4.2.2 Habitat Attributes

Three 50 metre x 100 metre (5000m^2) quadrats were established within the survey area to provide quantitative data on the following fauna habitat attributes (Figure 3):

- Number and size of hollows,
    - Large – suitable for large arboreal marsupials such as *Trichosurus vulpecula* Common Brushtail Possum,
    - Medium – suitable for medium sized arboreal marsupials such as *Petaurus norfolcensis* Squirrel Glider,
    - Small – suitable for small marsupials such as *Acrobates pygmaeus* Feather-tail Glider,
    - Owl – suitable for large forest owls such as *Ninox strenua* Powerful Owl.
- Number of Squirrel Glider feed species (following Menkhorst *et al*. 1988; Sharpe & Goldingay 1998; Smith & Murray 2003),
    - *Banksia* spp.
    - *Acacia* spp.
    - *Persoonia* spp.
    - *Melaleuca* spp.
    - *Leptospermum* spp.
    - *Xanthorrea* spp.
- Number and size of hollow logs.

Plot 1 and Plot 3 were located within the Coastal Sand Apple/Blackbutt Forest while Plot 2 was located within the Swamp Forest. An estimate of hollows per hectare per community was obtained.

4.2.3 Fauna

Fauna surveys were undertaken between 11 and 14 September 2006 by two ecologists. The following surveys were undertaken to target specific animal groups (refer to Figure 3) (see Appendix 1 for details of methods):

Non-Flying Mammals:

- Arboreal trapping targeting *Petaurus norfolcensis*,
- Terrestrial trapping targeting small dasyurid marsupials and native rodents,
- Koala spot surveys (PSC 2001), and
- Nocturnal spotlight surveys targeting *Phascolarctos cinereus* Koala, possums and gliders.

Flying Mammals:

- Ultrasonic call detection targeting Microchiropteran bats,
- Spotlighting for Megachirotperan bats.

Avifauna:

- Diurnal bird surveys targeting all habitat types within and adjacent to the study area.

Herpetofauna:

- Nocturnal and diurnal surveys for amphibians in suitable habitat,
- Opportunistic habitat searches for reptiles.

5.0 RESULTS

5.1 Desktop Studies

5.1.1 Proximate Threatened and Migratory Species

A search of the Atlas of NSW Wildlife (DEC 2006) indicates that 26 threatened fauna species (excluding marine mammals and reptiles, oceanic and estuarine birds), 9 threatened flora species and 1 endangered population have been recorded within the local area (Appendix 2). Of these, 18 fauna species, 3 flora species and 1 endangered population are considered to have potential habitat within the study area (refer to Table 23 in section 7.0).

The Protected Matters Search Tool (DEH 2005) indicates that 8 threatened fauna species, 5 threatened flora species and 7 terrestrial migratory birds have been recorded within a 10 kilometre radius of the study area (Appendix 3). Of these, 6 threatened fauna species, 5 threatened flora species and 6 terrestrial migratory birds are considered to have potential habitat within the study area (Table 23; Section 7).

A habitat assessment for threatened and migratory species is included in Appendix 2.

5.1.2 Regional Vegetation Mapping

Table 2 shows the vegetation communities mapped by House (2003) within a 1 kilometre radius of the study area.

TABLE 2 – LHCCREMS VEGETATION COMMUNITIES (HOUSE 2003)

Map Unit	Description	Canopy Label	Inferred EEC	Area (ha)
33	Coastal Sand Apple - Blackbutt Forest	*A. costata / E. pilularis / Banksia serrata*		109.19
37	Swamp Mahogany - Paperbark Forest	*Melaleuca quinquenervia / E. robusta / C. glauca*	Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.	176.44
46	Freshwater Wetland Complex	*Ludwigia peploides subsp montevidensis / Paspalum distichum / Eleocharis sphacelata / Juncus usitatus*	Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.	3.98
47	Mangrove-Estuarine Complex	*Avicennia marina subsp australasica / Sarcocornia quinqueflora subsp quinqueflora / Aegiceras corniculatum*		20.76
48	Coastal Clay Heath	*Allocasuarina distyla /Hakea dactyloides / Melaleuca nodosa*		1.28

As indicated in Table 2, 5 vegetation communities have been mapped as occurring within a 1 kilometre radius of the study area (House 2003). Of these, Map Unit (MU) 37 and MU 33 are indicated as occurring within the study area. MU 37 is considered to be representative of “swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions” an Endangered Ecological Community (ECC) listed pursuant to Schedule 1 of Part 2 of the TSC Act (NSW Scientific Committee 2004).

5.2 Flora

Flora surveys resulted in the identification of 114 species from 47 families (Appendix 4). Of these, 15 (13%) were exotic. *Lantana camara* and *Chrysanthemoides monilifera* are listed as Noxious weeds in Port Stephens LGA and as such the requirements of the *Noxious Weeds Act 1993* as they relate to these species would need to be complied with. This is discussed further in section 6.2 of this report.

TABLE 3 – TOTAL FLORA SURVEY EFFORT

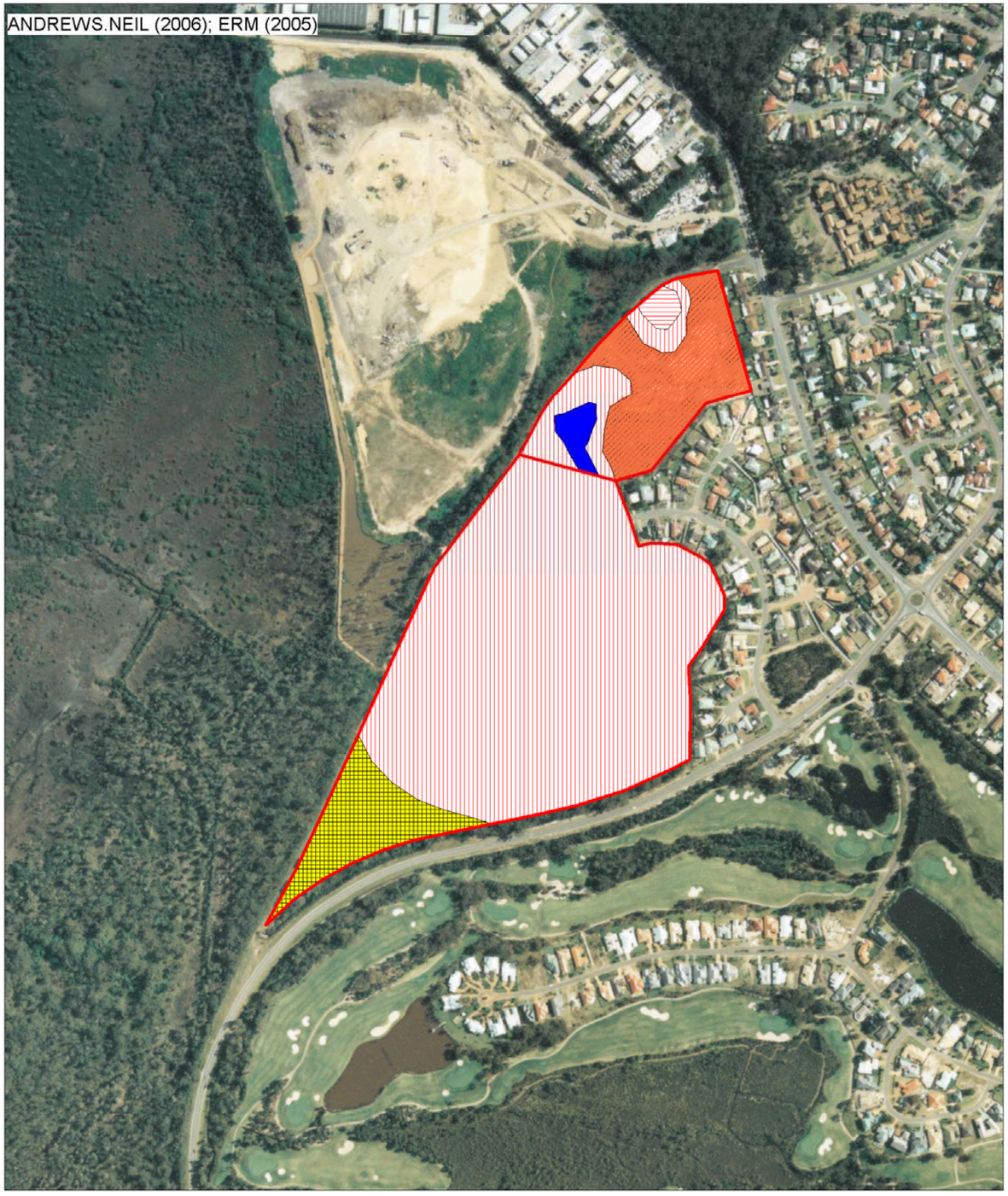
Survey Method	Aggregate Effort
Random Meander	18 Hours
400m^2 Quadrats	9 quadrats

5.2.1 Vegetation Communities

Table 4 identifies the vegetation communities identified within the study area by ERM (2005a) and Andrews.Neil (2006) (refer to Figure 4).

TABLE 4 – VEGETATION COMMUNITIES WITHIN STUDY AREA

Map Unit	Description	Reference	Location in Study Area	Area (m^2)	Area (ha)
1	Coastal Sand Apple/Blackbutt Forest	ERM (2005a); Andrews.Neil (2006)	Stage 1; Stage 2	157636	15.76
2	Lepironia Swamp	ERM (2005a)	Stage 1	3129	0.31
3	Disturbed Re-growth	ERM (2005a)	Stage 1	26487	2.65
4	Swamp Mahogany Paperbark Forest	ERM (2005a)	Stage 1	1994	0.2
5	Swamp Forest	Andrews.Neil (2006)	Stage 2	18035	1.8



Vegetation Communities
(Andrews.Neil 2006; ERM 2005)

- MU 1 - Coastal Sand Apple/Blackbutt Forest
- MU3 - Disturbed Re-growth
- MU 2 - Lepironia Swamp
- MU 5 - Swamp Forest
- MU 4 - Swamp Mahogany Paperbark Forest

Vegetation Communities (House 2003)

- MU 48 - Coastal Clay Heath
- MU 33 - Coastal Sand Apple - Blackbutt Forest
- MU 46 - Freshwater Wetland Complex
- MU 47 - Mangrove-Estuarine Complex
- MU 37 - Swamp Mahogany - Paperbark Forest

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FIGURE 4: Vegetation Communities

PROJECT: Salamander Waters

CLIENT: Port Stephens Council

WORKSPACE: T:\04\04107 Hill PDA (PS Council) Salamander Waters\Map\03 wor\Ecology Figures\Final Figures\050707_Figure_4.WOR

NOTE: All features are approximate only and subject to detailed survey.

Vegetation communities identified in stage 2 by Andrews.Neil (2006) are described below. Map Unit 2, 3 and 4 have been described in previous ecological assessments (Conacher Travers 1998; ERM 2005a).

Map Unit 1 - Coastal Sand Apple/Blackbutt Forest

Description	This community occupies approximately 16 hectares of the study area (Figure 4). It is characterised by a tall tree stratum co-dominated by *Angophora costata*, *Eucalyptus pilularis* and *Corymbia gummifera*. The middle stratum is dominated by *Monotoca elliptica* and *Banksia serrata* with the dominance varying throughout the site. The lower stratum is characterised by a relatively continuous layer of *Pteridium esculentum* indicating that the study area is subject to fairly frequent fire. This community is consistent with the description of Map Unit 33 – Coastal Sand Apple-Blackbutt Forest (House 2003).
Habitat Value	This community provides habitat for a range of fauna species. There is a high density of hollow bearing trees which would provide roosting/nesting/denning habitat for hollow dependant fauna. The middle stratum contains a high density of *Banksia serrata* providing a seasonal foraging resource for nectarivorous species such as Squirrel Glider. Continuous vegetation within the lower stratum together with a high density of woody debris and hollow logs provides good quality habitat for terrestrial vertebrates.
Upper Stratum (≤ 20m)	*Angophora costata, Eucalyptus pilularis, Corymbia gummifera*.
Mid Stratum (≤ 12m)	*Monotoca elliptica*, *Banksia serrata*, *Persoonia levis*, *Acacia longifolia*, *Xylomelum pyriforme*, *Dodonaea triquetra*.
Lowest Stratum (≥ 1m)	*Pteridium esculentum*, *Imperata cylindrica*, *Tetratheca ericifolium*, *Ricinocarpus pinifolius*, *Bossaiea rhombifolia*, *Gonocarpus micranthus*, *Lomandra longifolia*.
Vines/Climbers	*Kennedia rubicunda*, *Cassytha glabscens*, *Hardenbergia violaceae*, *Pandorea pandorana*, *Billaderia scandens*.

Map Unit 5 - Swamp Forest

Description	This community occurs within the south western section of the study area and is approximately 1.8 hectares in area (Figure 4). It is likely that this community is representative of a remnant ecotone between low lying swamp forest and coastal sand Apple/Blackbutt forest due to the existence of emergent *Angophora costata* and the frequent occurrence of *Banksia serrata*. Generally, this community is characterised by a relatively continuous tree stratum dominated by *Melaleuca quinquenervia* and to a lesser extent *M. sieberi*. *Eucalyptus robusta* generally occurs as an emergent however a number of juvenile *E. robusta* occur in the middle stratum. The lower stratum is dominated by *Baloskion tetraphyllum, Blechnum indicum* and *Gahnia clarkeii*. *Pteridium esculentum* frequently occurs towards the edges of the community. This community is consistent with the description of MU 37 – Swamp Mahogany Paperbark Forest (House 2003) and as such would represent the EEC "swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions" (NSW Scientific Committee 2004).
Habitat Value	This community provides habitat for a range of fauna species. Notably, *Phascolarctos cinereus* Koala and *Petaurus norfolcensis* Squirrel Glider were both recorded within this community during the survey period.
Emergent (≤ 20m)	*Eucalyptus robusta*, *Angophora costata.*
Upper Stratum (≤ 14m)	*Melaleuca quinquenervia, M. sieberi.*
Mid Stratum (≤ 10m)	*M. seeberi*, *M. quinquenervia*, *Banksia serrata, Leptospermum polygalifolium, Monotoca elliptica, Elaeocarpus reticulatus*.
Lowest Stratum (≤ 2m)	To 2m: *Baloskion tetraphyllum*, *Blechnum indicum, Gahnia clarkeii, Leptocarpus tenax, Gleichenia dicarpa*.
Vines/Climbers	*Pandorea pandorana, Smilax glycine*.

5.3 Fauna

TABLE 5 – PREVAILING WEATHER CONDITIONS

Parameter		September 2006			
		11	12	13	14
*Temperature**		9°C - 18°C	9°C - 18°C	9°C - 21°C	6°C - 24°C
Wind		Strong S	Moderate-Strong S	Nil	Nil
Cloud		100%	100%	50%	Nil
*Rain** *(24 hrs to 9:00am)*		25-50mm	10-25mm	1-5mm	0
Sun	*Rise*	5:43	5:42	5:37	5:35
	Set	18:12	18:13	18:16	18:17
Moon	*Rise*	9:15	10:15	14:20	15:35
	Set	20:01	20:42	00:11	02:16

*Rainfall and Temperature data from Australian Bureau of Meteorology http://www.bom.gov.au/cgi-bin/climate/rainmaps accessed 19 September 2006.

Fauna surveys resulted in the identification of 75 species consisting of 1 reptile, 6 amphibians, 50 birds and 18 mammals (Appendix 5). Of these, 5 species are listed as Vulnerable pursuant to the TSC Act and 4 bird species are listed as Migratory pursuant to the EPBC Act (Table 7; Figure 5).

TABLE 6 – TOTAL FAUNA SURVEY EFFORT

Survey Method	Aggregate Effort
Arboreal HWR Glider Traps	84 trap nights
Terrestrial A –Type Elliott Traps	57 trap nights
Mammal Spotlighting	8 hours
Koala Spot Surveys	8 hours
Bat Detection	26 hours
Habitat Search	8 hours
Diurnal Avifauna	3 hours

TABLE 7 – THREATENED AND MIGRATORY SPECIES

Family	Scientific	Common	Legal Status*
MYOBATRACHIDAE	*Crinia tinnula*	Wallum Froglet	V (TSC Act)
PHASCOLARCTIDAE	*Phascolarctos cinereus*	Koala	V (TSC Act)
PETAURIDAE	*Petaurus norfolcensis*	Squirrel Glider	V (TSC Act)
MOLOSSIDAE	*Mormopterus norfolkensis*	Eastern Free-tail Bat	V (TSC Act)
VESPERTILIONIDAE	*Miniopterus australis*	Little Bent-wing Bat	V (TSC Act)
ANATIDAE	*Cygnus atratus*	Black Swan	M (EPBC Act)
	Chenonetta jubata	Australian Wood Duck	M (EPBC Act)
CHARADRIIDAE	*Elseyornis melanops*	Black-fronted Dotterel	M (EPBC Act)
SYLVIIDAE	*Acrocephalus stentoreus*	Clamorous Reed-Warbler	M (EPBC Act)

*V = Vulnerable; M = Migratory

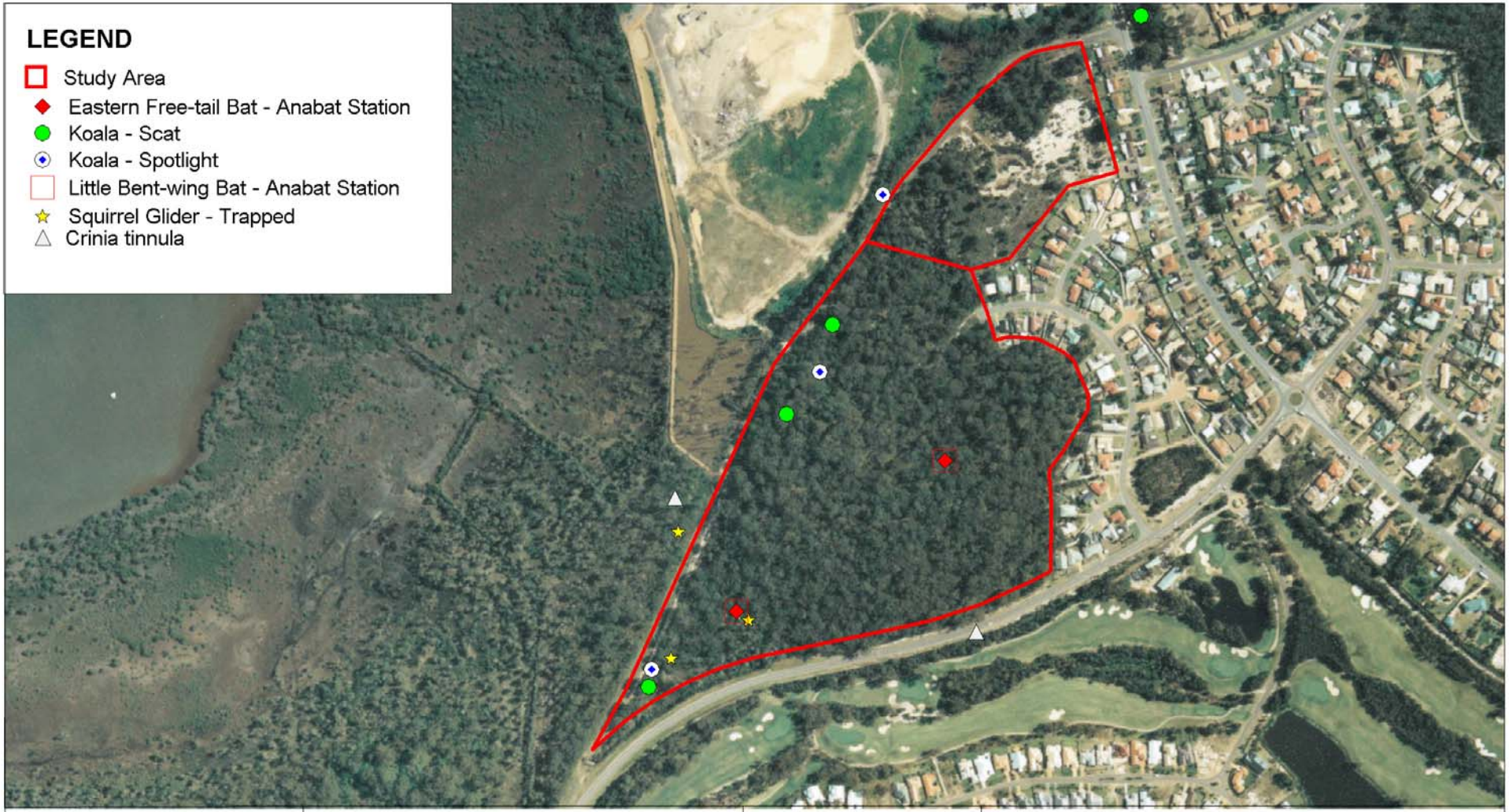

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FIGURE 5: Field Surveys

PROJECT: Salamander Waters

CLIENT: Port Stephens Council

WORKSPACE: T:\04\04107 Hill PDA (PS Council) Salamander Waters\Map\03 wor\Ecology Figures\Final Figures\050707_Figure_5.WOR

NOTE: All features are approximate only and subject to detailed survey.