Cryptostylis hunteriana (Leafless Tongue Orchid)

Five *Cryptostylis hunteriana* clumps containing 13 above-ground stems were recorded during the current survey within the Narrabeen Doyalson Coastal Woodland vegetation community within the CHB development lands (Figure 3-5). Several other records for this species occur within the local area. This find is significant as this species is extremely difficult to locate due to sporadic flowering (Bell, 2001). There are six locations where this species has been located in the Wyong LGA and southern Lake Macquarie LGA being Charmhaven, Wyee, Chain Valley Bay, Vales Point and Freemans Waterhole (Bell, 2001). In recent times, an individual was located within the Wallarah Peninsula, at Murrays Beach (Conacher Travers, 2004). Thus the find of a seventh population within the area is significant. The location of the species within Scribbly Gum habitat is also consistent with the habitat in which this species has been found to be growing. Other locations include Bulahdelah, Nelson Bay, Lemon Tree Passage, Ben Boyd NP, Gilbrater Range NP, Ku-ring-gai Chase NP, Pigeon House, and the south coast. Further afield it occurs in Victoria and Queensland (Bell, 2001).

A major population of this species was located at Bulahdelah within the Bulahdelah Bypass area where the largest population has been found (Parson Brinckenoff, 2004). Approximately 50% of this population is to be translocated as part of the proposal and ongoing research and monitoring will be performed to assess the success of this translocation.

In conclusion, this population is significant locally, regionally, and at both a State and Federal level, due to the low numbers of this species recorded. Very few of these populations are reserved within defined conservation reserves and it is recommended that this population be conserved within the CHB development lands layout.

Plate 3-1 *Cryptostylis hunteriana* within CHB development lands

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

LEGEND
- CHB Development Lands
- *Cryptostylis hunteriana*
- *Cryptostylis hunteriana habitat*

TITLE:
Figure 3-5
Cryptostylis hunteriana
Location & Habitat

CLIENT: Rosecorp Pty Ltd

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 5050 at A3 Size
DRAWN: E. Graham
APPROVED: D. Landenberger
DATUM: MGA Zone 56 (GDA 94)
DATE: 23/11/2007
LAYOUT REF: J:\JOBS\24k\24619 - Gwandalan\Draftin .... nfo \Workspaces\24619.FIG6.Cryptostylis Location & Habitat A-A3.221
CONTOUR INTERVAL: N/A
JOB REF: 24619

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

3.2 SEPP 14 Wetland Boundary Survey Results

Groundtruthing found that the northern SEPP 14 wetland boundary, as indicated by wetland vegetation, exists to the north of the DoP boundary (Figure 3-6). The delineation of the boundary of the SEPP 14 wetland was determined by the presence of sedges, Melaleucas or other wetland flora species. The SEPP 14 wetland extends into the southern portion of the site at CHB; however, it lies approximately 35m outside of the CHB development lands boundary at the closest point. Figure 3-6 indicates both the new groundtruthed wetland boundary delineated using a Trimble GEOXH GPS with post processing, and the broad-scale DoP SEPP 14 boundary.

TITLE:
Figure 3-6
SEPP 14 Wetlands

CLIENT:
Rosecorp Pty Ltd

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 19300 at A4 Size **DRAWN:** E. Graham **APPROVED:** D. Landenberger

DATUM: MGA Zone 56 (GDA 94) **DATE:** 23/11/2007

LAYOUT REF: J:\JOBS\24k\24619 - Gwandalan\Draftin .... n\o \Workspaces\24619.FIG9.SEPP14 Wtelands A-A4.221107.WOR

CONTOUR INTERVAL: N/A

JOB REF: 24619

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

3.3 Fauna

The results of the threatened fauna database searches and targeted Eastern Pygmy Possum surveys are discussed below. Please refer to previous survey reports (Wildthing, 2003a; 2003b; 2004a; 2004b; 2004c; EcoBiological, 2006a; 2006b; and RPS HSO, 2007d) for details of the findings of previous investigations.

3.3.1 Habitat description

CHB development lands

The majority of CHB development lands have been subject to high levels of disturbance associated with coal mining operations and facilities and offers little habitat to native flora and fauna. However, high quality native vegetation does occur within small areas on the fringes of the CHB development lands. These high quality native remnants contain a variety of shrub and groundcover that is likely to support small terrestrial mammals and reptiles. Additionally, hollow-bearing trees recorded in the south of the CHB development lands (Figure 3-8) provide an important resource for hollow-dependent fauna species.

Gwandalan development lands

Much of the Gwandalan development lands contain vegetation in good to high condition, which is likely to provide habitat that supports a range of fauna species. Habitats that are likely to be important include abundant hollow-bearing trees, fallen timber and logs, shrub and groundcover (shelter and foraging opportunities), canopy species (foraging opportunities), dams and riparian areas.

Offset lands

The offset lands contain a range of habitats that would support a range of fauna species including intact creeklines and riparian vegetation, abundant hollow-bearing trees, variations in shrub and groundcover densities (shelter and foraging resources), canopy foraging resources. As per the MoU, in area alone the offset lands comprise more than 80% of the southern Lkae Macquarie holdings.

3.3.2 NPWS Threatened Species Database Search Results

The results of the above search indicated that twenty-seven (27) threatened fauna species have been previously recorded within 5km (DECC Wildlife Atlas 2007) of the site. Figure 3-7 indicates the location of these local records in relation to the site. Of these species, five have been recorded within the site (indicated by an asterisk (*)). Section 4 provides an assessment of the likelihood of occurrence of these threatened species within the site based on the presence of local records, findings of previous surveys and the presence of suitable habitat.

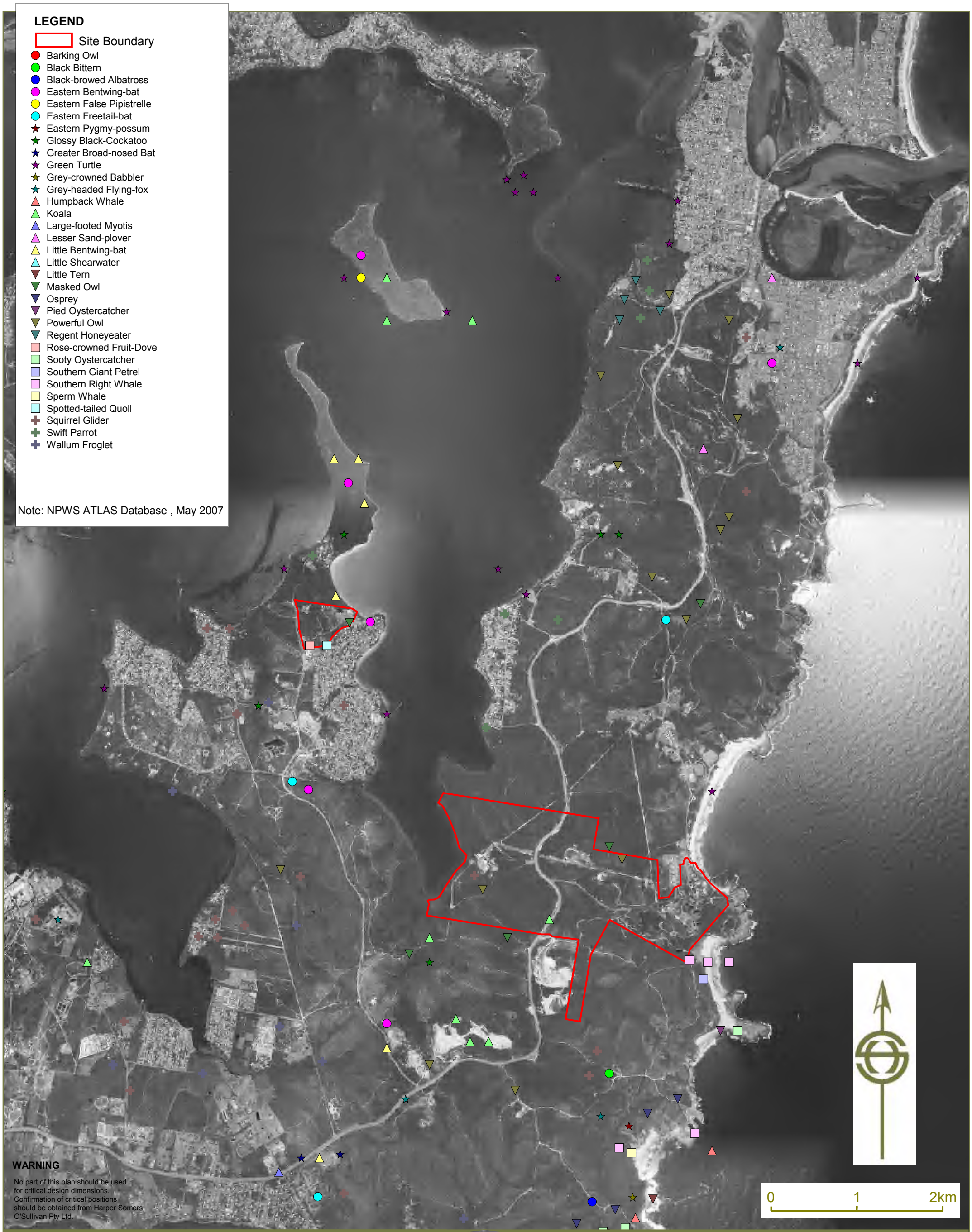
- *Calyptorhynchus lathami** Glossy Black-Cockatoo*
- *Lathamus discolor* Swift Parrot
- *Crinia tinnula* Wallum Froglet
- *Ixobrychus flavicollis* Black Bittern

- *Ephippiorhynchus asiaticus* Black-necked Stork
- *Pandion haliaetus* Osprey
- *Haematopus fuliginosus* Sooty Oystercatcher
- *Haematopus longirostris* Pied Oystercatcher
- *Charadrius mongolus* Charadrius mongolus
- *Sterna albifrons* Little Tern
- *Ptilinopus regina* Rose-crowned Fruit-Dove
- *Ninox connivens* Barking Owl
- *Ninox strenua* Powerful Owl
- *Tyto novaehollandiae** Masked Owl*
- *Xanthomyza phrygia* Regent Honeyeater
- *Dasyurus maculatus* Spotted-tailed Quoll
- *Phascolarctos cinereus** Koala*
- *Cercartetus nanus* Eastern Pygmy-possum
- *Squirrel Glider* Squirrel Glider
- *Pteropus poliocephalus* Grey-headed Flying-fox
- *Mormopterus norfolkensis* Eastern Freetail-bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Miniopterus australis** Little Bentwing-bat*
- *Miniopterus schreibersii oceanensis** Eastern Bentwing-bat*
- *Myotis adversus* Large-footed Myotis
- *Scoteanax rueppellii* Greater Broad-nosed Bat

In addition to the above threatened species a number of threatened oceanic fauna species, including oceanic bird species and whale species, occurred within a 10km perimeter buffer of the site, as a consequence of the site's proximity to oceanic habitats. These species have not been included within the above 10km threatened species list as potential impacts within the site will not include the habitats of those oceanic species.

A small number of species for which records do not occur within 10km of the site (due in part, to a measure of difficulty in their surveying and limits on previous and current survey works) are considered as having a moderate or greater opportunity of occurring within the site on at least an intermittent basis. For this reason those species are included below:

- *Hoplocephalus bitorquatus* Pale-headed Snake
- *Hoplocephalus stephensii* Stephen's Banded Snake
- *Lophoictinia isura* Square-tailed Kite
- *Tyto tenebricosa* Sooty Owl
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat



TITLE:

Figure 3-7

NPWS Atlas Fauna Records

CLIENT:

ROSECORP PTY LTD

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

SCALE: 1: 40000 at A3 Size

DRAWN: S. Bishop

APPROVED: D.L.

DATUM: MGA Zone 56 (GDA 94)

DATE: 22/11/2007

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Draft .... ology\Southern Lands\ALL WORKSPACES\Catho Report Figures\24530 FIG.4-2 NPWS FLORA MAP A-A3.wor

CONTOUR INTERVAL: N/A

JOB REF: 24530

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

3.3.3 Targeted Eastern Pygmy Possum Survey Results

The Common Antechinus (*Antechinus stuartii*) was the only fauna species captured during targeted Eastern Pygmy Possum surveys (Table 3-2). No other species were recorded within the CHB development lands during the targeted survey.

Table 3-3 Trapping Results

Date	Trap Number	Species	Sex
13/11/07	A9	*Antechinus stuartii*	Female
13/11/07	D1	*Antechinus stuartii*	Female
14/11/07	A9	*Antechinus stuartii*	Female
14/11/07	D1	*Antechinus stuartii*	Female
15/11/07	A9	*Antechinus stuartii*	Female
16/11/07	A10	*Antechinus stuartii*	Female
16/11/07	A7	*Antechinus stuartii*	Female
16/11/07	D4	*Antechinus stuartii*	Female

Lambertia formosa was scattered within potential habitat identified by EcoBiological (2006a) and was the only Proteaceae flowering within the CHB development lands at the time of the survey. Other Proteaceae observed within the CHB development lands included *Banksia serrata*, *B. spinulosa*, *B. oblongifolia*, *B. robur* and *Hakea bakeriana*.

3.4 Opportunistic Observations

Three significant opportunistic observations were made during field surveys, being:

- evidence of Glossy Black-Cockatoo within Gwandalan development lands,
- a White-bellied Sea-Eagle (*Haliaeetus leucogaster*) nest within the offset lands; and
- Wallum Froglet (*Crinia tinnula*) within the SEPP 14 Wetland to the south of the CHB development lands. One Wallum Froglet, listed as Vulnerable under the *TSC Act*, was recorded calling briefly from SEPP 14 wetland to the south of the CHB development lands during mapping of the northern SEPP 14 boundary.

The White-bellied Sea-Eagle is listed as Migratory under the *EPBC Act.* The White-bellied Sea-Eagle nest was found within a large *Angophora costata* (Smooth-barked Apple) adjacent to the west of the SEPP 14 wetland in the southern portion of the offset lands (Figure 3-8). The nest was in current use with two to three juvenile White-bellied Sea-Eagles occupying the nest. An adult was observed landing to feed young. The nest had a large build-up of nesting material under the tree, indicating that it is likely to have been in use for multiple breeding seasons.

The Glossy Black-Cockatoo was recorded within the Gwandalan development lands via characteristic chewed cones during targeted flora searches (August and November). Additionally, numerous trees containing suitable hollows for roosting/breeding were noted within the Gwandalan development lands.

A Rufous Fantail (*Rhipidura rufifrons*), a species listed as Migratory under the *EPBC Act*, was recorded adjacent to Munmorah Palm-Apple Dry Drainage Line Forest within Lot 5 DP 774923 to the west of the coal dump within the offset lands (Figure 3-8).

No evidence of Masked Owl was found within the potential roost trees searched at Gwandalan.

3.5 Corridors and Connectivity

The site is located within a large tract of vegetation that extends from Swansea in the north, west to Summerland Point and to Toukley in the south. Two estates managed by NSW National Parks and Wildlife Service are located in close proximity to the site, Munmorah SCA and Lake Macquarie SCA. Other large holdings include land owned by Coal & Allied to the north of the offset lands and to the south of Gwandalan development areas.

The CHB development lands are situated in an area that is mostly disturbed and as such is not likely to sever any existing connectivity with large areas of vegetation. Some minor loss of fringing vegetation would very slightly reduce the overall fragment size. However, this reduction in size is not considered significant in a wider locality perspective.

The development lands at Gwandalan are part of a tract of vegetation running north to south linking Lake Macquarie SCA with vegetation to the south. Land immediately to the west of the site also provides a north-south vegetated corridor. The proposed development of the lands at Gwandalan would reduce the overall fragment size in this area and reduce the width of the existing north-south connectivity (Figure 1-1).

The proposal includes offset lands to be transferred to DECC conservation estates, which aim to provide key green corridors as discussed in the LHCP and LHRS.

WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

LEGEND

Site Location

Fauna Species

White-bellied Sea Eagle Nest
Migratory EPBC Act

Wallum Froglet
TSC Act (V)

Glossy Black Cockatoo
TSC Act (V)

Rufous Fantail
Migratory EPBC Act

Hollow-bearing Trees

Areas containing Hollow-bearing Trees

0 500 1,000
metres

TITLE: Figure 3-8
Significant Fauna Observations

CLIENT: Rosecorp Pty Ltd

SCALE: 1: 13700 at A3 Size **DRAWN:** E. Graham **APPROVED:** D. Landenberger

DATUM: MGA Zone 56 (GDA 94) **DATE:** 23/11/2007

LAYOUT REF: J:\JOBS\24k\24619 - Gwandalan\Draftin .... nfo\Workspaces \24619.FIG12.Significant Fauna Observations A-A3.221107.WOR

CONTOUR INTERVAL: N/A

JOB REF: 24619

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

4 THREATENED SPECIES AND COMMUNITIES ASSESSMENT

4.1 Introduction

This section discusses the potential impacts on threatened species and endangered ecological communities listed under the *TSC Act* and/or *EPBC Act* arising from the proposal. The aim of this section is to provide an overall assessment of the significance of potential impacts arising from the proposal at CHB development lands and Gwandalan development lands and takes into consideration the proposed offset lands. These assessments have been developed through habitat assessment and targeted survey undertaken by RPS HSO during recent investigations in addition to information provided within previous assessments undertaken by Wildthing (2003a; 2003b; 2004a; 2004b; 2004c) and EcoBiological (2006a; 2006b).

Threatened flora and fauna species (listed under the *TSC Act 1995* and the *EPBC Act 1999*) that have been gazetted / recorded from within the vicinity of the site have been considered within this assessment. EEC's and Endangered Populations known from the broader area have also been addressed. Each species / community / population is considered for its potential to occur within the site and the likely level of impact as a result of the overall proposal. This assessment deals with each species / community / population separately and identifies the ecological parameters of significance associated with the overall proposal. Separate assessments were undertaken for the Gwandalan development lands, CHB development lands and for the offset lands due to the differences in the types of habitats present and level of disturbance.

4.2 Assessment of Likelihood of Occurrence of Threatened Species and Communities

The assessment of likelihood of occurrence of threatened species, populations and/or EECs was undertaken relying on habitat assessments from previous ecological survey reports (Wildthing, 2003a; 2003b; 2004a; 2004b; 2004c; EcoBiological, 2006a; 2006b; and RPS HSO, 2007) in conjunction with site visits to undertake fieldwork for this EAR.

Those species / communities that have been identified as having either a moderate level of impact (or greater) as a result of the proposed development estate or that have been recorded within the site during field investigations have been subject to further assessment within Section 4.3 of this report.

'Species' or **'EEC / Population'** – Lists each threatened species / EEC / population known from the vicinity of the site. The status of each threatened species under the *TSC Act 1995* and *EPBC Act 1999* is also provided.

'Habitat Description and Known Populations' or **'Habitat Description and Known Stands / Populations'** – Provides a brief account of the species / community / population and the preferred habitat attributes required for the existence / survival of each species / community / population.

'Chance of Occurrence within Site'– Assesses the likelihood of each species / community / population to occur within the site in terms of the aforementioned habitat

description and taking into account local habitat preferences, results of recent field investigations, data gained from various sources and previously gained knowledge via fieldwork undertaken within other ecological assessments in the locality.

'Likely Level of Impact within Development Estate'– Assesses the likely level / significance of impacts to each species / community / population that would result from the proposed development estate, taking into account both short and long-term impacts. This assessment is largely based on the chance of occurrence of each species / community with due recognition to other parameters such as home range, habitat use, connectivity etc. It also considers the scope of the proposal, including the likely 'ecological footprint', duration of construction works, proposed remediation works etc. All impact assessment is undertaken with due consideration to the Offset lands forming part of the proposal.

Notes: (V) = Vulnerable Species listed under the *Threatened Species Conservation Act 1995*.
(E) = Endangered Species listed under the *Threatened Species Conservation Act 1995*.
(V*) = Vulnerable Species listed under the *Commonwealth EPBC Act 1999*.
(E*) = Endangered Species listed under the *Commonwealth EPBC Act 1999*.
(M*) = Migratory Species listed under the *Commonwealth EPBC Act 1999*.

Table 4-1 Threatened Species Assessment

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
PLANTS					
Acacia bynoeana Bynoe's Wattle (E, E*)	Small, prostrate shrub found in low heath and open woodland, generally on loamy clays and sand. Occurs from the Lower Hunter south to the Southern Highlands. Within the Hunter Sub-bioregion it has been found in several locations within the Cessnock LGA where it has been found growing in Kurri Sand Swamp Woodland (KSSW). Has also been recently recorded as isolated populations within Yellow Bloodwood Woodland and Blue-leaved Stringybark Woodland near Ellalong. Locally, it is known to occur with Coastal Plains Scribbly Gum Woodland and a record exists to the southwest of the site within the Lake Macquarie State Recreation Area.	**Low – Moderate** Targeted surveys were unable to record this species within the Gwandalan development lands, despite a small amount of potential habitat being present (Wildthing, 2003b). However, this cryptic species is relatively difficult to locate in the field and as such its presence within the site cannot be totally discounted.	**Low – Moderate** Targeted surveys were unable to record this species within the CHB development lands, despite a small amount of potential habitat being present (Wildthing, 2004a). However, this cryptic species is relatively difficult to locate in the field and as such its presence within the site cannot be totally discounted.	**Moderate** Potential habitat for this species occurs within the offset lands. Since targeted surveys were not undertaken across the entire offset lands, the species cannot be discounted as occurring.	**Low** Considered unlikely to be adversely affected by the proposal due to the conservation of areas of potential habitat for this species within offset lands, and the lack of records within development areas subjected to several flora surveys.
Angophora inopina Charmhaven Apple (V, V*)	Small to medium tree found in shallow sandy soils in open woodland, swamp woodland and wet heath. The main occurrences of this species are in the Wyong and Lake Macquarie LGA's (from Charmhaven to Wyee and Morisset, and north to near Toronto), with disjunct populations also in Port Stephens LGA (south of Karuah).	**Low - Moderate** Potential habitat for this species occurs within the Gwandalan development lands. However, the species was not recorded during flora surveys undertaken by Wildthing (2003b).	**Low - Moderate** Potential habitat for this species occurs within the CHB development lands. However, the species was not recorded during flora surveys undertaken by Wildthing (2004a) and EcoBiological (2006a; 2006b).	**Moderate** Potential habitat for this species occurs within the offset lands. Since targeted surveys were not undertaken across the entire offset lands, the species cannot be discounted.	**Low** The current proposal is unlikely to adversely impact upon this species, due to its absence from potential habitat within the development lands and the retention of potential habitat within offset lands to be dedicated to conservation.
Callistemon linearifolius (V)	Shrub that grows in dry sclerophyll forest on the coast and adjacent ranges. Significant populations recently found within the Lower Hunter, including Werakata National Park. Re-sprouting / juvenile specimens difficult to distinguish from other *Callistemon* species such as *C. rigidus* or *C. linearis* without the aid of flowering parts. Locally this species has been recorded where dry forest habitats interface with salt tolerant vegetation communities, such as Swamp Oak Rushland Forest and Riparian Melaleuca forest.	**Low - Moderate** Potential habitat for this species occurs in the drainage lines within the Gwandalan development lands. However, the species was not recorded during flora surveys undertaken by Wildthing (2003b).	**Low - Moderate** Potential habitat for this species occurs in the drainage lines within the CHB development lands. However, the species was not recorded during flora surveys undertaken by Wildthing (2004a) and EcoBiological (2006a; 2006b).	**Moderate** Potential habitat for this species occurs in the drainage lines within the offset lands. Since targeted surveys were not undertaken across the entire offset lands, the species cannot be discounted.	**Low** The current proposal is unlikely to adversely impact upon this species, due to its absence from potential habitat within the development lands and the retention of potential habitat within offset lands to be dedicated to conservation.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Caladenia tessellata Tessellated Spider Orchid (E, V*)	A small terrestrial orchid, which regrows its single leaf on an annual basis. It is known to occur in grassy woodland and locally it has potential to occur within Coastal Plains Scribbly Gum Woodland. It has been recorded within Munmorah State Conservation Area to the southwest of the site.	**Low – Moderate** Flora surveys were conducted within the flowering season for this species by RPSHSO (2007) and it was not recorded within the Gwandalan development lands. However, habitat assessment suggests that there is potential for this species to occur in woodland habitats with a heathy to grassy understorey of which there is a small area in the east of the Gwandalan development lands.	**Low – Moderate** Targeted flora surveys were conducted by Ecobiological (2006) within the flowering season for this species and it was not recorded within the CHB development lands.	**Moderate** No targeted searches for this species were undertaken within the offset lands; however, there is habitat within the Narrabeen Doyalson Coastal Woodland and Narrabeen Wallarah Sheltered Grassy Woodland.	**Low** Due to the conservation of those areas representing potential habitat for this species it is unlikely that the current proposal will adversely impact upon this species.
Chamaesyce psammogeton (E)	Perennial prostrate herb, which grows on sand dunes near the sea. Within the region records exist from Myall Lakes National Park and Wamberal Lagoon Nature Reserve.	**Low** No potential habitat (sand dunes) exists within the site for this species.	**Low – Moderate** Highly marginal habitat exists within the Coastal Headland Complex in the north of the CHB development lands. However, the species was not recorded during flora surveys (Wildthing, 2004a; EcoBiological, 2006a; 2006b).	**Low – Moderate** Marginal habitat exists within the Coastal Headland Complex to the north of the CHB development lands. However, the species was not recorded during flora surveys.	**Low** A small amount of highly marginal habitat exists within the CHB development lands. However, similar habitat also exists within offset lands which would be dedicated to conservation. This species may be indirectly impacted upon by increased residential development due to increased usage of the CHB beach outside of the site (where more suitable habitat exists) if measures to protect potential habitat from pedestrian traffic are not incorporated into the occupation phases of residential development.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Cryptostylis hunteriana Leafless-tongue Orchid (V, V*)	A cryptic Saprophytic orchid species that flowers between December and February. Distribution limits N-Gibraltar Range S- south of Eden. Grows in a variety of habitats from tall open forests to swamp heath on sandy soils. Local records exist from the Wallarah Peninsula to the north of the site.	**Moderate** The relatively wide range of possible habitats that this species potentially occurs within and the ubiquitous presence of a closely related species, *C. subulata and C. erecta*, with which this species is sometimes associated, suggests that it may occur within any of the wooded habitats within the Gwandalan development lands, except those that are very wet or saline in nature. Targeted searches for this species failed to locate it within the Gwandalan development lands. However, due to the large amount of habitat within the site and the cryptic nature of this species its presence within the site cannot be discounted.	**High** This species (approximately 13 individuals) was recorded within the Narrabeen Doyalson Coastal Woodland within the CHB development lands.	**Moderate - High** This species generally occupies Scribbly Gum woodland habitats within the local region and there are some similar habitats (with a heathy understorey) within the offset lands.	**Moderate** The areas of potential habitat which are located within the offset lands provide a small amount of habitat for this species. However, the majority of the offset lands is not optimal habitat for this species. The presence of this species within the CHB development lands is of notable significance. If this species and the habitat surrounding it are retained then the impact of the proposal will be minimal. In addition, a buffer area is recommended to be implemented in combination with appropriate nutrient and sediment controls to mitigate any runoff from the proposed adjoining urban development. The removal of suitable habitat within the Gwandalan development lands would further reduce the amount of habitat available to the species in the local area.
Cynanchum elegans White-flowered Wax Plant (E, E*)	Occurs scattered along the NSW Northern Coast south to Wollongong usually in dry, littoral or subtropical rainforest and occasionally Melaleuca scrub or woodland. A climbing or twining plant species that flowers from August to May with peak flowering in November. One record within the Atlas of NSW Wildlife data occurs within the Lower Hunter Region and Central Coast at Green Point to the north of Belmont.	**Low – Moderate** The wet sclerophyll habitats, within the east of the Gwandalan development lands represents sub-optimal habitat for this species. However, it was not recorded during flora surveys within the development estate and there are very few records for this species within the region.	**Low - Moderate** The littoral rainforest remnants described by EcoBiological (2006) contain potential habitat for this species. However, it was not recorded during flora surveys performed by EcoBiological (2006) within the CHB development lands and there are very few records for this species within the region.	**Moderate** Due to its potential to occur across a wide range of wet sclerophyll habitats, the offset lands contain a range of opportunities for this species. Targeted surveys for the species were not undertaken within the offset lands.	**Low** Whilst some potential habitat for this species occurs within the development estate large areas of superior habitat for this species will be conserved within the offset lands.
Dendrobium melaleucaphilum Spider Orchid (E)	Epiphytic orchid growing mostly growing on *Melaleuca stypheloides*, but occasionally on rainforest tress or rocks. Extends from south of the Blue Mountains to Queensland. Preferred habitat is coastal swamp forests.	**Low – Moderate** Although the favoured host plant for this orchid, *Melaleuca stypheloides*, was recorded within the site during flora surveys, there are no known records for this orchid species in the Lake Macquarie area and it was not recorded during flora surveys within the Gwandalan development lands (Wildthing 2003b). Nevertheless due to the occurrence of potential habitat its presence within the site cannot be totally discounted.	**Low – Moderate** Although the favoured host plant for this orchid, *Melaleuca stypheloides*, was recorded within the site during flora surveys, there are no known records for this orchid species in the Lake Macquarie area and it was not recorded during flora surveys within the CHB development lands (Wildthing, 2004a; EcoBiological, 2006a; 2006b). Nevertheless due to the occurrence of potential habitat its presence within the site cannot be totally discounted.	**Low - Moderate** Although the favoured host plant for this orchid, *Melaleuca stypheloides*, was recorded within the offset lands during flora surveys, there are no known records for this orchid species in the Lake Macquarie area. Nevertheless due to the occurrence of potential habitat and the lack of targeted surveys undertaken within offset lands, its presence within the site cannot be totally discounted.	**Low** Unlikely to be adversely affected by the current proposal due to the setting aside of the majority of the wet sclerophyll forests which represent potential habitat for conservation purposes (ie in the offset lands).

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Diuris praecox Newcastle Doubletail (V, V*)	Found predominantly in coastal Eucalypt forests on hilltops or slopes. This species has been recorded at a number of dry woodland locations to the south east of Lake Macquarie.	**Moderate - High** Records for this species occur to the Northeast of the Gwandalan development lands (Atlas of NSW Wildlife data). Onsite habitat in the vicinity is commensurate with the sites of other records in the area. The species was not recorded during targeted surveys (RPS HSO 2007). However, due to the cryptic nature of this species (i.e. does not flower every year) the presence of this species within the Gwandalan development lands cannot be discounted.	**Moderate - High** Records for this species occur to the north and south of the CHB development lands (Atlas of NSW Wildlife data). Onsite habitat in the vicinity is commensurate with the sites of other records in the area. The species was not recorded during targeted surveys within the CHB development lands by EcoBiological (2006a) within the flowering period. However, due to the cryptic nature of this species (ie does not flower every year) the presence of this species within the CHB development lands cannot be discounted.	**High** Records for this species occur to the north and south of the offset lands (Atlas of NSW Wildlife data). Onsite habitat in the vicinity is commensurate with the sites of other records in the area. Targeted surveys have not been performed within the offset lands for this species. However, due to the presence of potential habitat within the offset lands and the lack of targeted surveys undertaken within the offset lands, the presence of this species within the offset lands cannot be discounted, and is predicted as likely.	**Low - Moderate** Those areas representing the most suitable habitat for this species will be retained within offset lands that would be dedicated to conservation. It is unknown if the development proposal will removal any individuals of this species due to the cryptic nature of this orchid. However, it is unlikely to be adversely affected by the current proposal as there are vast tracts of potential habitat for this species to be retained within the offset lands.
Eucalyptus camfieldii Camfield's Stringybark (V)	Tree or mallee to 10m high, but often less. Rare and localised, in coastal shrub heath on sandy soils on sandstone, often restricted drainage. Records from the Hunter Sub-bioregion are largely in near-coastal areas from the Port Stephens LGA to the Central Coast. An isolated stand of trees consistent with this species has been recorded near Kurri Kurri (K. Hill pers. comm.). A local record to the southwest of the site is reported in the Atlas of NSW Wildlife data.	**Low - Moderate** Potential habitat for this species exists within the Narrabeen Snappy Gum Forest vegetation community. Local status of this species is not clear, due to widespread presence of *Eucalyptus capitellata* within the site, a species to which *E. camfieldii* is very closely aligned. No individuals of this species were detected within the Gwandalan development lands (Wildthing, 2003b); however, due to the abundance of potential habitat within the site and its known occurrence within the locality, the likelihood of it occurring within the site cannot be discounted.	**Low - Moderate** Potential habitat for this species exists within the Narrabeen Doyalson Coastal Woodland vegetation community. Local status of this species is not clear, due to widespread presence of *Eucalyptus capitellata* within the site, a species to which *E. camfieldii* is very closely aligned. No individuals of this species were detected within the CHB development lands; however, due to the abundance of potential habitat within the site and its known occurrence within the locality, the likelihood of it occurring within the site cannot be totally discounted.	**Moderate** Records for this species occur within Lot 6 DP 771923 adjoining the Pacific Highway (Atlas of NSW Wildlife data). Onsite habitat in the vicinity is commensurate with the sites of other records in the area. During flora surveys by Wildthing (2003a; 2004c) within the offset lands, this species was not detected. Local status of this species is not clear, due to widespread presence of *Eucalyptus capitellata* within the offset lands, a species to which *E. camfieldii* is very closely aligned. Due to the abundance of potential habitat within the offset lands, the lack of targeted surveys across the entire offset lands and its known occurrence within the locality, the likelihood of it occurring within the offset lands cannot be discounted.	**Low** Whilst some potential habitat may be removed as part of the development proposal similar habitat will be reserved within the offset lands.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Eucalyptus parramattensis ssp. *decadens* Drooping Red Gum (V, V*)*	Red Gum species that grows in dry sclerophyll woodland on sandy soils, often in low damp sites. This species occurs almost exclusively in association with the Aeolian sand communities of Tomago and Kurri Kurri and ecotonal areas, but a small disjunct stand of stunted individuals have been recently recorded within a south-facing slope within the Coastal Headland Complex to the north of the CHB development lands (RPS HSO *pers. obs*).	**Low** Whilst the species has been recorded near CHB, no potential habitat for this species is present within the Gwandalan development lands and it was not recorded during flora surveys by Wildthing (2003b).	**Low** Whilst this species has been recorded on a south-facing slope within the Coastal Headland Complex to the north of the CHB development lands, it was not recorded within the CHB development lands by Wildthing (2004a) or EcoBiological (2006a; 2006b) during their flora surveys.	**Low** Whilst the species has been recorded near CHB, no potential habitat for this species (coastal headland complex/heath) occurs within the offset lands.	**Low** This species was not detected within the development lands at CHB but potential habitat is present both within the Coastal Headland Complex, with large areas of potential habitat on the headland to the east of the CHB development lands. Therefore, it is unlikely that this species will be affected by the proposal.
Genoplesium insignis Variable Midge Orchid (E)	Occurs within a restricted distribution between Chain Valley Bay and Wyong in the Wyong LGA. Habitat is described as a *Themeda australis* ground cover layer with shrubs and *Eucalyptus haemastoma*, *Corymbia gummifera*, *Angophora costata* and *Allocasuarina littoralis* in the canopy layer. This species has been recorded within Lake Macquarie State Conservation Area to the south of the site.	**Low – Moderate** Habitat for this species exists within the Narrabeen Snappy Gum Forest vegetation community within the site. No individuals were detected during targeted surveys within the flowering period (RPSHSO, 2007). However, due to the noted occurrence of this species in the local area and its cryptic nature, its presence within the site cannot be totally discounted.	**Low – Moderate** Habitat for this species exists within the Narrabeen Doyalson Coastal Woodland vegetation community within the CHB development lands. No individuals were detected during targeted surveys within the flowering period by EcoBiological (2006a). However, due to the noted occurrence of this species in the local area and its cryptic nature, its presence within the site cannot be totally discounted.	**Low – Moderate** A small area of potentially suitable habitat occurs in the south of the offset lands within the Narrabeen Doyalson Coastal Woodland. Since no targeted surveys for the species were undertaken within the offset lands, the presence of the species cannot be totally discounted.	**Low** Those areas representing the best potential habitat opportunities for this species would be conserved within the offset lands.
Grevillea parviflora subsp. *parviflora (V, V*)*	Occurs in light, clayey soils in woodlands. Most plants appear capable of suckering from a rootstock. Relatively widespread within the Cessnock LGA, and occurs within Werakata National Park. Other populations known from the North Cooranbong area. Much confusion surrounds the taxonomy of this species and other similar *Grevillea* taxa (S. Bell *pers. comm.*), and a NPWS-funded study of the species is currently in progress.	**Low – Moderate** Potential habitat for this species occurs throughout the dry sclerophyll areas, particularly in the Narrabeen Coastal Sheltered Apple-Peppermint Forest. However, the species was not recorded during flora surveys undertaken by Wildthing (2003b).	**Low – Moderate** Potential habitat for this species occurs throughout the dry sclerophyll areas, particularly in the Narrabeen Wallarah Sheltered Grassy Forest. However, the species was not recorded within the CHB development lands during flora surveys by Wildthing (2004a) and EcoBiological (2006a; 2006b).	**Moderate** Potential habitat for this species occurs throughout the dry sclerophyll areas, particularly in the Narrabeen Wallarah Sheltered Grassy Forest. Since targeted surveys within the entire offset lands were not undertaken, the presence of the species cannot be discounted.	**Low** Those areas representing the best potential habitat opportunities for this species would be conserved within the offset lands.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Microtis angusii Angus's Onion Orchid (E, E*)	Record from the Terry Hill's district of Sydney. Occurs upon disturbed soil horizons that were originally ridgetop lateritic soils supporting a distinctive open to low open forest community, Duffy's Forest Vegetation Community, which is listed as an EEC. Suspected occurrences in the southern Lake Macquarie hinterland are derived from a tentative record by Bell (1998) in the Lake Macquarie State Conservation area, which occurs to the south of Gwandalan.	**Low – Moderate** Habitat for this species exists within the Narrabeen Snappy Gum Forest vegetation community within the Gwandalan development lands. However, the species was not recorded during targeted surveys within the flowering period (RPSHSO, 2007). Due to the noted occurrence of this species in the local area and its cryptic nature, its presence within the site cannot be entirely discounted.	**Low – Moderate** Habitat for this species exists within the Narrabeen Doyalson Coastal Woodland vegetation community within the CHB development lands. However, the species was not recorded during targeted surveys undertaken within the flowering period (EcoBiological, 2006a). Due to the noted occurrence of this species in the local area and its cryptic nature, its presence within the site cannot be entirely discounted.	**Low – Moderate** A small area of potentially suitable habitat occurs in the south of offset lands within the Narrabeen Doyalson Coastal Woodland. Since targeted surveys within the entire offset lands were not undertaken, the presence of the species cannot be discounted.	**Low** Whilst some habitat may be removed as part of the development proposal similar habitat will be reserved within the offset lands.
Melaleuca biconvexa Biconvex Paperbark (V, V*)	A shrub to small tree, which grows in poorly drained areas from Jervis Bay to Port Macquarie. Records in the Hunter Region are confined to western Lake Macquarie (Atlas of NSW Wildlife data).	**Low** The closest records for this species occur to the west of Lake Macquarie and this species was not recorded during flora surveys conducted within the Gwandalan development lands by Wildthing (2003b). Therefore it is considered unlikely to exist within the Gwandalan development lands.	**Low** The closest records for this species occur to the west of Lake Macquarie and this species was not recorded during flora surveys conducted within the CHB development lands by Wildthing (2004a) and EcoBiological (2006a; 2006b). Therefore it is considered unlikely to exist within the CHB development lands.	**Low – Moderate** The closest records for this species occur to the west of Lake Macquarie. However, suitable habitat exists within riparian areas of the offset lands and since targeted surveys were not undertaken across the entire offset lands, the presence of the species cannot be totally discounted.	**Low** It is unlikely that the current proposal will represent a threat to this species due to the low chance of it occurring within the site. .
Melaleuca groveana Grove's Paperbark (V)	Restricted to exposed heath and heath woodland, mainly at high altitudes in coastal and sub-coastal districts. Hunter Region records exist from the Tomaree and Yengo National Parks (Atlas of NSW Wildlife data).	**Low** There is no exposed habitat for this species within the Gwandalan development lands. Therefore, it is considered unlikely to exist within the site.	**Low – Moderate** The most likely habitat onsite occurs within heathlands and stunted woodland in the northwest of the CHB development lands. However, there are no local records for this species, the nearest coastal records occurring on the Tomaree Peninsula (Port Stephens) and the species was not recorded during flora surveys conducted by Wildthing (2004a) or EcoBiological (2006a) within the CHB development lands.	**Low** No heathland or exposed woodland habitat was found to exist within the offset lands.	**Low** It is unlikely that the current proposal will represent a threat to this species due to the low chance of it occurring within the site and the lack of records from flora surveys.
Pultenaea maritima Coast Headland Pea (V)	A prostrate shrub species with foliage similar to *P. villosa* of which it was previously considered a subspecies. Occurring on headlands between Newcastle and Byron Bay.	**Low** No headland habitat for this species is present within the Gwandalan development lands.	**Low – Moderate** Suitable habitat exists within exposed headlands (Coastal Headland Complex) within the north-east of the CHB development lands. However, the species was not recorded during previous flora surveys by Wildthing (2004a) and EcoBiological (2006a; 2006b).	**Low – Moderate** There are opportunities for this species to occur in Coastal Headland Complex in the north-east of the offset lands. However, the species was not recorded during flora surveys in the area.	**Low** Whilst a small area of potential habitat will be removed as part of the development proposal, potential habitat for this species will be conserved within the offset lands.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Rutidosis heterogama (V, V*)	Small Asteraceous herb occurring in the Hunter Region growing in disturbed areas and adjacent parcels of bushland within the Cessnock LGA. This species is also noted as occurring within coastal heathland habitats between Wyong and Evans Head on sandy substrates or moist areas within open forest.	**Low** No habitat for this species is present within the Gwandalan site.	**Low - Moderate** There is opportunity for this species to occur within heathland and stunted woodland habitats in the east of the CHB development lands and coastal records for this species occur to the north of the site. However, targeted surveys did not detect this species within the CHB development lands (Wildthing, 2004a; EcoBiological 2006a; 2006b).	**Low - Moderate** There is opportunity for this species to occur within heathland and stunted woodland habitats in the northeast of the offset lands and coastal records for this species occur to the north of the site.	**Low** Whilst a small area of potential habitat will be removed as part of the development proposal, potential habitat for this species will be conserved within the offset lands.
Syzygium paniculatum Magenta Lilly Pilly (V, V*)	A shrub to small tree, found in sub-tropical and littoral rainforest on sandy soils or sheltered gullies mostly near water courses. Distribution between Bulahdelah and Jervis Bay. Hunter Region records confined to the Lake Macquarie hinterland (Atlas of NSW Wildlife data).	**High** (natural??) Three individuals were recorded within the Established Native Garden vegetation community within the Gwandalan development lands by Wildthing (2004a). Wildthing (2004a) concluded that they were likely to have been planted and represented little ecological constraints.	**Low – Moderate** Potential habitat for this species occurs within the drainage flats and associated mesic vegetation assemblages of mid to lower slope drainage lines in the west of the site. However, this species was not recorded within the CHB development lands during flora surveys undertaken by Wildthing (2004a) and EcoBiological (2006a; 2006b).	**Moderate – High** Potential habitat for this species occurs within the drainage flats and associated mesic vegetation assemblages of mid to lower slope drainage lines within the offset lands. Due to the presence of local records and lack of targeted surveys across the entire offset lands, the species has potential to occur within the offset lands.	**Low** The three individuals to be removed as a result of the proposal within Gwandalan development lands are considered likely to have been planted and are of little ecological significance. Additionally, areas representing the best potential habitat opportunities for this species will be conserved within the offset lands. Therefore it is considered unlikely to be affected by the proposal.
Tetratheca juncea Black-eyed Susan (V)	Occurs in a variety of forested and heathy habitats. Locally found in Open Forests and Woodlands with dense, undisturbed understorey, often in association with *Angophora costata* / *Corymbia gummifera* on slopes with south-easterly aspects. A number of records exist from the local area including several records from the northern slopes of the site (Atlas of NSW Wildlife data).	**High** This species was recorded throughout the site by Wildthing (2003b) during its flowering season. A population of this species (over 180) was recorded throughout the Narrabeen Snappy Gum Forest and the Narrabeen Coastal Sheltered Peppermint-Apple Forest within the Gwandalan development lnads. The distribution of the species was spread throughout the Gwandalan development lands.	**High** This species was recorded throughout the CHB development lands by Wildthing (2003a) and EcoBiological (2006b) during its flowering season. A population of this species (159) was recorded by RPSHSO in the current survey. These individuals were recorded within the Narrabeen Doyalson Coastal Woodland, Coastal Plains Smooth-barked Apple Woodland and the Narrabeen Wallarah Sheltered Grassy Forest within the site.	**High** This species was recorded at a number of sites throughout the offset lands. Whilst no population counts were performed, it is estimated to be a large population as other populations located in the immediate area in identical habitat have numbered in the thousands. This species was recorded throughout the Narrabeen Doyalson Coastal Woodland, Coastal Plains Smooth-barked Apple Woodland and the Narrabeen Wallarah Sheltered Grassy Forest within the site.	**Low - Moderate** Although a small portion of the current population within the Gwandalan and CHB development lands would be removed, a large portion would be retained within the offset lands. Whilst, no exact population size figure is known for the offset lands it is expected to be at least double what is currently within the Gwandalan and CHB development lands. In addition, large populations are currently reserved within offset lands within the Wallarah Peninsula (approx 30,000). As such, conservativeluy the amount to be removed by the proposal represents 0.3% of the population within the Wallarah Peninsula. Therefore, it is unlikely that the current proposal will place the local population of this species at a greater risk of extinction. The land dedications for conservation will ensure long term protection for large numbers of this species.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
HERPETOFAUNA					
Crinia tinnula Wallum Froglet (V)	Occurs in coastal, low-lying acid Paperbark forest, within the 'wallum country' (often on sandy soils). Regional records for this species are confined to three main areas; Lake Macquarie, Central Coast and Medowie / Port Stephens (Atlas of NSW Wildlife data).	**Low - Moderate** Marginal habitat present within the site in Swamp Sclerophyll vegetation assemblages. However, the species was not recorded by Wildthing (2003b) during surveys.	**Low - Moderate** Marginal habitat present within the CHB development lands immediately adjacent to SEPP 14 wetland; however, the species was not recorded during targeted surveys (EcoBiological, 2006a) undertaken in appropriate conditions where the species was recorded calling at a known site elsewhere (EcoBiological, 2006a).	**High** Suitable habitat was found within wetland areas in the south-west portion of the offset lands (Wildthing, 2003a). Additionally, the species was recorded within SEPP 14 wetland in Munmorah SCA to the south of CHB development lands during recent field investigations by RPS HSO.	**Low -Moderate** *CHB development lands* Potential indirect impacts are alteration to hydrology, water quality and erosion and sedimentation. However, provided the recommended SEPP 14 wetland buffers are adopted, in conjunction with adequate stormwater controls, these potential indirect impacts would be minimised. *Gwandalan development lands* Provided recommendations to retain riparian areas and carefully manage stormwater within the Gwandalan development lands are adopted, potential habitat at this site would be retained.
Hoplocephalus bitorquatus Pale-headed Snake (V)	A nocturnal and partially arboreal snake, which inhabits a wide range of habitats from rainforest to drier Eucalypt forest. This species is patchily distributed from Tuggerah to Cape York Peninsula (Cogger 1996). Records in the Hunter Sub-bioregion exist from Paterson (Atlas of NSW Wildlife data).	**Low - Moderate** Due to its generalist habitat requirements, this species could potentially exist in any of the woodland or open forest habitats associated with the site.	**Low - Moderate** Due to its generalist habitat requirements, this species could potentially exist in any of the woodland or open forest habitats associated with the site.	**Low - Moderate** Due to its generalist habitat requirements, this species could potentially exist in any of the woodland or open forest habitats associated with the site.	**Low** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Additionally, potential habitats within the offset lands would be dedicated to conservation as estates managed by DECC.
Hoplocephalus stephensii Stephen's Banded Snake (V)	A nocturnal and partially arboreal snake which inhabits a range of habitats from rainforests to both wet and dry sclerophyll forests from Gosford north into southern QLD (Swan *et. al.* 2004).	**Low - Moderate** Due to its generalist habitat requirements, this species could potentially exist in any of the woodland or open forest habitats associated with the site.	**Low - Moderate** Due to its generalist habitat requirements, this species could potentially exist in any of the woodland or open forest habitats associated with the site.	**Low - Moderate** Due to its generalist habitat requirements, this species could potentially exist in any of the woodland or open forest habitats associated with the site.	**Low** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Additionally, potential habitats within the offset lands would be dedicated to conservation as estates managed by DECC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Litoria aurea Green and Golden Bell Frog (E, V*)	Inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. Thought to be displaced from more established sites by other frog species, thus explaining its existence on disturbed sites. Previously widespread within the Sydney Basin Bio-region, but now sparsely distributed within the Lower Hunter and Central Coast areas.	**Low - Moderate** Marginal habitat exists within the dams within the Gwandalan development lands. However, the species was not recorded during field surveys (Wildthing, 2003b).	**Low – Moderate** Wetland habitats within the site are commensurate with potential habitat for this species. However, this species was not recorded within the site during targeted fauna surveys encompassing potential habitat during appropriate seasonal and weather conditions (EcoBiological, 2006a).	**Low - Moderate** Small ponds within creeks and drainage lines are likely to provide some marginal habitat for the species.	**Low** The occurrence of this species within the site is relatively unlikely; however, habitats within which this species might potentially occur would be retained within offset lands. Additionally, it is likely that the proposed residential development would require sediment retention ponds that could be landscaped to provide habitat for the species.
Litoria littlejohni Little John's Tree Frog (V, V*)	A pale brown frog with dark speckles, which occurs along permanent rocky creeks with thick fringing vegetation associated with Eucalypt woodlands and heaths among sandstone outcrops. Occurs on the plateaus and eastern plains of the Great Dividing Range. Records within the Hunter Region are from within the Watagan National Park.	**Low** This frog is not likely to occur within the site, given the apparent specificity of habitat to sandstone–based creeks within the high country to the west of Lake Macquarie.	**Low** This frog is not likely to occur within the site, given the apparent specificity of habitat to sandstone–based creeks within the high country to the west of Lake Macquarie.	**Low** This frog is not likely to occur within the site, given the apparent specificity of habitat to sandstone–based creeks within the high country to the west of Lake Macquarie.	**Low** Considered unlikely to be affected by the proposal.
Mixophyes balbus Southern Barred Frog (E, V*)	A relatively large and muscular frog, growing to about 8 cm in length. Southern Barred Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. The species has suffered a marked decline in distribution and abundance, particularly in south-east NSW. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	**Low** The site does not offer suitable stream habitat for this species which is known to prefer foothills and escarpment areas well to the west of the site in the Watagan Mountains.	**Low** The site does not offer suitable stream habitat for this species which is known to prefer foothills and escarpment areas well to the west of the site in the Watagan Mountains.	**Low** Despite the presence of moderately suitable habitat within the lower drainage slopes of the site, there are no records for this species in the vicinity of the site and this species is known to prefer foothills and escarpment areas well to the west of the site in the Watagan Mountains.	**Low** Considered unlikely to be affected by the proposal.
Mixophyes iteratus Giant Barred Frog (V)	A large frog up to 115 mm in length. It inhabits rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000m. Found in coastal and upland areas from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold. Deep damp leaf-litter is preferred shelter and foraging sites for this frog.	**Low** The site does not offer suitable stream habitat for this species which is known to prefer foothills and escarpment areas well to the west of the site in the Watagan Mountains.	**Low** The site does not offer suitable stream habitat for this species which is known to prefer foothills and escarpment areas well to the west of the site in the Watagan Mountains.	**Low** Despite the presence of moderately suitable habitat within the lower drainage slopes of the site, there are no records for this species in the vicinity of the site and given the preference of this frog for rainforest and wet sclerophyll forest within mountainous country, it is unlikely to occur within the site.	**Low** Considered unlikely to be affected by the proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Pseudophryne australis Red-crowned Toadlet (V)	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains and occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter.	**Low** This frog has quite specific habitat requirements being restricted to substantial areas of Hawkesbury sandstone. It is therefore unlikely to occur within the site.	**Low** This frog has quite specific habitat requirements being restricted to substantial areas of Hawkesbury sandstone. It is therefore unlikely to occur within the site.	**Low** This frog has quite specific habitat requirements being restricted to substantial areas of Hawkesbury sandstone. It is therefore unlikely to occur within the site.	**Low** Considered unlikely to be affected by the proposal.
Avifauna					
Lophoictinia isura Square-tailed Kite (V)	Inhabits open forests and woodlands, particularly those on fertile soils with abundant passerines. They may also range in nearby open habitats but not into extensive treeless regions. This species is notably absent from alpine regions and small isolated remnant woodlands in large open areas. Records exist from the Cessnock and Maitland LGA's and there are records for this species from Cooranbong in the southwest of the Lake Macquarie LGA (Atlas of NSW Wildlife data; HBOC records). Records for this species within the Lower Hunter are generally limited to Autumn.	**Low – Moderate** Due to the generalist habitat requirements of this species, it could potentially occur within the site on a seasonal basis. Records in the Hunter Sub-bioregion are generally sparse and it would be difficult to locate during targeted surveys.	**Low – Moderate** Due to the generalist habitat requirements of this species, it could potentially occur within the site on a seasonal basis. Records in the Hunter Sub-bioregion are generally sparse and it would be difficult to locate during targeted surveys.	**Low – Moderate** Due to the generalist habitat requirements of this species, it could potentially occur within the site on a seasonal basis. Records in the Hunter Sub-bioregion are generally sparse and it would be difficult to locate during targeted surveys.	**Low** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Additionally, potential habitats within the offset lands would be dedicated to conservation as estates managed by DECC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Pandion haliaetus Osprey (V, M*)	Requires water bodies for fishing in close proximity (usually <1km) to suitably tall nesting site such as dead tree, power pole etc. Recorded from various sites around Lake Macquarie, Port Stephens and the Hunter River Estuary. An accidental species on freshwater wetlands away from the coast. Coastal records for this species occur to the south of the site.	**Low - Moderate** The species is known to forage within Lake Macquarie locally and suitable nesting habitat within large trees is present within the site. However, the species, or nesting evidence was not recorded during previous surveys (Wildthing, 2003b) or during recent site visits (RPS HSO, 2007 and present report).	**Low - Moderate** An Osprey record occurs to the south of the site, but this species is more suited to closed or protected estuarine waters than open beach habitats as occur on the eastern side of the site. Pairs are known from southern Lake Macquarie, which is more suited to their hunting technique, but are more likely to nest in forest adjacent to the lake than to fly over to the site's forests for nesting purposes. This species was not recorded during fauna surveys, however it would not be considered unusual to see an occasional individual over the site.	**Moderate** The species is known to forage within Lake Macquarie locally and suitable nesting habitat within large trees is present within the site. Particularly suitable sites exist on the shores of Lake Macquarie at Crangan Bay. However, the species, or nesting evidence was not recorded during previous surveys (Wildthing, 2003a), nor by RPS Ecologists whilst undertaking vegetation mapping.	**Low** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small, marginal portion of the habitat available within the entire site (including offset lands). Additionally, more suitable habitats within which this species potentially occurs within the site at Crangan Bay would be retained within the offset lands that would be dedicated to conservation as estates managed by DECC.
Charadrius mongolus Lesser Sand Plover (V, M*)	When in Australia, this migratory species inhabits sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats. Prey includes molluscs, worms, crustaceans and insects.	**Low** This species may fly over the site; however, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site; however, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site; however, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species forages, roosts and nests on within sheltered estuarine habitats. These habitats are located outside of the proposed development areas. As such the species is considered unlikely to be impacted by the proposal.
Haematopus fuliginosus Sooty Oystercatcher (V)	Marine, usually rock shoreline, high rocky islets, boulders below cliffs, wave-cut platforms and reefs. Also inhabits sandy beaches and coves between rocky headlands (Morcombe, 2000). Also occurs within closed estuarine habitats where rocky substrates are present (e.g. Hunter Estuary).	**Low** This species may fly over the site and has been recorded nearby. However, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site and has been recorded flying between the rocky headlands at the north and south of CHB by RPS Ecologists. However, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site and has been recorded flying between the rocky headlands at the north and south of CHB by RPS Ecologists. However, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species forages, roosts and nests on rocky shoreline habitats. These habitats are located outside of the proposed development areas. As such the species is considered unlikely to be impacted by the proposal.
Haematopus longirostris Pied Oystercatcher (V)	This species prefers undisturbed sandy shell-grit or pebble beaches, sandspits and sandbars, tidal mudflats and estuaries, coastal islands. Occasionally rocky reefs, shores rock-stacks, brackish or saline wetlands. Also grassy paddocks, golf-courses or parks near coast. Forages for molluscs, crustaceans, polychaetes, ascidians, echinoderms and small fish, probes for worms in short wet grass.	**Low** This species may fly over the site and has been recorded nearby. However, the site does not offer suitable sandy beach habitat and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site and has been recorded on the beach of CHB by RPS Ecologists. However, the site does not offer suitable sandy beach habitat and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site and has been recorded on the beach of CHB by RPS Ecologists. However, the site does not offer suitable sandy beach habitat and the species is considered unlikely to utilise the site.	**Low** This species forages and nests on sand beaches and inlets and sometimes roosts on rocky shorelines. These habitats are located outside of the proposed development areas. As such the species is considered unlikely to be impacted by the proposal.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Ixobrychus flavicollis Black Bittern (V)	Solitary species, living near water (estuarine to brackish) in mangroves and other trees which need to form only a narrow fringe of cover. A riparian species that occasionally ventures into the open within estuarine habitats.	**Low** Essentially an estuarine and riparian species, there is limited opportunity for this species within the site.	**Low** Essentially an estuarine and riparian species and although the SEPP 14 wetland to the south contains suitable habitat, there is limited opportunity for this species within the CHB development lands.	**Moderate** The western boundary of the offset lands on the shore of Lake Macquarie offers suitable habitat for this species. Additionally, the SEPP 14 wetland to the south of the CHB development lands would provide habitat for this species.	**Low** Potential habitat is located within the offset lands that would be dedicated to conservation and as such the species is considered unlikely to be affected by the proposal. Further suitable habitat occurs within brackish ponds in Munmorah SCA to the south of the site.
Ephippiorhynchus asiaticus Black-necked Stork (E)	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	**Low-Moderate** Marginal habitat within farm dams onsite; however, the species is not considered likely to occur on more than an occasional basis.	**Low-Moderate** Marginal habitat present within the dams onsite and although the SEPP 14 wetland to the south contains suitable habitat, the species is not considered likely to occur within the CHB development lands on more than an occasional basis.	**Moderate** The western boundary of the offset lands on the shore of Lake Macquarie offers suitable habitat for this species. Additionally, the SEPP 14 wetland to the south of the CHB development lands would provide habitat for this species.	**Low** Potential habitat is located within the offset lands that would be dedicated to conservation and as such the species is considered unlikely to be affected by the proposal. Further suitable habitat occurs within brackish ponds in Munmorah SCA to the south of the site.
Sterna albifrons Little Tern (E)	Migratory bird from eastern Asia, which occurs in sheltered coastal environments.	**Low** This species may fly over the site; however, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site; however, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species may fly over the site; however, the site does not offer suitable estuarine or coastal habitats and the species is considered unlikely to utilise the site.	**Low** This species forages over the ocean, roosts and nests on sandy protected habitats. These habitats are located outside of the proposed development areas. As such the species is considered unlikely to be impacted by the proposal.
Callocephalon fimbriatum Gang-gang Cockatoo (V)	Occurs in forests and woodlands where it forages on the seed capsules of Eucalypts. Sedentary, seasonally nomadic or part-migratory, this species shows a general trend to leave highland habitats in winter for more lowland districts. Requires large Eucalypt tree hollows for nesting. Records exist from the Watagan Mountains and adjacent lowlands and foot hills (Atlas of NSW Wildlife data; Author pers. obs.).	**Low – Moderate** Most local records for this species occur from the Watagan Mountains and their adjacent lowlands, well to the west of the site. However, seasonal movements of this species to areas east of the Watagans have been observed (RPS HSO Ecologists pers. obs.) and this species is known to feed on the fruit of *Eucalyptus signata*, which is present within the site. Therefore its use of the site on at least an intermittent basis cannot be discounted.	**Low – Moderate** Most local records for this species occur from the Watagan Mountains and their adjacent lowlands, well to the west of the site. However, seasonal movements of this species to areas east of the Watagans have been observed (RPS HSO Ecologists pers. obs.) and this species is known to feed on the fruit of *Eucalyptus signata*, which is present within the site. Therefore its use of the site on at least an intermittent basis cannot be discounted.	**Low – Moderate** Most local records for this species occur from the Watagan Mountains and their adjacent lowlands, well to the west of the site. However, seasonal movements of this species to areas east of the Watagans have been observed (RPS HSO Ecologists pers. obs.) and this species is known to feed on the fruit of *Eucalyptus signata*, which is abundant within the site. Therefore its use of the site on at least an intermittent basis cannot be discounted.	**Low** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Additionally, potential habitats within the offset lands would be dedicated to conservation as estates managed by DECC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Calyptorhynchus lathami Glossy Black-Cockatoo (V)	Occurs in forests and woodlands where it forages predominantly on *Allocasuarina* cones. Requires large Eucalypt tree hollows for nesting. Records within the Hunter Sub-bioregion predominantly from relatively undisturbed forested areas on the ranges such as the Watagan Forests, with isolated records from the valley floor remnants. Locally there are records from Gwandalan and Point Wollstonecraft (Atlas of NSW Wildlife data) to the west of the site.	**High** The species was recorded by RPS HSO (2007) and during recent field investigations within the Gwandalan development lands. Additionally, suitable nesting/breeding hollows are abundant within trees within the Gwandalan development lands.	**Moderate** Suitable foraging habitat for the species has been mapped within the CHB development lands by EcoBiological (2006a). However, the species was not recorded during previous investigations (EcoBiological 2006a; Wildthing, 2004a; 2004c).	**High** Recorded during previous investigations (Wildthing, 2003a) and suitable foraging habitat for the species exists within stands of *Allocasuarina*. Additionally, suitable nesting/breeding hollows are abundant within trees within the offset lands.	**Low - Moderate** *CHB development lands* The portion of potential foraging and nesting habitat to be removed as a result of the proposal within CHB development lands is a small portion of the habitat available within the entire site (including offset lands). Additionally, potential foraging and nesting habitats within the offset lands would be dedicated to conservation as estates managed by DECC. **Moderate** *Gwandalan development lands* The proposal would remove known foraging and potential breeding habitat for the Glossy Black-Cockatoo within the Gwandalan development lands. Abundant foraging and roosting habitat is present within offset lands to the south. To avoid a high impact, the nesting status of the Gwandalan site would need to be discounted by pre-development surveys.
Xanthomyza phrygia Regent Honeyeater (E, E*)	Nomadic Honeyeater that disperses to non-breeding areas, including the coast, in winter, where flowering trees are sought. Within the Lake Macquarie LGA this species is generally associated with *Eucalyptus robusta* (Swamp Mahogany). Local occurrences are during winter months when this species flowers, although their stronghold is west of the great divide and it appears that movements to the coast only occur when foraging resources to the west and, to some extent, the Central to Lower Hunter Valley fail.	**Moderate** Potential foraging habitat within the Gwandalan development lands for this species exists in the form of winter-flowering *E. robusta*. Therefore its seasonal presence within the site on at least an intermittent basis cannot be discounted.	**Low-Moderate** Potential foraging habitat for this species was found to occur to the west of the CHB development lands (Wildthing, 2004a) and to the south within Munmorah SCA. However, no *E. robusta*, a key foraging species exists within the development lands. As such, whilst the species may utilise adjacent areas, little favoured habitat is present within the CHB development lands.	**Moderate** Potential foraging habitat for this species was found to occur within Coastal Sand Mahogany-Paperbark Swamp Forest and Narrabeen Foreshore Red Gum-Ironbark Forest vegetation communities within the offset lands.	**Low-Moderate** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Furthermore, potential habitats within the offset lands would be dedicated to conservation as estates managed by DECC. Additionally, provided recommendations to retain the riparian areas within the Gwandalan development lands are adopted, important foraging habitat at this site (*Eucalyptus robusta*) would also be retained.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Lathamus discolor Swift Parrot (E, E*)	On the mainland this species frequents Eucalypt forests and woodlands with large trees having high nectar production during winter. Mainland winter foraging sites often vary from year to year. Nests only in Tasmania. When recorded within the Lake Macquarie LGA this species is often associated with winter flowering eucalypt species such as *E. robusta* and *E. tereticornis* (RPS Ecologist pers. obs.), but they are known to forego nectar resources for lerps, which occur on a variety of eucalypt species. Locally this species has been recorded on Point Wollstonecraft and Nord's Wharf to the west (Atlas of NSW Wildlife data).	**Moderate** Due to the occurrence of records within the vicinity of the site, its high mobility and the presence of winter-flowering eucalypts, such as *E. robusta* and *E. tereticornis* within the site, the presence of this species within the site on at least an intermittent basis would not be unexpected.	**Low - Moderate** Potential foraging habitat for this species was found to occur to the west of the CHB development lands (Wildthing, 2004a) and to the south within Munmorah SCA. However, no *E. robusta*, a key foraging species exists within the development lands. As such, whilst the species may utilise adjacent areas, little favoured habitat is present within the CHB development lands.	**Moderate – High** Due to the occurrence of records within the vicinity of the site, its high mobility and the presence of potential foraging habitat for this species within the Coastal Sand Mahogany-Paperbark Swamp Forest and Narrabeen Foreshore Red Gum-Ironbark Forest vegetation communities within the offset land, it is likely that this species occurs within the site on at least an intermittent basis.	**Low-Moderate** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Furthermore, potential habitats within the offset lands would be dedicated to conservation as estates managed by DECC. Additionally, provided recommendations to retain the riparian areas within the Gwandalan development lands are adopted, important foraging habitat at this site (*Eucalyptus robusta*) would also be retained.
Ninox strenua Powerful Owl (V)	Occurs in sclerophyll forests and woodlands where suitable prey species occur (being predominantly arboreal mammals). Requires large hollows, usually in Eucalypt trees, for nesting. Roosts in dense vegetation within such areas. Records from the Hunter Sub-bioregion are fairly widespread (HBOC records; RPS HSO ecologists pers. obs.).	**Moderate** Suitable foraging habitat including prey species recorded within the site and habitat assessment noted hollows of sufficient size to represent potential breeding sites for this species. However, the species was not recorded within the site during previous surveys (Wildthing, 2003b).	**Moderate** Suitable foraging habitat recorded within the site. However, no trees containing hollows suitable for the species (large vertical hollows in large mature trees) were recorded within the CHB development lands. Additionally, the species was not recorded within the site during previous surveys (Wildthing, 2004a; 2004c)	**Moderate - High** Suitable foraging habitat including prey species recorded within the site and habitat assessment noted hollows of sufficient size to represent potential breeding sites for this species. The species was not recorded within the site during previous surveys (Wildthing, 2003a); however, not all offset lands have been surveyed in detail for Powerful Owl. Recorded to the north of the site by RPS HSO (2007d).	**Low - Moderate** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Additionally, those areas containing the highest quality foraging habitat and nesting habitat for this species are proposed as offset lands to be conserved as DECC estate.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Tyto novaehollandiae Masked Owl (V)	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate / preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well. Records from the Hunter Sub-bioregion are fairly widespread within the sub-coastal districts and often of road kill birds (HBOC records; RPS HSO ecologists pers. obs.). Local records for this species occur on Point Wollstonecraft, several elsewhere on the Wallarah Peninsula and within the site near the northern and southern boundaries.	**High** The species was recorded during previous surveys (Wildthing, 2003b) and there are a number of local records for this species. Additionally, the terrestrial mammal species that they prefer occur within the site in abundance. Therefore it is highly likely that the site represents part of the home range of individuals of this species. Numerous hollows of sufficient size to represent potential breeding sites for this species were noted during habitat assessment. However, no evidence of owl occupation of hollows (owl pellets, whitewash, prey remains etc was observed during searches of potential roost trees whilst undertaking targeted flora surveys.	**Moderate - High** Since there are a number of local records (including in adjacent offset lands) it is considered likely that the site represents part of the home range of individuals of this species. A small number of hollows of sufficient size to represent potential breeding sites for this species were noted during habitat assessment.	**High** The species was recorded during previous surveys (Wildthing, 2003a) and there are a number of local records for this species. Additionally, the terrestrial mammal species that they prefer occur within the site in abundance. Therefore it is highly likely that the site represents part of the home range of individuals of this species. Numerous hollows of sufficient size to represent potential breeding sites for this species were noted during previous habitat assessment.	**Low - Moderate** *CHB development lands* The portion of potential foraging and nesting habitat to be removed as a result of the proposal within CHB development lands is a small portion of the habitat available within the entire site (including offset lands). Additionally, potential foraging and nesting habitats within the offset lands would be dedicated to conservation as estates managed by DECC. **Moderate** *Gwandalan development lands* The proposal would remove known foraging and potential breeding habitat for the MaskedOwl within the Gwandalan development lands. Abundant foraging and roosting habitat is present within offset lands to the south. To avoid a high impact, the nesting status of this species within the Gwandalan site would need to be discounted by pre-development surveys.
Tyto tenebricosa Sooty Owl (V)	Occurs in wet Eucalypt forest and rainforest with tall emergent trees, often in easterly facing gullies. Within these areas this species hunts for a range of mainly mammalian prey at all levels of the forest strata. Roosts in tree hollow or dense canopy vegetation. Also nests in large Eucalypt tree hollows. Most Hunter records exist from the Watagan mountains (Atlas of NSW Wildlife data), but this species has also been observed to the southwest of Awaba (RPS HSO ecologist pers. obs.).	**Low** Despite the presence of mesic vegetation assemblages within the forested drainage lines of the site, these communities cannot be classified as wet sclerophyll and are not considered to be of sufficient extent or structural complexity to support this species.	**Low** Despite the presence of mesic vegetation assemblages within the forested drainage lines of the site, these communities cannot be classified as wet sclerophyll and are not considered to be of sufficient extent or structural complexity to support this species.	**Low - Moderate** Suitable habitat exists within gullies along drainage lines in the west of the offset lands within the Narrabeen Wallarah Sheltered Grassy Forest vegetation community and Munmorah Palm-Apple Dry Drainage Line Forest. However, few local records exist of the species.	**Low** The current proposal is unlikely to impact upon this species due to a lack of suitable habitat within the CHB or Gwandalan development lands. Suitable habitat within offset lands would be dedicated to conservation as estates managed by DECC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
MAMMALS					
Planigale maculata Common Planigale (V)	A cryptic species known from a variety of habitats ranging from rainforest, wet and dry sclerophyll forests to grasslands, marshlands and rocky areas. In these habitats it shelters under logs and rocks and any available burrows such as cracking soils. It is a ferocious predator of small insects, often tackling prey of its own size. Within the Hunter Sub-bioregion, no records exist on the Atlas of NSW Wildlife. Records from the wider locality occur only from the Watagan Mountains and Barrington Tops National Park	**Low – Moderate** Given its generalist habitat requirements it could potentially occur anywhere containing wooded habitat; although, given the complete lack of records in the Lake Macquarie LGA outside of the Watagan Mountains it is considered relatively unlikely to occur within the site.	**Low – Moderate** Given its generalist habitat requirements it could potentially occur anywhere containing wooded habitat; although, given the complete lack of records in the Lake Macquarie LGA outside of the Watagan Mountains it is considered relatively unlikely to occur within the site.	**Low – Moderate** Given its generalist habitat requirements it could potentially occur anywhere containing wooded habitat; although, given the complete lack of records in the Lake Macquarie LGA outside of the Watagan Mountains it is considered relatively unlikely to occur within the site.	**Low** Considered unlikely to be resident within the proposed development lands at CHB and Gwandalan. Additionally, suitable habitat within offset lands would be dedicated to conservation as estates managed by DECC.
Dasyurus maculatus Spotted-tailed Quoll (V)	Found in a variety of forested habitats where suitable prey species occur. This species creates a den in fallen hollow logs or among rocky outcrops. Generally does not occur in otherwise suitable habitats that are in close proximity to urban development, although isolated records from such areas do exist. In the southern Lake Macquarie locality there are a number of records, including a 1998 record from Point Wollstonecraft.	**Low – Moderate** The chances of occurrence are relatively low despite the occurrence of local records and connectivity with large tracts of vegetation, due to the levels of ongoing disturbance within the site.	**Low – Moderate** The chances of occurrence are relatively low despite the occurrence of local records, due to the levels of ongoing disturbance within the site.	**Moderate** Suitable habitat connected with large areas of habitat is present within the site and may support the species. The species was not recorded during previous investigations (Wildthing, 2003a); however, not all offset lands have been surveyed in detail for Spotted-tailed Quoll.	**Low** Considered unlikely to be resident within the proposed development lands at CHB and Gwandalan. Additionally, suitable habitat within offset lands would be dedicated to conservation as estates managed by DECC.
Petaurus australis Yellow-bellied Glider (V)	Usually associated with tall, mature wet Eucalypt forest. Also known from tall dry open forest and mature woodland. The diverse diet of this species is primarily made up of Eucalypt nectar, sap, honey dew, manna and invertebrates found under decorticating bark and pollen. Tree hollows for nest sites are essential, as are suitable food trees in close proximity. Most records in the Lower Hunter Region occur in the Watagan Mountains and other areas exhibiting significant stands of forest (Atlas of NSW Wildlife data).	**Low** No coastal records occur for this species in the vicinity of the site and habitat is marginal at best. Additionally, the species was not recorded within the site during surveys which included call playback for the Powerful Owl, which is known to trigger territorial responses from the Yellow-bellied Glider (Wildthing, 2003b).	**Low** No coastal records occur for this species in the vicinity of the site and habitat is marginal at best. Additionally, the species was not recorded within the site during surveys which included call playback for the Powerful Owl, which is known to trigger territorial responses from the Yellow-bellied Glider (Wildthing, 2004a).	**Low - Moderate** No coastal records occur for this species in the vicinity of the site. However, tall wet forest within gullies in the Narrabeen Wallarah Sheltered Grassy Forest vegetation community, offers marginal foraging and denning habitat for the species. Surveys for Yellow-bellied Glider were not undertaken within this portion of offset habitat.	**Low** The current proposal is unlikely to impact upon this species due to a lack of suitable habitat within the development lands. Additionally, potential habitat within offset lands would be dedicated to conservation as estates managed by DECC.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Petaurus norfolcensis Squirrel Glider (V)	Occurs in Eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. Also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species. Widely distributed across the lower Hunter Sub-bioregion, few records from the Upper Hunter (Atlas of NSW Wildlife data). Locally there are a number of records for this species on the Gwandalan peninsula to the west of the site.	**Moderate** Suitable foraging and denning habitat exists within the site. However, the species was not recorded within the site during fauna surveys, although the closely related Sugar Glider (*Petaurus breviceps*) was recorded (Wildthing, 2004a).	**Moderate** Suitable foraging and denning habitat exists within the site. However, the species was not recorded within the site during fauna surveys, including targeted trapping surveys (Wildthing, 2003b).	**Moderate - High** Suitable foraging and denning habitat exists within the offsets land. A record for this species exists in the west of the offset lands (NPWS Atlas of Wildlife data). However, this species was not recorded within the site during fauna surveys, although the closely related Sugar Glider (*Petaurus breviceps*) was recorded.	**Low** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Additionally, the species was not recorded within the development lands during targeted surveys and suitable habitat within offset lands would be dedicated to conservation as estates managed by DECC.
Phascolarctos cinereus Koala (V)	Occurs in forests and woodlands where it requires suitable feed trees (particularly *Eucalyptus* spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions. Records from the Hunter Sub-bioregion are generally scarce, with a small number of records from Cessnock, Singleton and Muswellbrook LGA's. Within the Greater Hunter Region it is largely confined to the Port Stephens area, the Lake Macquarie hinterland and the Watagan Mountains (Atlas of NSW Wildlife data).	**Low – Moderate** Schedule 2 feed trees occur within the Gwandalan development lands and Koala records occur within the local area (Atlas of NSW Wildlife data). However, no evidence of Koalas was observed during previous fauna surveys that included scat searches and spotlighting (Wildthing 2003b).	**Low – Moderate** Schedule 2 feed trees occur within the CHB development lands and records for Koalas occur within offset lands to the west of the site from 1996 (Atlas of NSW Wildlife data). However, no evidence of Koalas was observed during previous fauna surveys that included scat searches and spotlighting (Wildthing 2004a).	**Moderate** Suitable habitat exists within offset lands, particularly the combination of (Narrabeen Wallarah Sheltered Grassy Forest, Narrabeen Doyalson Coastal Woodland, Narrabeen Foreshore Redgum-Ironbark Forest, Coastal Sand Mahogany-Paperbark Swamp Forest). Records for Koalas occur within the west of the offset lands from 1996 (Atlas of NSW Wildlife data). No evidence of Koalas was observed during previous fauna surveys that included scat searches and spotlighting (Wildthing, 2003a). However, all offset lands were not surveyed for Koala presence.	**Low** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Furthermore, habitats within the offset lands are considered to contain habitat of higher quality than that to be removed as a result of the proposal. Additionally, provided recommendations to retain the riparian areas within the Gwandalan development lands are adopted, important foraging habitat at this site (*Eucalyptus robusta*) would also be retained.
Cercartetus nanus Eastern Pygmy Possum (V)	Occurs from rainforest through sclerophyll forest to tree heath. Favoured food includes banksias, myrtaceous shrubs and trees and insects. Nesting sites are generally in drier habitats. Records in the Hunter Sub-bioregion are very scarce. Within the Greater Hunter Region records exist from the Watagan Mountains and Barrington Tops National Park (Atlas of NSW Wildlife data).	**Low - Moderate** Marginal habitat exists within the Gwandalan development lands, with occurrences of *Banksia spinulosa* and *Lambertia formosa* offering some limited foraging resources. The lack of overall foraging diversity is likely to preclude the species.	**Moderate** Potential habitat occurs within the CHB development lands. However, the species was not recorded during targeted trapping surveys.	**Low - Moderate** Marginal habitat exists within Scribbly Gum woodland in the offset lands, with occurrences of *Banksia spinulosa* and *Lambertia formosa* offering some limited foraging resources. The lack of overall foraging diversity is likely to preclude the species.	**Low - Moderate** Suitable habitat for the species would be removed as a result of the proposal. However, the species was not recorded during targeted surveys. Known habitat is protected to the south within Munmorah SCA. Marginal habitat within offset areas would be conserved as DECC estate.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Pteropus poliocephalus Grey-headed Flying-fox (V, V*)	Forages over a large area for nectar / fruits etc. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforest. Frequently observed to forage in flowering Eucalypts. May occur anywhere within the Hunter Sub-bioregion where food or roosting resources are available.	**Moderate - High** Suitable foraging habitat exists within flowering myrtaceous tree species and fruiting ornamental tree species. However, the species was not recorded during previous surveys (Wildthing, 2003b).	**Moderate - High** Suitable foraging habitat exists within flowering myrtaceous tree species. However, the species was not recorded during previous surveys (Wildthing, 2004a).	**Moderate - High** Suitable foraging habitat exists within flowering myrtaceous tree species. Suitable camp/roosting sites were identified within the drainage lines by Wildthing (2004a) and during vegetation mapping. However, the species was not recorded during previous surveys (Wildthing, 2004a).	**Low - Moderate** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Furthermore, suitable habitat within offset lands would be dedicated to conservation as estates managed by DECC. Additionally, provided recommendations to retain the riparian areas within the Gwandalan development lands are adopted, important foraging habitat at this site (*Eucalyptus robusta*) would also be retained.
Miniopterus schreibersii Eastern Bentwing-Bat (V)	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat. Widely distributed across the Hunter Sub-bioregion, particularly in sub-coastal districts (Atlas of NSW Wildlife data). A number of records for this species occur within the vicinity of the site.	**High** This species is likely to use the site regularly as part of its foraging range and was recorded during previous surveys (Wildthing, 2003b). No potential roosting habitat is knownt within the Gwandalan development lands.	**High** This species is likely to use the site regularly as part of its foraging range and was recorded during previous surveys (Wildthing, 2004a). No potential roosting habitat is known within the CHB development lands.	**High** This species is likely to use the site regularly as part of its foraging range and was recorded during fieldwork. Potential cave-roosting habitat may occur within rock outcrops within the offset lands.	**Low - Moderate** Although it is likely that a small amount of foraging habitat for this species will be modified during the process of development, large areas containing foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC. Potential roosting habitat within the site would not be affected by the current proposal and foraging opportunities will continue to exist within the development estate.
Miniopterus australis Little Bentwing-bat (V)	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests. Requires caves or similar structures for roosting habitat. Largely confined to more coastal areas in the Hunter region (Atlas of NSW Wildlife data). A number of records for this species occur within the local area (Atlas of NSW Wildlife data).	**High** This species is likely to use the site regularly as part of its foraging range and was recorded during previous surveys (Wildthing, 2003b). No potential roosting habitat is known within the Gwandalan development lands.	**High** This species is likely to use the site regularly as part of its foraging range and was recorded during previous surveys (Wildthing, 2004a). No potential roosting habitat is known within the CHB development lands.	**High** This species is likely to use the site regularly as part of its foraging range and was recorded during fieldwork. Potential cave-roosting habitat may occur within rock outcrops within the offset lands.	**Low - Moderate** Although it is likely that a small amount of foraging habitat for this species will be modified during the process of development, large areas containing foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC. Potential roosting habitat within the site would not be affected by the current proposal and foraging opportunities will continue to exist within the development estate.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Mormopterus norfolkensis Eastern Freetail-bat (V)	This species forages predominantly in dry forests and woodlands east of the divide. It roosts in tree hollows, under bark and within man-made structures. Found within a scattered distribution across the Lower Hunter Region. Locally it occurs within the Lake Macquarie hinterland and a record exists from the north of the site (Atlas of NSW Wildlife data).	**Moderate** This species is potentially likely to use the site as part of its foraging range, and may use the numerous hollows within the site for roosting and breeding habitat.	**Moderate** This species is potentially likely to use the site as part of its foraging range, and may use the hollow-bearing trees within the site for roosting/breeding habitat.	**Moderate** This species is potneitally likely to use the site as part of its foraging range, and may use the abundant hollows within the site for roosting/breeding habitat.	**Low - Moderate** Although it is likely that a relatively small amount of foraging habitat for this species will be modified during the process of development, large areas containing foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC. Potential roosting/breeding habitat within the numerous hollow-bearing trees would be removed within the Gwandalan development lands.
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat (V)	Occurs in a range of habitats from rainforest to arid shrubland, roosts in tree-hollows. Near coastal records occur to the south in the Wyong and Gosford LGAs (Atlas of NSW Wildlife data).	**Moderate** Due to its mobility and the occurrence of other records in near coastal districts to the south it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the numerous hollow-bearing trees within the Gwandalan development lands.	**Moderate** Due to its mobility and the occurrence of other records in near coastal districts to the south it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the small amount of hollows within the south-east of the CHB development lands.	**Moderate** Due to its mobility and the occurrence of other records in near coastal districts to the south it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the abundant hollows across the offset lands.	**Low - Moderate** Although it is likely that a relatively small amount of foraging habitat for this species will be modified during the process of development, large areas containing foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC. Potential roosting/breeding habitat within the numerous hollow-bearing trees would be removed within the Gwandalan development lands.
Falsistrellus tasmaniensis Eastern False Pipistrelle (V)	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows. Few records occur within the Hunter Sub-bioregion, but locally a record fro this species occurs on Pulbah Island to the northwest (Atlas of NSW Wildlife data).	**Moderate** Due to its mobility and the occurrence of records within the locality it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the site.	**Moderate** Due to its mobility and the occurrence of records within the locality it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the site.	**Moderate** Due to its mobility and the occurrence of records within the locality it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the site.	**Low - Moderate** Although it is likely that a relatively small amount of foraging habitat for this species will be modified during the process of development, large areas containing foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC. Potential roosting/breeding habitat within the numerous hollow-bearing trees would be removed within the Gwandalan development lands.
Chalinolobus dwyeri Large-eared Pied Bat (V)	This species forages in tall open forests, including dry forests and the edges of rainforest. It roosts in mine shafts and similar structures. Hunter Region records for this species are largely confined to the Watagan Mountains well to the west of the site (Atlas of NSW Wildlife data).	**Low - Moderate** Marginal foraging habitat exists within the site. However, due to the absence of records from within the local area it is unlikely that this species would occur within the site.	**Low - Moderate** Marginal foraging habitat exists within the site. However, due to the absence of records from within the local area it is unlikely that this species would occur within the site.	**Low - Moderate** Marginal foraging habitat exists within the site. However, due to the absence of records from within the local area it is unlikely that this species would occur within the site.	**Low** Although this species is considered unlikely to occur within the site, abundant potential foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Myotis adversus Large-footed Myotis (V)	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Roosts in colonies of between a dozen and several hundred individuals in caves, mines and disused railway tunnels. Local records for this species occur at Vales Point and Lake Munmorah (Atlas of NSW Wildlife data).	**Moderate** This species has been recorded within the locality of the site and there are foraging opportunities within the various dams in the site and adjacent Lake Macquarie. No known cave-roosting sites occur within the site for this species.	**Moderate** This species has been recorded within the locality of the site and there are foraging opportunities within the various dams in the site. No known cave-roosting sites occur within the site for this species.	**Moderate** This species has been recorded within the locality of the site and there are foraging opportunities within the adjacent Lake Macquarie. No known cave-roosting sites occur within the site for this species.	**Low - Moderate** The portion of potential habitat to be removed as a result of the proposal (CHB and Gwandalan development lands) is a small portion of the habitat available within the entire site (including offset lands). Furthermore, suitable habitat within offset lands adjacent to Lake Macquarie would be dedicated to conservation as estates managed by DECC.
Scoteanax rueppellii Greater Broad-nosed Bat (V)	Forages in moister gullies and wet sclerophyll forests as well as in lightly wooded areas and open spaces / ecotones. This species roosts in tree hollows and is relatively widespread within the Lower Hunter Region and extends to a local record at the southern end of Ruttleys Road (Atlas of NSW Wildlife data).	**Moderate** Due to its mobility and the occurrence of records within the locality it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the site.	**Moderate** Due to its mobility and the occurrence of records within the locality it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the site.	**Moderate** Due to its mobility and the occurrence of records within the locality it is potentially likely that this species uses the site on at least an intermittent basis. Potential roosting habitat for this species occurs within the site.	**Low - Moderate** Although it is likely that a relatively small amount of foraging habitat for this species will be modified during the process of development, large areas containing foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC. Potential roosting/breeding habitat within the numerous hollow-bearing trees would be removed within the Gwandalan development lands.
Vespadelus troughtoni Eastern Cave Bat (V)	A cave dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. The distribution of this species is largely to the north of the Hunter (Strahan 1995), with one record at Windermere Park in south-western Lake Macquarie (Atlas of NSW Wildlife data).	**Low** Considered unlikely to occur within the site on more than a rare occasion.	**Low** Considered unlikely to occur within the site on more than a rare occasion.	**Low** Considered unlikely to occur within the site on more than a rare occasion.	**Low** Although this species is unlikely to occur within the site, abundant potential foraging habitat within offset lands would be dedicated to conservation as estates managed by DECC
ENDANGERED ECOLOGICAL COMMUNITIES					

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions	Associated with periodic or semi-permanent inundation by freshwater, although there may be minor saline influence in some wetlands. They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains. Wetlands or parts of wetlands that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum*, *Leersia hexandra* and *Carex appressa*. Wetlands or parts of wetlands subject to regular inundation and drying may include large emergent sedges over 1 metre tall, such as *Baumea articulata, Eleocharis equisetina* and *Lepironia articulata*. Correlates with LHCCREMS Map Unit (MU) 46 – 'Freshwater Wetland Complex'.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC. Whilst there are several man made dams within the site, these are not commensurate with this EEC.	**Low** The vegetation communities mapped within the site are not considered to be sufficiently representative of this EEC. The artificial dams do provide some species which are representative of this community but these dams are highly degraded with weed infestation and sediment runoff.	**High** This community occurs in three locations to the south and south east of the site. These areas are all part of the SEPP 14 wetland which is located to the south of the site within the Munmorah State Conservation Area. The dam within the south west of the site is also part of this community as it contains a good diversity of native flora species and is considered to be commensurate with this EEC. The exception being the dam in the south eastern corner of the site where this dam contains a wide variety of native species and fringes the SEPP 14 wetland located within Munmorah State Conservation Area. The area of this EEC within the site is 1.78ha.	**Low - Moderate** Those areas where this community occurs within the site will be retained as offset lands within the current proposal. Therefore it is unlikely that this community will be directly impacted upon by the current proposal. However, indirect threats to the long-term integrity of this community may potentially exist without appropriate sediment and water management control measures incorporated into planning and construction phases of the development.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Littoral Rainforest	Littoral rainforest occurs on both sand dunes and on soils derived from underlying rocks. Littoral Rainforest is a closed forest in structure, and the species composition is strongly influenced by the close proximity to the ocean. The floristic composition consists of predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy. Littoral Rainforest comprises the *Cupaniopsis anacardioides – Acmena* spp. alliance of Floyd (1990). This alliance as described by Floyd includes five sub-alliances – *Syzygium leuhmannii – Acmena hemilampra, Cupaniopsis anacardioides, Lophostemon confertus, Drypetes – Sarcomelicope – Cassine – Podocarpus* and *Acmena smithii – Ficus - Livistona – Podocarpus.* While the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as *Angophora costata*, *Banksia integrifolia, Eucalyptus botryoides* and *E. tereticornis* occur in many stands.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**High** EcoBiological (2006b) delineated a vegetation community which appeared to be commensurate with Littoral Rainforest EEC within the CHB development lands. Whilst this community was described as highly degraded it has components which are similar to this community. The rainforest was not mapped completely and it is difficult to determine the exact area of the community. Further survey and anaylsis of this community is recommended to determine the exact extent and species composition.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**Moderate - High** The area to be removed as a result of the proposal within the CHB development lands is considered to be degraded (EcoBiological, 2006b). However, since the vegetation community has not been accurately delineated and mapped, it is difficult to determine the extent or magnitude of potential impacts arising from the proposal. It is likely that this community extends to the south within Munmorah SCA.
Themeda Grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner bioregions	Community occurring on sandstone, old sand dunes and basalt, which is characterised by *Themeda australis* (Kangaroo Grass). *T. australis* within the community is sometimes limited to only a few metres square, but on some substrates, such as old sand dunes the community can be relatively extensive in size. *T. australis* within the community is often stunted and prostrate as are the shrubs and trees occurring within the community. In the Lower Hunter and Central Coast regions this community occurs on coastal landforms with *Pimelea linifolia*, *Westringia fruticosa*, and *Banksia integrifolia* the most commonly associated species. Aerial interpertation has revealed that habitat for this community does occur on the headland to the east of the CHB development lands.	**Low** The vegetation communities mapped by Widlthing within the site are not considered to be representative of this EEC.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**Low** This community was not identified as occurring within the site.

Species	Habitat Description and Known Populations	Chance of Occurrence within Gwandalan Development Lands	Chance of Occurrence within CHB Development Lands	Chance of Occurrence within Offset Lands	Likely Level of Impact
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bio-regions	This community is associated with periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains, typically occurring on grey-black clay-loams and sandy loams. Usually occurring below 20 m altitude. Within the site this community correlates with LHCCREMS MU 40 'Swamp Oak – Rushland Forest'.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**High** This community occurs within the west of the site on the shore of Lake Macquarie. The area of this EEC within the site is 5.266ha.	**Low** Those areas where this community occurs within the site will be retained as offset lands within the current proposal. Therefore it is unlikely that this community will be impacted upon by the current proposal.
Coastal Saltmarsh in the North Coast Bioregion	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner occurs in the intertidal zone on the shores of estuaries and lagoons, including when they are intermittently closed along the NSW coast. Classified by the Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS) as Map Unit (MU) 47a.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**High** This community occurs in small patches within the Mangrove-Estuarine Saltmarsh Vegetation community.	**Low** This community was not identified as occurring within the development lands. Therefore it is unlikely that this community will be impacted upon by the current proposal.
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions	The community is associated with humic clay or sandy loams on waterlogged or episodically flooded alluvial flats and drainage lines within coastal floodplains. It is generally characterised by an open to dense canopy of Eucalypts and / or Paperbarks. Canopy heights generally vary from 8m to 25m depending on species composition. In the Hunter Region the canopy often contains *Eucalyptus robusta* and / or *Melaleuca quinquinervia* although other species, such as *Casuarina glauca*, *Eucalyptus resinifera* subsp. *hemilampra* and *Livistona australis* may be present. Within the site this community correlates with LHCCREMS MU 37 'Swamp Mahogany - Paperbark Forest'.	**High** During recent targeted *Cryptostylis hunteriana* surveys (RPS HSO, 2007), the drainage line within the site was observed to contain species representative of Swamp Sclerophyll Forest, despite previous surveys mapping this area as Narrabeen Coastal Sheltered Peppermint Forest (Wildthing, 2003b). This EEC was not listed until 2004 and therefore this vegetation community was not detected at the time of that survey. The area of this EEC within the site is 1.198ha.	**Low** The vegetation communities mapped within the site are not considered to be representative of this EEC.	**High** This community occurs within four areas of this site. Two are located adjoining the Estuarine Swamp Oak Forest adjacent to Lake Macquaire. The third portion is located in the drainage line to the west of the Pacific Highway and the final section is located within a drainage line in the north east of the site. The area of this EEC within the site is 11.22ha.	**Moderate** A small area of this EEC may be removed as part of the development proposal at Gwandalan (1.198ha), with over 11.22ha to be retained within the offset lands at CHB. The retained areas in the vicinity of the proposed development may be the subject of indirect threats such as urban runoff, there appropriate sediment and water management control measures are recommended to be incorporated into planning and construction phases of the development. Appropriate landscaping associated with development may help reduce impacts of incremental loss of *E. robusta*.

4.3 Assessment of Significant Species / Communities

As per the assessment carried out within Table 4-1, the following species / communities listed under *TSC Act* and/or *EPBC Act* have been deemed appropriate to be applied further detailed assessment due to projected potential levels of impacts (greater than low level) likely to result from the proposal.

Flora

- *Cryptostylis hunteriana* Leafless Tongue Orchid
- *Diuris praecox* Newcastle Doubletail
- *Tetratheca juncea* Black-eyed Susan

Endangered Ecological Communities

- Freshwater Wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bio-regions
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

Fauna

- *Crinia tinnula* Wallum Froglet
- *Calyptorhynchus lathami* Glossy Black-Cockatoo
- *Xanthomyza phrygia* Regent Honeyeater
- *Lathamus discolor* Swift Parrot
- *Ninox strenua* Powerful Owl
- *Tyto novaehollandiae* Masked Owl
- *Cercartetus nanus* Eastern Pygmy Possum
- *Pteropus poliocephalus* Grey-headed Flying-fox
- *Miniopterus schreibersii* Eastern Bentwing-bat
- *Miniopterus australis* Little Bentwing-bat
- *Mormopterus norfolkensis* Eastern Freetail-bat
- *Saccolaimus flaviventris* Yellow-bellied Sheathtail-bat
- *Falsistrellus tasmaniensis* Eastern False Pipistrelle
- *Myotis adversus* Large-footed Myotis

- *Scoteanax rueppellii* Greater Broad-nosed Bat

Migratory fauna listed under EPBC Act

- *Xanthomyza phrygia* Regent Honeyeater
- *Haliaeetus leucogaster* White-bellied Sea-Eagle

4.3.1 Threatened Flora

Cryptostylis hunteriana

Cryptostylis hunteriana was identified whilst performing targeted parallel transect searches for *T. juncea* within the Narrabeen Doyalson Coastal Woodland within the northern portion of CHB development lands (Hamlet 6). Five patches containing 13 aboveground stems were identified. This orchid appears naturally rare, and difficult to locate with only seven populations being discovered within the Lake Macquaire and Wyong LGAs. It is highly recommended that these individuals and the surrounding habitat for this species be retained as part of the development layout.

The retention of these individuals and the surrounding habitat is vital due to the ecology of this species, as it is leafless and thus lacks chlorophyll and survives by an intimate symbiotic relationship with a mycorrhizal fungus at its roots. This fungus provides all the nutrients required by the plant, this fungus in turn obtains these nutrients from the decaying organic matter (Jones, 1988). The pollinator of this species has been recorded as the ichneumonid wasp *Lissopimpla excelsa,* which also pollinates five other *Cryptostylis* species in Australia (Bell, 2001). Therefore, this may be one of the reasons this species is often found with other *Cryptostylis* species. Thus the ecological requirements of this pollinator would also need to be assessed to ensure successful pollination of *C. hunteriana* into the future. Thus successful translocation of *C. hunteriana* would be extremely difficult without intimate knowledge of the ecological requirements of both the symbiotic fungus and the wasp *Lissopimpla excelsa*. It must be noted that wasps were observed within close proximity to where these *C. hunteriana* individuals were growing.

To ensure the survival of this species into the future it is recommended that appropriate nutrient and sediment control measures be put into place to avoid any runoff from having adverse effects on this threatened flora species if development is to occur within close proximity of this species.

If the entire population and the surrounding habitat is retained within the development layout and the recommendations which are outline above are adopted it is unlikely that the development will have a significant impact upon this species.

Diuris praecox

Diuris praecox was not recorded within the CHB or Gwandalan development lands; however, suitable habitat is present. The proposal would represent an incremental loss of suitable *D. praecox* habitat within the local area. However, a large portion of suitable *D. praecox* habitat exists within the offset lands that would be dedicated to conservation as estates managed by DECC. Due to the proposed conservation of a large portion of *D. praecox* habitat within the offset lands, the proposed development at CHB and Gwandalan is not considered likely to have a significant impact on the species.

Tetratheca juncea

A total of 583 *Tetratheca juncea* plants were located during the targeted surveys within the site (Figure 3-3 and Figure 3-4 show the distribution). A total of 369 *T.juncea* clumps would be removed as part of the proposal (189 recorded within the CHB development lands and 180 recorded by Wildthing (2003b) within the Gwandalan development lands).

It must be noted that EcoBiological (2006a) found this species in other areas of the CHB development lands and these could not be relocated during surveys by RPS HSO (November 2007) as they had probably finished flowering. Thus the population estimate of 189 individuals within the CHB development lands would be a slight underestimation of the actual population.

Whilst 369 *T. juncea* clumps would be removed as a result of the proposal within Gwandalan and CHB development lands, a large population would be conserved within the offset lands. Additionally, much larger populations are currently conserved within Wallarah National Park to the north of the site (over 9,900 individuals) and further populations located by RPS HSO (2007) within Coal & Allied lands at Gwandalan and Nords Wharf area which would be conserved in conservation reserves the number conserved is likely to increase. Thus, in the Wallarah Peninsula the total number of *T. juncea* totals over 49,000. Of these over 30,000 are to be conserved in conservation reserves. Such a large number of known plants protected in several disjunct but proximate conservation areas bode well for the long term security of the species within the locality. Therefore, as the large numbers of *T. juncea* and the majority of the habitat will be conserved it is considered unlikely that any impact will be significant in regards to the long term viability of the Wallarah population.

4.3.2 Endangered Ecological Communities

The EEC's which are present within the site are listed below. Only a very small amount of one EEC would be affected by the proposal. Additionally, any long-term discernable impacts are considered likely to be quite minimal. The impacts upon extant EEC's within the development lands are summarised below.

Freshwater Wetlands on Coastal Floodplains

CHB development lands

This EEC occurs within the offset lands that would be retained as part of the proposal. This community abuts and becomes part of the SEPP 14 wetland which occurs to the south of the CHB development lands. If nutrient and sediment control measures are put in place to mitigate runoff, particularly during the construction phase, then this would minimise any adverse impacts from the development and thus a significant impact would be unlikely to result. Therefore, it is considered unlikely that the development proposal at CHB development lands would have a significant impact upon this EEC.

Littoral Rainforest

EcoBiological (2006b) identified Littoral Rainforest EEC within an area of approximately 3.9ha within the CHB development lands. The community was found to be significantly degraded by weeds and surrounded by scrub (EcoBiological 2006b). Littoral Rainforest was not mapped as a separate vegetation community by

EcoBiological (2006b), but was found to occur within the eastern portion of Narrabeen Wallarah-Sheltered Grassy Forest. Further Littoral Rainforest exists to the south in the locality of Frazer Park within Munmorah SCA.

The Littoral Rainforest within the CHB development lands is likely to occupy less than 3.9ha and is a disturbed representation of the community within the local area. As such, the removal of Littoral Rainforest within the CHB development lands is considered to be a small, disturbed portion of the community that exists within conservation reserves to the south.

Swamp Sclerophyll Forest (includes both Swamp Mahogany – Paperbark Forest and Riparian Melaleuca Swamp Woodland communities)

An area of this EEC is proposed to be removed within the Gwandalan development lands. Approximately 1.198ha (9.6%) of the community would be removed as part of the proposal and approximately 11.22ha (90.4%) would be conserved within the offset lands at both CHB and to the west of the Pacific Highway at Crangan Bay. Given that the majority of this EEC (90%) will be reserved within the offset lands, it is considered highly unlikely that removal of such a small area of this EEC would significantly compromise the viability of the local stand. Some portions of this vegetation community adjoin the development lands. If nutrient and sediment control measures are put in place to mitigate runoff, prior to and during the construction phase, then this would minimise any potential adverse impacts from the development would be avoided.

4.3.3 Threatened Fauna

Wallum Froglet

CHB development lands

The Wallum Froglet was recorded within SEPP 14 wetland in Munmorah SCA to the immediate south of the CHB development lands. Limited habitat exists for the Wallum Froglet within the CHB development lands immediately adjacent to SEPP 14 wetlands. The key potential impacts on the Wallum Froglet resulting from the proposal are confined to indirect impacts such as sedimentation, alteration in hydrology and drainage channel profiles associated with stormwater runoff from the proposed residential development.

The combination of potential water derived impacts is likely to represent the Key Threatening Process (KTP) “Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands”. Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed development estate to ensure that potential impacts to downstream wetland habitats are prevented.

The proposal at CHB development lands is not considered likely to isolate Wallum Froglet since connectivity is maintained from the SEPP 14 wetland to the west following suitable habitat in drainage lines. Furthermore, the majority of CHB development lands are in a highly disturbed condition on the upper slopes and are not likely to be utilised by the species.

Gwandalan development lands

Although this species was not recorded within the Gwandalan development lands, there is some potential for it to exist within the Swamp Sclerophyll Forest vegetation

community. Providing recommendations to retain riparian vegetation within the Gwandalan development lands are adopted, potential Wallum Froglet habitat would be retained and potential impacts would be limited to indirect impacts. The potential indirect impacts likely to result from the proposal include sedimentation, alteration in hydrology and drainage channel profiles associated with stormwater runoff from the proposed residential development.

The combination of potential water derived impacts is likely to represent the Key Threatening Process (KTP) "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed development estate to ensure that potential impacts to downslope riparian habitats are prevented.

The proposal at Gwandalan development lands is not considered likely to isolate Wallum Froglet provided riparian areas are retained since connectivity would exist along drainage lines.

Glossy Black-Cockatoo

CHB development lands

The Glossy Black-Cockatoo was not recorded within the CHB development lands; however, potential Glossy Black-Cockatoo foraging habitat exists within the north-east and south of the CHB development lands, as mapped by EcoBiological (2006a). Additionally, hollow-bearing trees recorded within the south of the CHB development lands contain a small number of hollows of a suitable size for Glossy Black-Cockatoo nesting.

Whilst direct impacts associated within the CHB development lands include removal of potential foraging habitat and a small amount of potential nesting habitat, this is considered to be a small, disturbed portion of the foraging and nesting habitat available within offset lands that would be dedicated to conservation as estates managed by DECC.

Potential indirect impacts on the Glossy Black-Cockatoo are considered to be limited to minor predation by domestic animals resulting from the proposal within the CHB development lands. However, the implementation of responsible pet ownership would reduce this potential impact on the Glossy Black-Cockatoo.

The proposal at CHB development lands is not considered likely to isolate Glossy Black-Cockatoo since the species is highly mobile and capable of travelling long distances.

Gwandalan development lands

Known foraging habitat for the Glossy Black Cockatoo exists within the Gwandalan development lands as indicated by the presence of a large number of chewed *Allocasuarina* cones, characteristic of the species. Additionally, the numerous hollow-bearing trees observed within the Gwandalan development lands contain hollows of a suitable size to support Glossy Black-Cockatoo nesting/breeding.

The Coastal Plains Smooth-barked Apple Woodland and Narrabeen Wallarah Sheltered Grassy Forest contain *Allocasuarina littoralis* and *A. torulosa* throughout the offset lands and represent potential Glossy Black-Cockatoo foraging habitat. Abundant hollows that may be used for Glossy Black-Cockatoo breeding also exist

within the offset lands proposed to be dedicated to conservation as estates managed by DECC.

Direct impacts associated with the Gwandalan development lands include the removal of known Glossy Black-Cockatoo foraging habitat (Narrabeen Snappy Gum Forest and Narrabeen Coastal Sheltered Peppermint-Apple Forest) that contains abundant hollows that may potentially support breeding. Breeding within the Gwandalan development lands would be a significant finding for this species listed under *TSC Act 1995*. Removal of breeding habitat during breeding may result in the breeding failure for a pair of Glossy Black-Cockatoo at that time. Additionally, since Glossy Black-Cockatoo tend to breed in close proximity to other breeding pairs, more than one breeding event may be disturbed. Long-term implications of removal of potential breeding habitat may include a reduction in the local population size due to limited breeding habitat. However, suitable breeding habitat would be retained within offset lands located further to the south and would provide for long term protection of breeding and foraging habitat for the species.

To avoid any of the above outlined scenarios, it is recommended that taregetd surveys for Glossy Black-Cockatoo breeding pairs be undertaken with the Gwanadalan lands prior to any proposed vegetation removal.

Potential indirect impacts on the Glossy Black Cockatoo are considered to be limited to minor predation by domestic animals resulting from the proposal within the Gwandalan development lands. However, the implementation of responsible pet ownership would reduce this potential impact on the Glossy Black-Cockatoo.

The proposal at Gwandalan development lands is not considered likely to isolate Glossy Black-Cockatoo since the species is highly mobile and capable of travelling long distances.

Regent Honeyeater

This species does not occur in the Central Coast and Lower Hunter Region on a continuous basis, as its stronghold is the western slopes of the Great Dividing Range. Nevertheless, Regent Honeyeaters are recorded in Swamp Sclerophyll vegetation communities and associated woodlands on an intermittent seasonal basis in the Lake Macquarie LGA when resources in the west or Lower Hunter are scarce.

CHB development lands

Little potential habitat for the Regent Honeyeater exists within the CHB development lands due to the absence of the key foraging species *Eucalyptus robusta*. Adjacent areas within offset lands that would be dedicated to conservation and Munmorah SCA contain areas of *E. robusta* that may be used by the Regent Honeyeater on an intermittent basis.

As such the potential impacts associated with the CHB development lands are considered likely to be limited to indirect impacts on forage species (*E. robusta*) such as sedimentation, alteration in hydrology and drainage channel profiles associated with stormwater runoff from the proposed residential development.

The combination of potential water derived impacts is likely to represent the Key Threatening Process (KTP) “Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands”. Therefore, sediment and water management strategies will need to be incorporated into the planning, construction

and occupation phases of the proposed development estate to ensure that potential impacts to downstream wetland habitats are prevented.

The proposal at CHB development lands is not considered likely to isolate Regent Honeyeater since the species is highly mobile and capable of travelling long distances.

Gwandalan development lands

Potential foraging habitat for this species, in the form of *Eucalyptus robusta*, occurs within the Swamp Sclerophyll vegetation community and to a lesser extent *E. tereticornis*. Providing recommendations to retain riparian vegetation within the Gwandalan development lands are adopted, potential Regent Honeyeater habitat would be retained and potential impacts would be limited to indirect impacts. The potential indirect impacts likely to result from the proposal include sedimentation, alteration in hydrology and drainage channel profiles associated with stormwater runoff from the proposed residential development.

The combination of potential water derived impacts is likely to represent the Key Threatening Process (KTP) "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed development estate to ensure that potential impacts to downstream wetland habitats are prevented.

The proposal at Gwandalan development lands is not considered likely to isolate Regent Honeyeater since the species is highly mobile and capable of travelling long distances.

Swift Parrot

This species does not occur in the Central Coast and Lower Hunter Region on a continuous basis, as it only moves into South-eastern Australia during the winter months and spends the summer in Tasmania. Local records for this species occur at Nord's Wharf and on the Gwandalan peninsula.

CHB development lands

Little potential habitat for the Swift Parrot exists within the CHB development lands due to the absence of the key foraging species *Eucalyptus robusta*. Adjacent areas within offset lands that would be dedicated to conservation and Munmorah SCA contain areas of *E. robusta* that may be used by the Swift Parrot on an intermittent basis.

As such the potential impacts associated with the CHB development lands are considered likely to be limited to indirect impacts on forage species (*E. robusta* and *E. tereticornis*) such as sedimentation, alteration in hydrology and drainage channel profiles associated with stormwater runoff from the proposed residential development.

The combination of potential water derived impacts is likely to represent the Key Threatening Process (KTP) "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed development estate to ensure that potential impacts to downstream wetland habitats are prevented.

The proposal at CHB development lands is not considered likely to isolate Swift Parrot since the species is highly mobile and capable of travelling long distances.

Gwandalan development lands

Potential foraging habitat exists for this species, in the form of *Eucalyptus robusta* within the Swamp Sclerophyll vegetation community and *E. tereticornis* on the shores of Lake Macquarie within the Open Woodland vegetation community mapped by Wildthing (2003b). Providing recommendations to retain riparian vegetation within the Gwandalan development lands are adopted, potential Swift Parrot habitat would be retained and potential impacts would be limited to indirect impacts. The potential indirect impacts likely to result from the proposal include impacts on forage species such as sedimentation, alteration in hydrology and drainage channel profiles associated with stormwater runoff from the proposed residential development.

The combination of potential water derived impacts is likely to represent the Key Threatening Process (KTP) "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". Therefore, sediment and water management strategies will need to be incorporated into the planning, construction and occupation phases of the proposed development estate to ensure that potential impacts to downstream wetland habitats are prevented.

The proposal at Gwandalan development lands is not considered likely to isolate Swift Parrot since the species is highly mobile and capable of travelling long distances.

Powerful Owl

CHB development lands

Potential foraging habitat exists within the lesser disturbed areas of the CHB development lands. However, the species was not recorded during previous investigations (Wildthing, 2004a). No hollow-bearing trees containing hollows of a suitable size for Powerful Owl were recorded within the CHB development lands.

Direct impacts associated with the proposal at CHB development lands are limited to the removal/modification of potential foraging habitat which includes vegetated areas and edges of vegetation. This area of foraging habitat to be removed as a result of the proposal is a small portion of the foraging habitat available to the species within offset lands that would be dedicated to conservation as estates managed by DECC. Indirect impacts on the Powerful Owl are considered to only be a minor reduction in prey availability (possums and gliders) due to removal of foraging and shelter habitat for these species.

The proposal at CHB development lands is not considered likely to isolate Powerful Owl since the species is highly mobile and capable of travelling long distances.

Gwandalan development lands

Potential foraging habitat exists within the Gwandalan development lands. However, the species or evidence of the species (such as response to call playback, whitewash, owl pellets, and prey remains etc) was not recorded during previous investigations (Wildthing, 2004a). A number of hollow-bearing trees containing hollows that appeared to be of a suitable size for Powerful Owl were observed within the Gwandalan development lands.

Direct impacts associated with the proposal at Gwandalan development lands are the removal/modification of 26ha of potential foraging habitat that contains a number of potential roost trees. To avoid any potential impact on roosting / nesting birds, consideration should be given to targeted surveys for this species prior to any proposed vegetation clearance activities.

A large portion (310ha) of foraging habitat available to the species exists within offset lands and would be dedicated to conservation as estates managed by DECC. Indirect impacts on the Powerful Owl are considered to only be a minor reduction in prey availability (possums and gliders) due to removal of foraging and shelter habitat for these species.

The proposal at Gwandalan development lands is not considered likely to isolate Powerful Owl since the species is highly mobile and capable of travelling long distances.

Masked Owl

CHB development lands

The Masked Owl was not recorded within the CHB development lands; however, it was recorded within adjacent offset lands and the species is considered likely to forage within vegetated areas and edges within the CHB development lands. A small number of hollow-bearing trees containing hollows that appeared to be of a suitable size for Masked Owl were observed within the south of the CHB development lands. Direct impacts associated with the CHB development lands include a small reduction in the amount of foraging and potential nesting habitat.

The offset lands contain known Masked Owl foraging habitat and abundant hollow-bearing trees that may be used for nesting/breeding. The proposed CHB development lands are considered to be a small portion of the habitat available to the Masked Owl within offset lands that would be dedicated to conservation as estates managed by DECC.

Indirect impacts on the Masked Owl are considered to only be a minor reduction in prey availability (small terrestrial mammals) due to removal of foraging and shelter habitat for these prey species.

The proposal at CHB development lands is not considered likely to isolate Masked Owl since the species is mobile and capable of travelling through surrounding vegetation.

Gwandalan development lands

The Masked Owl was recorded within the Gwandalan development lands during previous investigations by Wildthing (2003b). The Gwandalan development lands also contain abundant hollows that would be potentially suitable for roosting/nesting of Masked Owl. However, no evidence of hollow occupation was observed during searches under potential nesting sites for owl pellets, prey remains, whitewash etc during threatened flora searches.

Direct impacts associated with the development at Gwandalan include removal/modification of 26ha of known foraging and potential breeding habitat for the Masked Owl. Breeding within the Gwandalan development lands would be a significant finding for this species listed under *TSC Act*. Removal of breeding habitat during breeding may result in the breeding failure for a pair of Masked Owl at that

time. Long-term implications of removal of potential breeding habitat may include alterations in home-ranges of the local population and the potential loss of one pair of Masked Owl. To avoid any potential impact on roosting / nesting birds, consideration should be given to targeted surveys for this species prior to any proposed vegetation clearance activities. Suitable breeding habitat would be retained within offset lands located further to the south.

Indirect impacts on the Masked Owl are considered to be a reduction in prey availability (mainly small- to medium-sized terrestrial mammals) due to removal of foraging and shelter habitat for these prey species.

The proposal at Gwandalan development lands is not considered likely to isolate Masked Owl since the species is mobile and capable of travelling through surrounding vegetation.

Eastern Pygmy Possum

CHB development lands

The Eastern Pygmy Possum was not recorded within the CHB development lands during targeted surveys; however, potential habitat exists within heathland containing a range of foraging resources (Proteaceae). Additionally, the species has been recorded within Munmorah SCA to the south (NPWS Atlas of NSW Wildlife data). Approximately 3-4ha of potential Eastern Pygmy Possum habitat exists within the CHB development lands.

Direct impacts associated with the CHB development lands consist of the removal of an estimated 3-4ha of potential habitat for the species. However, should the recommended SEPP 14 wetland buffer be implemented a large portion of Eastern Pygmy Possum habitat would also be retained.

The offset lands were found to contain limited habitat for the Eastern Pygmy Possum, with small patches of *Banksia spinulosa* and *Lambertia formosa* providing the only habitat. Munmorah SCA is considered likely to contain most of the habitat for the Eastern Pygmy Possum in the local area.

Gwandalan development lands

As found within the offset lands, limited habitat for the Eastern Pygmy Possum exists with small patches of *Banksia spinulosa* and *Lambertia formosa* providing the main foraging resource. Munmorah SCA is considered likely to contain most of the habitat for the Eastern Pygmy Possum in the local area, with small areas also occurring within the CHB development lands.

As such few impacts on the Eastern Pygmy Possum are considered likely to occur as a result of the proposal at the Gwandalan development lands.

Grey-headed Flying Fox

CHB development lands

Potential foraging habitat for the Grey-headed Flying Fox exists within the CHB development lands due to the presence of flowering myrtaceous tree species. No camps or potential camp sites for the Grey-headed Flying Fox occur within the CHB development lands and as such are unlikely to be impacted by the proposal. Direct impacts associated with the proposed CHB development lands are limited to the

removal of foraging habitat which includes vegetated areas of the size (less than half the CHB development lands), which is a small portion of the habitat available within offset lands (310ha) that would be dedicated to conservation as estates managed by DECC. Furthermore, the Grey-headed Flying Fox is known to forage within residential areas among ornamental trees and shrubs.

Potential indirect impacts arising from the proposal at CHB development lands are expected to be limited to a slight increase in mortality that may result from barbed-wire injury and netting of fruit trees. However, these impacts may be mitigated by sensitive construction fencing and responsible gardening by residents.

The proposal at CHB development lands is not considered likely to isolate Grey-headed Flying Fox since the species is highly mobile and capable of travelling long distances.

Gwandalan development lands

Potential foraging habitat for the Grey-headed Flying Fox exists within the Gwandalan development lands due to the presence of flowering myrtaceous tree species and ornamental tree species. No camps or potential camp sites for the Grey-headed Flying Fox occur within the Gwandalan development lands and as such are unlikely to be impacted by the proposal. Direct impacts associated with the proposed CHB development lands are limited to the removal of 26ha of foraging habitat, which is a small portion of the habitat available within offset lands (310ha) that would be dedicated to conservation as estates managed by DECC. Furthermore, the Grey-headed Flying Fox is known to forage within residential areas among ornamental trees and shrubs.

Potential indirect impacts arising from the proposal at Gwandalan development lands are expected to be limited to a slight increase in mortality that may result from barbed-wire injury and netting of fruit trees. However, these impacts may be mitigated by sensitive construction fencing and responsible gardening by residents.

The proposal at Gwandalan development lands is not considered likely to isolate Grey-headed Flying Fox since the species is highly mobile and capable of travelling long distances.

Eastern Bentwing-Bat

CHB development lands

The proposal would result in the removal/modification of up to 60ha of foraging habitat for the Eastern Bentwing Bat within the CHB development lands. No potential cave roost habitat was recorded within the CHB development lands and as such breeding habitat would not be affected by the proposal. The portion of foraging habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Eastern Bentwing Bat are expected to occur as a result of the proposal at CHB development lands.

The Eastern Bentwing Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Gwandalan development lands

The proposal would result in the removal/modification of up to 26ha of foraging habitat for the Eastern Bentwing Bat within the Gwandalan development lands. No potential cave roost habitat was recorded within the Gwandalan development lands and as such breeding habitat would not be affected by the proposal. The portion of foraging habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Eastern Bentwing Bat are expected to occur as a result of the proposal at Gwandalan development lands.

The Eastern Bentwing Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at Gwandalan development lands.

Little Bentwing-Bat

CHB development lands

The proposal would result in the removal/modification of up to 60ha of foraging habitat for the Little Bentwing Bat within the CHB development lands. No potential cave roost habitat was recorded within the CHB development lands and as such breeding habitat would not be affected by the proposal. The portion of foraging habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Little Bentwing Bat are expected to occur as a result of the proposal at CHB development lands.

The Little Bentwing Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Gwandalan development lands

The proposal would result in the removal/modification of up to 26ha of foraging habitat for the Little Bentwing Bat within the Gwandalan development lands. No potential cave roost habitat was recorded within the Gwandalan development lands and as such breeding habitat would not be affected by the proposal. The portion of foraging habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Little Bentwing Bat are expected to occur as a result of the proposal at Gwandalan development lands.

The Little Bentwing Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at Gwandalan development lands.

Eastern Freetail-Bat

CHB development lands

The proposal would result in the removal/modification of up to 60ha of foraging habitat for the Eastern Freetail Bat within the CHB development lands. In addition, a small number of hollow-bearing trees that may be utilised for roosting/breeding by the Eastern Freetail Bat. The portion of foraging and roosting habitat to be

removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Eastern Freetail Bat are expected to occur as a result of the proposal at CHB development lands.

The Eastern Freetail Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Gwandalan development lands

The proposal would result in the removal/modification of up to 26ha of foraging habitat for the Eastern Freetail Bat within the Gwandalan development lands. In addition, the abundant hollow-bearing trees present onsite may be utilised for roosting/breeding by the Eastern Freetail Bat. The portion of foraging and roosting habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Eastern Freetail Bat are expected to occur as a result of the proposal at Gwandalan development lands.

The Eastern Freetail Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at Gwandalan development lands.

Yellow-bellied Sheathtail-Bat

This species was not recorded during the survey but is known to occur in the Central Coast Region within a range of woodland habitats. Due to its mobility and occurrence in the near-coastal districts to the south, it is likely that this species uses the site on at least an intermittent basis.

CHB development lands

The proposal would result in the removal/modification of up to 60ha of foraging habitat for the Yellow-bellied Sheathtailed Bat within the CHB development lands. In addition, a small number of hollow-bearing trees that may be utilised for roosting/breeding by the Yellow-bellied Sheathtailed Bat. The portion of foraging and roosting habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Yellow-bellied Sheathtailed Bat are expected to occur as a result of the proposal at CHB development lands.

The Yellow-bellied Sheathtailed Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Gwandalan development lands

The proposal would result in the removal/modification of up to 26ha of foraging habitat for the Yellow-bellied Sheathtailed Bat within the Gwandalan development lands. In addition, the abundant hollow-bearing trees present onsite may be utilised for roosting/breeding by the Yellow-bellied Sheathtailed Bat. The portion of foraging and roosting habitat to be removed/modified as a result of the proposal is considered

to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Yellow-bellied Sheathtailed Bat are expected to occur as a result of the proposal at Gwandalan development lands.

The Yellow-bellied Sheathtailed Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at Gwandalan development lands.

Eastern False Pipistrelle

This species was not recorded during the survey but a record from Pulbah Island in Lake Macquarie strongly suggests that it is likely to uses the site on at least an intermittent basis.

CHB development lands

The proposal would result in the removal/modification of up to 60ha of foraging habitat for the Eastern False Pipstrelle within the CHB development lands. In addition, a small number of hollow-bearing trees that may be utilised for roosting/breeding by the Eastern False Pipstrelle. The portion of foraging and roosting habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Eastern False Pipstrelle are expected to occur as a result of the proposal at CHB development lands.

The Eastern False Pipstrelle is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Gwandalan development lands

The proposal would result in the removal/modification of up to 26ha of foraging habitat for the Eastern False Pipstrelle within the Gwandalan development lands. In addition, the abundant hollow-bearing trees present onsite may be utilised for roosting/breeding by the Eastern False Pipstrelle. The portion of foraging and roosting habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Eastern False Pipstrelle are expected to occur as a result of the proposal at Gwandalan development lands.

The Eastern False Pipstrelle is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at Gwandalan development lands.

Large-footed Myotis

CHB development lands

Foraging habitat for the Large-footed Myotis exists within dams that contain open water within the CHB development lands. No cave roosting habitat was recorded within the CHB development lands and as such breeding habitat for the Large-footed Myotis would not be affected.

The proposal would result in the removal/modification of foraging habitat for the Large-footed Myotis within the CHB development lands. The portion of foraging habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (310ha) that would be dedicated to conservation as estates managed by DECC.

Potential indirect impacts on the Large-footed Myotis that may occur as a result of the proposal are related to potential impacts on the SEPP 14 wetland to the south of the CHB development lands. A reduction in the quality of these wetland areas, particularly open ponds to the south of the CHB development lands may impact on the prey abundance and availability for the Large-footed Myotis.

The Large-footed Myotis is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Gwandalan development lands

Foraging habitat for the Large-footed Myotis exists within dams that contain open water within the Gwandalan development lands. No cave roosting habitat was recorded within the Gwandalan development lands and as such breeding habitat for the Large-footed Myotis would not be affected.

The proposal would result in the removal/modification of four dams that represent foraging habitat for the Large-footed Myotis within the Gwandalan development lands. The portion of foraging habitat to be removed/modified as a result of the proposal (four dams) is considered to be a small portion of that which is present within the offset lands that would be dedicated to conservation as estates managed by DECC.

No indirect impacts on the Large-footed Myotis are expected to occur as a result of the proposal at Gwandalan development lands.

The Large-footed Myotis is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Greater Broad-nosed Bat

This species was not recorded during the survey but a record from Pulbah Island in Lake Macquarie strongly suggests that it is likely to uses the site on at least an intermittent basis.

CHB development lands

The proposal would result in the removal/modification of up to 60ha of foraging habitat for the Greater Broad-nosed Bat within the CHB development lands. In addition, a small number of hollow-bearing trees that may be utilised for roosting/breeding by the Greater Broad-nosed Bat. The portion of foraging and roosting habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (310ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Greater Broad-nosed Bat are expected to occur as a result of the proposal at CHB development lands.

The Greater Broad-nosed Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at CHB development lands.

Gwandalan development lands

The proposal would result in the removal/modification of up to 26ha of foraging habitat for the Greater Broad-nosed Bat within the Gwandalan development lands. In addition, the abundant hollow-bearing trees present onsite may be utilised for roosting/breeding by the Greater Broad-nosed Bat. The portion of foraging and roosting habitat to be removed/modified as a result of the proposal is considered to be a small portion of that which is present within the offset lands (approximately 310 ha) that would be dedicated to conservation as estates managed by DECC. No indirect impacts on the Greater Broad-nosed Bat are expected to occur as a result of the proposal at Gwandalan development lands.

The Greater Broad-nosed Bat is a highly mobile species capable of travelling long distances and as such is not considered likely to be isolated by the proposal at Gwandalan development lands.

4.3.4 Migratory species listed under EPBC Act

A White-bellied Sea-Eagle nest, including two to three juvenile birds, was recorded within the offset lands. These lands are not proposed to be developed. However, potential impacts may arise resulting from the publicisation of the location of the nest. Potential impacts include disturbance of breeding and abandonment of nest.

DECC should consider classifying the location of the White-bellied Sea-Eagle nest as sensitive to ensure ongoing protection, including looking at ways of limiting acceess into the area.

4.4 Key Threatening Process (KTP)

A Key Threatening Process (KTP) is defined in the *TSC Act (1995)* as a process that threatens, or could threaten, the survival or evolutionary development of species, populations or ecological communities. Something can be a threat if it:

- *adversely affects two or more threatened species, populations or ecological communities; or*
- *could cause species, populations or ecological communities that are not currently threatened to become threatened.*

Key Threatening Processes are listed in Schedule 3 of the *TSC Act 1995*. Those potentially applicable to the proposal are as follows:

1. Loss of Hollow-bearing trees;
2. Clearing of native vegetation;
3. Human-caused climate change;
4. Infection of native plants by *Phytophthora cinnamomi;*
5. Invasion of native plant communities by exotic perennial grasses;

6. Removal of dead wood and dead trees;
7. Predation by the Feral Cat;
8. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;
9. Invasion of Native Plant Communities by Bitou and Boneseed;
10. Exotic Vines and Scramblers; and
11. Lantana camara.

1. Loss of Hollow-bearing Trees

The proposed development would require the removal of 26ha of vegetation containing hollow-bearing trees within Gwandalan development lands and a small portion within CHB development lands. As such, the proposal is considered as contributing to the Key Threatening Process "Removal of Hollow-bearing Trees.

CHB development lands

A small number of hollow-bearing trees were observed within the south of the CHB development lands and would cumulatively contribute to this KTP. However, the dedication of offset lands to conservation would conserve the abundant hollow-bearing trees observed and the fauna they support.

Gwandalan development lands

The Gwandalan development lands contain numerous hollow-bearing trees with a variety of hollow sizes. Hollow-bearing trees within the Gwandalan site appear to be of a variety of ages with many over 100cm DBH.

A range of fauna species may utilise hollows within the Gwandalan development lands including a range of woodland birds, owl species, mammals such as possums and gliders, reptiles and frogs. Threatened fauna species that potentially utilise hollows within the Gwandalan development lands include:

- Forest Owls including Masked Owl (*Tyto novaehollandiae*), which was recorded within the Gwandalan development lands, and Powerful Owl *(Ninox strenua);*
- Glossy Balck-Cockatoo *(Calyptorhynchus lathami),* which has been confirmed as foraging on the site;
- Threatened hollow-roosting microchiropteran bat species such as East Coast Freetail Bat (*Mormopterus norfolkensis*), Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*), Eastern False Pipstrelle (*Falsistrellus tasmaniensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*); and
- Squirrel Glider (*Petaurus norfolcensis*), of which potential habitat exists on site.

Hollow-bearing trees to be removed as a result of the proposal contain numerous hollows of a size to potentially support Masked Owl, which has been recorded onsite.

However, no evidence of owl occupation was found during searches of potential roost trees at Gwandalan during targeted flora searches.

Microchiropteran bats are unlikely to be significantly impacted upon, due to their mobility and the presence of abundant hollow-bearing trees throughout lands to be conserved within offset lands. Potential habitat for Squirrel Glider exists within Gwandalan development lands; however, the species was not recorded during targeted surveys. Additionally, large portions of potential Squirrel Glider habitat would be dedicated to conservation and managed as DECC estates.

Conclusion

The offset lands were found to contain numerous hollow-bearing trees of various sizes that potentially support the threatened fauna species of concern (Masked Owl, microchiropteran bat species and Squirrel Glider) in addition to many others.

It is considered that proposal is likely to represent a cumulative impact, with regard to this KTP, particularly for the Gwandalan development lands. However, the greater abundance of similar and greater quality habitat within offset lands that would be secured for conservation would provide long term protection of hollow-bearing trees in the local area.

2. Clearing of Native Vegetation

The proposed development will require the removal of native vegetation and as such is considered to contribute to the Key Threatening Process "Clearing of Native Vegetation".

CHB development lands

Most of the CHB development lands have been historically disturbed resulting in a landscape of artificial surfaces, bare ground, grassland, regrowth and small areas of remnant native vegetation. The vegetation communities recorded within the CHB development lands were:

- Coastal Sand Wallum Heath-Scrub;
- Narrabeen Wallarah Sheltered Grassy Forest;
- Coastal Headland Complex (Grassland & Shrubland);
- Coastal Holocene Banksia Scrub; and
- Regenerating Vegetation.

More than half of the CHB development lands are vegetated and would be removed or modified as a result of the proposal. As such the proposal at CHB development lands would cumulatively contribute to this KTP; however, this is considered to be a minor contribution considering the large amount of high quality native vegetation within the offset lands to be dedicated to conservation.

Gwandalan development lands

Whilst some portions of the Gwandalan development lands have been subject to some development such as residences, facilities and grazing, a large portion of high quality native vegetation is also present. Vegetation communities recorded within the

Gwandalan development lands include Open Woodland (which has a parkland-type structure with a cleared understorey); Narrabeen Snappy Gum Forest; Coastal Sand Mahogany-Paperbark Swamp Forest and Narrabeen Coastal Sheltered Peppermint-Apple Forest.

Less than 26ha of vegetation would be removed as a result of the proposal within the Gwandalan development lands. As such the proposal at Gwandalan development lands would contribute to this KTP.

Conclusion

Approximately 310ha of native vegetation within the offset lands would be dedicated to conservation as estates managed by DECC. It is considered that proposal is likely to represent a cumulative impact, with regard to this KTP, particularly for the Gwandalan development lands. The greater abundance of similar and greater quality habitat within offset lands that would be secured for conservation would provide long term protection of vegetation in the local area.

3. Human caused climate change

The proposal is likely to contribute to the Key Threatening Process "Human Caused Climate Change" as a result of clearing vegetation. It is considered that clearing and modification of the landscape would constitute only a minor incremental increase in the effects of this KTP. Thus the extent to which the proposal could contribute to this process is considered unlikely to be significant.

4. Infection of native plants by Phytophthora cinnamomi

Phytophora cinnamomi is a water mould (like a fungus) that attacks the roots of susceptible plants, in many cases killing the plants. In some native plant communities, epidemic disease can develop causing death of large numbers of plants.

P. cinnamomi may spread with the movement of infected soil or plant material by people, animals and may be transported by percolating through the soil, in creeks or storm runoff. People can also transport the fungus to new areas on dirt adhering to vehicles, items they are carrying or footwear.

Humans have the capacity to spread the fungus long distances and across barriers which sets us apart from the natural mechanisms which normally spread this water mould. Therefore, not a lot can be done to control the natural spread of the water mould or to destroy it, in native plant communities. Due to the use of heavy machinery that will be used for construction of the development estate there is opportunity for the KTP "Infection of native plants by *Phytophthora cinnamomi*". The transportation of *Phytophthora cinnamomi* from other areas may occur by the movement of soils attached to earth moving machinery. Precautionary measures such as clearing of machinery prior to clearing can help to limit the potential for this KTP to occur, and should be addressed in Environment Management plans generated for site construction activities.

5. Invasion of native plant communities by exotic perennial grasses

There is opportunity for the KTP "Invasion of native plant communities by exotic perennial grasses" to occur within the site due to the removal of vegetation and the exposing of underlying soils. For the most part, this KTP already occurs within much of the CHB development lands due to their predominantly cleared and disturbed

nature and to a lesser extent within Gwandalan development lands due to pasture and lawn maintenance. It is expected that those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP to impact upon surrounding offset lands.

6. Removal of dead wood and dead trees

During the clearing of vegetation within the site a number of dead trees and fallen timber are likely to be removed and this may represent opportunity for the KTP "Removal of dead trees and dead wood".

Most of the CHB development lands have been highly disturbed as a result of previous mining activities and provide little dead trees or fallen timber resources. However, small areas of high quality native vegetation do contain a very small number of dead standing trees and a small amount of fallen timber.

Much of the Gwandalan development lands contain high quality native vegetation in good condition (Narrabeen Snappy Gum Forest and Narrabeen Coastal Sheltered Peppermint-Apple Forest). Within these vegetation communities dead trees and fallen timber are a relatively common occurrence and would require removal as part of the proposal within Gwandalan development lands. The Open Woodland vegetation community has a well maintained understorey with little fallen timber remaining on the ground and few dead trees.

The offset lands were found to contain numerous dead trees and fallen timber and would be dedicated to conservation as estates managed by DECC.

It is considered that the proposal is likely to represent a cumulative impact, with regard to this KTP, particularly for the Gwandalan development lands. However, the greater abundance of similar and greater quality habitat within offset lands that would be secured for conservation would provide long term protection of dead trees and dead wood in the local area.

7. Predation by feral cats

The increase of residential development within the area has the potential to increase opportunities for the KTP "Predation by feral cats". This KTP is unlikely to significantly impact upon local wildlife provided responsible pet ownership is adopted.

8. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

The displacement of natural vegetation communities within residential development is likely to increase the opportunity for the KTP "Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands". This is due to increased water flows and runoff potentials as a consequence of water falling upon manmade surfaces.

Of greatest risk with regard to this KTP are the SEPP 14 wetland to the south of CHB development lands, Swamp Sclerophyll Forest within Gwandalan development lands and threatened fauna associated with these communities such as Wallum Froglet.

Strict measures need to be implemented to minimise the potential impacts on SEPP 14 wetland that are likely to be associated with the proposal at CHB development lands as discussed in Section 4.6 of this report. In addition, impact to these threatened entities would be prevented by the implementation of sediment and water

management plans during the planning and construction phases of development and suitable stormwater runoff treatment and control, coupled with adequate riparian vegetation retention.

9. Invasion of Native Plant Communities by Bitou and Boneseed

This species is currently well established along the Coastal heath vegetation communities and it occurs sporadically throughout the dry sclerophyll forests within the CHB development lands, Gwandalan development lands and offset lands. There is a chance that this plant may spread at the edges of the development due to the removal of the canopy layer and exposing of underlying soils which contain high number of seeds. It is recommended that a weed management program be undertaken targeting this species to ensure that the development proposal does not increase the area of occupancy. It is recommended that any topsoil which is removed from the vicinity of any Bitou plants not be used for any of the landscaping areas and be disposed of according to guidelines set out by Council. It is expected that those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP.

10. Exotic Vines and Scramblers

Two species of exotic vines which have been listed within this KTP are present within the site namely, *Ipomoea cairica* (Mile a minute) and *Asparagus aethiopicus* (Asparagus Fern). The two species occur within the EEC of Swamp Sclerophyll Forest on Coastal Floodplains (Swamp Mahogany Paperbark Forest) within the offset lands. The densities of these species are low. *Ipomoea cairica* occurs with other weeds such as Lantana and Bitou and it is recommended that weeding be undertaken to prevent the further spreading and thus exacerbation of this KTP.

11. *Lantana camara*

There is a small opportunity for *Lantana camara* to establish, due to the removal of canopy vegetation and the exposing of underlying soils. This exotic plant species already occurs within the site in relatively high densities in some areas. It is likely that the development will considerably reduce the incidence of Lantana within the development estate. Nevertheless there will still be opportunities for this KTP at the edges of the development without appropriate management. It is expected that those measures employed to reduce potential sediment and erosional impacts to surrounding areas will contribute to minimising the potential for this KTP.

4.5 SEPP 44 (Koala Habitat Protection)

SEPP 44 - Koala Habitat Protection aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

4.5.1 First Consideration – Is the Land 'Potential Koala Habitat'?

Schedule 2 of State Environmental Planning Policy (SEPP) No. 44 – 'Koala Habitat Protection' lists 10 tree species that are considered indicators of 'Potential Koala Habitat'. The presence of any of the species listed on a site proposed for

development triggers the requirement for an assessment for 'Potential Koala Habitat'. SEPP 44 defines potential Koala Habitat as:

> *"areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component".*

The site was found to contain potential Koala habitat as defined by SEPP 44 due to the following Schedule 2 species compositions at greater than 15% of the total number of trees:

- **CHB development lands** - EcoBiological (2006b) identified two species listed under Schedule 2 of SEPP 44, namely *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum) and *E. punctata* (Grey Gum).
- **Gwandalan development lands** - Wildthing (2003b) identified three species listed under Schedule 2 of SEPP 44, namely *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum), *E. tereticornis* (Forest Red Gum) and *E. robusta* (Swamp Mahogany). The most commonly occurring species within the Gwandalan development lands is *Eucalyptus haemastoma*.
- **Offset lands** - The offset lands were found to contain areas with a range of Koala feed trees listed under Schedule 2 of SEPP 44 from *E. propinqua* (Small Fruited Grey Gum) within gullies of Narrabeen Wallarah Sheltered Grassy Forest, *E. robusta* within Swamp Sclerophyll Forest communities, *E. tereticornis* on the foreshore of Lake Macquarie, to *E. haemastoma* (Broad-leaved Scribbly Gum) and *E. punctata* (Grey Gum) in more elevated areas.

4.5.2 Second Consideration – Is the Land 'Core Koala Habitat?'

Searches were made for any secondary indications of Koalas on the site including scats, scratches on tree trunks, scent markings on tree trunks, tracks in the soil and audible noises including territorial or mating calls, fighting and movement in the trees during previous investigations (Wildthing 2003a; 2003b; 2004a; 2004b; 2004c). Searches for direct observations of Koalas were also conducted during nocturnal surveys. Whilst both the CHB and Gwandalan development lands were searched for the presence of Koala (Wildthing, 2004a; 2003b), not all of the offset lands were searched for Koala, particularly the north-west area adjacent to Crangan Bay. No animals were noted within the development lands and no secondary evidence of the presence of Koalas was found. However, a Koala record exists within the offset lands from 1996.

Records of Koala within 10 km of the site are summarised in Table 4.2 below.

Table 4-2 Locations of Koala records within 10km of the site

Year	Location description
1949, 1971, 1974, 1975	Pulbah Island in Lake Macquarie
1951	North of Swansea
1986	Wangi Point
1996	Southwest of Vales Point
1996	Along Pacific Highway within offset lands
2003	Approximately 500m to the southwest of offset lands
2003	Approximately 1.5 km to the south of offset lands, immediately to the south of Lake Macquarie SCA
2003	Approximately 1.5 km to the south of offset lands, immediately to the south of Lake Macquarie SCA
2003	Approximately 1.5 km to the south of offset lands, immediately to the south of Lake Macquarie SCA

The presence of a Koala record (see Table 4-2 and Figure 3-7) and extensive areas containing a range of Schedule 2 Koala feed trees within the offset lands (particularly the western portion) indicates that a local Koala population may occur within these lands. Searches within all offset lands for Koala were not undertaken and as such the presence of core Koala habitat in these lands cannot be reliably determined.

No evidence of Koala was found during targeted searches within the CHB and Gwandalan development lands. Recent records of Koala exist within the local area; however, the absence of any Koala evidence indicates that the species is likely to occur only on a very rare occasion, at best.

In conclusion given that no direct evidence of secondary indication of Koala presence was observed within the CHB or Gwandalan development lands during any of the previous investigations (Wildthing 2003a; 2003b; 2004a; 2004b; 2004c) it is considered unlikely that the site represents core Koala habitat as defined by SEPP 44.

4.6 SEPP 14 (Coastal Wetlands)

The close proximity of the SEPP 14 wetland to the CHB development lands (approximately 35m at the closest point) is of potential concern. Part of the proposal within the CHB development lands is located upslope of the SEPP 14 and as such it has the potential to influence the sensitive receiving environment of the wetland. Due to the low-lying nature and complex hyrdology of wetlands, even potential impacts that may occur near the downstream outlet may also potentially impact on the remainder of the wetland upstream. Such examples include pollutant dispersal, erosion and sedimentation, and resultant impacts on habitats, vegetation and micro-ecological niches.

Potential impacts on the wetland as a result of the proposal at CHB development lands include:

- Alteration in the amount and type of flow entering the wetland and potential subsequent impacts on wetland and heath vegetation;
- Addition of pollutants to the wetland from construction machinery, residential vehicle traffic and stormwater;
- Erosion and sedimentation within the wetland resulting from construction in upslope areas;
- Removal of wetland vegetation; and
- Invasion of weeds through vegetation clearance and residential landuse.

Strict measures will need to be implemented to minimise the potential impacts on SEPP 14 wetland that are likely to be associated with the proposal at CHB development lands. A riparian buffer may be implemented that aim to protect the integrity of the SEPP 14 wetland such as:

- A primary riparian buffer of 50 m from wetland vegetation, where no land uses are permitted that significantly detract from the potential of the buffer to achieve the goal of wetland protection. This buffer would consist predominantly of existing fringing vegetation.

Where this buffer is unable to be adequately implemented within the proposed development design, additional control measures should be investigated in consultation with experienced wetland hydrologists and engineers to ensure that potential impacts on the SEPP 14 wetland are minimised. This is particularly the case in the section where the wetland boundary is located 35m from the CHB development lands.

Other general recommendations to minimise potential impacts on the SEPP 14 wetland include:

- Where feasible, roads should enclose the residential development to avoid encroachment of residences into surrounding bushland;
- A weed management and monitoring plan should be developed and implemented to minimise the potential for the invasion of aquatic and terrestrial weed species into the SEPP 14 wetland and buffer zones; and
- Stormwater treatment as appropriate should be undertaken to minimise potential impacts on the SEPP 14 wetland.

4.7 Key Thresholds Assessment (Part 3A)

As required by the Draft *Guidelines for Threatened Species Assessment* for Part 3A applications (DEC / DPI 2005), the following assessment of Key Thresholds (four in total) is provided for the proposed CHB and Gwandalan development lands.

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

It is considered that the information presented within this document, and in particular the proposal that includes the proposed land dedication to DECC for the site, when viewed holistically with the proposed conservation measures as detailed within the MoU and this EAR, is likely to result in maintained biodiversity values within the region and improved long-term conservation of these values.

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

The habitats utilised by the threatened species, populations and ecological communities considered likely to occur or that were recorded within the development lands are well represented in the proposed offset lands that would be dedicated to conservation.

The population of *Cryptostylis hunteriana* (listed as Vulnerable under *TSC Act* and *EPBC Act*) found within the CHB development lands requires protection to prevent impacts such that may reduce the long-term viability of the local population. The proposal within the CHB development lands at present would require removal of *C. hunteriana*, which has not been recorded from the offset lands and which may result in the loss of the local population should the species only occur within the CHB development lands. It is highly recommended that this population and surrounding suitable habitat be retained within the development layout to avoid a significant impact on this species. Further investigations into the occurrence of the species within the offset lands could be undertaken to further inform this EAR.

Additionally, the occurrence of potential breeding habitat for the Masked Owl and Glossy Black-Cockatoo (listed as Vulnerable under *TSC Act*) within the Gwandalan development lands is of note. The removal of breeding habitat could potentially reduce the breeding success and subsequently the long-term viability of the local Glossy Black-Cockatoo and Masked Owl populations. The potential for Masked Owl and/or Glossy Black-Cockatoo breeding to occur within the Gwandalan development lands could be further investigated to provide more reliable assessment of the potential impacts on these species resulting from the proposal at Gwandalan prior to any vegetation clearance.

A small number of *Tetratheca juncea* plants (369) would be removed as part of the current development proposal within CHB and Gwandalan development lands. There were at least 214 individuals identified within the offset lands, with this number expected to highly conservative due to the high number this species found in the lands surrounding the site. It is estimated that 49,000 individuals occur within the Wallarah Peninsula and local area. Of these over 30,000 are to be reserved within existing and proposed conservation reserves. Therefore, it is considered that the

removal of 0.3% of the population within the local area would not reduce the long term viability of the local population of this species.

3. Whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.

The habitats utilised by the threatened species, populations and ecological communities considered likely to occur or that were recorded within the development lands are well represented in the proposed offset lands that would be dedicated to conservation.

However, the loss of potential breeding habitat within the Gwandalan development lands for the Glossy Black-Cockatoo and Masked Owl may reduce the breeding success of the species within the local area.

Furthermore, the loss of *C. hunteriana* known habitat including 5 clumps within the CHB development lands may represent the loss of a local population. If these clumps and the surrounding habitat is retained it is unlikely that the proposal will place this species at risk of extinction. However, if these individuals are removed it may accelerate the rate of extinction of this species due to the low numbers of these species recorded within the local area.

The removal of a small population of *Tetratheca juncea* by the proposal is unlikely to place the local population at risk of extinction due to the large numbers which are to be conserved within conservation reserves within the locality (approximately 30,000).

4. Whether or not the proposal will adversely affect critical habitat.

There is no declared "Critical Habitat" within the site locality, and as such the proposal will not adversely affect any such habitat.

5 RECOMMENDATIONS

The following recommendations have been outlined to ensure that the ecological impact of the proposal is minimised as far as possible:

- Retain the *Cryptostylis hunteriana* individuals that were identified and the surrounding Narrabeen Doyalson Coastal Woodland at CHB development lands which is habitat for this species. Implement a buffer of at least 50m to protect this sensitive orchid from any proposed development areas. A management plan should be prepared to ensure the conservation and long term survival of this threatened species within the CHB development lands.

- Whilst the Littoral Rainforest EEC identified within the CHB development lands was considered to be significantly degraded by weeds by EcoBiological (2006b), the extent of the community may actually be less than the area of 3.9ha given by EcoBiological (2006b) since this figure included surrounding scrub. As such, further survey and analysis should be undertaken to map the exact extent of the community within the CHB development lands and to provide a more detailed flora survey.

- Whilst searches were conducted for the evidence of owl activity within potential Masked Owl roosts within Gwandalan development lands, further investigation of breeding activity is required. Targeted Masked Owl surveys within the Gwandalan development lands should be undertaken prior to any vegetation removal and should include stagwatching of potential roosts, spotlighting and call playback.

    - In the case that Masked Owl breeding is recorded within the Gwandalan development lands the following recommendations apply:

        - Vegetation removal should not commence until young have fledged. This may require ongoing monitoring by experienced ecologists. Once the nest is no longer being used, vegetation clearance should occur within the next 3 months to prevent nesting re-occurring.

- The high concentrations of Glossy Black-Cockatoo chewed cones observed within Gwandalan development lands in August 2007 and the high abundance of potential nesting hollows may indicate that the species may breed within the Gwandalan development lands. Targeted searches for Glossy Black-Cockatoo nesting sites within the Gwandalan development lands should be undertaken during the appropriate season (March to August) prior to vegetation removal (ie during March - August in the same year as vegetation removal is proposed). Multiple visits would be required during this survey period to assess whether the species breeds within the site.

    - In the case that Glossy Black Cockatoo is found to be breeding within the Gwandalan development lands:

        - Vegetation removal should not commence until young have fledged. This may require ongoing monitoring by experienced ecologists. Once the nest is no longer being used, vegetation clearance may occur. Vegetation removal should not occur within the breeding period (March-August)

- Protection and minimisation of disturbance to White-bellied Sea-eagle nest occurring in the offset lands in consultation with DECC.

- Strict management of stormwater runoff from both CHB and Gwandalan development lands must occur to minimise potential impacts on EECs, SEPP 14 wetlands and known Wallum Froglet habitat.

- Implement the following SEPP 14 buffers:

    - A primary riparian buffer of 50 m from wetland vegetation, where no land uses are permitted that significantly detract from the potential of the buffer to achieve the goal of wetland protection. This buffer would consist predominantly of existing fringing vegetation.

    - Where these buffers are unable to be implemented within the proposed development design, additional control measures should be investigated in consultation with experienced wetland hydrologists and engineers to ensure that potential impacts on the SEPP 14 wetland are minimised.

- A weed management and monitoring plan for the CHB development lands should be developed and implemented to minimise the potential for the invasion of aquatic and terrestrial weed species into the SEPP 14 wetland and buffer zones. The weed management and monitoring plan for CHB development lands should be developed in consultation with DECC to ensure consistency with management strategies undertaken for the adjacent Munmorah SCA and offset lands which would be transferred to DECC;

- The management of the development and conservation land interface is critical to ensure that no direct or indirect impacts occur in the short and long term on dedicated offset lands. As such, appropriate management plans should be prepared and implemented within the CHB and Gwandalan development lands in consultation with DECC to ensure consistency of management strategies with adjacent offset lands.

- The minimum amount of clearing should take place as a general objective of the project, particularly within those areas that currently contain identified native vegetation communities. These areas have been described within this report. This is especially important within those areas identified as containing vegetation consistent with EEC's.

- It is recommended that a *Tetratheca juncea* management plan be prepared for the CHB and Gwandalan development lands to ensure the conservation and long term survival of this threatened species within the retained areas of the development estate. The *T. juncea* management plan for the CHB and Gwandalan development lands should be developed in consultation with DECC to ensure consistency with management strategies undertaken for adjacent offset lands (which would be transferred to DECC).

- Mature and / or hollow-bearing trees should be retained wherever feasible and with regards to public safety within the development framework, particularly within Gwandalan development lands where there are no offsets immediately adjacent to the site.

- Pre-clearing inspections should be undertaken by an ecologist in wooded areas where threatened fauna species have been recorded or are considered likely to occur. This is particularly important in areas where threatened fauna have been noted during recent surveys either breeding or nest-building. No breeding attempts should be disrupted during the course of the project, particularly by threatened fauna.

- During the construction phase, for any tree removal within forested areas, and in particular where hollow-bearing trees may be removed, all works should be supervised by an ecologist to recover any native fauna that are potentially displaced. Furthermore, where such risks occur, site-specific ecological advice should be sought to minimise impacts during the entire process. A clearing protocol should be adopted for the removal of trees containing suitable habitat hollows as follows (this is considered as a guideline, variations on the methods employed may be required to accommodate site specific factors):

    - All hollow bearing trees are to be flagged by an ecologist prior to the commencement of works on site.

    - Underscrubbing of the entire site should be carried out by a 4x4 tractor with a slashing deck, this will minimise the establishment of degradation processes and leave a layer of mulch to aid in soil retention in the event of adverse weather. At this time felling of non habitat trees can take place, however a matrix of trees *must* be maintained to allow animal movement into the designated refuge area.

    - After a period of two weeks, clearing of habitat trees should commence. Clearing must be carried out moving from the fringe of the matrix towards the refuge area. Trees should be 'soft felled' and inspected immediately by an ecologist for displaced fauna. All trees must be left for a minimum of two nights prior to being moved to a stockpile, to allow resident fauna to vacate tree hollows.

  Note: Clearing should ideally take place outside of the main breeding seasons of resident fauna, preferably during late Autumn and Winter.

- Species selection for future landscaping works and seed stock for revegetation should be limited to locally occurring native species to maintain local genetic diversity. This should include *Eucalyptus robusta* and other regionally significant species.

- Appropriate vegetation, habitat and bushfire management plans should be included under an overarching Environmental Management Plan for the Gwandalan and .

- Where possible, earthworks (and certainly all works in the vicinity of drainage lines) should be undertaken during appropriate (i.e. dry) weather conditions. This will ensure that any potential erosion events will be intercepted and that no downstream impacts occur within any of the drainage lines. This will help to maintain existing habitat characteristics for native fauna in those areas, including those for threatened species.

- Nutrient and sediment control devices should be erected pre-clearing and post-construction works in sensitive areas where degradation processes may be triggered such as areas adjacent to watercourses until suitable

rehabilitation has occurred to maintain surface integrity. Furthermore, stockpiles should be subject to individual sediment and nutrient control devices.

- Where possible, landscape sediment retention ponds with fringing wetland vegetation (eg *Typha* sp.) to provide habitat for species such as Green and Golden Bell Frog.

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APPENDIX A: MEMORANDUM OF UNDERSTANDING

THE MINISTER FOR THE ENVIRONMENT

and

THE MINISTER FOR PLANNING

and

COASTAL HAMLETS PTY LTD

and

LAKESIDE LIVING PTY LTD

MEMORANDUM OF UNDERSTANDING

I V KNIGHT
Crown Solicitor
60-70 Elizabeth Street
SYDNEY NSW 2000

200600938 D2006/178441

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MEMORANDUM OF UNDERSTANDING

THIS MOU is made on 16TH of October 2006.

Between

1. **THE MINISTER FOR THE ENVIRONMENT** of Level 36, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales; and

2. **THE MINISTER FOR PLANNING** of Level 34, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales

   (together, the "Government"); and

3. **Coastal Hamlets PTY LTD** ACN 100 126 994 (the "CHB Landholder").of 51 Riley St, Woolloomooloo, NSW 2011, a Rosecorp group company; and

4. **Lakeside Living Pty Ltd** ACN 054 400 814 (the "Gwandalan Landholder") of 51 Riley St, Woolloomooloo, NSW 2011, a Rosecorp group company.

Background

A. The New South Wales Government intends to implement an Environmental Land Offset Scheme for the Lower Hunter region to complement and support the Lower Hunter Regional Strategy and the Lower Hunter Regional Conservation Plan.

B. The Environmental Land Offset Scheme aims to:

   (i) increase public ownership of certain land in the Lower Hunter region for dedication as a conservation reserve; and

   (ii) recognise the development potential of certain other land in the Lower Hunter region.

C. The purpose of this MOU is to set out the parties' intentions with respect to the implementation of the Environmental Land Offset Scheme, insofar as it concerns the Landholder.

1. Definitions and interpretation

1.1 In this MOU, unless the context otherwise requires:

"**Conservation reserve**" means any land intended to be reserved or dedicated under the *NPW Act* and includes references to a national park, nature reserve, state conservation area or regional park, as those terms are defined under that Act

"**Development potential of Schedule 1 land**" means the development potential specified in Schedule 1 for each parcel of Schedule 1 land (either hectares or dwellings or both).

"**Dwelling**" has the same meaning as in the *Standard Instrument—Principal Local Environmental Plan.*

"**Environmental Land Offset Scheme**" insofar as it concerns the Landholder means the Environmental Land Offset Scheme described in clause 3 of this MOU.

"**EP&A Act**" means the *Environmental Planning and Assessment Act 1979*, as amended from time to time.

"**Lower Hunter Regional Conservation Plan**" means the Lower Hunter Regional Conservation plan released by the NSW Department of Environment and Conservation, published on that Department's website and as amended from time to time.

"**Lower Hunter Regional Strategy**" means the Lower Hunter Regional Strategy released by the NSW Department of Planning, published on that Department's website and as amended from time to time.

"**Map**" means the untitled map identifying the Coastal Hamlets Pty Ltd holdings in Catherine Hill Bay that is incorporated into this MOU by reference.

"**MOU**" means this Memorandum of Understanding which includes the Schedules and map that are incorporated into this MOU by reference

"**NPW Act**" means the *National Parks and Wildlife Act 1974* as amended from time to time.

"**Rezoning**" means the mechanism of changing the landuse zone for a parcel of land contained in a environmental planning instrument (as defined by the the EP&A Act), noting that this change in landuse zone may be effected by the gazettal of a State Environmental Planning Policy or a local environmental plan.

"**Schedule 1 land**" means the parcels of land owned by the CHB Landholder and the Gwandalan Landholder, referred to in the Lower Hunter Regional Strategy and identified in Schedule 1, or part thereof.

"**Schedule 2 land**" means the parcels of land owned by the CHB Landholder and identified in Schedule 2, or part thereof.

"**TSC Act**" means the *Threatened Species Conservation Act 1995* as amended from time to time.

"Transferred Schedule 2 land" means Schedule 2 land, or part thereof, transferred to the Minister for the Environment in accordance with clause 3.2.

"Wyong Residential Development Strategy" means the Wyong Residential Development Strategy released by Wyong Shire Council in December 2002 and published on the Council's website.

2. Implementation

2.1 The parties are committed to using their best endeavours to implement this MOU.

2.2 The parties acknowledge and agree that:

(a) this MOU is intended to express the parties' objectives and firm intentions with regard to those matters with which it deals, but is not intended to create enforceable or binding legal obligations between them;

(b) nothing in this MOU shall be taken to fetter the discretion of the Minister for Planning in exercising functions under the *EP&A Act* or the Minister for the Environment in exercising functions under the NPW Act or the TSC Act; and

(c) nothing in this MOU is intended to constitute a representation, warranty or guarantee by or on behalf of the Government, the Minister for Planning or the Minister for the Environment.

2.3 All parties acknowledge and agree that they have not relied or acted or forborne from acting in any way as a result of any statement made by any of the parties in this MOU or in discussions leading up to this MOU.

3. The Environmental Land Offset Scheme

3.1 The Landholder intends to develop land identified in the Lower Hunter Regional Strategy by preparing a Rezoning application as soon as practicable and at least within 5 years that is consistent with the development potential of Schedule 1 land.

3.2 The Minister for Planning intends to use reasonable endeavours to allow the Landholder to achieve the development potential of Schedule 1 land by either:

(a) Rezoning the land through an amendment to State Environmental Planning Policy 2005 (Major Projects) and approval of any concept plan submitted under Part 3A of the EP&A Act; and/or

(b) Facilitating the rezoning of the land through the gazettal of a Local Environmental Plan prepared by the relevant local government authority and made by the Minister for Planning and approval of any concept plan submitted under Part 3A of the EP&A Act ; and/or

(c) Any other means that achieves or encourages the more intensive use of the land;

in accordance with the Lower Hunter Regional Strategy, the Lower Hunter Regional Conservation Plan and subject to the requirements of the *EP&A Act*.

3.3 The Landholder intends to transfer ownership of Schedule 2 land to the Minister for the Environment upon the rezoning of Schedule 1 land.

3.4 The Minister for the Environment intends to ensure Transferred Schedule 2 land is dedicated as part of the national park estate or as a conservation reserve.

3.5 The Landholder intends not to undertake any action or activity, pending transfer of Schedule 2 land or rezoning of Schedule 1 land that will have detrimental effect on the conservation or Aboriginal heritage values of Schedule 2 lands except where the Landholder is

(a) directed to undertake such an action or activity by another Government agency or instrumentality (such as the Rural Fire Service and the NSW Department of Primary Industries), or

(b) is otherwise required by law to undertake such an action or activity.

4. Agreement

4.1 Notwithstanding clause 3, the details of the Environmental Land Offset Scheme described in clause 3 are the subject of ongoing negotiation by the parties, which they propose will form part of a legally enforceable agreement to be entered into by them.

4.2 All parties are to use their best endeavours to enter into such an agreement referred to in clause 4.1 as soon as possible noting a target date of three months for this to occur.

4.3 The parties acknowledge that the proposed agreement referred to in clause 4.1 will include a schedule of commitments that set out the sequencing and staging of Schedule 1 land and the dedication for conservation of Schedule 2 lands.

4.4 The parties acknowledge that:

(a) If there is any reduction in Schedule 2 Land to be transferred then a proportional reduction will result for the development potential of the Catherine Hill Bay Schedule 1 Land

(b) If the development potential of the Catherine Hill Bay Schedule 1 Land in relation to the number of dwellings or lots to be achieved is reduced then a proportional reduction will occur in the amount of Schedule 2 Land to be transferred to the Minister for the Environment

5. Term

5.1 This MOU starts on the date it is signed by both parties and continues until the parties enter into an agreement of the type referred to in clause 4, or 5 years, whichever is the later.

This Memorandum of Understanding is signed on 16TH October 2006.

The Honourable Bob Debus MP
The Minister for the Environment

The Honourable Frank Sartor MP
The Minister for Planning

Bryan Rose, Director, for and on behalf of
Coastal Hamlets Pty Ltd

Bryan Rose, Director, for and on behalf of
Lakeside Living Pty Ltd

SCHEDULE 1 – POTENTIAL DEVELOPMENT LANDS

This Schedule forms part of the MOU.

Schedule 1 Land

Property description	Map reference	Development potential
	Catherine Hill Bay – lands shaded green	• Residential development covering up to 60 hectares to achieve 600 dwellings
	Gwandalan – identified as Precinct 1A in the Wyong Residential Development Strategy	Residential development over 26 hectares to achieve 12 dwellings per hectare as proposed in the Residential Development Strategy

SCHEDULE 2 – ENVIRONMENTAL LANDS OFFSETS

This Schedule forms part of the MOU.

Schedule 2 Land

Property description	Map reference	Area
	Catherine Hill Bay and Wallarah Peninsula – Coastal Hamlets Pty Ltd lands within the white outline and not shaded green	Approximately 310 hectares


DEDICATED AREA FOR
GREEN BUFFER 310 ha
83.8% OF ROSECORP SITE
RIO TINTO &
C.A. LAND
60Ha
16.2%
LAKE MUNMORAH
NATIONAL PARK
GRANGAN BAY
MOONEE

APPENDIX B: DGEAR'S

Office of the Director General

Contact: Stephanie Ballango
Phone: 02 9228 6101
Fax: 02 9228 6570
Email: stephanie.ballango@planning.nsw.gov.au

Our ref: Y07/1866
File Ref: S06/00813

Mr Bryan Rose
Managing Director
Rosegroup Pty Ltd
51 Riley St
Wolloomooloo NSW 2011

Dear Mr Rose,

Subject: Catherine Hill Bay and Gwandalan – Director General's Requirements

I refer to your letter and preliminary documentation dated 14 June 2007 requesting the Ministers authorisation to submit a revised concept plan and four individual project applications and the issuing of Director Generals Requirements (DGRs) pursuant to Part 3A project in the *State Environmental Planning Policy (Major Projects) 2005* (Major Projects SEPP) for land at Catherine Hill Bay and Gwandalan.

I can advise that the Minister for Planning made a declaration on 25 June 2007 that the revised concept plan and 4 project applications are subject to Part 3A of the EP&A Act. A notice of the Minister's declaration was published in the Government Gazette on 6 July 2007.

I have attached a copy of the DGRs for the concept plan and four individual project applications. These requirements have been prepared in consultation with the relevant Government authorities, and are based on the information you provided. Please note that under Section 75F(3) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), I may alter these requirements at any time.

As you are aware, the Australian Department of Environment and Water Resources (DEWR) has advised that the proposed development at Catherine Hill Bay and Gwandalan is a controlled action under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). As part of the recent bilateral agreement between the NSW Government and the Australian Government, the Department of Planning sought input from DEWR to the preparation of the DGRs under Part 3A of the EP&A Act. DEWR's comments have been included in the attached DGRs.

Once you lodge the EA for the Concept Plan and four individual project applications they will be the subject of individual tests of adequacy to determine whether the DGRs have been adequately addressed. I may choose to consult with the relevant authorities to determine if they adequately addresses the DGRs. If I consider the EAs to be inadequate, you will be required to revise them prior to public exhibition.

Once the test of adequacy has been undertaken, you will be advised on the consultation and public exhibition arrangements that will apply, including the number of copies (hard copy and CD-ROM) of the EA that will be required for exhibition purposes.

The DGRs will be placed on the Department's website along with other relevant information which becomes available during the assessment of the project. It would be appreciated if all documents submitted are in a suitable format for the web (such as, PDF) and preferably less than 2Mb but no more than 5Mb. Could you please make arrangements for an electronic version of the individual EAs for the project to be hosted on a suitable website and confirm the proposed URL at your earliest convenience.

Finally, please note that the DGRs require a report from a quantity surveyor identifying the capital investment value for the concept plan and the four individual project applications. This report is to be provided at the time of lodgement so that the fees applicable to the applications (see Division 1A, Part 15 of the *Environmental Planning and Assessment Regulation 2000*) can be determined prior to public exhibition of your documentation. At this time, you should provide your completed application form.

Should you have any enquiries, please contact Stephanie Ballango, Team Leader – Strategic Assessments or Antony Pedroza, Senior Planner – Strategic Assessment on 9228 6545.

Yours sincerely

Sam Haddad
Director General

cc. Matthew Crozier
Crozier CGS Pty Ltd

Director-General's Requirements

Section 75F of the Environmental Planning and Assessment Act 1979

Project	**Concept approval** A residential subdivision of the Gwandalan portion of the site and the following for the Catherine Hill Bay portion of the site: An extension of the existing village and restoration of heritage buildings; A new coastal village of up to 600 dwellings; Conservation and public areas comprising approximately 85% of the site; Commercial/retail component; and Associated infrastructure. **4 Project applications** Site preparation works and subdivision at Gwandalan; Site preparation works across the entire Catherine Hill Bay / Moonee site along with subdivision of the site into "super lots"; Subdivision and construction of the Village Centre Precinct; and Subdivision and construction of Hamlet 3.
Location	**Catherine Hill Bay** (Lots 5, 6 and 7 in DP 774923, Part Lot 2031 in DP841175, Lot 2 in DP8049795, Lot 201 in DP702669, Lot A in DP 384745, Lot B in DP 384745, Lot 2 in DP 809795, Lots 3 and 4 in DP 129431) **Gwandalan** (Lot 3 in DP 588206).
Proponent	Lakeside Living Pty Ltd and Coastal Hamlets Pty Ltd
Date issued	1 August 2007
Expiry date	1 August 2009
General requirements (to be addressed by concept plan and each project application individually)	Each Environmental Assessment (EA) must include (1) an executive summary; (2) a detailed description of the project including the: (a) strategic justification for the project; (b) alternatives considered; and (c) various components and stages of the project; (3) a statement that the proposal is being assessed under the Bilateral Agreement, which requires the NSW Government to undertake assessment of the proposal which will address matters of national environmental significance; (4) a consideration of the following with any variations to be justified: (a) all relevant State Environmental Planning Policies (with particular regard to Major Projects SEPP, SEPP 55, SEPP 71 and *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*, (b) applicable planning instruments, (c) relevant legislation and policies, including the *NSW Coastal Policy 1997*, Lower Hunter Regional Strategy, and the draft Central Coast Regional Strategy, (d) Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (5) a consideration of the proposal and cumulative impacts in relation to the development of other future urban land identified in the Lower Hunter Regional Strategy;

	(6) a draft Statement of Commitments, outlining commitments to the project's management, provision / contribution towards infrastructure, mitigation and monitoring measures with a clear identification of who is responsible for these measures; (7) a conclusion justifying the project, taking into consideration the environmental and construction impacts of the proposal, mitigation measures to address these impacts, the cumulative impacts of the proposal, the suitability of the site, and whether or not the project is in the public interest; (8) following consultation with relevant agencies, Councils and other proponents who are proposing development in the vicinity of the site: (a) identify the development contributions or works in kind applicable to the site or within the LGA including regional and local infrastructure, public transport, social infrastructure and community facilities (including open space); and (b) identify any public benefits to be provided by the development and their consistency with any current development contribution plans; (9) A signed statement from the author of the EA certifying that the information contained in the report is neither false nor misleading; and (10) A report from a quantity surveyor identifying the capital investment value for the concept plan and the four individual project applications.
Key Issues (to be addressed by concept plan and each project application individually)	Each EA must address the following key issues: **Independent Panel of Experts** Demonstrate that the proposal is consistent with the Interim Report to Minister from the Independent Panel of Experts constituted to assess the proposed development. In the event that there are inconsistencies between the proposal and the recommendations of the Panel's Report, justification for the departure must be provided as well as evidence demonstrating how a better outcome will be achieved. **EPBC Act – Controlled action** (1) Impacts on species listed under Section 18 and 18A of the *Environment Protection and Biodiversity Conservation Act 1999*; (2) Impacts on other threatened species, populations or ecological communities, critical habitat (including riparian habitat) and native vegetation generally; (3) Impacts on migratory species listed under the *Environment Protection and Biodiversity Conservation Act 1999*; (4) Impacts on RAMSAR Wetlands; (5) Any relevant State and Commonwealth Government Technical and policy guidelines, including the NSW Department of Planning's *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*: *Guide to implementation in NSW* (May 2007); (6) Proposed offset measures to avoid or mitigate impacts on matters of national environmental significance; and (7) Matters outlined in Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulation 2000.* **Heritage** Provide a heritage impact statement in accordance with current NSW Heritage Office guidelines and DECC's *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* that details the heritage significance of the area and any impacts the development may

	have upon this significance. The significance is to include an assessment of natural areas, places of Aboriginal, historic or archaeological significance and consider the impact on existing settlements and the iconic elements, such as the Coal Loader Jetty. **Flora and Fauna impact** Address the impact of the development on threatened species and their habitats having regard to the Threatened Species Assessment Guidelines and recommend offset measures to avoid or mitigate impacts on threatened species and their habitat. **Utilities and Infrastructure** (1) Prepare a utility and infrastructure servicing report and plan for the Site that includes (but is not limited to): (a) identifying and assessing the capacity of existing utility and infrastructure servicing the site, (b) identifying that adequate water supply is available for bushfire suppression operations, (c) identifying all necessary augmentation works to service the site and whether these works can sustain this and other development foreshadowed for the Wallarah Peninsula shown in the Lower Hunter Regional Strategy, and (d) demonstrate compliance with the requirements of any public authorities in regard to the connection to, relocation and/or adjustment of services affected by the development proposal. (2) Provide appropriate detailed information on the drainage, sewerage and stormwater management measures to be incorporated on Site, including (but not limited to): (a) sustainable water measures (such as on site stormwater detention, water sensitive urban design measures, and water recycling); (b) sediment and erosion control measures; and (c) the quality and quantity impacts on surface water, groundwater, the sea or any nearby beach, or an estuary, a coastal lake, a coastal creek or other similar body of water, or a rock platform. **Mining Activities** (1) Assess the potential for the proposed development and associated conservation offsets to: (a) restrict access to and future mining of remnant coal resources at Catherine Hill Bay and particularly below the Gwandalan site; and (b) restrict access for existing petroleum exploration on Petroleum Exploration Licence (PEL) Nos. 5 and 446 and any future exploration; and (c) adversely affect or delay the progress of Lakecoal's Mine Closure Plan for Consolidated Coal Lease (CCL) 706 lodged with Department of Primary Industries. (2) Assess the impact of the proposed development on options to retain or demolish and/or on-going maintenance of the coal loading jetty, located on Mining Purpose Lease (MPL) 211. (3) Provide a risk analysis examining the impacts of the former mining use of the site, and in the vicinity of the site, has on future development. **Contamination and Geotechnical** (1) Identify and address contamination and geotechnical issues

	associated with the works proposed by the project applications. All relevant legislation and guidelines related to contamination and geotechnical issues are to be addressed. (2) Provide a geotechnical report that includes details on the classification of soil type generally found within the subject site and demonstrate how the proposal complies with all relevant Australian Standards, including AS2870 (Residential Slabs and Footings). **Urban design and built form** (1) Provide plans and documentation for the project applications that is of a quality suitable to assess the building typology (including the quantum of floor space). Plans and documentation should be equivalent to the standard ordinarily required for lodgement under Part 4. (2) Address Crime Prevention Through Environmental Design principles with consideration given to the relationship to surrounding areas; pedestrian and bicycle movement to, within and through the site; key connections to the existing village and coast. **Ecologically Sustainable Development** Demonstrate how the development will commit to ESD principles in design, construction and ongoing operation phases. **Energy Savings Action Plan** (1) Demonstrate that the development is capable of achieving the requirements of BASIX and what (if any) commitments will be made on other environmental rating tools such as Greenstar and the Australian Building Rating Scheme. (2) Prepare an Energy Savings Action Plan in accordance with the requirements of the DWE and the *Guidelines for Energy Savings Action Plans*, DEUS 2005. **Traffic and Transport** Prepare a Traffic Study in accordance with RTA's *Guide Traffic Generating Developments* that includes (but is not limited to) the following: (a) Identify all relevant vehicular traffic routes and intersection for access and egress; (b) Current traffic counts for all of the above traffic routes and intersections; (c) The anticipated vehicular traffic generated from the proposed lots; (d) Consideration of the traffic impact on the existing intersections and the capacity of the Pacific Highway to safely and efficiently cater for the additional vehicular traffic generated; (e) An analysis of the cumulative traffic and transport impacts of this development on the existing township and taking into consideration other proposed developments; and (f) Traffic analysis, using SIDRA or similar traffic model, for the relevant intersections including: (i) Current and traffic growth projects for the life of the project; (ii) 95th percentile back of queue lengths; and (iii) Delays and level of service on all legs. **Bushfire** (1) Demonstrate compliance with the current version of *Planning for Bush*

	Fire Protection and AS3959 (Building in Bush Fire Prone Areas). The EA is to identify the ongoing management arrangements of any proposed APZ. (2) Identify future management regimes for any areas of hazard remaining within the subject area. This should focus on the level of hazard posed to future development by the land or adjacent land and how the hazard may change as a result of development. **Impacts on Crown land** Identify potential direct and indirect impacts arising from the development on the adjacent Munmorah State Conservation Area and Point Wollstonecraft State Recreation Area. **Site preparation works** Provide a report that includes (but is not limited to): (a) a detailed survey showing existing and proposed levels and quantities of fill necessary for site preparation works; (b) details on the source of fill including types of materials and their source; and (c) details of the quantity and quality of any excess material and arrangements for its disposal. **Subdivision** (1) Provide proposed plans of subdivision that identify all covenants, easements and notations proposed for each land title and, if relevant, how the subdivision is to be staged. (2) Provide detail on the management arrangements for all land to be subdivided, including (but not limited to) titling arrangements; land ownership (particularly future public land); and all proposed covenants and restrictions, including those relating to access. (3) Outline the long-term management and maintenance of any areas of open space or conservation (including off-set areas) or both, including the ownership and control, management and maintenance of funding public access revegetation and rehabilitation works and bushfire management. **Previous Submissions** The EA is to respond to the issues raised in submissions received by the Department following the public exhibition of the Concept Plan between 3 January 2007 and 2 March 2007.
Consultation	During the preparation of the EA, you should undertake an appropriate and justified level of consultation with any relevant parties, having regard to previous consultation with the Independent Panel of Experts and the Community Reference Group. Any such consultation prior to exhibition should be documented in the EA. In particular, consultation should be considered with: *(1) Agencies and other authorities:* (a) Commonwealth Department of Environment and Water Resources; (b) Lake Macquarie Council; (c) Wyong Shire Council; (d) Hunter Water; (e) Gosford/Wyong Council's Water Authority; (f) Local Aboriginal Land Council;

	(g) Catchment Management Authority - Hunter – Central Rivers; (h) NSW Department of Water and Energy; (i) NSW Department of Primary Industries; (j) NSW Department of Environment and Climate Change; (k) Heritage Office, Department of Planning; (l) NSW Roads and Traffic Authority; (m) NSW Emergency Service agencies, namely NSW Police Department, the Ambulance Service of NSW, the State Emergency Service, NSW Rural Fire Service, and NSW Fire Brigades; and (n) All utility providers.
Deemed Refusal Period	120 days