 852). The refined boundary of the wetland is shown in Figure 5 of Ecotone Ecological Consultants (2008). The boundary of the subject site has been located to completely avoid the SEPP 14 wetland, including a 20m buffer. The wetland will be protected from runoff from the site by the landscaped bund wall surrounding the works area. Treated runoff from the site will be discharged from a single point at the northern end of the site and directed towards the north-east. Runoff from the site will therefore not impact on the wetland.

4.2.3 Koala Habitat Assessment – SEPP 44

Assessment of potential koala habitat under SEPP 44 requires the following step be undertaken:

a) identification of "potential Koala Habitats" within the proposed development area; if the total tree cover contains 15% or more of the koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be "potential" koala habitat. Identification of 'potential koala habitat requires the determination of the presence of 'core koala habitat';
b) identification of "core Koala habitat" within the development area. "Core Koala habitat" is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;
c) identification of "core Koala habitat" will require that a plan of management must accompany the DA application;
d) if the rezoning of lands, other than to environmental protection, involves potential or core Koala habitat then the Director of planning may require a local environmental study be carried out.

The subject site itself consists primarily of grassland and as such does not represent koala habitat. Much of the forest/woodland surrounding the subject site has been identified as 'potential koala habitat' based on the presence of food tree species listed in SEPP 44 (Ecotone 2008). Three food

tree species, *Eucalyptus tereticornis*, *E. haemastoma* and *E. robusta*, listed on Schedule 2 of SEPP 44 occur in the buffer surrounding the subject site, mainly within the north-western parts. Ball honeymyrtle swamp forest is dominant in much of the remaining buffer and although melaleuca species are not listed in SEPP 44 some species are known to be important koala habitat in other areas (e.g. *Melaleuca quinquenervia* in Port Stephens LGA). Therefore at least the scribbly gum/swamp mahogany/paperbark swamp forest in the north-western part of the study area represents 'potential koala habitat'. However the lack of evidence of koala presence through scat searches and the fact that no records occur near the subject site indicates that the study area does not represent 'core koala habitat' as defined in SEPP 44, therefore further assessment under SEPP 44 is not required. The potential for the koala to occur on the subject site, regardless of SEPP 44, has already been assessed in **Table 6** above.

4.2.4 Local and Regional EPIs and Planning Policies

The NSW Wetlands Management Policy

Since a SEPP 14 wetland occurs along part of the eastern boundary of the site, *The NSW Wetlands Management Policy* (DLWC 1996) is relevant. This policy aims to minimise any further loss or degradation of wetlands and where possible, restore degraded wetlands. A set of nine principles for sustainable management of wetlands has been adopted by the policy to achieve this goal. The relevance of these principles to the proposal is discussed below:

Principle One*: Water regimes needed to maintain or restore the physical, chemical and biological processes of wetlands will have formal recognition in water allocation and management plans.*

The Water Management Plan is designed to manage the quantity and quality of stormwater discharged from the site to mitigate impacts on the downstream freshwater and SEPP14 wetland communities, maintaining the hydrology and water quality variation to within the range experienced by these communities.

Principle Two*: Land use and management practices that maintain or rehabilitate wetland habitats and processes will be encouraged.*

The potential impacts of the proposed land use activities within the subject site on the wetland habitat will be mitigated by water management measures and the landscaped buffer formed by the bund around the site perimeter. These will ensure that the quality of the adjoining wetland habitat will be maintained.

Principle Three*: New developments will require allowance for suitable water distribution to and from wetlands .*

At present, there is a drainage channel between the wetland and the subject site. Discharge from the site will be managed to mitigate impacts on the receiving environment and to maintain the hydrology required to sustain the wetland communities. Existing drainage pathways relating to external catchment flows will also be maintained as much as possible.

Principle Four*: Water entering wetlands will be of sufficient quality so as not to degrade the wetlands .*

As discussed above, water from the subject site will be managed to mitigate potential impacts associated with water quality.

***Principle Five**: The construction of purpose-built wetlands on the site of viable natural ones will be discouraged.*

This will not occur as a result of the proposal.

***Principle Six**: Natural wetlands should not be destroyed, but when social and or economic imperatives require it, the rehabilitation or construction of a wetland should be required.*

This will not occur as a result of the proposal.

***Principle Seven**: Degraded wetlands and their habitats and processes will be actively rehabilitated as far as is practical.*

The wetland on adjoining land will be effectively protected from further degradation, but any active rehabilitation of the wetland would not form part of the current proposal.

***Principle Eight**: Wetlands of regional or national significance will be conserved.*

The wetland on adjoining land is of regional significance under SEPP 14, and the water management and other protective measures discussed above will ensure its conservation.

***Principle Nine**: The adoption of a stewardship ethos and co-operative action between land and water owners and managers, government authorities, non-government agencies and the general community is necessary for effective wetland management.*

The proposal has been designed and will be constructed with the full co-operation and consultation between all stakeholders with an interest in the land on which the adjoining wetland occurs.

Hunter REP

The only parts of the Hunter Regional Environmental Plan (1989) that could potentially be relevant to flora and fauna within the subject site are the objectives of Part 8 (Conservation and Recreation), Division 1 (Natural Areas), which state:

"*The objectives of this plan in relation to planning strategies concerning natural areas are to:*

(a) protect natural areas of geological, ecological or scenic interest such as important forests, bushlands, wetlands, rivers, estuaries, lakes, beach and dune systems, headlands, mountain ridges and escarpments,
(b) strictly control any reduction in the extent of important natural areas, especially important habitats such as natural wetlands,
(c) protect and preserve bushland within larger urban areas because of its natural, aesthetic, recreational, educational, scientific, soil conservation and habitat values, and
(d) improve the aesthetic appeal and image of the region where possible and preserve existing amenity"

Given the quality and quantity of natural vegetation currently occurring within the study area and the scale of the proposed development; most of these objectives are essentially irrelevant, or of peripheral relevance only. The plan is essentially aimed at protection of more extensive and significant areas of biodiversity.

Lower Hunter Regional Strategy

This strategy provides recommendations for the provision of regional scale green corridors and future conservation lands in designated areas within the context of urban and industrial expansion and upgrading of transport infrastructure within the Lower Hunter region. This issue of provision of green corridors, wildlife corridors and conservation lands was considered and resolved during the ecological study and assessment for the parcel of land for the Teralba LES (Ecotone Ecological Consultants 2008) which includes the land occupied by the proposed recycling facility.

4.3 Commonwealth Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act was gazetted in 2000 and replaced several earlier Commonwealth statutes. This Act focuses Commonwealth interests on matters of national environmental significance (NES) including integrated biodiversity conservation and the management of important protected areas. The Act also establishes a streamlined environmental assessment and approvals process.

The matters of NES as identified in the Act which require assessment and approval to be addressed by the Commonwealth include:

- World Heritage properties
- National Heritage places
- RAMSAR wetlands
- Nationally threatened species and ecological communities (Part 13, Division 1, Subdivision A of the EPBC Act)
- Migratory species
- Commonwealth Marine areas
- Nuclear actions (including uranium mining)

The assessment and approval process applies to any action that has, will have or is likely to have a significant impact on a matter of NES. An 'action' is defined as a project, development, undertaking or an activity or series of activities. As of 18 January 2007, a bilateral agreement has been signed between the Commonwealth and the state of NSW which essentially accredits the NSW assessment process of environmental impact for the purposes of the EPBC Act, provided that the assessment has been done in accordance with the bilateral agreement. This has effectively removed the need for duplication of assessment effort by both the Commonwealth and state.

With regard to flora and fauna, the only matters of NES relevant to the study area are nationally listed threatened species and migratory species. The relevant criteria given in the administrative guidelines for the Act to determine whether the action will or is likely to have a significant impact on a nationally threatened species are assessed in **Table 9** below.

Table 9: Assessment of Potential Impact on Species Listed Under the EPBC ACT 1999.

Significant Impact Criteria and Assessment	
Critically Endangered and Endangered Ecological Communities None	
Critically Endangered and Endangered Species Flora – None Fauna – Swift parrot and regent honeyeater	
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	*a) lead to a long-term decrease in the size of a population;* The swift parrot and regent honeyeater are only likely to visit the study area on an opportunistic, occasional basis and are unlikely to be greatly affected by the proposal.
	b) reduce the area of occupancy of the species; While a very small area of potential foraging habitat for the swift parrot and regent honeyeater may be lost as a result of the proposal, this is unlikely to have a significant impact on either of these species.
	c) fragment an existing population into two or more populations; The proposal would not fragment an existing population of the swift parrot or regent honeyeater into two or more populations.
	d) adversely affect habitat critical to the survival of a species; The proposal would not adversely affect habitat critical to the survival of the swift parrot or regent honeyeater.
	e) disrupt the breeding cycle of a population; No breeding habitat for the swift parrot or regent honeyeater has been recorded within the study area and none is likely to be affected. The proposal would not disrupt the breeding cycle of a population of any of these species.
	f) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; The proposal would not affect the habitat of the swift parrot or regent honeyeater to such an extent that one or more of these species would be likely to decline.
	g) result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;* The proposal is highly unlikely to result in an invasive species harmful to the swift parrot or regent honeyeater from becoming established within the study area.
	h) introduce disease that may cause the species to decline; or The proposal is highly unlikely to result in the introduction of a disease that would cause the swift parrot or regent honeyeater to decline.
	i) interfere with the recovery of the species. While the proposal may result in the minor loss of some potential foraging habitat for the swift parrot and regent honeyeater, this would not interfere significantly with the recovery of these species.

Vulnerable Species Flora – *Angophora inopina* (scrub apple/ Charmhaven apple) Fauna –Grey-headed flying-fox and large-eared pied bat.	
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	*a) lead to a long-term decrease in the size of an important population*** *of a species;* *Angophora inopina* – Up to seven individuals of *Angophora inopina* may be placed at risk as a result of the proposal along the western site boundary, but would be protected from the bund wall by retaining walls wherever practicable. Given the abundance of the species in the land immediately adjoining the subject site (at least 52 individuals) and beyond, the proposal is unlikely to result in a long-term decrease in the size of the local population. Grey-headed flying-fox and large-eared pied bat - Due to the small area of potential habitat that may be removed and the disturbed nature of the subject site the proposal will not result in a long-term decrease in the size of an important population of either of these bat species.
	b) reduce the area of occupancy of an important population; *Angophora inopina* – No reduction in the current area of occupation of the species is expected to occur. Grey-headed flying-fox and large-eared pied bat – Due to the small area of potential habitat and the disturbed nature of the habitat to be removed the proposal will not result in a reduction in the area of occupancy of an important population.
	c) fragment an existing important population into two or more populations; *Angophora inopina* – The proposal may place a small number of trees at risk on the edge of the existing population, but would not fragment it into two or more populations. Grey-headed flying-fox and large-eared pied bat - the proposal will not fragment an existing important population of either of these species into two or more populations.
	d) adversely affect habitat critical to the survival of a species; *Angophora inopina,* grey-headed flying-fox and large-eared pied bat– the proposal would not adversely affect habitat critical to the survival of any of these species.
	e) disrupt the breeding cycle of an important population; *Angophora inopina* – The possible disturbance to a few trees from the edge of the existing population would have little effect on the breeding cycle of the population. Grey-headed flying-fox and large-eared pied bat - – neither of these species are known or likely to breed within the study area. The proposal would not disrupt the breeding cycle of an important population of either species.
	f) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline; *Angophora inopina* – An incremental area at the edge of the habitat for the species may be disturbed by the proposal, but the quality of the remaining habitat would be protected from indirect impacts by the bund wall and weed management as part of the Landscape Plan. Grey-headed flying-fox and large-eared pied bat – a small area of foraging habitat is likely to be lost as a result of the proposal but this would not affect the grey-headed flying-fox or large-eared pied bat to the extent that the species is likely to decline.
	*g) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***;* *Angophora inopina* – Full management of the species' habitat in the retained vegetation in the south of the site would be applied according to the Landscape Plan, including weed control. Weeds would also be managed along the bund wall around the entire perimeter of the site and prevented from invading adjoining bushland habitat. Grey-headed flying-fox and large-eared pied bat – the proposal is highly unlikely to result in an invasive species harmful to the grey-headed flying-fox or large-eared pied bat becoming established within the study area.
	h) introduce disease that may cause the species to decline; or

	<u>*Angophora inopina*</u> – Provided that appropriate protocols are established during and after construction to prevent introduction of root-rot fungus (*Phytophthora cinnamomi*) into the site, the proposal should not result in the introduction of a disease that might cause the species to decline. <u>Grey-headed flying-fox and large-eared pied bat</u> – it is highly unlikely that the proposal would result in the introduction of a disease that may cause the grey-headed flying-fox or large-eared pied bat to decline.
	i) interfere substantially with the recovery of the species. <u>*Angophora inopina*,</u> <u>Grey-headed flying-fox and large-eared pied bat</u> – given the minimal impacts on habitat and professional bushland management as part of the Landscape Plan, the proposal would not interfere substantially with the recovery of any of these species.
Migratory Species Regent honeyeater, white-throated needletail, white-bellied sea-eagle*, rainbow bee-eater, satin flycatcher*, rufous fantail*, black-faced monarch, great egret and cattle egret* (*species recorded in study area)	
An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:	*a) 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;* No important habitat for migratory species would be substantially modified as a result of the proposal.
	b) 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 It is highly unlikely that an invasive species that is harmful to any of the above listed migratory species would become established within the study area as a result of the proposal.
	c) seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion[##] of the population[###] of a migratory species. The proposal would not seriously disrupt the lifecycle of any of the above listed migratory species.

^ *'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:*

- *for activities such as foraging, breeding, roosting or dispersal*
- *for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)*
- *to maintain genetic diversity and long term evolutionary development*
- *for the reintroduction of populations or recovery of the species or ecological community*

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the Minister under the EPBC Act.

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- *a geographically distinct regional population, or collection of local populations or*
- *a population, or collection of local populations, that occurs within a particular bioregion.*

** Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

[**]An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- *key source populations either for breeding or dispersal,*
- *populations that are necessary for maintaining genetic diversity, and/or*
- *populations that are near the limit of the species range.*

****Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.*

[#]An area of 'important habitat' for a migratory species is:

- *habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or*
- *habitat that is of critical importance to the species at particular life-cycle stages; and/or*
- *habitat utilised by a migratory species which is at the limit of the species range; and/or*

- *habitat within an area where the species is declining.*

[##]*Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).*

[###] *'Population', in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.*

4.3.1 Key Threatening Processes

Seventeen key threatening processes have been finally determined under the EPBC Act. Those that could be potentially relevant to the proposal are discussed below:

1) Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*): Infection of some species of native plants by this plant pathogen could occur into the site if contaminated soil were inadvertently imported in fill or on machinery, tools, boots or clothing. Protocols should be established to prevent this occurring.
2) Land Clearance: Very little if any clearance of native vegetation would occur as a result of this proposal. This key threatening process has little relevance in the context of the current proposal.
3) Infection of amphibians with chytrid fungus resulting in chytridiomycosis: The movement of water, soil or plant matter from wet drainage lines or onto the subject site during construction has the potential to spread chytrid fungus. The level of chytrid fungus prevalence on the subject site and in the surrounding area is unknown but should not be assumed to be absent.
4) Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases: As with any industrial activity, the proposal during both its construction and operational phases could result in an incremental contribution to the anthropogenic global emissions of greenhouse gases thus contributing to the overall loss of terrestrial climatic habitat for some threatened species on a global basis.

4.3.2 Summary of Impacts on EBPC Act Matters of NES

According to the criteria given in the administrative guidelines for the EPBC Act, the proposal is unlikely to have a significant impact on any nationally listed threatened or migratory flora or fauna species.

4.4 Impacts on Non-listed Species and Communities

A total of 58 non-listed native flora species were recorded during the field survey,

No native flora species recorded within the study area are listed on the national ROTAP (Rare or Threatened Australian Plants) database (Briggs & Leigh 1996). Some common and unlisted flora species recorded in the buffer zone of the study area have local conservation significance according to Lake Macquarie Council (Forest Fauna Surveys and Eastcoast Flora Survey 2001). These include:

- *Adiantum aethiopicum* (maidenhair fern) – has local conservation significance, and
- *Eucalyptus signata* (scribbly gum) – southern limit at Munmorah.

If any removal of these species does occur it would be restricted to along the western boundary and would be very minor. Such removal would be unlikely to place their local populations at risk of extinction.

The following natural flora communities are considered to have regional conservation significance according to Lake Macquarie Council (Forest Fauna Surveys and Eastcoast Flora Survey 2001) because of their natural rarity and the historical extent of clearing:

- Swamp Forests – Communities 1 and 2
- Wetlands and Wetland Vegetation Communities – part Communities 1 & 2
- Coastal Plains Scribbly Gum Woodland – Community 3

Given their status as EECs or listed wetlands, the impacts on the swamp forest and wetland communities have been formally assessed above. Minimal, if any, impact would occur on the transitional scribbly gum community along the western boundary of the subject site.

With regard to fauna, 87 non-listed native species were recorded during the field survey for the LES in 2007 compared with the 34 species recorded in 2009 for the current proposal. The lower diversity is to be expected given the much smaller study area, the lack of natural habitat within much of the subject site and the lower survey effort. Although the loss of habitat associated with the proposal would decrease or modify the extent of fauna habitat available for some species (mainly foraging by birds and microbats) impacts would be low given the disturbed nature of the subject site and the presence of similar or better quality adjoining habitat. Therefore it is not expected that the proposal would greatly impact any of these fauna species.

5.0 MITIGATION MEASURES

The project will involve some disturbance at the edge of natural vegetation comprising flora and fauna habitat, including one threatened flora species and one EEC, within or immediately adjoining the subject site. The following measures are recommended to ameliorate the minor impacts that may occur on flora and fauna habitat, particularly in the south-eastern corner and along the western boundary as a result of the proposal.

- The site perimeter fence (stock fence) should be installed prior to the commencement of construction works to prevent accidental intrusions into adjoining areas of natural vegetation, particularly the swamp and wetland areas.
- Temporary fences or barriers should be installed on the development side of the surveyed edges of the EEC in the south-eastern and south-western corners of the property during construction to protect the EEC from accidental intrusions by machinery and to prevent inappropriate stockpiling of soil and building materials in the EEC areas.
- Runoff/sedimentation from the proposed works areas should be managed during the construction phase using current best practice sediment and erosion control measures. In particular, management of runoff into and protection of the water quality of the adjoining SEPP 14 wetland and swamp EEC in the south-eastern corner should be implemented during construction of the bund wall.
- A protocol for the prevention of *Phytophthora cinnamomi* infection of native plants should be developed and implemented during construction.
- Weed control protocols should be developed and implemented as an integral part of the Landscape Plan. All weeds from areas cleared during construction should be completely removed from the site and not allowed to enter adjacent habitat. Noxious weeds in the areas if retained or restored vegetation must be controlled by law according to the requirements for the particular class of weed (including implementation of recommended control plans for Class 4 weeds where applicable).
- As part of the Landscape Plan, significant weeds must be controlled along the perimeter of the site in the area of the landscaped bund wall and APZ and prevented from invading adjoining natural bushland.
- All species to be used for rehabilitation and restoration of retained natural areas and the bund wall in the Landscape Plan shall be of local provenance. Suitable species to use are designated by an 'R' in **Appendix 1**
- Include *Angophora inopina* (propagated from seed of local provenance) in the planting list in the Landscape Plan to be planted in areas of similar habitat to that in which it currently occurs in the site, to offset any trees that cannot be protected due to the proposal.
- Depending on the number and size of trees to be removed, a tree felling protocol may need to be developed and implemented to minimize harm to any fauna species during the clearing of trees. The tree felling protocol should be developed and implemented by a suitably qualified ecologist with previous experience supervising the felling of trees. The tree felling protocol should involve as a minimum the following key steps of: establishment of the best time of the year for felling (depends on the likely species to be affected) and if necessary, pre-felling mapping of habitat trees, inspections of trees for nests or other evidence of current occupation by fauna on the day of felling, procedures for the safe removal of fauna species from trees prior to and post felling, a relocation/release protocol, a protocol for the salvaging of tree hollows for rehabilitation works (it would appear from the plans that no hollow bearing trees will need to be removed).

6.0 CONCLUSIONS

An assessment of the impacts on flora and fauna in relation to the proposed recycling facility at Teralba has been made based on a combination of literature review and field survey. The resulting information has been used to address Part 3A of the *Environmental Planning and Assessment Act 1979* and other relevant legislation.

The subject site consists almost entirely of cleared, open and weedy pasture. However, threatened and significant ecological communities and flora species surround the subject site up to its boundary. A small rectangle at the edge of the EEC *Swamp Sclerophyll Forest on Coastal Floodplains* would be removed or modified by the proposal in the south-western corner of the subject site. This patch amounts to approximately 80m^2 in area and is in poor condition. This loss would be offset within the property in areas of retained natural vegetation at the southern end of the site that would be restored and rehabilitated.

One vulnerable flora species listed by both the NSW TSC Act and Commonwealth EPBC Act, *Angophora inopina*, occurs at moderate abundance around the perimeter of the site within the 30m buffer beyond the subject site. Seven individuals of the species that occur along the western boundary or slightly within the subject site may be affected by the bund wall, but would be protected from the wall by retaining walls wherever practicable. Given the proposed protective measures in combination with the presence of numerous individuals of this species within the 30m buffer area beyond the subject site that would remain unaffected, a significant impact on the local population of the species is not considered likely.

Eight threatened fauna species (squirrel glider *Petaurus norfolcensis*, grey-headed flying-fox *Pteropus poliocephalus*, east-coast freetail-bat *Mormopterus norfolkensis*, eastern bent-wing bat *Miniopterus schreibersii oceanensis*, little bent-wing bat *Miniopterus australis*, large-eared pied bat *Chalinolobus dwyeri*, osprey *Pandion haliaetus* and masked owl *Tyto novaehollandiae*) were recorded within the local area during the 2007 surveys for the LES. In addition, a probable identification of a southern myotis *Myotis macropus* call was made using ultrasonic call analysis. All of these threatened species are listed as Vulnerable in Schedule 2 of the NSW TSC Act. The large-eared pied bat is also listed as Vulnerable and the osprey as Migratory on the EPBC Act. Four additional listed migratory species, the cattle egret, rufous fantail satin flycatcher and white-bellied sea-eagle, were also recorded within the LES study area.

No threatened species were recorded during the 2009 surveys and habitat assessment of the subject site however the squirrel glider was recorded in 2007 in adjoining habitat and therefore could occur within the proposed vegetated buffer zone. The threatened bat species mentioned above could forage within the subject site particularly along the edge of the buffer zone and the east-coast freetail-bat has the potential to roost within tree hollows in the buffer zone. The masked owl could forage within the subject site for terrestrial rodent such as the introduced house mouse and black rat however it is not expected to nest or roost within the buffer zone of the subject site as only one large tree hollows was identified. The osprey may fly over the subject site however it would not use the habitats available for foraging, nesting or roosting.

It was concluded at the Part 3A assessment stage of this report that impacts on threatened fauna (as well as non-threatened species) would be minimal for the following reasons:

- the subject site is primarily devoid of natural habitats;
- no identified hollow bearing habitat trees will need to be removed;
- large areas of better quality habitat occur on adjoining land;

- most of the species assessed are highly mobile and either have a large home range and/or are nomadic; and
- vegetated corridors for terrestrial and arboreal species, such as the squirrel glider, will still remain in their current state.

Impacts from increased noise, traffic movements, dust and lighting (if operating after dark and/or security lights) have the potential to displace fauna from the buffer zone however this is not considered likely to result in the local extinction of any of the species assessed.

It is also concluded under the Commonwealth EPBC Act that a significant impact would not occur on listed endangered, vulnerable or migratory species and therefore referral to the federal minister of the environment is not required.

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8.0 APPENDICES

Appendix 1 – Flora recorded within the Study Area

The following is a list of all flora species recorded within the study area. Please note that this list may be not fully comprehensive, and should be regarded as an indication of the flora present. A period of some years is often needed to identify all species present in an area, particularly for cryptic or seasonally detectable species (such as orchids and small grass-like herbs).

Notes:

* indicates an exotic or introduced native species
R indicates locally indigenous species that are potentially suitable for revegetation or replanting works

Nomenclature follows Harden (1990, 1992, 1993, 2002), Harden & Murray (2000) and subsequent recent revisions from PlantNET.

CLASS FILICOPSIDA (Ferns)

ADIANTACEAE		
Adiantum aethiopicum	R	Common maidenhair fern
Pellaea falcata	R	Sickle fern
DENNSTAEDTIACEAE		
Hypolepis muelleri	R	Harsh ground fern
Pteridium esculentum		Bracken

CLASS MAGNOLIOPSIDA (Flowering Plants)

Subclass Magnoliidae (Dicotyledons)

APIACEAE		
*Hydrocotyle bonariensis**		Kurnell curse
Hydrocotyle peduncularis	R	-
APOCYNACEAE		
Parsonsia straminea		Common silkpod / monkey rope
ARALIACEAE		
Polyscias sambucifolia	R	Elderberry panax
ASTERACEAE		
*Ageratina adenophora**		Crofton weed
*Ambrosia artemisiifolia**		Annual ragweed
*Cirsium vulgare**		Spear thistle / black thistle
*Conyza bonariensis**		Flaxleaf Fleabane
*Erechtites valerianifolia**		Brazilian fireweed
*Gamochaeta spicata**		Cudweed
*Hypochaeris radicata**		Flatweed/catsear
*Senecio madagascariensis**		Fire weed
*Sonchus oleraceus**		Common sowthistle
Vernonia cinerea	R	-
BRASSICACEAE		
*Cardamine hirsuta**		Common bittercress / hairy woodcress
CARYOPHYLLACEAE		
*Cerastium glomeratum**		Mouse-eared chickweed
*Stellaria media**		Common chickweed
CONVOLVULACEAE		

Dichondra repens	R	Kidney weed
Polymeria calycina	R	Swamp bindweed
DILLENIACEAE		
Hibbertia aspera subsp. *aspera*	R	Rough guinea flower
ERICACEAE - Subfamily Styphelioideae		
Leucopogon juniperinus	R	Prickly beard heath
EUPHORBIACEAE		
Breynia oblongifolia	R	Coffee bush
Glochidion ferdinandi var. *ferdinandi*		Cheese tree
FABACEAE - Subfamily Faboideae		
*Erythrina crista-galli**		Cockspur coral tree
Hardenbergia violacea	R	False sarsaparilla
Kennedia rubicunda	R	Dusky coral pea
*Medicago polymorpha**		Burr medic
*Trifolium repens**		White clover
Vicia sativa subsp. *nigra**		Narrow-leaved vetch
FABACEAE - Subfamily Mimosoideae		
Acacia ulicifolia	R	Prickly Moses
GERANIACEAE		
Geranium solanderi var. *solanderi*		Cutleaf cranesbill
HALORAGACEAE		
Gonocarpus micranthus	R	Creeping raspwort
Gonocarpus teucrioides	R	Germander raspwort
LOBELIACEAE		
Pratia purpurascens	R	White root
MALVACEAE		
*Modiola caroliniana**		Redflower mallow
*Sida rhombifolia**		Paddy's lucerne
MYRTACEAE		
Angophora costata	R	Smooth-barked apple
Angophora floribunda	R	Rough-barked apple
***Angophora inopina* TSC Act Vulnerable**	**R**	**Scrub / Charmhaven apple**
Callistemon rigidus	R	Stiff bottlebrush
Corymbia gummifera	R	Red bloodwood
Eucalyptus acmenoides	R	White mahogany
Eucalyptus haemastoma	R	Broad-leaved scribbly gum
Eucalyptus resinifera subsp. *resinifera*	R	Red mahogany
Eucalyptus robusta	R	Swamp mahogany
Eucalyptus tereticornis	R	Forest red gum
Leptospermum juniperinum	R	Prickly tea-tree
Leptospermum polygalifolium subsp. *polygalifolium*	R	Tantoon / lemon-scented tea-tree
Melaleuca linariifolia	R	Snow-in-summer / flax-leaved paperbark
Melaleuca nodosa	R	Ball honey-myrtle
Melaleuca sieberi	R	Sieber's paperbark
Melaleuca thymifolia	R	Thyme honeymyrtle
PHYTOLACCACEAE		
*Phytolacca octandra**		Inkweed
PITTOSPORACEAE		
Bursaria spinosa subsp. *spinosa*	R	Blackthorn / sweet bursaria
PLANTAGINACEAE		

*Plantago lanceolata**		Common plantain
POLYGONACEAE		
Persicaria decipiens	R	Slender knotweed
PRIMULACEAE		
*Anagallis arvensis**		Pimpernel
PROTEACEAE		
Banksia oblongifolia	R	Fern-leaved banksia
RANUNCULACEAE		
Ranunculus inundatus	R	River buttercup
ROSACEAE		
Rubus fruticosus species aggregate*		Blackberry
SOLANACEAE		
*Solanum mauritianum**		Wild tobacco tree
*Solanum nigrum**		Blackberry nightshade
VERBENACEAE		
*Lantana camara**		Lantana
*Verbena bonariensis**		Purpletop
VIOLACEAE		
Viola hederacea	R	Native violet
Subclass Liliidae (Monocotyledons)		
CYPERACEAE		
Carex appressa	R	Tall sedge
Gahnia clarkei	R	Tall saw sedge
Gahnia sieberiana	R	Red-fruited saw sedge
JUNCACEAE		
Juncus usitatus	R	Common rush
LEMNACEAE		
Spirodela punctata		Duck weed
LOMANDRACEAE		
Lomandra longifolia	R	Spiny-headed mat-rush
ORCHIDACEAE		
Caladenia catenata	R	White fingers
PHORMIACEAE		
Dianella caerulea var. *producta*	R	Blue flax lily
POACEAE		
*Andropogon virginicus**		Whisky grass
*Cortaderia selloana**		Pampas grass
Cynodon dactylon		Couch
Dichelachne crinita	R	Longhair plumegrass
Echinopogon caespitosus var. *caespitosus*	R	Bushy hedgehog grass
*Ehrharta erecta**		Panic veldtgrass
Entolasia marginata	R	Bordered panic
Entolasia stricta	R	Wiry panic
Imperata cylindrica var. *major*		Blady grass
Lachnagrostis filiformis		Blown grass
Microlaena stipoides var. *stipoides*	R	Weeping grass
Oplismenus aemulus	R	Basket grass

*Paspalum dilatatum**		Paspalum
*Pennisetum clandestinum**		Kikuyu
*Setaria gracilis**		Slender pigeon grass
XANTHORRHOEACEAE		
Xanthorrhoea latifolia subsp. *latifolia*	R	A grass-tree

Appendix 2. Data from the Flora Quadrats

Quadrat 1

Size: 20 x 20 m
Location: Patch of vegetation in SW corner of the site
Grid Reference: 370354 E; 6354737 N (WGS84)
Topography / Slope / Drainage: Flat, low-lying, poorly drained and damp
Soil Type: Alluvial clay/ loam – brown/grey
Disturbances: Cattle grazing, minor past clearing/ tree removal
Signs of Fire: Moderate charring (estimated <10 yr.)
Weed infestation: Minor – purple top, whisky grass

Species
*Ageratina adenophora**
Angophora costata
Callistemon rigidus
*Cirsium vulgare**
*Conyza bonariensis**
Dichondra repens
Eucalyptus resinifera subsp. *resinifera*
Gahnia sieberiana
*Gamochaeta spicta**
Geranium solanderi var. *solanderi*
Hardenbergia violacea
Hydrocotyle peduncularis
*Hypochaeris radicata**
*Lantana camara**
Leptospermum polygalifolium subsp. *polygalifolium*
Lomandra longifolia
Melaleuca linariifolia
Melalueca nodosa
Melalueca sieberi
Microlaena stipoides var. *stipoides*
Oplismenus aemulus
*Plantago lanceolata**
Polymeria calycina
Pratia purpurascens
Ranunculus inundatus
*Solanum nigrum**
*Verbena bonariensis**
Viola hederacea

Quadrat 2

Size: 20 x 20 m
Location: Central west of western boundary
Grid Reference: 370391 E; 6354965 N (WGS84)
Topography / Slope / Drainage: Flat, slightly elevated, moist
Soil Type: Sandy loam – grey/brown
Disturbances: past clearing and tree removal
Signs of Fire: Minor charring, (estimated <10 yr.)
Weed infestation: Minor-lantana

Species
*Andropogon virginicus**
Angophora inopina
Banksia oblongifolia
Caladenia catenata
Dichondra repens

Echinopogon caespitosus var. *caespitosus*
Eucalyptus robusta
Gahnia clarkei
Gahnia sieberiana
*Gamochaeta spicta**
Geranium solanderi var. *solanderi*
Glochidion ferdinandi var. *ferdinandi*
Hardenbergia violacea
*Hypochaeris radicata**
Imperata cylindrica var. *major*
*Lantana camara**
Leptospermum juniperinum
Melaleuca linariifolia
Melalueca nodosa
Melalueca sieberi
Melalueca thymifolia
Pteridium esculentum
Viola hederacea
Xanthorrhoea latifolia subsp. *latifolia*

Quadrat 3

Size: 20 x 20 m
Location: Northern boundary
Grid Reference: 370555 E; 6355012 N (WGS84)
Topography / Slope / Drainage: Flat, low-lying, damp
Soil Type: Sandy loam – grey/brown
Disturbances: past clearing and tree removal
Signs of Fire: Minor basal charring (estimated >5 yr.)
Weed infestation: Minor-wild tobacco

Species
*Conyza bonariensis**
Dianella caerulea var. *producta*
Dichondra repens
*Ehrharta erecta**
Entolasia marginata
Entolasia stricta
Gahnia clarkei
*Gamochaeta spicta**
Geranium solanderi var. *solanderi*
*Lantana camara**
Melalueca nodosa
Microlaena stipoides var. *stipoides*
Oplismenus aemulus
Pellea falcata
Pratia purpurascens
Pteridium esculentum
Rubus fruticous species aggregate*
*Sida rhombifolia**
*Solanum mauritianum**
*Stellaria media**

Appendix 3. Actions Required in Relation to Notifiable Weeds Pursuant to the Noxious Weeds Act 2003

Section 8 of the amended Noxious Weeds Act 1993 classifies noxious weeds into 5 weed control classes as follows:

(a) Class 1 - State Prohibited Weeds,
(b) Class 2 - Regionally Prohibited Weeds,
(c) Class 3 - Regionally Controlled Weeds,
(d) Class 4 - Locally Controlled Weeds,
(e) Class 5 - Restricted Plants.

The characteristics of each class are as follows:

(a) Class 1 noxious weeds are plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.
(b) Class 2 noxious weeds are plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.
(c) Class 3 noxious weeds are plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.
(d) Class 4 noxious weeds are plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.
(e) Class 5 noxious weeds are plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

A noxious weed that is classified as a Class 1, 2 or 5 noxious weed is referred to in the Act as a "**notifiable weed**".

The relevant sections of the Act that define the actions required in relation to **notifiable weeds** are reproduced below:

Section 15: An occupier of land (other than a local control authority) on which there is a **notifiable weed** must notify the local control authority for the land of that fact within 3 days after becoming aware that the **notifiable weed** is on the land. ***Maximum penalty (for an occupier other than a public authority): 20 penalty units***

Section 16: For the purpose of proving in any prosecution under section 15 (1) that an occupier of land was aware that a **notifiable weed** was located on the land, if it is proved that the occupier or an employee of the occupier or other person using the land ought reasonably to have known that a **notifiable weed** was located on the land, that is evidence that the occupier was aware that it was on the land.

Section 28:
(1) A person (including a public authority) must not sell or purchase:
(a) any **notifiable weed** material or other noxious weed material prescribed by the regulations, or
(b) any animal or thing which has on it, or contains, **notifiable weed** material or other noxious weed material prescribed by the regulations, knowing it to be, or to have on it or to contain, any such weed material.
(2) An occupier of land (including a public authority) must not knowingly remove or cause to be removed from the land any animal or thing which has on it, or contains, **notifiable weed material** or other noxious weed material prescribed by the regulations. ***Maximum penalty: 50 penalty units.***
(3) Notifiable weed material:
(a) in subsection (1) extends to the weed material of a weed that is a **notifiable weed** in any part of the State, and
(b) in subsection (2) is limited to the weed material of a weed that is a **notifiable weed** in that part of the State that includes the land that is relevant for the purposes of that subsection.

Section 29: An occupier of land (including a public authority) must not use or permit the land to be used for the purpose of disposing of, transporting or selling soil, turf or fodder, if the occupier knows, or ought reasonably to know, that there is a weed on the land that is a **notifiable weed** in any part of the State. ***Maximum penalty: 50 penalty units*.**

Section 40: An inspector who has reasonable cause to suspect that **notifiable weed** material of a weed that is a notifiable weed in any part of the State is or may be present in an agricultural machine may require the person apparently in charge of the machine to treat the machine immediately, in the manner specified by the inspector, to remove any such weed material.

For further information about notifiable noxious weeds, contact: Weeds Hotline 1800 680 244 or email: weeds@dpi.nsw.gov.au (NSW Department of Primary Industries).

Appendix 4. Fauna recorded within the Study Area

Notes:
Species listed as ordered in CSIRO List of Australian Vertebrates (CSIRO 2006).

* indicates introduced species (not native to the area)
Bold indicates a threatened species
V – Vulnerable, E – Endangered, M – Migratory, PD – Preliminary Determination

Observation types:

O	observed	W	Heard	H	Hair, feathers or skin
F	tracks/scratchings	P	scat	E	Nest/roost
T	Trapped or netted	Y	Bone or teeth	Z	In raptor/owl pellet
K	Dead	X	In scat	R	Road kill
M	Miscellaneous	U	Ultrasonic call	d	Definite identification
p	Probable identification				

Family / Scientific Name	Common Name	TSC Act	EPBC Act	
Amphibians				
Family: *MYOBATRACHIDAE*				
Limnodynastes peronii	Striped marsh frog			W
Uperoleia fusca	Dusky toadlet			W
Birds				
Family: *PELECANIDAE*				
Pelecanus conspicillatus	Australian pelican			O
Family: *ARDEIDAE*				
Ardea ibis	Cattle egret		**M**	O
Family: *THRESKIORNITHIDAE*				
Threskiornis spinicollis	Straw-necked ibis			O
Family: *ACCIPITRIDAE*				
Haliastur sphenurus	Whistling kite			O
Haliaeetus leucogaster	White-bellied sea-eagle		**M**	O
Accipiter fasciatus	Brown goshawk			O
Family: *CHARADRIIDAE*				
Vanellus miles	Masked lapwing			O
Family: *COLUMBIDAE*				
Ocyphaps lophotes	Crested pigeon			O
Family: *ALCEDINIDAE*				
Dacelo novaeguineae	Laughing kookaburra			O
Family: *CLIMACTERIDAE*				
Cormobates leucophaeus	White-throated treecreeper			O
Family: *MALURIDAE*				
Malurus cyaneus	Superb fairy-wren			O
Family: *PARDALOTIDAE*				
Pardalotus striatus	Striated pardalote			O
Gerygone mouki	Brown warbler			O
Acanthiza pusilla	Brown thornbill			O
Acanthiza nana	Yellow thornbill			O

Family: *MELIPHAGIDAE*				
Philemon corniculatus	Noisy friarbird			O
Manorina melanophrys	Bell miner			O
Lichenostomus chrysops	Yellow-faced honeyeater			O
Melithrepus lunatus	White-naped honeyeater			O
Myzomela sanguinolenta	Scarlet honeyeater			O
Family: *PETROICIDAE*				
Eopsaltria australis	Eastern yellow robin			O
Family: *PSOPHODIDAE*				
Psophodes olivaceus	Eastern whipbird			O
Family: *PACHYCEPHALIDAE*				
Pachycephala pectoralis	Golden whistler			O
Colluricincla harmonica	Grey shrike-thrush			O
Family: *DICRURIDAE*				
Rhipidura fuliginosa	Grey fantail			O
Family: *ARTAMIDAE*				
Cracticus nigrogularis	Pied butcherbird			O
Gymnorhina tibicen	Australian magpie			O
Strepera graculina	Pied currawong			O
Family: *CORVIDAE*				
Corvus coronoides	Australian raven			O
Family: *PASSERIDAE*				
Neochmia temporalis	Red-browed firetail			O
Family: *STURNIDAE*				
Acridotheres tristis *	Common myna			O
Mammals				
Family: *PSEUDOCHEIRIDAE*				
Pseudocheirus peregrinus	Common ringtail possum			P
Family: *PHALANGERIDAE*				
Trichosurus vulpecula	Common brushtail possum			P

Appendix 5. Fauna recorded within the wider Study Area for the LES (Ecotone 2008)

Notes:
AMG reference for site
Map Grid56 371000E 6355000N (Newcastle 9232 1:100000 mapsheet)

* indicates introduced species (not native to the area)
Bold indicates a threatened species
V - Vulnerable, E – Endangered, M- Migratory

Observation types:

O	observed	W	Heard	H	Hair, feathers or skin
F	tracks/scratchings	P	scat	E	Nest/roost
T	Trapped or netted	Y	Bone or teeth	Z	In raptor/owl pellet
K	Dead	X	In scat	R	Road kill
M	Miscellaneous	U	Ultrasonic call	d	Definite identification
p	Probable identification				

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Mammals						
Family: *DASYURIDAE*						
Antechinus stuartii	Brown Antechinus			14	T	1028
Family: *PETAURIDAE*						
Petaurus breviceps	Sugar Glider			1	O	1138
Petaurus norfolcensis	**Squirrel Glider**	**V**		**5**	**T,O**	**1137**
Family: *PSEUDOCHEIRIDAE*						
Pseudocheirus peregrinus	Common Ringtail Possum			5	O	1129
Family: *ACROBATIDAE*						
Acrobates pygmaeus	Feathertail Glider			1	O	1147
Family: *PHALANGERIDAE*						
Trichosurus vulpecula	Common Brushtail Possum			3	O	1113
Family: *PTEROPODIDAE*						
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V**	**V**	**5+**	**O,W**	**1280**
Family: *RHINOLOPHIDAE*						
Rhinolophus megaphyllus	Eastern Horseshoe Bat				Ud	1303
Family: *MOLOSSIDAE*						
Mormopterus sp. 2 (Adams et al)	A Freetail-bat				Up	1049
Mormopterus norfolkensis	**East-coast Freetail-bat**	**V**			**Ud**	**1329**
Tadarida australis	White-striped Freetail-bat				W	1324
Family: *VESPERTILIONIDAE*						
Miniopterus schreibersii oceanensis	**Eastern Bent-wing Bat**	**V**			**Ud**	**1341**
Miniopterus australis	**Little Bent-wing Bat**	**V**			**Ud**	**1346**
Nyctophilus sp.					Ud	
Nyctophilus gouldi	Gould's Long-eared Bat			1	T	1334
Chalinolobus dwyeri	**Large-eared Pied Bat**	**V**	**V**		**Ud**	**1353**
Chalinolobus gouldii	Gould's Wattled Bat			2	T,Ud	1349
Chalinolobus morio	Chocolate Wattled Bat				Ud	1351

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Myotis macropus	**Southern Myotis**	**V**			**Up**	**1357**
Vespadelus darlingtoni	Large Forest Bat				Upo	1022
Vespadelus vulturnus	Little Forest Bat			1	T,Ud	1379
Family: *MURIDAE*						
Mus musculus *	House Mouse			1	O,T	1412
Rattus lutreolus	Swamp Rat			2	T	1398
Rattus rattus *	Black Rat			9	T	1408
Reptiles						
Family: *CHELIDAE*						
Chelodina longicollis	Eastern Snake-necked Turtle			4	O	2017
Family: *SCINCIDAE*						
Lampropholis delicata	Grass Skink			1	O	2450
Amphibians						
Family: *MYOBATRACHIDAE*						
Crinia signifera	Common Eastern Froglet			5+	W	3134
Limnodynastes peronii	Striped Marsh Frog			10+	W	3061
Limnodynastes tasmaniensis	Spotted Grass Frog			2	W	3063
Uperoleia fusca	Dusky Toadlet			3+	W	3035
Family: *HYLIDAE*						
Litoria caerulea	Green Tree Frog			1	W	3171
Litoria fallax	Eastern Dwarf Tree Frog			5+		3183
Birds						
Family: *ANATIDAE*						
Cygnus atratus	Black Swan			2	O	0203
Anas superciliosa	Pacific Black Duck			2	O, W	0208
Anas castanea	Chestnut Teal					0210
Family: *PHALACROCORACIDAE*						
Phalacrocorax melanoleucos	Little Pied Cormorant					0100
Phalacrocorax varius	Pied Cormorant					0099
Phalacrocorax sulcirostris	Little Black Cormorant					0097
Family: *PELECANIDAE*						
Pelecanus conspicillatus	Australian Pelican					0106
Family: *ARDEIDAE*						
Egretta novaehollandiae	White-faced Heron					0188
Ardea intermedia	Intermediate Egret					0186
Ardea ibis	Cattle Egret		**M**			0977
Family: *THRESKIORNITHIDAE*						
Threskiornis molucca	Australian White Ibis					0179
Threskiornis spinicollis	Straw-necked Ibis					0180
Family: *ACCIPITRIDAE*						
Pandion haliaetus	**Osprey**	**V**	**M**	**2**	**O**	**0241**
Haliastur sphenurus	Whistling Kite					0228
Haliaeetus leucogaster	White-bellied Sea-Eagle		M			0226

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Accipiter fasciatus	Brown Goshawk					0221
Accipiter novaehollandiae	Grey Goshawk			1	O, E	0220
Family: *CHARADRIIDAE*						
Vanellus miles	Masked Lapwing			2	W	0133
Family: *COLUMBIDAE*						
Ocyphaps lophotes	Crested Pigeon					0043
Geopelia placida	Peaceful Dove					0030
Geopelia humeralis	Bar-shouldered Dove					0032
Family: *CACATUIDAE*						
Cacatua galerita	Sulphur-crested Cockatoo					0269
Family: *PSITTACIDAE*						
Trichoglossus haematodus	Rainbow Lorikeet					0254
Platycercus elegans	Crimson Rosella					0282
Platycercus eximius	Eastern Rosella					0288
Family: TYTONIDAE						
Tyto novaehollandiae	**Masked Owl**	**V**		**2**	**O, W**	**0250**
Family: *PODARGIDAE*						
Podargus strigoides	Tawny Frogmouth			1	O	0313
Family: *AEGOTHELIDAE*						
Aegotheles cristatus	Australian Owlet-nightjar			1	W	0317
Family: *ALCEDINIDAE*						
Dacelo novaeguineae	Laughing Kookaburra					0322
Family: *CLIMACTERIDAE*						
Cormobates leucophaeus	White-throated Treecreeper					0558
Family: *MALURIDAE*						
Malurus cyaneus	Superb Fairy-wren			2	O, W	0529
Family: *PARDALOTIDAE*						
Pardalotus punctatus	Spotted Pardalote					0565
Sericornis frontalis	White-browed Scrubwren					0488
Acanthiza pusilla	Brown Thornbill					0475
Acanthiza nana	Yellow Thornbill					0471
Acanthiza lineata	Striated Thornbill					0470
Family: *MELIPHAGIDAE*						
Anthochaera chrysoptera	Little Wattlebird					0637
Plectorhyncha lanceolata	Striped Honeyeater					0585
Philemon corniculatus	Noisy Friarbird					0645
Manorina melanophrys	Bell Miner					0633
Manorina melanocephala	Noisy Miner					0634
Meliphaga lewinii	Lewin's Honeyeater					0605
Lichenostomus chrysops	Yellow-faced Honeyeater					0614
Phylidonyris novaehollandiae	New Holland Honeyeater					0631
Phylidonyris nigra	White-cheeked Honeyeater					0632
Acanthorhynchus tenuirostris	Eastern Spinebill					0591
Myzomela sanguinolenta	Scarlet Honeyeater					0586

Family / Scientific Name	Common Name	TSC Act	EPBC Act	Number of individuals	Observation type	NPWS code
Family: *PETROICIDAE*						
Eopsaltria australis	Eastern Yellow Robin					0392
Family: *PSOPHODIDAE*						
Psophodes olivaceus	Eastern Whipbird					0421
Family: *PACHYCEPHALIDAE*						
Pachycephala pectoralis	Golden Whistler					0398
Colluricincla harmonica	Grey Shrike-thrush					0408
Family: *DICRURIDAE*						
Myiagra cyanoleuca	Satin Flycatcher		**M**			0366
Grallina cyanoleuca	Magpie-lark					0415
Rhipidura rufifrons	Rufous Fantail		**M**			0362
Rhipidura fuliginosa	Grey Fantail					0361
Rhipidura leucophrys	Willie Wagtail					0364
Family: *ORIOLIDAE*						
Oriolus sagittatus	Olive-backed Oriole					0671
Family: *ARTAMIDAE*						
Artamus leucorynchus	White-breasted Woodswallow					0543
Cracticus torquatus	Grey Butcherbird					0702
Cracticus nigrogularis	Pied Butcherbird					0700
Gymnorhina tibicen	Australian Magpie					0705
Strepera graculina	Pied Currawong					0694
Family: *CORVIDAE*						
Corvus coronoides	Australian Raven					0930
Family: *PTILONORHYNCHIDAE*						
Ptilonorhynchus violaceus	Satin Bowerbird					0679
Family: *PASSERIDAE*						
Neochmia temporalis	Red-browed Firetail					0662
Lonchura castaneothorax	Chestnut-breasted Mannikin					0657
Family: *HIRUNDINIDAE*						
Hirundo neoxena	Welcome Swallow					0357
Hirundo ariel	Fairy Martin					0360
Family: *ZOSTEROPIDAE*						
Zosterops lateralis	Silvereye					0574
Family: *STURNIDAE*						
Acridotheres tristis *	Common Myna					0998

Appendix 6. Fauna Survey Effort March 2007

Survey Technique	Date	Survey Details
Tree trapping	26/03/07- 30/03/07	Line 1: 10 "B" Elliotts Line 2: 10 "B" Elliotts Line 3: 10 "B" Elliotts
Ground trapping	26/03/07- 30/03/07	Line 1: 20 "A" Elliotts 3 "B" Elliotts 2 cage traps Line 2: 10 "A" Elliotts 4 "B" Elliotts Line 3: 20 "A" Elliotts 3 "B" Elliotts 2 Cage Traps
Spotlight survey	12/03/07 26/03/07 30/03/07	Duration: 30 min (2 persons) Duration: 1 hr (3 persons) Duration: 1 hr (2 persons)
Stag watch	12/03/07 26/03/07 30/03/07	Duration: 1 hr (2 persons) Duration: 1 hr (3 persons) Duration: 1 hr (2 persons)
Nocturnal call playback	12/03/07 26/03/07 30/03/07	Duration: 1¼ hrs (2 persons) Duration: 1¼ hrs (3 persons) Duration: 1½ hrs (2 persons)
Ultrasonic bat call detection	12/03/07 26/03/07 30/03/07	2 units x 2½ hrs 1 units x 2 hrs 2 units x 4 hrs
Harp trapping	26/03/07- 30/03/07	2 x 4 nights
Koala scat search	30/03/07	Two searches (20 trees per search)
Diurnal Reptile Survey	30/03/07	Duration: 1 hour (1 person)
Diurnal Bird Surveys	27/03/07 30/03/07	2 sites (1 person x 45 mins at each site) 1 sites (1 person x 30 mins)

Appendix 7. Project Personnel and Relevant Licenses

REPORT COMPONENT	STUDY TEAM MEMBERS	QUALIFICATIONS
Overall Project Management, Flora Field Surveys, Flora Descriptions & Impact Assessment, Report Writing	Stefan Rose	B.A. (Biol. Sci), M.Env.Stud., MAIBiol, MECA
Literature Review	Amy Rowles	B. Sc. (Hons) Biology/Ecology
Fauna Field Surveys 2009 & Habitat Descriptions	Steven Cox	B. Appl. Sci. (Hons), MECA
Fauna Field Surveys 2007, Fauna Impact Assessment & Report Writing	Ray Williams	Biol. Tech. Cert., MECA
Figure Preparation	Jenny Lewis	B.Sc (Res. & Env. Mgt.), TAFE Cert II (Conserv. & Land Mgt. Nat. Area Rest.), MECA
Fauna Field Surveys and Analysis of Bat Detector Calls 2007	Narawan Williams	TAFE Cert II (Conserv. & Land Mgt. Nat. Area Rest.), MECA
Report Review	Brian Wilson	B. Appl. Sc. (Env. Biol.) Adv. Dip. Bus. Mgmt MAIBiol, MEIANZ, MECA

Relevant licences held by Ecotone Ecological Consultants

TYPE	FOR	LICENCE NO	NAME	DATE VALID TO	ORGANISATION	LOCATION
Animal Research Authority	Vertebrate Fauna Surveys	AW94/082	Brian Wilson	15-Nov-10	Animal Care and Ethics Committee of the Director-General of NSW Agriculture	NSW
Certificate of Approval	Vertebrate Fauna Surveys	DG's ACEC 94/082	Brian Wilson	15-Nov-11		
Licence to	Access NPWS Wildlife Atlas Data Base	CON93002	Brian Wilson	30-Jun-10	NSW Department of Environment and Climate Change	
Scientific Licence	Harm/ trap/ release: protected fauna; pick/ hold: native flora	S10555	Brian Wilson Stefan Rose Steven Cox Jenny Lewis Amy Williams Narawan Williams Anne Williams	31-Dec-10		
	As above plus bat banding	S10556	Ray Williams	31-Dec-10		