FLORA AND FAUNA ASSESSMENT

PROPOSED REZONING and REVISED MASTER PLAN

for

CHARLTON CHRISTIAN COLLEGE, FASSIFERN

Prepared for
Charlton Christian College

ECOTONE ECOLOGICAL CONSULTANTS Pty Ltd
39 Platt Street, Waratah NSW 2298
phone: (02) 4968 4901 fax: (02) 4968 4960
e-mail: info@ecotoneconsultants.com.au
web: www.ecotoneconsultants.com.au

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1.0 INTRODUCTION

1.1 Background and Scope

This Assessment has been prepared for Charlton Christian College. It is in support of a Rezoning Application and a s96 Application for a revised Master Plan of the existing Charlton Christian College, Fassifern.

Much of the material in this report is based upon previous Flora and Fauna Impact Assessments undertaken for the construction of a new library building, sports oval, assembly hall and car parking area at the site (Ecotone Ecological Consultants 2005, 2008a, 2009). This report also refers to the comprehensive field investigations undertaken by this firm for assessment of the initial stage of construction works for the college that were undertaken in 1997 (Ecotone Ecological Consultants 1997). The current report integrates these findings with supplementary field investigations that have been undertaken within the site to verify and where necessary update the results of the previous investigations. The report assesses the current applications in compliance with the latest survey requirements, legislation, planning policies, threatened species and endangered communities schedules.

The general aims of this assessment are to:

- describe the existing biological environment of the revised parts of the Master Plan 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; and
- provide advice on the most appropriate rezoning for the site.

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 subject site;

(b) the second stage being the completion of targeted supplementary field surveys for threatened species regarded as potential subject species, and surveys to investigate the inherent biological attributes of the site; 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 Section 5A of the *EP&A Act*.

For this report,

- the *subject site* is defined as the land area directly affected by the amended development proposals relating to the revised Master Plan (the proposed carpark 1, detention basin, middle school buildings and PE Court and APZ),
- the *study area* consists of the subject site plus the immediately surrounding land potentially affected by the proposal or future development proposals, in this case the entire parcel of land owned by the college and comprising approximately 11 hectares of land; 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	Don Fox Planning for Charlton Christian College
Location	Charlton Christian College Bounded by Fassifern Road, Narara Street and Great Northern Railway, Fassifern Total Area: approximately 11.06 hectares Map sheet: 9232 Newcastle Zone 56 367000 E; 6349000 N (AGD66)
LGA	Lake Macquarie
Study Locality Description	The study locality is situated in the Lake Macquarie area. Lake Macquarie itself makes up a large proportion of the locality, with Fassifern situated to the west of the lake. The locality includes a mosaic of sparsely to densely populated urban suburbs and commercial areas, rural residential, semi-rural and rural properties and industrial development. The locality also contains significant areas of bushland and protected natural areas (including Awaba and Heaton State Forests and Tingira Heights, Pulbah Island and Moon Island Nature Reserves). Significant remnant bushland also occurs on private land. Being part of the coastal plain, the topography of the study locality is generally flat to gently undulating.
Geology	The locality lies on quaternary gravel, sand, silt and clay deposits, draining into Stony Creek and Fennell Bay of Lake Macquarie (NSW Department of Mineral Resources 1995).
Study Area and Subject Site Description	The subject site consists of two small parcels of natural bushland south-west and south-east of and immediately adjacent to the existing school buildings. The study area is on undulating land at an elevation of approximately 40 m ASL. An intermittent drainage line traverses the subject land from south to north. All surface run-off from the site flows to the north, connecting with a storm water channel which underpasses Fassifern Road, eventually entering Lake Macquarie.
Current landuse and general condition	The bushland of the study area is partially developed with the balance, mainly at the western end, supporting natural, uncleared bushland. Current disturbances to the bushland include slashing around the edges of the developed area to provide bushfire protection to existing buildings, partially cleared areas for demountable buildings and materials storage associated with current construction and minor weed invasion in edge zones. Unformed tracks and trails traverse the subject land. A slashed powerline easement passes through the western part of the site.
Significant features	None in particular.
Surrounding landuse	Suburban: Residential houses, a major railway line (Great Northern Railway), main road (Fassifern Road) and utility easement (power line), undeveloped natural bushland areas.

1.3 Aims of the Assessment

This report examines two applications in relation to the college land:

- A s96 application to amend the currently approved master plan to reflect a revised layout for the school; and
- A rezoning application for a split zoning from the currently zoned 10 – Investigation Area under Lake Macquarie LEP 2004 to:
    - Residential 2(1) (or R2 according to the standard template equivalent zone) for the developed school areas including APZ; and
    - Zone 7(1) or 7(2) (Conservation Primary or Secondary) (or E2 according to the standard template equivalent zone) for the managed conservation zone containing natural bushland in the western portion of the site.

The revised Master Plan has only minor changes from that which is currently approved. These include:

- An Asset Protection Zone (APZ) of 70m width along the western edge of the school buildings area;
- A new car park and detention basin in the western part of the site partially within the powerline easement; and
- Minor revised development footprints for some proposed school buildings and facilities.

The current impact assessment addresses the changes (shown in **Figure 2**) as far as they affect natural vegetation and flora or fauna habitat.

1.4 Asset Protection Zone

The Asset Protection Zone (APZ) as shown in the Master Plan is required to be to the standard of an Inner Protection Area (IPA). It is of 70m width and would involve the following modifications to the natural vegetation therein as specified by Appendix 2 of Planning for Bushfire Protection (NSW Rural Fire Service 2006).

In broad terms, the IPA should provide a tree canopy cover of less than 15% and a managed understorey (maintained grass, slashed ground layer or similar). Any tree canopies should be located greater than 2 metres from any part of the roofline of a dwelling. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 metres from an exposed window or door. Trees should have lower limbs removed up to a height of 2 metres above the ground (NSW Rural Fire Service 2006).

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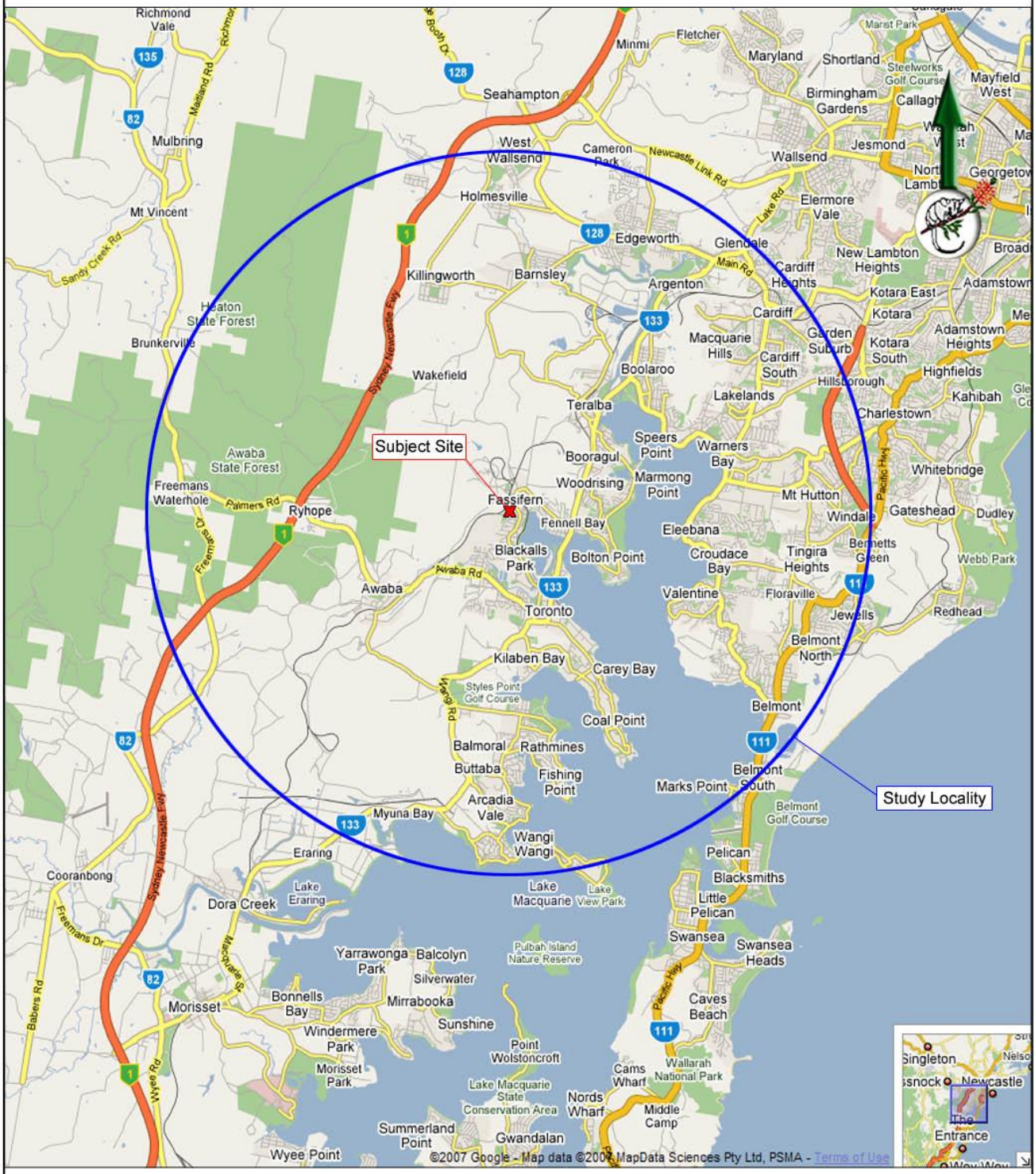

Base Map Source: Google Maps http://maps.google.com.au

0 2 4km

Ecotone Ecological Consultants Pty Ltd

Figure 1. Study Locality

Supplementary Flora and Fauna Impact Assessment: Proposed Additions to the Charlton Christian College, Fassifern

July 2009

Figure 2. Revised Master Plan

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 NSW Office of Environment and Heritage, Atlas of NSW Wildlife Database for the Newcastle (9232), Cessnock (9132), Gosford (9131) and Lake Macquarie (9231) 1: 100 000 map sheets as at 24th August 2012.

The results of previous survey work by Ecotone Ecological Consultants within the Charlton Christian College site have also been reviewed (Ecotone Ecological Consultants 1997, 2005, 2008a, 2009).

2.1.1 Flora

Threatened species

From the review, a total of eleven threatened flora species and three otherwise significant flora species (ROTAP only) are known to occur within the study locality. These are listed in **Table 2** below. Four of the threatened species, *Acacia bynoeana*, *Corybas dowlingii*, *Cynanchum elegans* and *Senecio spathulatus* are classified as Endangered on Schedule 1, Part 1 and seven species are classified as Vulnerable on Schedule 2 of the *TSC Act*. In terms of national listings, one of the species, *Cynanchum elegans* is listed as Endangered and five are listed as Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.* All except four of the species are also listed under the national database known as ROTAP (Briggs & Leigh 1996).

Three species, *Angophora inopina, Grevillea parviflora* subsp. *parviflora* and *Tetratheca juncea* have been recorded within 2.5km of the site centre. Two of these species, *Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora,* have been recorded within the Charlton Christian College site during previous field survey work (Ecotone Ecological Consultants 2005 & 2008a).

Table 2. Records of Rare or Threatened Flora within the Study Locality

Scientific 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						
Acacia bynoeana	E1	V	3VC-	1966-2007	52	0
Angophora inopina	V	V	-	1997-2010	564	1
Callistemon linearifolius	V	-	2RCi	2004-2008	37	0
Corybas dowlingii	E1	-	-	2008	1	0
Cryptostylis hunteriana	V	V	3VC-	1998	1	0
Cynanchum elegans	E1	E	3ECi	1995-2005	2	0
Grevillea parviflora subsp. *parviflora*	V	V	-	1994-2012	101	21
Melaleuca biconvexa	V	V	-	1945 - 2007	2	0
Senecio spathulatus	E1		-	1920	1	
Syzygium paniculatum	V	V	3RCi	1995-2007	4	0
Tetratheca juncea	V	V	3VCi	1770-2010	1087	9
ROTAP ONLY SPECIES						
Callistemon shiressii	U	-	3RC-	2008	4	0
Eucalyptus fergusonii subsp. *dorsiventralis*	U	-	2RC-	2000	2	0
Macrozamia flexuosa	P13	-	2K	1997-2005	14	0

Notes:
367500 E 6348800 N are the approximate co-ordinates of the subject site.
Nomenclature follows Harden (1990-1993, 2002) and Harden & Murray (2000).
Status (TSC): refers to the NSW *Threatened Species Conservation Act* 1995 (TSC)
E1 - Schedule 1, Part 1: Endangered Species
V - Schedule 2: Vulnerable Species
P13 - Protected Native Plants (Schedule 13 of the NP&W Act 1974)
U - Unprotected Flora and Fauna (fauna in Schedule 11 and flora not in Schedule 13 of the NP&W Act 1974)
Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC)
E - Endangered Species
V - Vulnerable Species
ROTAP coding (Briggs and Leigh 1996)
2 Geographic range in Australia less than 100km
3 Geographic range in Australia greater than 100km
E Endangered Species: at risk of disappearing from the wild within 10-20 years if present land use and other threats continue to operate
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
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
i indicates that 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 NSW Office of Environment and Heritage and other sources, and may contain errors or omissions.

Endangered Populations of Plants

The endangered population of *Eucalyptus parramattensis* C. Hall. subsp. *parramattensis* in Wyong and Lake Macquarie local government areas could occur in the study locality. However this endangered population was not recorded within the study area during previous investigations by Ecotone Ecological Consultants (1997, 2005 & 2008a) and is considered highly unlikely to occur.

Endangered Ecological Communities

A number of Endangered Ecological Communities (EECs) are known or have potential to occur within the study locality. However based on the results of previous investigations (Ecotone Ecological Consultants 1997, 2005 & 2008a & 2012), none are considered likely to occur within the subject site. The EEC *Swamp Sclerophyll Forest on Coastal Floodplains* is likely to occur within the study area, but only within the Conservation Area at the far northern end of the school lands.

2.1.2 Fauna

Threatened Species

A total of 44 threatened fauna species have previously been recorded within the study locality. Marine, estuarine or aquatic species (e.g., Southern Giant Petrel, Terek Sandpiper, Little Tern, Dugong, Green Turtle and Loggerhead Turtle) for which habitat is clearly absent from this site have been excluded.

Of the species listed, there are 26 bird, 15 mammal, two amphibian and one reptile species. Of these, two species are currently classified as Critically Endangered on Schedule 1a, Part 1 of the *TSC Act 1995* (Red Goshawk and Regent Honeyeater). Four species are currently regarded as Endangered on Schedule 1, Part 1 of the *TSC Act 1995* (Pied Oystercatcher, Curlew Sandpiper, Swift Parrot and Black-necked Stork). A further 38 of the species are currently listed as Vulnerable on Schedule 2 of the Act.

Nationally, the Swift Parrot and Spotted-tailed Quoll are listed as Endangered and the Regent Honeyeater as Endangered and Migratory. A further four species are listed as Vulnerable and three as Migratory under the Commonwealth *EPBC Act 1999*.

Twelve species have been recorded within 2.5km of the site, including the Black Bittern, Osprey, Powerful Owl, Spotted-tailed Quoll, Squirrel Glider, Koala, Eastern Bent-wing Bat, Eastern Freetail Bat, Eastern False Pipistrelle, Greater Broad-nosed Bat, Little Bent-wing Bat and Grey-headed Flying-fox. Three of these species, the Little Bentwing-bat, Eastern Bentwing-bat and Grey-headed Flying-fox, were positively identified within the Charlton Christian College site during previous field surveys (Ecotone Ecological Consultants 1997, 2005 & 2008a). One additional species, the East-coast Freetail-bat, was given a tentative (possible) identification based on ultrasonic call analysis. All four species are listed as Vulnerable in the TSC Act.

The local threatened fauna species are listed below in **Table 3.**

Table 3. Records of Threatened Fauna 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
AMPHIBIANS						
Crinia tinnula	Wallum froglet	V	-	1999	1	-
Pseudophryne australis	Red-crowned toadlet	V	-	1999	1	-
TERRESTRIAL REPTILES						
Hoplocephalus stephensii	Stephens' banded snake	V	-	2008 - 2009	2	-
BIRDS						
Ptilinopus regina	Rose-crowned fruit-dove	V	-	1996	1	
Ephippiorhynchus asiaticus	Black-necked stork	E1	-	1986	1	-
Ixobrychus flavicollis	Black bittern	V	-	1983 - 2010	8	1
Circus assimilis	Spotted harrier	V	-	1987	1	-
Erythrotriorchis radiatus	Red goshawk	E4A	V	1987	1	-
Hieraaetus morphnoides	Little eagle	V	-	1996 - 2010	3	-
Pandion cristatus	Eastern osprey	V	Mi	1981 - 2007	16	4
Haematopus longirostris	Pied oystercatcher	E1	-	1994 - 2007	9	-
Charadrius mongolus	Lesser sand-plover	V	Mi	1996	1	-
Irediparra gallinacea	Comb-crested jacana	V	-	1984	1	-
Calidris ferruginea	Curlew sandpiper	E1	Mi	1994 - 1997	7	-
Callocephalon fimbriatum	Gang-gang cockatoo	V	-	1992 - 2004	3	-
Calyptorhynchus lathami	Glossy black-cockatoo	V	-	1992 - 2009	15	-
Glossopsitta pusilla	Little lorikeet	V	-	1986 - 2009	31	-
Lathamus discolor	Swift parrot	E1	E	1983 - 2003	16	-
Neophema pulchella	Turquoise parrot	V	-	1991	1	-
Ninox connivens	Barking owl	V	-	2002 - 2008	3	-
Ninox strenua	Powerful owl	V	-	1982 - 2011	56	3
Tyto novaehollandiae	Masked owl	V	-	1994 - 2011	49	1
Tyto tenebricosa	Sooty owl	V	-	1989 - 2008	11	-
Climacteris picumnus victoriae	Brown treecreeper (eastern subspecies)	V	-	1986 - 2008	5	-
Chthonicola sagittata	Speckled warbler	V	-	1971	1	-
Anthochaera phrygia	Regent honeyeater	E4A	E, Mi	1983 - 2002	3	-
Epthianura albifrons	White-fronted chat	V	-	1970 - 1996	7	-
Daphoenositta chrysoptera	Varied sittella	V	-	1991 - 2009	13	-
Petroica boodang	Scarlet robin	V	-	1986 - 2009	5	-
NON-FLYING TERRESTRIAL MAMMALS						
Dasyurus maculatus	Spotted-tailed quoll	V	E	1980 - 2011	11	1
Phascolarctos cinereus	Koala	V	V	1952 - 2008	19	3
Cercartetus nanus	Eastern pygmy-possum	V	-	2011	1	-
Petaurus australis	Yellow-bellied glider	V	-	2007 - 2008	7	-
Petaurus norfolcensis	Squirrel glider	V	-	1977 - 2009	80	3

FLYING MAMMALS						
Pteropus poliocephalus	Grey-headed flying-fox	V	V	1997 - 2010	41	3
Saccolaimus flaviventris	Yellow-bellied sheathtail-bat	V	-	1993	1	-
Mormopterus norfolkensis	Eastern freetail-bat	V	-	1997 - 2008	24	-
Chalinolobus dwyeri	Large-eared pied bat	V	V	1997 - 2008	8	-
Falsistrellus tasmaniensis	Eastern false pipistrelle	V	-	1997 - 2006	4	1
Miniopterus australis	Little bentwing-bat	V	-	1993 - 2010	67	8
Miniopterus schreibersii oceanensis	Eastern bentwing-bat	V	-	1993 - 2009	61	10
Myotis macropus	Southern myotis	V	-	2005 - 2008	6	-
Scoteanax rueppellii	Greater broad-nosed bat	V	-	1993 - 2008	18	3
Vespadelus troughtoni	Eastern cave bat	V	-	2001 - 2008	7	-

Notes:
367500 E 6348800 N are the approximate co-ordinates of the subject site.
Status (TSC): refers to the NSW *Threatened Species Conservation Act* 1995 (TSC)
E1 – Schedule 1, Part 1: Endangered Species
E2 – Schedule 1, Part 2: Endangered Population
E4A – Schedule 1a, Part 1: Critically Endangered Species
V – Schedule 2: Vulnerable Species
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 NSW Office of Environment and Heritage and other sources, and may contain errors or omissions.

Endangered Fauna Populations

No Endangered Populations of fauna are likely to occur within the study locality.

2.2 EPBC Act Protected Matters Report

The Commonwealth EPBC Act Protected Matters Search Tool was accessed on the 5th of December 2012 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. Please note that species or other matters identified from the report as occurring, or having potential to occur within the study locality, may not be relevant to the study area or subject site itself. Threatened, migratory and invasive species or threatened ecological communities that could occur in the study locality are listed in **Table 4**

Table 4. Threatened and migratory species, threatened ecological communities and invasive species predicted to occur within the study locality under EPBC modelling

Scientific Name	Common Name	Status EPBC	Species or species habitat to occur within study locality (10km), according to EPBC modelling.
Threatened Ecological Communities			
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia		Critically Endangered	Likely
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland		Critically Endangered	May
Plants			
Acacia bynoeana	Bynoe's Wattle	V	Likely
Angophora inopina	Charmhaven Apple	V	Likely
Asterolasia elegans		E	Likely
Cryptostylis hunteriana	Leafless Tongue - orchid	V	May
Eucalyptus camfieldii	Camfield's Stringybark	V	Likely
Grevillea parviflora subsp. *parviflora*	Small – flower Grevillea	V	Likely
Melaleuca biconvexa	Biconvex Paperbark	V	Known
Pelargonium sp. *striatellum* (G.W.Carr 10345)	Omeo Stork's-bill	E	Likely
Pterostylis gibbosa	Illawarra greenhood, rufa greenhood, pouched greenhood	E	May
Rhizanthella slateri	Eastern Underground Orchid	E	May
Streblus pendulinus	Siah's Backbone,	E	Likely
Syzygium paniculatum	Magenta Lilly Pilly	V	Likely
Tetratheca juncea	Black-eyed Susan	V	Known
Birds			
Anthochaera phrygia	Regent Honeyeater	E, Mi	Likely
Botaurus poiciloptilus	Australasian Bittern	E	Known
Rostratula australis	Australian Painted Snipe	V	Likely
Dasyornis brachypterus	Eastern Bristlebird	E	Likely
Erythrotriorchis radiatus	Red Goshawk	V	Known
Stemula nereis nereis	Fairy Tern	V	May
Mammals			
Chalinolobus dwyeri	Large-eared Pied Bat Large Pied Bat	V	May
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll (south-eastern mainland)	E	May
Petrogale penicillata	Brush-tailed Rock-wallaby	V	Likely
Pseudomys novaehollandiae	New Holland Mouse	V	Likely
Pteropus poliocephalus	Grey-headed Flying-fox	V	Known (foraging)
Phascolarctus cinereus	Koala	V	Known
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	May
Frogs			
Litoria aurea	Green and Golden Bell Frog	V	May
Litoria littlejohni	Littlejohn's Tree Frog	V	May

Scientific Name	Common Name	Status EPBC	Species or species habitat to occur within study locality (10km), according to EPBC modelling.
Mixophyes balbus	Stuttering Frog	V	Likely
Mixophyes iteratus	Giant Barred Frog	E	Likely
Reptiles			
Caretta caretta	Loggerhead Turtle	E	Known
Chelonia mydas	Green Turtle	V	Known
Dermochelys coriacea	Leatherback Turtle,	E	Likely
Eretmochelys imbricata	Hawksbill Turtle	V	Likely
Hoplocephalus bungaroides	Broad-headed Snake	V	Likely
Natator depressus	Flatback Turtle	V	Known
Fish			
Epinephelus daemelii	Black Rockcod	V	Likely
Migratory species (terrestrial only)			
Haliaeetus leucogaster	White-bellied Sea-Eagle	Mi	Likely
Hirundapus caudacutus	White-throated Needletail	Mi	Known
Merops ornatus	Rainbow Bee-eater	Mi	May
Monarcha melanopsis	Black-faced Monarch	Mi	Known
Myiagra cyanoleuca	Satin Flycatcher	Mi	Likely (Breeding)
Rhipidura rufifrons	Rufous Fantail		May
Xanthomyza phrygia	Regent Honeyeater	E, Mi	Likely
Migratory Wetland Species			
Ardea alba	Great Egret, White Egret	Mi	Likely (breeding)
Ardea ibis	Cattle Egret	Mi	Likely (breeding)
Arenaria interpres	Ruddy Turnstone	Mi	Known
Calidris acuminata	Sharp-tailed Sandpiper	V, Mi	Known
Calidris canutus	Red Knot		Known
Calidris ferruginea	Curlew Sandpiper		Known
Calidris ruficollis	Red-necked Stint		Known
Charadrius bicinctus	Double-banded Plover		Known
Charadrius leschenaultii	Greater Sand Plover		Known
Charadrius mongolus	Lesser Sand Plover		Known
Gallinago hardwickii	Latham's Snipe		May
Heteroscelus brevipes	Grey-tailed Tattler		Known
Limicola falcinellus	Broad-billed Sandpiper		Known
Limosa lapponica	Bar-tailed Godwit		Known
Numenius madagascariensis	Eastern Curlew		Known
Numenius phaeopus	Whimbrel		Known
Pluvialis fulva	Pacific Golden Plover		Known
Rostratula benghalensis (sensu lato)	Painted Snipe	V	Likely
Tringa stagnatilis	Marsh Sandpiper		Known

Scientific Name	Common Name	Status EPBC	Species or species habitat to occur within study locality (10km), according to EPBC modelling.
Invasive Species			
Bufo marinus	Cane Toad		Likely
Felis catus	Cat		Likely
Oryctolagus cuniculus	Rabbit		Likely
Sus scrofa	Pig		Likely
Vulpes vulpes	Red Fox		Likely
Alternanthera philoxeroides	Alligator Weed		Likely
Asparagus asparagoides	Bridal Creeper		Likely
Cabomba caroliniana	Cabomba		Likely
Chrysanthemoides monilifera	Bitou Bush, Boneseed		May
Genista sp. X *Genista monspessulana*	Broom		May
Lantana camara	Lantana		Likely
Lycium ferocissimum	African Boxthorn		May
Nassella neesiana	Chilean Needle Grass		Likely
Pinus radiata	Radiata Pine		May
Rubus fruticosus species aggregate	Blackberry		Likely
Salix spp. *except S. babylonica, S.x calodendron & S.x reichardtiji*	Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow		Likely
Salvinia molesta	Salvinia		Likely
Ulex europaeus	Gorse		Likely

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*.
O Species listed under the Commonwealth *EPBC Act* as "overfly marine area"

The Protected Matters Search Tool also generates a list of matters protected under the EPBC Act that may occur in or nearby the search area. Potentially relevant matters are listed in **Table 5** below.

Table 5. Summary of Potentially Relevant Matters under the Commonwealth EPBC Act 1999

Protected Matter	Details	Potentially Relevant?
World Heritage Properties	None	No
National Heritage Places	None	No
Wetlands of International Significance (Ramsar sites)	1 • Hunter Estuary Wetlands	No
Commonwealth Marine Areas	None	No
Threatened Species	38	Yes
Migratory Species	36	Yes
Commonwealth Lands	6	No
Commonwealth Heritage Places	None	No

Protected Matter	Details	Potentially Relevant?
Listed Marine Species	36	No
Whales and Other Cetaceans	None	No
Critical Habitats	None	No
Commonwealth Reserves	None	No
Places on the Register of the National Estate (Natural)	2 • Fennel Bay Reserve (Public Reserve R 38237) • Reserve R 81914 Tingira Heights Fossil Insect Beds	No
State and Territory Reserves	3 • Lake Macquarie • Sugarloaf • Tingira Heights	No
Regional Forest Agreements	1 - North East NSW RFA, New South Wales	No
Invasive Species	18	Yes
Nationally Important Wetlands	1 • Lake Macquarie	No

2.3 Habitat Assessment of the Study Area

An updated habitat assessment was undertaken during the current investigations incorporating information from previous field survey work in the study area. The possible factors investigated and assessed for the study area included:

Flora: - Type and Structure of Vegetation
- Dominant Species;
- Subjective assessment of Floristic Diversity;
- Disturbance Regime, both past and ongoing
- Extent of Weed Invasion;
- Potential occurrence of Local Threatened and Significant Flora Species

Fauna: - Presence and Frequency of Large Mature Trees, Dead Trees and Hollow-bearing Trees;
- Height of Upper Strata
- Density of Shrub and Ground Cover;
- Presence of Fallen Timber and Rock Outcrops;
- Presence of Wet Areas or Water-bodies;
- Assessment of Previous and Present Land Use and Disturbance Regimes;
- Extent of Connectivity, Movement Corridors and Refugia;
- Presence of Critical Habitat Elements for Local Threatened Species;
- Searches for evidence of the presence of Threatened Species; and
- Fauna species diversity (all fauna observed or signs of fauna were recorded).

From the site assessment it was possible to:

- identify those parts of the study area that contain potentially significant habitats for threatened species and local biodiversity;
- identify potential constraints from an ecological perspective within the area of investigation; and
- generate a list of local and regional threatened species regarded as subject species.

With regard to significant habitat features for threatened fauna species, the current (2012) investigations focussed on hollow-bearing and nest box trees within the proposed carpark 1 and detention basin areas in the northern part of the site. Hollow-bearing trees provide habitat for a range of fauna species, including the threatened squirrel glider. While this species has not been recorded within the study area, it is considered to have potential to occur. Whilst it appears from the revised Master Plan that most of the habitat or next box trees may be affected (**Figure 3**), the plan

shows indicative locations of each of the project components only. Every effort will be made to avoid the identified habitat or nest box trees as far as possible in the final planning stage.

Table 6 contains a description and locations of the identified habitat trees in the northern part of the subject site where the proposed detention basin, car park 1 and additional school buildings are planned.

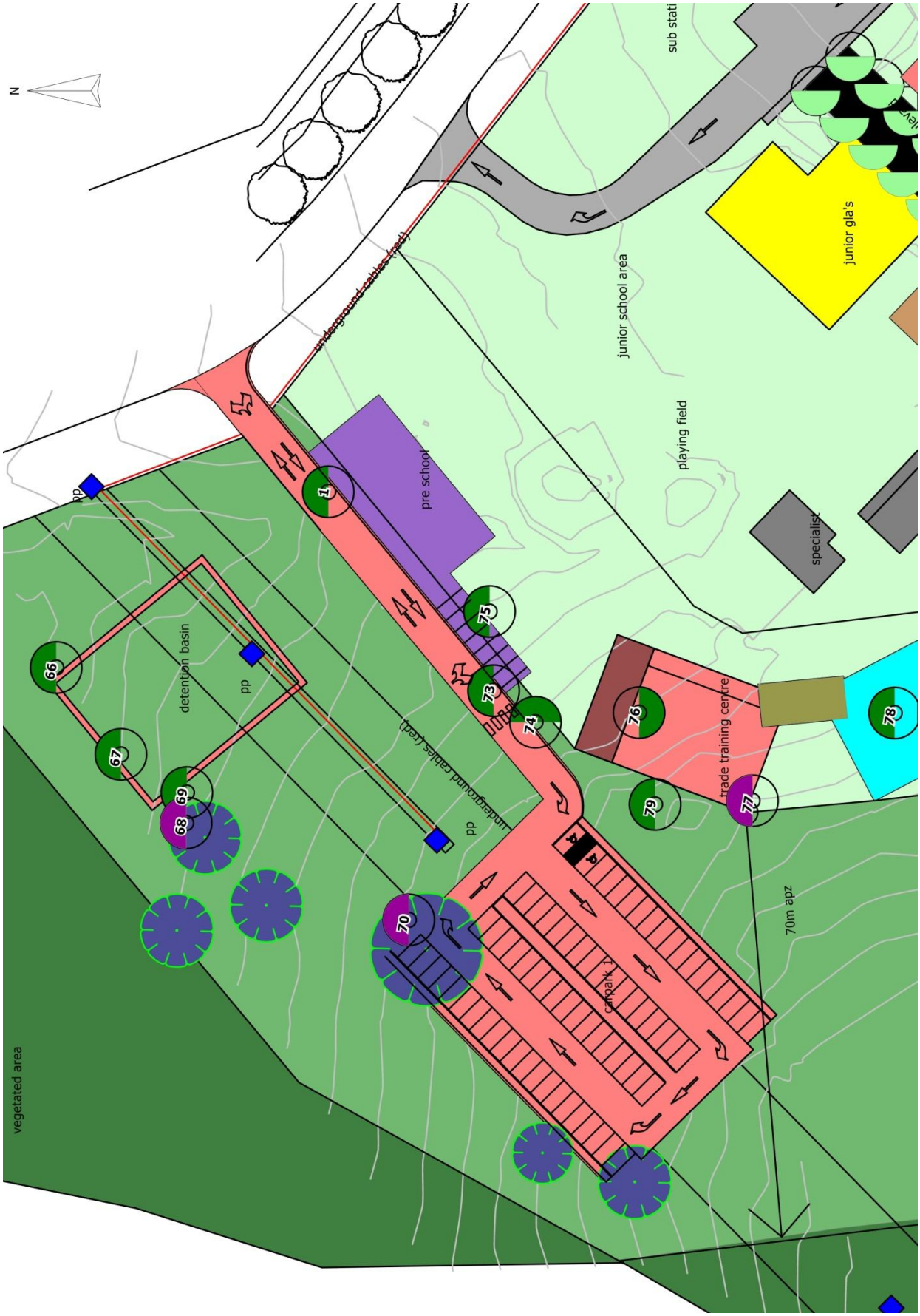

Figure 3. Location of Habitat Trees within the Proposal Areas

Table 6. Surveyed Habitat or Nest Box Trees within the Proposed Car Park 1 and Northern Detention Basin Area

Tree No	Species	DBH (cm)	Easting (WGS84)	Northing (WGS84)	Notes
1	*Eucalyptus piperita*	70	367514	6349159	Medium to large hollows - termite nest & infestation
66	*Angophora costata*	100	367484	6349203	Large hollow with bracken ferns in fork
67	*Eucalyptus piperita*	80	367470	6349192	Small hollows. Main trunk dead with hollows. Tree resprouted.
68	*Eucalyptus piperita*		367459	6349181	Nest box tree
69	Dead stag		367464	6349181	
70	*Eucalyptus piperita*		367444	6349144	Nest box tree
73	*Eucalyptus piperita*	70	367482	6349131	Burnt out hollow in base
74	*Eucalyptus piperita*	80	367477	6349124	Burnt out hollow in base
75	*Eucalyptus piperita*	60	367495	6349132	Burnt out hollow in base
76	*Eucalyptus piperita*	70	367479	6349107	Small hollows/spouts
77	*Eucalyptus piperita*	90	367465	6349088	Nest box tree
78	*Eucalyptus piperita*	60	367480	6349065	Small dead spouts
79	*Eucalyptus piperita*	80	367464	6349104	Leaning – small spouts

NB: grid references to handheld GPS accuracy (5-10m)

A summary of the essential flora and fauna habitat features within the school site is given in **Table 7**.

Table 7. Habitat Features

Habitat Feature	Habitat Description
1) Overall Type and Structure of Vegetation	The study area consists of remnant open eucalypt forest / woodland with a dense understorey. The vegetation is likely to be regrowth from past clearing and is regenerating. Minor fragmentation in the form of narrow vehicle and foot tracks occurs throughout the vegetation. The site of the proposed new carpark 1 and detention basin has been partially underscrubbed and cleared for the existing powerline easement and other areas are partially cleared for building compounds and vehicle tracks.
2) Dominant Species	The dominant trees species are Scribbly Gum *Eucalyptus signata*, Stringybark *E. globoidea*, Red Bloodwood *Corymbia gummifera* Smooth-barked Apple *Angophora costata* and Sydney Peppermint *Eucalyptus piperita* in the tree layer with peas and sclerophyllous shrubs in the understorey.
3) Density of Shrub and Ground Cover	Generally, the low shrub and groundcover strata of the remaining vegetation on the site are dense and consist mostly of sclerophyllous shrubs, pea species and native grasses. Weeds are sparse and mainly limited to garden escapes at the edge areas and herbaceous weed species.
4) Aspect and slope	The site is gently undulating on a north-facing slope.
5) Presence of; Large Mature Trees (>50cms DBH), Dead Trees Hollow-bearing Trees Fallen Timber	 Ten mature trees with greater than 50 cm dbh and two trees with nest boxes occur in the general area for the proposed carpark, detention basin or new buildings. One dead stag occurs within the same area Ten hollow-bearing trees were recorded within the proposed carpark and detention basin area. Some small fallen timber occurs, but few large fallen logs were

Habitat Feature	Habitat Description
	observed within the proposed development area.
Rock Outcrops	None
Wet Areas or Waterbodies	An ephemeral watercourse runs through the centre of the area for the proposed carpark and detention basin.
6) Extent of Weed Invasion	The bulk of the study area appears relatively free from weed invasion. However weeds are more prominent in more disturbed areas, including along edges.
7) Assessment of previous and present Land Use and Disturbance Regimes	Approximately half the area of the site of the proposed carpark 1 and detention basin is traversed by a slashed power transmission line easement. The area to the east where school buildings area proposed is highly disturbed by past clearing and installation of sheds and stockpile areas for current construction areas.
8) Extent of connectivity, movement corridors and refugia	The forest/woodland remnant within the study area is largely isolated from other natural vegetation by the urban development of Fassifern, roads and the main northern railway. However some connectivity exists with bushland areas west and south-west of the school site, and a tenuous corridor exists through to Fennell Bay via suburban blocks on the opposite side of Fassifern Road to the east of the site.

2.4 Determination of Local Threatened Flora and Fauna as Subject Species

2.4.1 Threatened Flora

Two threatened flora species have been previously recorded within the study area (*Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora*). Based on the current habitat assessment and results of previous survey and assessment work within the study area (Ecotone Ecological Consultants 1997, 2005, 2008a, 2009), no additional threatened flora species are considered likely to occur.

2.4.2 Threatened Fauna

Three threatened fauna species have been previously recorded within the study area (Little Bentwing-bat, Eastern bentwing-bat and Grey-headed Flying-fox). Calls of one additional microbat species (East-coast Freetail-bat) have been given a tentative (possible) identification based on ultrasonic call analysis. Based on the current habitat assessment and results of previous survey and assessment work within the study area, six additional threatened fauna species are considered to have some potential to occur or occasionally utilise habitats within the subject site (Eastern False Pipistrelle, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat, Squirrel Glider, Masked Owl and Powerful Owl).

2.4.3 Conclusion regarding Subject Species

The following species are considered subject species in this assessment:

<u>*Flora*</u>
- *Grevillea parviflora* subsp. *parviflora*
- *Tetratheca juncea*

<u>*Fauna*</u>
- East-coast Freetail Bat
- Eastern Bentwing Bat
- Little Bentwing Bat

- Eastern False Pipistrelle
- Greater Broad-nosed Bat
- Yellow-bellied Sheathtail-bat
- Grey-headed Flying-fox
- Squirrel Glider
- Masked Owl
- Powerful Owl

Targeted field surveys for all of these subject species have previously been carried out within the study area. Given the level of survey work already undertaken for previous assessments, the current targeted field survey concentrated on identifying important habitat features within the subject site, including the presence of any threatened flora species and potential roosting or breeding habitat for fauna. This is discussed further in **Section 3.0**. The potential impacts on those threatened subject species either known or considered to have a strong likelihood of presence in any of the currently proposed impact areas are presented in **Section 4.0** of this report.

3.0 SECOND STAGE ECOLOGICAL INVESTIGATION – FIELD SURVEYS

3.1 Floral Investigations

3.1.1 Methodology

Floral investigations by this firm within the study area were originally conducted in 1997 and since that time a number of flora surveys have been carried out, including targeted searches for threatened flora. The following is a summary of flora field surveys undertaken by this firm within the study area (including the current 2012 surveys):

20.05.97	-	Initial site inspection
05.11.97	-	Comprehensive flora survey and assessment, including targeted searches for threatened flora (entire study area)
09.09.05 & 02.12.05	-	Supplementary flora survey including general traverse of entire study area using random meander method, 20 x 20 m quadrats in each vegetation community type and targeted *Tetratheca juncea* survey
27.07.07	-	Comprehensive flora survey including random meander, three walking transects and two flora quadrats in each affected vegetation community type and targeted searches for threatened flora (for previous proposed oval site)
07.09.07 & 27.11.07	-	Targeted *Tetratheca juncea* survey (entire study area and surrounding land)
07.09.07	-	Targeted *Grevillea parviflora* subsp. *parviflora* survey (entire study area)
15.10.08	-	Targeted *Grevillea parviflora* subsp. *parviflora* survey (large area of bushland west of the Charlton Christian College grounds)
16.02.09	-	Targeted threatened flora survey within the current proposed development area for carpark 2.
25.06.09	-	Targeted threatened flora survey within the current proposed development area for the multipurpose hall.
10.07.12	-	Supplementary site inspection, targeted threatened flora survey and habitat assessment for an earlier version of the revised Master Plan.
29.11.12	-	Supplementary site inspection, targeted threatened flora survey and fauna habitat assessment for the current version of the revised Master Plan, focusing on new locations for the detention basin and carpark 1, including access road.
20.12.12	-	Accurate survey and plot positions of habitat and nest box trees at the northern end (Parker Scanlon)

The latest surveys on 10th July and 29th November 2012 involved a habitat assessment focusing mainly on the revised areas where the detention basin and carpark 1 are to be located in the north-western corner of the site mainly within the cleared powerline easement. The surveys focused on the potential presence of hollow bearing trees or other significant fauna habitat features, threatened flora species or threatened ecological communities.

3.1.2 Results

Vegetation Communities

From previous fieldwork, four distinct natural vegetation communities were found to occur within the entire study area (Ecotone Ecological Consultants 1997).

In decreasing order of the relative areas of the site that were covered by each community (prior to clearing for development of existing school facilities), these are:

1. Scribbly Gum / Red Bloodwood / Smooth-barked Apple / Stringybark Open Forest (45%)
2. Red Bloodwood / Smooth-barked Apple Woodland / Open Forest (40%)
3. Sydney Peppermint / Smooth-barked Apple Open Forest (10%)
4. Riparian Zone (5%)

Descriptions of the structure and floristics of the vegetation communities within the site is given in **Table 8**.

Table 8. Description of the Vegetation Communities within the Study Area

Stratum	Height	% cover*	Dominant species	Comments
COMMUNITY 1 - OPEN FOREST : Scribbly Gum/Red Bloodwood/Smooth-barked Apple/Stringybark				
Tree layer	18 - 22 m	20 - 40	*Eucalyptus signata* *E. capitellata* *Angophora costata* *Corymbia gummifera*	Habitat: Gentle N-NE facing slope on shallow sandstone-derived sandy-clay soil. Structure/Characteristics: Some areas are partially disturbed mainly by underscrubbing for Asset Protection. Outside of these areas, the community consists of intact advanced regrowth open forest with moderate shrub layer and moderate to dense ground layer. Distribution within Subject Site: Occupies the majority of the subject site on the north facing slopes below Community 2. Condition & Presence of Weeds: Some areas have been underscrubbed for Asset Protection and the soil scraped. Other areas are in better condition and weeds are generally sparse. Conservation Status: No particular conservation significance according to relevant legislation.
Small tree layer	2 - 5 m	10 - 30	*Allocasuarina littoralis* *Leptospermum trinervium* *Acacia falcata* *Eucalyptus* saplings	
Shrub layer	1 – 2 m	0 - 20	*Banksia spinulosa* *Lambertia formosa* *Dodonaea triquetra* *Acacia longifolia*	
Ground layer	To 1 m	70 - 80	*Dillwynia retorta* *Themeda australis* *Poa labillardieri* *Entolasia stricta* *Epacris pulchella* *Xanthorrhoea latifolia* *Daviesia ulicifolia* *Acacia myrtifolia* *Pimelea linifolia* *Ptilothrix deusta* *Patersonia sericea* *Dianella caerulea*	

*projective foliage canopy cover

Stratum	Height	% cover*	Dominant species	Comments
COMMUNITY 2 – WOODLAND / OPEN FOREST : Red Bloodwood/Smooth-barked Apple				
Tree layer	15 - 18 m	25 - 35	*Angophora costata* *Corymbia gummifera* *Eucalyptus capitellata*	Habitat: Elevated flat to gently sloping ridgeline. Structure/Characteristics: Some areas are partially disturbed mainly by underscrubbing for Asset Protection. Outside of these areas, the community consists of intact advanced regrowth woodland to open forest with sparse to moderate shrub layer and moderate to dense ground layer. Distribution within Subject Site: Occupies the southern end of the site, along the ridgeline adjacent to Narara Street. Condition & Presence of Weeds: Most parts are in moderately good condition except for the disturbed and edge areas where weeds have invaded. Conservation Status: No particular conservation significance according to relevant legislation.
Small tree layer	3 - 4 m	10 - 20	*Allocasuarina littoralis* *Eucalyptus* saplings	
Shrub layer	1 – 2 m	0 - 20	*Dodonaea triquetra* *Podolobium ilicifolium* *Bossiaea obcordata* *Pultenaea* spp. *Xanthorrhoea latifolia* *Acacia longifolia* *Acacia myrtifolia*	
Ground layer	To 1 m	70 - 80	*Imperata cylindrica* *Themeda australis* *Entolasia stricta* *Tricoryne elatior* *T. simplex* *Comesperma ericinum* *Pomax umbellata* *Platysace ericoides* *Hardenbergia violacea* *Kennedia rubicunda* *Eustrephus latifolius* *Epacris pulchella* *Daviesia ulicifolia* *Pultenaea paleacea* *Dianella caerulea*	

*projective foliage canopy cover

Stratum	Height	% cover*	Dominant species	Comments
COMMUNITY 3 – OPEN FOREST : Sydney Peppermint/Smooth-barked Apple				
Tree layer	18 - 25 m	30 - 40	*Eucalyptus piperita* *Angophora costata* *Corymbia gummifera* *Eucalyptus umbra*	Habitat: Lower moister slopes adjacent to drainage lines and riparian areas. Structure/Characteristics: Some areas are partially disturbed mainly by underscrubbing for Asset Protection. Outside of these areas, the community consists of intact advanced regrowth open forest with sparse to moderate shrub layer and moderate to dense ground layer. Distribution within Subject Site: Situated adjacent to the western boundary, occupying a large proportion of the conservation area. Condition & Presence of Weeds: Most parts are in moderately good condition except for the disturbed and edge areas, power line easement and lower creek line where weeds have invaded. Conservation Status: No particular conservation significance according to relevant legislation.
Small tree layer	3 - 4 m	10 - 20	*Acacia irrorata* subsp. *irrorata* *Allocasuarina littoralis* *Eucalyptus* saplings	
Shrub layer	1 – 2 m	0 - 20	*Dodonaea triquetra* *Podolobium ilicifolium* *Bossiaea obcordata* *Pultenaea* spp. *Xanthorrhoea latifolia* *Acacia longifolia* *Acacia myrtifolia*	
Ground layer	To 1 m	70 - 80	*Imperata cylindrica* *Themeda australis* *Entolasia stricta* *Tricoryne elatior* *T. simplex* *Pomax umbellata* *Platysace ericoides* *Hardenbergia violacea* *Kennedia rubicunda* *Eustrephus latifolius* *Epacris pulchella* *Daviesia ulicifolia* *Pultenaea paleacea* *Dianella caerulea*	

*projective foliage canopy cover

Stratum	Height	% cover*	Dominant species	Comments
COMMUNITY 4 – RIPARIAN ZONE : Paperbark/Cheese Tree/Tea Tree				
Tree layer	18 - 25 m	10 - 20	*Eucalyptus piperita* *Eucalyptus capitellata* *Angophora costata* *Corymbia gummifera*	Habitat: Lower, flatter part of drainage line. Structure/Characteristics: Dense Paperbark/cheese tree/tea tree forest with emergent eucalypts. Distribution within Subject Site: Confined to a drainage line in the far north-western corner of the site, in the Conservation Area. Condition & Presence of Weeds: Noxious and environmental weeds have invaded this community including crofton weed (*Ageratina adenophora*), pennywort (*Hydrocotyle bonariensis*), small-leaved privet (*Ligustrum sinense*) and stinking Roger (*Tagetes minuta*). Conservation Status: This community would qualify as the EEC *Swamp Sclerophyll Forest on Coastal Floodplains* (NSW TSC Act) but is situated wholly within the Conservation Area and would not be affected by any component of the Master Plan.
Small tree layer	5 - 6 m	30 - 40	*Glochidion ferdinandi* *Melaleuca linariifolia* *Acacia irrorata* subsp. *irrorata*	
Shrub layer	2 – 3 m	50 - 60	*Callistemon linearis* *Leptospermum juniperinum* *Leptospermum polygalifolium* *Melaleuca sieberi* *Dodonaea triquetra* *Acacia longifolia*	
Ground layer	To 1 m	40 - 50	*Centella asiatica* *Gahnia clarkei* *Juncus alexandri* *Adiantum aethiopicum* *Polymeria calycina* *Imperata cylindrica* *Entolasia stricta* *Eustrephus latifolius* *Epacris pulchella* *Pultenaea paleacea* *Dianella caerulea*	

*projective foliage canopy cover

Comparison with Regional Vegetation Mapping

The regional mapping of vegetation in the Lower Hunter and Central Coast (LHCCREMS 2003) shows four map units occupying the entire college site:

- MU15 – Coastal Foothills Spotted Gum-Ironbark Forest
- MU30 – Coastal Plains Smooth-barked Apple Woodland
- MU31 – Coastal Plains Scribbly Gum Woodland
- MU42 – Riparian Melaleuca Swamp Woodland

This is mostly incorrect on the basis of the flora investigations. The bulk of the study area (Vegetation Community 1) shown as MU15 by the mapping would be more appropriately classified as MU31, which is shown as only occurring at the edge of Fassifern Road. The bulk of the site would constitute this map unit intergrading with MU30 – Coastal Plains Smooth-barked Apple Woodland towards the southern end (Vegetation Community 2). In the lower slopes and gully towards the western boundary, Vegetation Community 3 would most closely correspond to MU11 – Coastal Sheltered Apple-Peppermint Forest which is not mapped within the site by LHCCREMS. The depiction of MU42 – Riparian Melaleuca Swamp Woodland occupying the far north-western part of the site is more or less correct and corresponds to Community 4 from this study.

Floral Diversity

While a comprehensive flora survey was not undertaken for the current proposals, based on the results of previous surveys, moderate species diversity is present in the study area with 75% of species being locally indigenous. Within the entire Charlton Christian College site, a cumulative total of 185 flora species from 59 families were identified as a result of the combined 1997, 2005, 2007 and 2012 surveys conducted by Ecotone Ecological Consultants. This included 5 ferns, 123 dicotyledons and 57 monocotyledons. A few minor environmental weeds were present.

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

Condition of the Vegetation and Presence of Weeds

Within the subject site, some better quality bushland remnants occur, though other areas lack an understorey due to underscrubbing and the soil scraping. Some edge areas are disturbed by the dumping of garden refuse and minor rubbish. Informal foot tracks also occur. Weeds are generally limited to herbaceous species (e.g. Flatweed, Fireweed, Fleabane and Carpet Grass) and do not occur at great abundance. Three of the weed species recorded (Crofton Weed *Ageratina adenophora*, Blackberry *Rubus fruticosus* and Lantana *Lantana camara*) are listed noxious weeds within the control area of Lake Macquarie City Council according to the *Noxious Weeds Act 1993*.

Threatened or Significant Flora Species and Endangered Ecological Communities

Two threatened flora species have previously been recorded within the Charlton Christian College grounds (*Tetratheca juncea* and *Grevillea parviflora* subsp. *parviflora*). Neither of these species has been recorded from any of the sites where various components of the Master Plan are proposed.

One Threatened Ecological Community, Swamp Sclerophyll Forest on Coastal Floodplains (NSW TSC Act) occurs within the Charlton Christian College grounds but in the Conservation Area. No Threatened Ecological Communities listed by the Commonwealth EPBC Act occur within the subject site.

3.2 Faunal Investigations

3.2.1 Methodology

Previous surveys were undertaken within the Charlton Christian College site by Ecotone Ecological Consultants in 1997, 2005 and 2007. The following methodologies were used:

- Bird survey (1997, 2005)
- Frog survey (1997, 2005)
- Hollow-bearing tree survey (2007)
- Nocturnal call playback (1997, 2005, 2007)
- Opportunistic observations (1997, 2005, 2007)
- Reptile survey (1997)
- Spotlighting survey (1997, 2005, 2007)
- Ultrasonic bat call detection (1997, 2005, 2007)
- Targeted fauna habitat assessment and habitat tree survey (2009)

Given the level of previous survey work, the current surveys on 10th July and 29th November 2012 were limited to a fauna habitat assessment and habitat tree survey of the trees within the northern area where carpark 1, a detention basin and further buildings are proposed (refer to Section 2.3).

3.2.2 Results

A cumulative total of 51 species were recorded during the combined 1997, 2005, 2009 and 2012 surveys conducted by Ecotone Ecological Consultants within the Charlton Christian College site. This total consisted of 32 bird, 11 mammal, four frog and four reptile species. In addition, three species of insectivorous bat were given a tentative (possible) identification based on ultrasonic call analysis. Of all the species recorded, only two (Spotted Turtle-dove and Cat) were introduced species.

A list of all species recorded in the study area during the combined surveys is presented in **Appendix 2**. The cumulative results are summarised below.

Mammals
A total of 11 mammals were recorded within the study area during the combined 1997, 2005 and 2007 field surveys, with an additional three insectivorous bats tentatively identified. Of these, three are arboreal mammals (Sugar Glider, Common Ringtail Possum and Common Brushtail Possum), one is an introduced species (the Cat) and the remainder are bats. All of the arboreal mammals and most of the insectivorous bat species have the potential to utilise hollow-bearing trees within the study area, including the subject site.

Birds
A combination of formal bird census and opportunistic recordings resulted in a cumulative total of 32 bird species recorded during the 1997, 2005 and 2007 surveys. Only one introduced species, the Spotted Turtle-dove, was recorded, with the remainder being native species commonly found in areas of remnant bushland. Two nocturnal bird species were recorded, the Southern Boobook and Tawny Frogmouth. No threatened owls responded during any of the call playback sessions.

Amphibians
Four species of frog (Common Eastern Toadlet, Spotted Marsh Frog, Red-backed Toadlet and Eastern Dwarf Tree Frog) were recorded calling within the Charlton Christian College site during the 1997 and 2005 surveys. Some of these species could potentially make use of the ephemeral drainage line east of the proposed science building.

Reptiles

Four reptile species (Jacky Dragon, Eastern Water Skink, Garden Sun-skink and Grass Sun-skink) were recorded within the study area during the 1997 and 2005 surveys. All of these species have some potential to occur within the subject site.

Threatened Fauna Species

Three threatened fauna species (**Grey-headed Flying-fox *Pteropus Poliocephalus*, Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis*** and **Little Bent-wing Bat *Miniopterus australis***) were positively identified within the study area during the combined 1997, 2005 and 2007 surveys. In addition, one species of threatened insectivorous bat (**East-coast Freetail-bat *Mormopterus norfolkensis*)** was given a tentative (possible) identification based on ultra-sonic call analysis. All four species are listed as Vulnerable in the TSC Act.

4.0 ASSESSMENT OF THE PROPOSAL

4.1 Potential Impacts due to the Revised Master Plan

The main impact on flora and fauna as a result of the revised Master Plan would be due to the Asset Protection Zone (APZ) of 70m along the western edge of the buildings area. Being entirely an Inner Protection Area, this would further modify the natural vegetation that occurs in this area, including some removal of trees to achieve the required canopy cover. The vegetation in most of this area is already partly modified for asset protection purposes. However, further modification of vegetation would occur in the north-western corner of the site, extending to the far side of the existing electricity easement.

Potential ecological constraints of the site as documented from previous flora and fauna investigations within the site include:

- Hollow bearing trees;
- Threatened flora species – *Grevillea parviflora* subsp. *parviflora* and *Tetratheca juncea*;
- Threatened fauna species – Eastern bentwing bat, Little bentwing bat, Masked owl, Powerful owl and Squirrel glider.

Only one small occupied habitat area of *Tetratheca juncea* (Vulnerable TSC and EPBC Acts) has been recorded within the subject site near the intersection of Narara Street and Rexton Parade. This habitat area would be retained within the proposed conservation area according to the revised Master Plan. The small patch appears to be declining in number, and in successive seasonal surveys had decreased from a population of 15 individuals (Ecotone Ecological Consultants 1997) to 5 individuals (Ecotone Ecological Consultants 2009)

Two patches of *Grevillea parviflora* subsp. *parviflora* had been recorded from the site (Ecotone Ecological Consultants 2005 and 2008a). Both of these patches have now been removed by construction of the oval and the assembly hall. It was concluded that removal of these patches would not impose a significant impact on the local population of the species due to occurrences of the species in the large tract of natural bushland to the west of the site. It is not considered likely that any further occurrences of the species occur in the school lands, and therefore no additional impacts on the species are considered likely due to the revised Master Plan. No further occurrences were found during the targeted surveys in July and November 2012.

Three threatened fauna species have been recorded on the site to date, the Grey-headed flying-fox, Eastern Bentwing bat and Little Bentwing bat (*Miniopterus australis*). Additional threatened fauna species may occur on the site, but on the basis of previous impact assessments (Ecotone Ecological Consultants 1997, 2005, 2007) in combination with the current supplementary habitat assessment and habitat tree survey, none are considered likely to suffer a significant impact due to the revised Master Plan, provided every effort is made to retain the identified hollow-bearing and nest box trees at the advanced planning stage.

The current proposal to construct a carparking area, detention basin and additional buildings for the school together with the associated Asset Protection Zone (APZ) of cleared and managed vegetation will result in the loss of moderate areas of mostly regenerating, partially cleared and disturbed or modified habitat. The proposed locations of the carpark, detention basin and most of the PE Court occur within the APZ, which would need to be partially cleared and managed for fire. This would include the removal of most of the understorey and any combustible material, although no trees in this area are expected to require removal. Approximately half the area consists of a slashed powerline easement.

All vegetation within the proposed carparking, detention basin and buildings area would be lost as a result of the proposal, including the loss an unknown number of trees in these areas that contain potential roosting/breeding habitat for hollow-reliant fauna. These trees provide roosting and breeding habitat for a wide range of fauna species, including birds, microbats and arboreal mammals. However, it is expected that any loss of habitat trees will be minimised by refinement of the disturbance footprints at the advanced planning stages.

No threatened flora species are expected to be removed as a result of the revised Master Plan.

4.2 Proposed Rezoning

It is proposed to rezone the site from the current Zone 10 – Investigation Area into two zones:

- Residential 2(1) (equivalent to R2 according to the standard template zone in the draft LMEP 2012) for the developed part of the site containing all the school infrastructure, including the APZ.
- Conservation Primary 7(1) or Conservation Secondary 7(2) (equivalent to E2 according to the standard template zone in the draft LMEP 2012) for the managed conservation zone containing natural bushland in the western portion of the site.

Since the APZ should fall within the developed part of the site, it would be appropriate for the boundary between the zones to follow the western (outer) edge of the APZ. This reflects the different landuse in the respective parts of the site, with vegetation in the development zoned part of the site being managed primarily for fire protection, and vegetation in the conservation zone being managed primarily for conservation of flora and fauna.

The characteristics of each standard template zone under the draft Lake Macquarie LEP 2012 are as follows.

<u>Zone R2 Low Density Residential</u>

This zone replaces the current Zone 2(1) Residential under LMLEP 2004 and is the predominant residential zone used across the City.

Objectives of the zone are:

- To provide for the housing needs of the community within a low density residential environment.
- To enable **other land uses that provide facilities or services to meet the day to day needs of residents**.
- To maintain and enhance the residential amenity and character of the surrounding area.

Land uses permitted in the R2 zone without development consent include: Exempt development as provided in Schedule 2 of draft LMLEP 2012; home occupations.

Land uses permitted in zone R2 with development consent include: Bed and breakfast accommodation; boarding houses; building identification signs; business identification signs; child care centres; community facilities; dual occupancies; dwelling houses; **educational establishments**; emergency services facilities; environmental facilities; environmental protection works; exhibition homes; exhibition villages; filming; flood mitigation works; group homes (except group homes (transitional)); health consulting rooms; home businesses; home industries; hostels;

neighbourhood shops; places of public worship; recreation areas; respite day care centres; roads; secondary dwellings; semi-detached dwellings; seniors housing; shop top housing.

According to the dictionary contained in the draft LMEP 2012, 'educational establishment' means:

- a school, or
- a tertiary institution, including a university or a TAFE establishment, that provides formal education and is constituted by or under an Act.

This zone would seem more appropriate than Zone R3 (Medium Density Residential) given the low density nature of the surrounding residential development at Fassifern. An alternative zone to consider would be SP2 (Infrastructure). However, some local infrastructure (such as local schools rather than major educational facilities), are required to be zoned the same as adjacent land rather than SP2 (Infrastructure).

Zone E2 Environmental Conservation

This zone affords the highest level of conservation protection to environmental land outside National Parks. Note that the new zone replaces both land zoned 7(1) Conservation (Primary) and 7(2) Conservation (Secondary) under LMLEP 2004.

Objectives of the zone are:

- To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.
- To prevent development that could destroy, damage or otherwise have an adverse effect on those values.
- To conserve, enhance and manage corridors to facilitate species movement, dispersal, and interchange of genetic material.
- To encourage activities that meet conservation objectives.
- To enhance and manage areas affected by coastal processes.

Land uses permitted in the E2 zone without development consent include: exempt development as provided in Schedule 2 of draft LMLEP 2012, home occupations.

Land uses permitted in zone E2 with development consent include: bed and breakfast accommodation; building identification signs; business identification signs; car parks; community facilities; dual occupancies (attached); dwelling houses; eco-tourist facilities; emergency services facilities; environmental facilities; environmental protection works; filming; flood mitigation works; home-based child care; home businesses; home industries; information and education facilities; roads and secondary dwellings (attached).

An assessment of impact on threatened species known or likely to occur within the subject site due to the revised Master Plan and proposed Rezoning has been addressed below under the provisions of Section 5A of the *Threatened Species Conservation Act* 1995.

4.3 Commonwealth and NSW State Legislative Requirements

4.3.1 Threatened Species Assessment (Section 5A of the EP&A Act 1979)

The *TSC Act* was gazetted in late 1995 and aims to conserve threatened species, populations and ecological communities of animals and plants. Specific objectives of the *Act* are to: -

a) conserve biological diversity and promote ecologically sustainable development;

b) prevent the extinction and promote the recovery of threatened species, populations and ecological communities that are endangered;

c) protect critical habitat of those threatened species, populations and ecological communities;

d) eliminate or manage certain processes that threaten the survival or evolutionary development of those threatened species, populations and ecological communities;

e) ensure that the impact of threatening actions are properly assessed; and

f) encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

Section 5A of the *Environmental Planning & Assessment Act 1979* (*EP&A Act*) aims to improve the standard of consideration and protection afforded to threatened species, populations and communities, and their habitats in the planning process. The outcome of any threatened species assessment should be that developments and activities are undertaken in an environmentally sensitive manner, and that appropriate measures are undertaken to minimise adverse effects on threatened species or their habitats.

Under the *Threatened Species Conservation Amendment Act 2002*, Section 5A of the *EP&A Act* has been amended. This has also affected the *TSC Act 1995* and the *Fisheries Management Act 1994*. An essential outcome of the amendments is that as of late 2005, the previous "eight-part test" has been replaced with a set of revised factors now known as the "seven-part test".

The basic intent of the revised factors remains the same, the main change in emphasis being more towards impacts and losses at the local rather than the regional level. Additionally, recovery planning and threat abatement planning is explicitly considered in one of the factors. As with the previous eight-part test, the seven-part test should not be treated as a "pass or fail" test, but rather as a tool to assist in determining whether further assessment such as a Species Impact Statement (SIS) might need to be undertaken.

Determining authorities have an obligation under the *EP&A Act* to consider whether a proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats. In this regard, the determining authority must take into account the seven-part test.

No threatened flora species or threatened ecological communities are expected to be impacted as a result of the revised Master Plan. A seven-part test for the following threatened fauna species is presented below.

- East-coast Freetail Bat
- Eastern Bent-wing Bat
- Little Bent-wing Bat
- Eastern False Pipistrelle
- Greater Broad-nosed Bat

- Yellow-bellied Sheathtail-bat
- Grey-headed Flying-fox
- Masked Owl
- Powerful Owl
- Squirrel Glider

Seven-part Test of Significance for Threatened Fauna

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

Hollow-roosting Bats – East-coast Freetail-bat *Mormopterus norfolkensis*, Eastern False Pipistrelle *Pipistrellus tasmaniensis*, Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris* and Greater Broad-nosed Bat *Scoteanax rueppellii* (all Vulnerable – TSC Act)

These species are known to roost in tree hollows but may also utilise other roost sites (eg. buildings). In general, tree-roosting bats are vulnerable to habitat loss and modification, especially the loss of hollow-bearing trees and good quality foraging habitat. Any activity that reduces prey or roost availability contributes to the cumulative impacts on these species. Vegetation clearing may also impact on these species through a reduction in insect prey availability.

One threatened hollow-roosting bat, the East-coast Freetail-bat, was tentatively identified within the study area using ultrasonic call analysis during the 2007 survey. The other species listed above were not recorded but have potential to occur. The presence of hollow-bearing trees indicates that the study area contains habitat values potentially utilised by threatened hollow-roosting bat species for sheltering and breeding purposes, as well as providing potential foraging habitat.

As these species are likely to have large home ranges and multiple roost sites, the loss of the small amount of potential roosting and foraging habitat expected as a result of the proposal is unlikely to significantly impact any local population of threatened hollow-roosting bat species. However, in the event that a maternity roost is removed as a result of the proposal, then this has the potential to have an adverse effect on a local population of threatened insectivorous bat to the extent that it may be placed at risk of extinction in the worst case scenario. This is, however, considered unlikely as, although detailed breeding biology for the subject species is poorly known, other bat species are known to move their young to other roost sites on a regular basis during the breeding season.

Cave-roosting Bats – Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* and Little Bentwing-bat *Miniopterus australis* (both Vulnerable – TSC Act)

Both species of threatened cave-roosting bat identified as subject species (the Eastern Bent-wing Bat and the Little Bent-wing Bat) were recorded during the 1997, 2005 and 2007 field surveys. The limiting factor for cave-roosting species of insectivorous bat is the availability of roost sites, which include suitable caves, mines, road culverts and buildings. Recorded nursery caves are few in number and widely separated, leaving these species vulnerable should any of these areas be destroyed. At traditional roost sites, colony sizes can be large, numbering several thousand individuals.

No potential roost sites for cave roosting bats exist within the study area, however, nearby disused coal mines are likely to be used. A small area of potential foraging habitat on the site is likely to be lost as a result of the proposal. However due to their wide-ranging movement patterns it is considered highly unlikely that the proposal will place any local populations of cave-roosting insectivorous bat species at risk of extinction.

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

The Grey-headed Flying-fox is endemic to Australia and presently occurs along the east coast from Bundaberg in Queensland to Melbourne, Victoria (DECC threatened species profiles). Regular movements have been recorded over the Great Dividing Range to the western slopes of NSW and QLD. Although this species occurs over a large range the total area being utilised at any one time is relatively small.

This species utilises subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and mangroves, as well as urban gardens and fruit crops for foraging (Churchill, 1998; DECC threatened species profiles). The Grey-headed Flying-fox is considered an important pollinator and seed disperser of native trees, as they forage on nectar and pollen of eucalypts, angophoras, melaleucas and banksias, as well as fruit of rainforest trees and vines (DECC threatened species profiles; Strahan, 1995). The Grey-headed Flying-fox has been recorded to forage on more than 80 plant species of which eucalypt blossom is considered the major food source, with figs the most common fruit consumed (Churchill, 1998). These bats will disperse and commute up to 50km daily to foraging areas from their day roost (Strahan, 1995).

The Grey-headed Flying-fox was recorded within the study area during the 1997, 2005 and 2007 surveys. This species is likely to forage within the subject site on an opportunistic basis, particularly when trees and shrubs are flowering. A number of known seasonal or temporary Grey-headed Flying-fox camps exist within foraging range of the study area and a permanent camp is located at Blackbutt Reserve approximately 10km north-east of the subject site (well within foraging range). The proposed development is expected to result in the removal of a small area of foraging habitat for this species. While this contributes to the incremental loss of habitat affecting this species, it is considered unlikely that the life cycle of this species would be disrupted such that a viable local population will be placed at risk of extinction.

Masked Owl *Tyto novaehollandiae* (Vulnerable TSC Act)

Recorded as thinly distributed over much of eastern Australia, most records of this species are from a broad coastal strip in forest and woodland around southern and eastern Australia. The scattering of records within inland New South Wales are limited to areas where river red gum (*Eucalyptus camaldulensis*) occurs (Debus & Rose 1994).

The Masked Owl is generally considered to be a bird of forest margins and in this region is recorded mostly in drier open forest and woodland habitats. It is believed that this species prefers a more open vegetative structure than either the Powerful or Sooty Owl. This species has been particularly recorded in areas with a diversity of vegetation structural types and/or a mosaic of dense and sparse ground cover (Debus 1993). Debus & Rose (1994) analysed habitat types from confirmed nocturnal records and found that the majority of observations have been located within wet and dry forest and woodland, and from forest and woodland edge or adjacent open country. However, this species has also been recorded utilising treed urban areas. The high prevalence of road-kills of this species suggests that it makes use of the edge effect created by roads through wooded habitats (Debus & Rose 1994).

The Masked Owl has some potential to utilise the study area for foraging purposes, however, only two trees containing suitable potential breeding/roosting hollows were recorded within the general subject site area. The proposal is expected to result in the loss/modification of a small area of potential foraging habitat for the Masked Owl. Given the large home range of this species, the loss of foraging habitat as a result of the proposal is considered unlikely to disrupt the life cycle of the Masked Owl to such an extent that a viable local population of the species will be placed at risk of extinction.

Powerful Owl *Ninox strenua* (Vulnerable TSC Act)

This species ranges over a broad coastal and sub-coastal strip in south-eastern Australia, from southern Queensland to western Victoria where it is generally confined to altitudes below 1500m. The majority of records have been located east of the Great Dividing Range however a few recorded observations have been made on the inland slopes. Powerful Owls have been observed to inhabit and breed in forested areas within major urban centres such as Sydney and Brisbane. Within NSW, the majority of records have been located within open forests, but woodland, ecotones with cleared areas, riparian habitats and closed forests are also utilised (Debus & Chafer 1994).

The bird requires a large home range (350-1500ha.) to obtain sufficient abundance of prey items and the size of the territory appears to be related to the availability of prey (DECC threatened species profiles). Medium-sized arboreal mammals, particularly Common Ringtail and Common Brushtail Possums, Greater Gliders, Sugar Gliders, and birds are commonly taken. Records suggest that powerful owls are more inclined to forage within the tree canopy rather than utilise low perches beside breaks in ground cover (Debus & Chafer 1994).

While this species was not recorded during the field surveys, nearby records occur and it is possible that the Powerful Owl may forage within the study area. Suitable potential breeding/roosting hollows were recorded within the subject site, however, this species is more likely to breed and roost in larger tract of open forest than within the small remnant available in the study area. Therefore, the proposal is expected to result in the loss of a small area of potential foraging habitat for the Powerful Owl. Given the large home range of this species, the loss of foraging habitat as a result of the proposal is considered unlikely to disrupt the life cycle of the Powerful Owl to such an extent that a viable local population of the species will be placed at risk of extinction.

Squirrel Glider *Petaurus norfolcensis* (Vulnerable – TSC Act)

The distribution of this species is along the coast and ranges of eastern Australia from about Cairns in north Queensland to the Victorian/ South Australian border, extending to the western slopes and plains. This species usually inhabits dry open sclerophyll forest and woodland but there have been recent observations in moist regenerating forest and moist gullies. Although requiring nesting hollows, this species is not dependent on mature forest as sightings have been made in Eucalyptus plantations and forest remnants (Ray Williams, Ecotone Ecological Consultants, pers. obs.). It is possible that disused Ringtail Possum dreys and birds' nests are used in the absence of an abundance of suitable hollows.

No Squirrel Gliders were recorded in the study area, although the closely related Sugar Glider was recorded in 2005 and both species can occur in the same patch of bushland. The proposal is expected to result in the loss of a small area of potential foraging habitat for the Squirrel Glider as well as the loss of a number of potential breeding/roosting hollows. While it is unknown whether the Squirrel Glider resides within the subject site, the proposal would lead to the loss of potential foraging, roosting and breeding habitat. Given that large tracts of bushland occur adjacent to the subject site, it is considered unlikely that the proposal would adversely affect the life cycle of the Squirrel Glider such that a viable local population is likely to be placed at risk of extinction. However if a local population does occur, the proposal would contribute to the cumulative loss of habitat affecting this species.

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

Not Applicable

(c) ***in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:***

- **(i)** ***is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
- **(ii)** ***is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not Applicable

(d) ***in relation to the habitat of a threatened species, population or ecological community:***
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Hollow-roosting Bats – East-coast Freetail-bat *Mormopterus norfolkensis* and Greater Broad-nosed Bat *Scoteanax rueppellii* (both Vulnerable – TSC Act)

(i) A relatively small area of foraging habitat for threatened hollow-roosting bats is expected to be removed/modified as a result of the proposal. In addition, at few trees containing potential roosting/breeding habitat are expected to be removed as a result of the proposal.
(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.
(iii) The removal of vegetation associated with the proposal contributes to the cumulative effect of habitat loss for threatened hollow-roosting microbat species in the area. Given the large foraging range of these species, the amount of potential habitat to be removed as a result of the proposal is considered unlikely to impact the long-term survival of threatened tree-roosting microbat species in the locality. However, if a maternity roost is discovered within the area to be cleared, the removal of that roost tree may significantly impact the local population, particularly if the tree is removed during the breeding season.

Cave-roosting Bats – Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* and Little Bentwing-bat *Miniopterus australis* (both Vulnerable – TSC Act)

(i) No roosting/breeding habitat is likely to be removed or modified as a result of the proposal and the area of foraging habitat to be removed represents only a small amount of the available habitat in the area.
(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.
(iii) Given the large foraging range of these species, the amount of habitat to be modified/removed as a result of the proposal is considered unlikely to impact the long-term survival of threatened cave-roosting microbat species in the locality. However it would contribute to the cumulative loss of habitat affecting these species.

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

(i) A small area of foraging habitat for the Grey-Headed Flying-fox is expected to be removed as a result of the proposal.
(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.

(iii) The removal of vegetation associated with the proposal contributes to the cumulative effect of habitat loss for the Grey-headed Flying-fox in the area. However, given the large home range of this species, the amount of potential foraging habitat to be removed as a result of the proposal is considered unlikely to impact the long-term survival of the Grey-headed Flying-fox in the locality.

Masked Owl *Tyto novaehollandiae* (Vulnerable TSC Act)

(i) A small area of potential foraging habitat for the Masked Owl would be lost as a result of the proposal and one tree containing potentially suitable nesting hollows is expected to be removed.
(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.
(iii) In the unlikely event of a nest tree being discovered within the area to be cleared, the removal of that nest tree may have a significant impact on the long-term survival of the relevant species within the locality, particularly if it is removed during the breeding season. However this is highly unlikely to occur as no Masked Owl nesting activity was observed at the tree to be removed and despite numerous surveys this species has not been recorded within the study area.

Powerful Owl *Ninox strenua* (Vulnerable TSC Act)

(i) A small area of potential foraging habitat for the Powerful Owl would be lost as a result of the proposal and one tree containing potentially suitable nesting hollows is expected to be removed.
(ii) No habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.
(iii) In the unlikely event of a nest tree being discovered within the area to be cleared, the removal of that nest tree may have a significant impact on the long-term survival of the relevant species within the locality, particularly if it is removed during the breeding season. However this is highly unlikely to occur as this species is more likely to nest in larger forested area. In addition, no Powerful Owl nesting activity was observed at the tree to be removed and despite numerous surveys this species has not been recorded within the study area.

Squirrel Glider *Petaurus norfolcensis* (Vulnerable – TSC Act)

(i) A small area of potential foraging habitat for the Squirrel Glider is expected to be removed as a result of the proposal. In addition, one or more trees containing potentially suitable roosting/breeding hollows are expected to be removed as a result of the proposal.
(ii) The current proposal is unlikely to result in an area of habitat becoming fragmented or isolated from other areas of habitat.
(iii) While it is unknown whether a local population of the Squirrel Glider resides within the subject site, if a local population does occur, the foraging habitat and hollow-bearing trees expected to be lost as a result of the proposal is unlikely to be important to the long-term survival of that population. However the proposal would contribute to the cumulative loss of habitat affecting this species.

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

No areas of designated critical habitat so far identified under the provisions of the *Threatened Species Conservation Act* 1995 apply to the study area.

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

Recovery Plans

Two subject species, the Powerful Owl and Masked Owl, are the subject of a final Recovery Plan prepared by the NSW Department of Environment and Conservation (now Office of Environment and Heritage [OEH]. No recovery plans have been prepared for the remaining subject species.

Recovery Plan for the Large Forest Owls: Powerful Owl *Ninox strenua* Sooty Owl *Tyto tenebricosa* Masked Owl *Tyto novaehollandiae* (DEC 2006)

The main objective of the plan is to ensure that these threatened owl species persist in the wild in NSW in each region where they currently occur. Two specific objectives within the recovery plan have potential relevance to the current proposal. Objective 1 deals with minimising the loss and fragmentation of habitat and Objective 2 deals with minimising the impacts of development on large forest owl habitat. Given the large home range of these species and the small amount of potential habitat likely to be affected, the action proposed is considered not inconsistent with the objectives of this draft recovery plan. In the unlikely event of a nest tree being discovered within the area to be cleared, the removal of that nest tree may have a significant impact on the local population, particularly if it is removed during the breeding season. However no evidence of owl nesting activity was recorded within the subject site and neither species has been recorded in the study area despite numerous surveys.

Threat Abatement Plans

No threat abatement plans approved by OEH are considered relevant to the proposal.

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

To date, 36 key threatening processes have been finally determined under the provisions of the *TSC Act*. Those that are potentially relevant to the current proposal and the fauna present are discussed below.

1 Clearing of native vegetation
The revised Master Plan is expected to ultimately result in the clearing of a relatively small area of native vegetation within the subject site. While this represents only a small percentage of the native vegetation occurring within the study locality, it does contribute to the incremental cumulative loss of native vegetation within the local region. Consequently, a number of ecological impacts identified by the Final Determination for the threatening process (NSW Scientific Committee 2001) may occur including loss of local populations of individual species, increased greenhouse emissions, increased habitat for invasive species, loss of leaf litter layer and changes to soil biota.

2. Removal of dead wood and dead trees
Little fallen timber occurs within the subject site though at least one hollow-bearing dead tree is expected to be removed as a result of the proposal. The proposal is therefore considered likely to result in the operation of this key threatening process within the study area.

3. Loss of Hollow-bearing trees
A number of threatened fauna species are reliant on hollow-bearing trees for roosting and breeding purposes, including the Squirrel Glider, threatened owls and hollow-roosting insectivorous bats. A small number of trees containing hollows or other suitable fauna roost

habitat are expected to be removed as a result of the proposal. The proposal is therefore considered likely to result in the operation of this key threatening process within the subject site.

4. Invasion of native plant communities by exotic perennial grasses
One species of exotic perennial grass, *Axonopus fissifolius* (narrow-leaved carpet grass), has been recorded in the study area. However, many species of exotic perennial grass occur in the school grounds including Kikuyu, Quaking Grass, Shivery Grass, Prairie Grass and Parramatta Grass. Most of these grasses occur in the disturbed areas and at edges of bushland. Invading grasses can outcompete and displace native vegetation (NSW Scientific Committee 2003). Construction of the various components of the proposal would create a new edge with uncleared bushland, via which exotic grasses could invade. However, this potential threat could be ameliorated by appropriate weed control measures and management of natural vegetation including weed control in the areas adjacent to the completed sports field. Further details are given in the Recommendations.

5. Infection of native plants by Phytophthora cinnamomi
The introduction and spread of this fungus could affect locally occurring native species that are not currently listed by legislation and cause them to become threatened and could provide habitat and/or feeding resources for resident fauna. Species in this category identified by the Final Determination for the threatening process (NSW Scientific Committee 2002) that occur in the study area include *Angophora costata* and *Phyllanthus hirtellus.* Spores of the root-rot fungus *Phytophthora cinnamomi* could be introduced to the site on machinery or equipment that has been in a contaminated area, or in soil or fill imported to the site. Protocols should be established to ensure that machinery or fill brought in from off-site is certified to be free from the disease, or decontaminated before being allowed into the site.

6. Introduction and Establishment of Exotic Rust Fungi on Plants of the Family Myrtaceae
Spores of exotic rust (fungi of the Order Pucciniales) could be introduced to the site on vehicles, tools, machinery or equipment that have been in a contaminated area, on work clothing/vests/boots or with infected plant material. Introduction of the disease to the site could potentially infect species of the family Myrtaceae adjacent to the construction areas including APZs. One variant of a rust species (*Uredo rangelii*) has recently become naturalised in Australia and is commonly known as 'Myrtle Rust'. Naturally-occurring myrtaceous species recorded in the study area that are either known to be or potentially susceptible to infection by various species of rust include *Angophora costata, Corymbia gummifera* and *Leptospermum polygalifolium* (NSW Scientific Committee 2011). Protocols should be established to ensure that vehicles, machinery or clothing entering the site is certified to be free from the disease, or thoroughly washed/decontaminated before being allowed into the site. Plant material (particularly of angophoras, eucalypts, leptospermums or melaleucas) should not be allowed to enter the site unless known to be uncontaminated.

Other key threatening processes would be only peripherally or remotely relevant to the current proposal. A minute contribution to greenhouse gases causing global Anthropogenic Climate Change could result from the vegetation clearing associated with the proposal. The frequency of fire is not expected to increase, and in fact is more likely to decrease as a result of the proposed action.

Conclusions from the 7-part test for fauna: A number of potential impacts on threatened fauna that may occur as a result of the proposal have been identified through the 7-part test above. The main identified potential impact is the loss of a number of hollow-bearing trees. The loss of hollow-bearing trees has the potential to impact upon hollow-reliant fauna, particularly the East-coast Freetail-bat, Greater Broad-nosed Bat and Squirrel Glider. Of these, the insectivorous bats are only likely to be significantly impacted in the unlikely event that a tree containing a maternity roost is removed. With regard to the Squirrel Glider, it is unknown whether this species occurs within the study area, however if a population does occur, given the presence of large tracts of adjoining bushland, the loss of hollow-bearing trees and foraging habitat associated with the proposal is unlikely to have a significant impact on that local population. It is considered highly unlikely that the Powerful Owl and Masked Owl would

breed or roost within the subject site as a result of limited large tree hollow resources and the general disturbance near the site location and therefore, impacts on these owl species are expected to be low.

4.3.2 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act was gazetted on the 16th July 2000 replacing several earlier Commonwealth statutes. This Act focuses Commonwealth interests on matters of national environmental significance 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 national environmental significance 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 focuses on any action that has, will have or is likely to have a significant impact on a matter of national environmental significance. An 'action' is defined as a project, development, undertaking or an activity or series of activities.

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 are as follows:

Critically endangered and endangered species

Criteria

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

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

* 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.

Vulnerable species

Criteria

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

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

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.

Listed migratory species (non-threatened species only)

Criteria

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

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

An area of important habitat 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, or
- habitat utilised by a migratory species which is at the limit of the species range, or
- habitat within an area where the species is declining.

One fauna species listed as vulnerable in the *EPBC Act* 1999, the Grey-headed Flying-fox, was found to occur on the site. The extent to which the site could be utilised by this species is not regarded as being significant for the survival of the species.

In view of these considerations, it is not considered that referral to the Commonwealth Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) under the provisions of the *EPBC Act* 1999 is necessary.

4.4 Native Vegetation Act 2003

If the proposed development area is rezoned to Residential, any clearing of native vegetation as a result of the Master Plan is not likely to require approval under the Native Vegetation Act 2003.

5.0 CONCLUSION

An assessment of the potential effects on flora and fauna by the proposed minor amendments to the Master Plan for Charlton Christian College, Fassifern, has been made based on a combination of literature review and field survey. The resulting information has been used to address the requirements of Section 5A of the *Environmental Planning and Assessment Act 1979*. A proposal to rezone the land into two separate zones has also been reviewed and assessed.

The essential changes to the amended Master Plan include proposals to construct an additional carparking area (carpark 1), a new detention basin, and some new buildings and sports facilities for the existing school which will involve the removal of a number of trees, some of which contain potential roosting/breeding habitat for hollow-reliant fauna.

Three threatened fauna species, the Little Bentwing-bat, Eastern Bentwing-bat and Grey-headed Flying-fox, all listed as 'vulnerable' in the NSW *TSC Act*, have been recorded foraging or flying over the study area. No suitable roosting habitat exists on site for the Bentwing-bat species as they tend to roost in caves, mines or culverts. It is considered likely that both species are roosting in disused mine shafts at the nearby Newstan Colliery. The Grey-headed Flying-fox is also listed as vulnerable in the Commonwealth *EPBC Act* and a few individuals are likely to forage on site but no potential camp sites are available. A number of hollow-bearing trees occur within the study area, therefore potential roosting habitat within the site may be utilised by the East-coast Freetail Bat.

Other threatened fauna species have limited potential to occur, possibly only as occasional or seasonal visitors. These are the Squirrel Glider, Greater Broad-nosed Bat, East-coast Freetail-bat, Masked Owl and Powerful Owl. Several hollow bearing trees occur on site and these may provide roost/den sites for the above species, however, the habitat is considered to be marginal for the owl species.

No threatened flora species or threatened ecological communities are expected to be impacted by the revised Master Plan.

Provided the recommendations in this report are implemented, it is considered that the construction of the various components of the proposal for the school will not have a significant impact on threatened flora or fauna species, populations or ecological communities.

6.0 RECOMMENDATIONS

In order to maximise conservation of local flora and fauna and to ameliorate impacts of the proposal on the local natural environment (including potential habitat for threatened or significant species), it is recommended that the following steps be taken within the subject site:

a) According to Building Code & Bushfire Hazard Solutions, trees within the APZ for the proposed science building would be able to be retained without compromising the effectiveness of the APZ. While the understorey would need to be removed, the retention of trees in this area would provide foraging and shelter habitat for a range of fauna species found within the site.

b) Where possible, hollow bearing trees should be retained on site by careful design of the impact footprints for each component of the Master Plan at the advanced planning stage. It is accepted that as this is a school site, safety and bushfire issues will need to take priority.

c) In order to compensate for the predicted loss of tree hollows, the erection of nest boxes for gliders, birds and possibly bats within the Conservation Area could be considered, with monitoring and maintenance of the boxes carried out as a school project. See point e) below

d) During tree felling operations, an experienced wildlife handler should be present in order to rescue injured or displaced wildlife. It is suggested that some of the smaller trees be removed first, as wildlife is less likely to be encountered. The larger trees can then be removed in a clearer environment, making the rescue of fauna potentially easier.

e) A Conservation Management Plan has been prepared for the retained bushland in response to various proposed additions to the college (Ecotone Ecological Consultants 2008c). The report should be referred to for detailed site-specific advice on weed removal and management, replanting and rehabilitation of native species, hollow bearing tree removal protocol and fauna habitat augmentation (including next box installation and monitoring).

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8.0 APPENDICES

Appendix 1. Flora Species Recorded in the Study Area

The following is a list of all flora species recorded within the Charlton Christian College site during all field surveys in 1997, 2005 and 2007. 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
#indicates a declared noxious species in the Lake Macquarie control area
R indicates locally indigenous species that are potentially suitable for revegetation or replanting works
T - indicates species suitable for removal and relocation.

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

CLASS / FAMILY / *Scientific Name*		**Common Name**
CLASS FILICOPSIDA (Ferns)		
ADIANTACEAE		
Adiantum aethiopicum	R	Common Maidenhair Fern
DAVALLIACEAE		
Nephrolepis cordifolia *		Fishbone Fern
DENNSTAEDTIACEAE		
Pteridium esculentum		Bracken
LINDSAEACEAE		
Lindsaea linearis	R	Screw Fern
SINOPTERIDACEAE		
Cheilanthes sieberi subsp. *sieberi*		Mulga Fern
CLASS MAGNOLIOPSIDA (Flowering Plants) **Subclass Magnoliidae (Dicotyledons)**		
APIACEAE		
Centella asiatica	R	Swamp Pennywort
Hydrocotyle bonariensis *		Pennywort / Kurnell Curse
Platysace ericoides	R	Heathy Platysace
ARALIACEAE		
Polyscias sambucifolia		Elderberry Panax
ASPARAGACEAE		
Protasparagus aethiopicus *		Asparagus Fern
ASTERACEAE		
Ageratina adenophora * #		Crofton Weed
Bidens pilosa *		Cobblers Pegs
Chrysocephalum apiculatum	R	Yellow Buttons
*Cirsium vulgare**		Spear Thistle / Black Thistle
Conyza parva *		Fleabane
Dimorphotheca pluvialis *		Cape Marigold
*Erechtites valerianifolia**		Brazilian Fireweed
Hypochaeris radicata *		Catsear
Senecio madagascariensis *		Fire Weed
*Sonchus oleraceus**		Common Sowthistle

Tagetes minuta *		Stinking Roger
CAMPANULACEAE		
Wahlenbergia gracilis	R	Native Bluebell
CASUARINACEAE		
Allocasuarina littoralis	R	Black Sheoak
CONVOLVULACEAE		
Dichondra repens	R	Kidney Weed
Polymeria calycina	R	Swamp Bindweed
DILLENIACEAE		
Hibbertia aspera	R	Rough Guinea Flower
Hibbertia empetrifolia subsp. *empetrifolia*	R	Trailing Guinea Flower
Hibbertia linearis	R	Showy Guinea Flower
DROSERACEAE		
Drosera peltata	R	A Sundew
ERICACEAE		
Epacris microphylla	R	Coral Heath
Epacris pulchella	R	NSW Coral Heath
Leucopogon appressus	R	A Beard Heath
Monotoca scoparia	R	-
FABACEAE - Subfamily Caesalpinoideae		
Senna pendula		Cassia / Senna
FABACEAE - Faboideae		
Bossiaea obcordata	R	Spiny Bossiaea
Daviesia ulicifolia	R	Gorse Bitter Pea
Dillwynia retorta species complex	R	Egg & Bacon Pea
Erythrina X sykesii *		Coral Tree
Genista monspessulana *		Montpellier Broom
Glycine clandestina species complex	R	Love Creeper
Glycine microphylla	R	A Love Creeper
Glycine tabacina	R	A Love Creeper
Gompholobium minus	R	Dwarf Wedge Pea
Gompholobium pinnatum	R	Pinnate Wedge Pea
Hardenbergia violacea	R	False Sarsaparilla
Hovea linearis	R	Narrow-leaf Hovea
Kennedia rubicunda	R	Dusky Coral Pea
Melilotus indicus *		Burr Medic
Mirbelia rubiifolia	R	Mirbelia
Oxylobium ilicifolium	R	Native Holly
Pultenaea elliptica	R	Eggs & Bacon
Pultenaea paleacea	R	Eggs & Bacon
Pultenaea retusa	R	Eggs & Bacon
Trifolium arvense *		Haresfoot Clover
Trifolium repens *		White Clover
Vicia sativa subsp. *angustifolia* *		Narrow-leaved Vetch
FABACEAE - Mimosoideae		
Acacia baileyana *		Cootamundra Wattle
Acacia brownii	R	A Wattle
Acacia falcata	R	Falcate Wattle
Acacia irrorata subsp. *irrorata*	R	Green Wattle
Acacia longifolia subsp. *longifolia*	R	Sydney Golden Wattle
Acacia myrtifolia	R	Myrtle Wattle
Acacia suaveolens	R	Sweet Wattle
Acacia ulicifolia	R	Prickly Moses
GERANIACEAE		
Geranium solanderi var. *solanderi*		Cutleaf cranesbill

GOODENIACEAE		
Goodenia bellidifolia subsp. *bellidifolia*	R	Daisy-leaved Goodenia
Goodenia heterophylla subsp. *heterophylla*	R	Variable-leaved Goodenia
HALORAGACEAE		
Gonocarpus tetragynus		Poverty Raspwort
Gonocarpus teucrioides		Germander Raspwort
LAURACEAE		
Cassytha glabella forma *glabella*		Devil's Twine
Cassytha pubescens		Devil's Twine
Cinnamomum camphora *		Camphor Laurel
LOBELIACEAE		
Pratia purpurascens		White Root
LORANTHACEAE		
Dendrophthoe sp.		A Mistletoe
MALVACEAE		
Sida rhombifolia *		Paddy's Lucerne
MENISPERMACEAE		
Stephania japonica	R	Snake Vine
MORACEAE		
Ficus coronata	R	Creek Sandpaper Fig
MYRTACEAE		
Angophora costata	R	Smooth-barked Apple
Callistemom linearis	R	Narrow-leaved Bottlebrush
Corymbia gummifera	R	Red Bloodwood
Eucalyptus acmenoides	R	White Mahogany
Eucalyptus agglomerata	R	Blue-leaved Stringybark
Eucalyptus capitellata	R	Brown Stringybark
Eucalyptus piperita	R	Sydney Peppermint
Eucalyptus racemosa	R	Narrow-leaved Scribbly Gum
Eucalyptus signata	R	Scribbly Gum
Eucalyptus umbra	R	Broad-leaved White Mahogany
Leptospermum juniperinum	R	Prickly Tea-tree
Leptospermum polygalifolium subsp. *cismontanum*	R	A Tea-tree
Leptospermum trinervium	R	Paperbark Tea-tree
Melaleuca linariifolia	R	Snow-in-summer
Melaleuca nodosa	R	Ball Honey-myrtle
Melaleuca sieberi	R	Sieber's Paperbark
OLEACEAE		
Ligustrum sinense *		Small-leaved / Chinese privet
Olea europaea subsp. *africana* *		African Olive
OXALIDACEAE		
Oxalis perennans		Oxalis
PHYLLANTHACEAE		
Breynia oblongifolia	R	Coffee Bush
Glochidion ferdinandi var. *ferdinandi*	R	Cheese Tree
Phyllanthus hirtellus	R	Thyme Spurge
PITTOSPORACEAE		
Billardiera scandens		Apple Dumplings
Bursaria spinosa		Blackthorn
Pittosporum undulatum		Sweet Pittosporum

PLANTAGINACEAE		
Plantago lanceolata *		Plantain / Lambs Tongue
Veronica plebeia		Trailing Speedwell
POLYGALACEAE		
Comesperma ericinum	R	Matchheads
Comesperma sphaerocarpum	R	-
Polygala myrtifolia *		Polygala
PRIMULACEAE		
*Anagallis arvensis**		Pimpernel
PROTEACEAE		
Banksia spinulosa var. *collina*	R	Hair-pin Banksia
***Grevillea parviflora* subsp. *parviflora* Vuln.**	**R**	**Small-flower Grevillea**
Hakea sericea	R	Bushy Needlebush
Isopogon anemonifolius	R	Drumsticks
Lambertia formosa	R	Mountain Devils
Persoonia levis	R	Broad-leaved Geebung
Persoonia linearis	R	Narrow-leaved Geebung
ROSACEAE		
Rubus fruticosus species aggregate*		Blackberry
RUBIACEAE		
Opercularia diphylla		A Stinkweed
Pomax umbellata	R	Pomax
SAPINDACEAE		
Dodonaea triquetra	R	Large-leaf Hopbush
SOLANACEAE		
*Solanum nigrum**		Blackberry nightshade
STYLIDIACEAE		
Stylidium lineare	R	Narrow-leaved Trigger Plant
THYMELAEACEAE		
Pimelea linifolia subsp. *collina*	R	Rice Flower
TREMANDRACEAE		
***Tetratheca juncea* TSC Act / EPBC Act- Vulnerable**	**R**	**Blackeyed Susan**
VERBENACEAE		
Lantana camara *		Lantana
*Verbena bonariensis**		Purple Top
Verbena rigida *		Veined Verbena
VIOLACEAE		
Hybanthus monopetalus	R	Slender Violet-Bush
VITACEAE		
Cayratia clematidea	R	Slender Grape

CLASS MAGNOLIOPSIDA (Flowering Plants)
Subclass Liliidae (Monocotyledons)

ALLIACEAE		
Nothoscordum borbonicum *		Onion Weed
ANTHERICACEAE		
Arthropodium minus		Small Vanilla Lily
Thysanotus juncifolius		Fringe Lily
Tricoryne elatior		Yellow Rush-lily

Tricoryne simplex	R	Yellow Rush-lily
ASPARAGACEAE		
*Asparagus aethiopicus**		Asparagus Fern
CYPERACEAE		
Carex appressa		Tussock sedge / Tall Sedge
Cyperus sanguinolentus		-
Gahnia clarkei	R	A Saw Sedge
Lepidosperma laterale	R	Flat Sword-sedge
Ptilothrix detusta	-	
DORYANTHACEAE		
Doryanthes excelsa	R	Gymea Lily
HAEMODORACEAE		
Haemodorum planifolium		Blood Root
IRIDACEAE		
Patersonia sericea	R	Silky Purple Flag
*Watsonia meriana **		Wild Watsonia
JUNCACEAE		
Juncus alexandri subsp. *melanobasis*	R	A Rush
Juncus subsecundus	R	A Rush
LOMANDRACEAE		
Lomandra longifolia	R	Spiny-headed Mat-rush
Lomandra multiflora subsp. *multiflora*	R	Many-flowered Mat-rush
Lomandra obliqua	R	Fish Bones
LUZURIAGACEAE		
Eustrephus latifolius	R	Wombat Berry
ORCHIDACEAE		
Caladenia sp. ??		Lady's Fingers
Microtis sp.		Onion Orchid
Orthoceras strictum		Horned Orchid
Thelymitra sp.		A Sun Orchid
PHORMIACEAE		
Dianella caerulea var. *cinarescens*	R	Blue Flax Lily
Dianella caerulea var. *producta*	R	Blue Flax Lily
Dianella revoluta var. *revoluta*	R	Spreading Flax Lily
POACEAE		
*Andropogon virginicus **		Whisky Grass
Aristida vagans		Three-awn Speargrass
Austrodanthonia bipartita	R	A Wallaby Grass
Austrostipa pubescens	R	A Speargrass
*Axonopus fissifolius**		Narrow-leaved Carpet Grass
*Briza maxima **		Quaking Grass
*Briza minor **		Shivery Grass
*Briza subaristata **		-
*Bromus cartharticus **		Prairie Grass
*Cynodon dactylon **		Couch
Deyeuxia quadriseta	R	A Bent Grass
Dichelachne micrantha	R	Short-hair Plume Grass
Dichelachne sieberiana	R	A Plume Grass
Echinopogon caespitosus var. *caespitosus*	R	Bushy Hedgehog Grass
Echinopogon ovatus	R	Forest Hedgehog Grass
*Ehrharta erecta **		Panic Veldtgrass
Entolasia marginata	R	Bordered Panic
Entolasia stricta	R	Wiry Panic

*Hyparrhenia hirta**		Coolatai grass
Imperata cylindrica var. *major*		Blady Grass
Panicum simile	R	Two Colour Panic
*Paspalum urvillei**	R	Tall paspalum / Vasey grass
Pennisetum clandestinum *		Kikuyu
Poa labillardierei var. *labillardierei*	R	Tussock Grass
Sporobolis indicus var. *capensis* *		Parramatta Grass
Stipa pubescens	R	Speargrass
Themeda australis	R	Kangaroo Grass
RESTIONACEAE		
Lepyrodia scariosa		-
XANTHORRHOEACEAE		
Xanthorrhoea latifolia subsp. *latifolia*	R/T	Grass Tree

Appendix 2. Fauna recorded within the Study Area

Notes:
AMG reference for site
Map Grid 56 Easting 367500 Northing 6349000

:* indicates introduced / non-endemic species
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	po	Possible identification		

Family / Scientific Name	Common Name	TSC Act	EPBC Act	1997	2005	2007	NPWS code
Mammals							
Family: *PETAURIDAE*							
Petaurus breviceps	Sugar Glider			+	2/O	F	1138
Family: *PSEUDOCHEIRIDAE*							
Pseudocheirus peregrinus	Common Ringtail Possum			+	O	-	1129
Family: *PHALANGERIDAE*							
Trichosurus vulpecula	Common Brushtail Possum			+	1/O	-	1113
Family*: MOLOSSIDAE*							
Mormopterus sp 2 (Adams *et al* 1988)	A Freetail-bat			+	U,po	U,po	1049
Mormopterus norfolkensis	**East-coast Freetail-bat**	**V**		-	-	U,po	1329
Mormopterus sp.	-			-	-	U,p	-
Tadarida australis	White-striped Freetail-bat			-	-	1/W	1324
Family: *VESPERTILIONIDAE*							
Miniopterus schreibersii oceanensis	**Eastern Bentwing-bat**	**V**		+	U,d	U,d	1341
Miniopterus australis	**Little Bentwing-bat**	**V**		+	U,d	U,d	1346
Nyctophilus sp.	-			-	-	U,d	-
Chalinolobus gouldii	Gould's Wattled Bat			+	U,d	U,d	1349
Chalinolobus morio	Chocolate Wattled Bat			-	-	U,po	1351
Vespadelus vulturnus	Little Forest Bat			+	U,d	U,d	1379
Family: *PTEROPODIDAE*							
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V**	**V**	+	1/O	1/O,W	1280
Family: FELIDAE							
Felis catus *	Cat			-	1/O	-	1536
Amphibians							
Family: *MYOBATRACHIDAE*							
Crinia signifera	Common Eastern Toadlet			+	W	-	3134
Limnodynastes tasmaniensis	Spotted Marsh Frog			+	-	-	3063
Pseudophryne coriacea.	Red-backed Toadlet			-	W/O	-	3118
Family: *HYLIDAE*							
Litoria fallax	Eastern Dwarf Tree Frog			+	W	-	3183

Appendix 2. continued

Family / Scientific Name	Common Name	TSC Act	EPBC Act	1997	2005	2007	NPWS code
Reptiles							
Family: *AGAMIDAE*							
Amphibolurus muricatus	Jacky Dragon			+	-	-	2194
Family: *SCINCIDAE*							
Eulamprus quoyii	Eastern Water Skink			+	-	-	2557
Lampropholis delicata	Garden Sun-skink			+	O	-	2450
Lampropholis guichenoti	Grass Sun-skink			+	-	-	2451
Avifauna							
Family: *ANATIDAE*							
Chenonetta jubata	Australian Wood Duck			-	2/O	-	0202
Family: *LARIDAE*							
Larus novaehollandiae	Silver Gull			+	-	-	0125
Family*: COLUMBIDAE*							
Streptopelia chinensis *	Spotted Turtle-dove			+	O	-	0989
Ocyphaps lophotes	Crested Pigeon			-	2/O	1/O,E	0043
Family: *CACATUIDAE*							
Calyptorhynchus funereus	Yellow-tailed Black-cockatoo			+	-	-	0267
Eolophus roseicapillus	Galah			+	O	-	0273
Cacatua galerita	Sulphur-crested Cockatoo			-	O	-	0269
Family: *PSITTACIDAE*							
Trichoglossus haematodus	Rainbow Lorikeet			-	O	-	0254
Platycercus eximius	Eastern Rosella			+	O	-	0288
Family: *CUCULIDAE*							
Eudynamys orientalis	Common (Pacific) Koel			+	O,W	-	0347
Scythrops novaehollandiae	Channel-billed Cuckoo			+	2/OW	-	0348
Family: *STRIGIDAE*							
Ninox boobook	Southern Boobook			+	1/W	-	0242
Family: *PODARGIDAE*							
Podargus strigoides	Tawny Frogmouth			-	2/O	1/O	0313
Family: *ALCEDINIDAE*							
Dacelo novaeguineae	Laughing Kookaburra			+	2/O	1/W	0322
Todiramphus sanctus	Sacred Kingfisher			+	1/WO	-	0326
Family: *CORACIIDAE*							
Eurystomus orientalis	Dollarbird			+	O,W	-	0318
Family: *MALURIDAE*							
Malurus cyaneus	Superb Fairy-wren			-	O,W	-	0529
Family: *PARDALOTIDAE*							
Pardalotus punctatus	Spotted Pardalote			+		-	0565
Family: *MELIPHAGIDAE*							
Anthochaera carunculata	Red Wattlebird			-	O,W	-	0638
Philemon corniculatus	Noisy Friarbird			+	-	-	0645
Manorina melanocephala	Noisy Miner			+	O,W	5+/O	0634

Appendix 2. continued

Family / Scientific Name	Common Name	TSC Act	EPBC Act	1997	2005	2007	NPWS code
Avifauna - continued							
Family: *MELIPHAGIDAE*							
Meliphaga lewinii	Lewins Honeyeater			+	-	-	0605
Lichenostomus chrysops	Yellow-faced Honeyeater			+	-	-	0614
Acanthorhynchus tenuirostris	Eastern Spinebill			+	-	-	0591
Myzomela sanguinolenta	Scarlet Honeyeater			+	-	-	0586
Family: *DICRURIDAE*							
Grallina cyanoleuca	Magpie-lark			+	-	-	0415
Family: *CAMPEPHAGIDAE*							
Coracina novaehollandiae	Black-faced Cuckoo-shrike			+	O,W	-	0424
Family: *ARTAMIDAE*							
Cracticus torquatus	Grey Butcherbird			+	O,W	-	0702
Cracticus nigrogularis	Pied Butcherbird			-	-	1/W	0700
Gymnorhina tibicen	Australian Magpie			+	O,W	-	0705
Strepera graculina	Pied Currawong			+	-	-	0694
Family: *CORVIDAE*							
Corvus coronoides	Australian Raven			-	O,W	-	0930

Appendix 3. Project Personnel and Relevant Licenses

Project Personnel

REPORT COMPONENT	STUDY TEAM MEMBERS	QUALIFICATIONS	RELEVANT EXPERIENCE
Project Management, Flora Field Survey, Report Writing	Stefan Rose	B.A. (Biol. Sci.), M.Env.Stud., MAIBiol, MECA	>20 years
Literature Review	Amy Rowles	B. Sc. (Hons) Biology/Ecology	>10 years
Figure Preparation	Annette Seabrook	B. Env Sc.; TAFE Diploma (GIS)	>2 years
Supplementary Fauna Field Survey	Gavin Ayre	B.Sc.	>5 years

Relevant licences held by Ecotone Ecological Consultants

TYPE	FOR	LICENCE NO	NAME	DATE VALID TO	ORGANISATION	LOCATION
Animal Research Authority	Vertebrate Fauna Surveys	08/8633	Brian Wilson	15-Nov-13	Animal care and ethics committee of the Director-General of NSW Agriculture	NSW
Certificate of Approval	Vertebrate Fauna Surveys	08/8633	Brian Wilson	15-Nov-14		
Licence to	Access NPWS Wildlife Atlas Data Base	CON93002	Brian Wilson	30-Jun-13	NSW Office of Environment and Heritage	
Scientific Licence	Harm/ trap/ release: protected fauna; pick/ hold: native flora	SL 100733	Brian Wilson Stefan Rose Jenny Lewis Amy Williams Narawan Williams Anne Williams Anna McConville Ray Williams	31-Mar-13		
	As above plus bat banding	SL 100734	Ray Williams	31-Mar-17		