November | 13

DARKHEART
Eco-Consultancy

STATUTORY ECOLOGICAL IMPACT ASSESSMENT

Proposed Residential Development Of Precinct 3, Old Bar.

Prepared For:

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NOTE:

This report is presented on an objective basis to fulfil the stated legislative obligations, consideration and requirements in order to satisfy the client's instructions to undertake the appropriate studies and assessments. It is not directly intended to advocate the proponent's ambitions or interests, but is to provide information required in the determination of development consent by the decision-making authority for the subject proposal.

To the best of our knowledge, the proposal described in this assessment accurately represents the proponent's intentions when the report was completed and submitted. However, it is recognised and all users must acknowledge that conditions of approval at time of consent, post development application modification of the proposal's design, and the influence of unanticipated future events may modify the outcomes described in this document. Completion of this report has depended on information and documents such as surveys, plans, etc provided by the proponent. While checks were made to ensure such information was current at the time, this consultant did not independently verify the accuracy or completeness of these information sources.

The ecological information contained within this report has been gathered from field survey, literature review and assessment based on recognised scientific principles, techniques and recommendations, in a proper and scientific manner to ensure thoroughness and representativeness. The opinions expressed and conclusions drawn from this report are intended to be objective, based on the survey results and this consultant's knowledge, supported with justification from collated scientific information, references/citations or specialist advice.

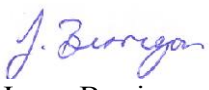
Furthermore, it is clarified that all information and conclusions presented in this report apply to the subject land at the time of the assessment, and the subject proposal *only*.

This report recognises the fact, and intended users must acknowledge also, that all ecological assessments are subject to limitations such as:

- Information deficits (eg lack of scientific research into some species and availability of information)
- Influences on fauna detectability eg season in which survey is undertaken
- Influences on species occurrence eg stage of lifecycle, migratory, etc
- Time, resource and financial constraints.

All users should take into account the above information when making decisions on the basis of the findings and conclusions of this report.

For and on behalf of Darkheart Eco-Consultancy,



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EXECUTIVE SUMMARY

The study site is approximately 57ha in area and forms part of an area of currently zoned future development land known as Precinct 3. It lies in the south of the small coastal town of Old Bar and is generally surrounded by a mix of residential areas, small rural holdings, vacant private land and State Forest.

The development proposal is to establish a new residential and large lot residential subdivision on the site containing a total of 519 Lots. The development footprint for the subdivision is approximately 48ha, and falls over land zoned R2 and R5 under the GTCC LEP 2010. A 7ha conservation zone/corridor is proposed in the northwest of the site, and a drainage reserve is planned adjacent to Forest Lane.

The vegetation on the site largely consists of derived grassland with some areas of open and modified forest in the north. Lack of management in recent years over some parts of the site has also seen the regeneration of shrubland and forest communities. Hollow-bearing trees were present in the northwest and northeast of the site, with the most significant trees generally falling into the conservation zone. Trees in the development footprint appear to be mostly dominated by common woodland birds.

Precinct 3 has been subject to a long history of disturbances such as clearing, underscrubbing, cattle grazing and sand mining in the southeast. No threatened flora species were detected, and none were considered likely occurrences. None of the site's vegetation communities qualified as Threatened Ecological Communities due to the lack of alluvial soils and/or indicative floristic assemblages.

A full suite of fauna surveys were undertaken on the site over 2 weeks which resulted in the detection of three threatened birds (Powerful Owl, Osprey, Brown Treecreeper), the Grey-Headed Flying Fox, the Little and Eastern Bent-Wing Bats, and the East-Coast Freetail-Bat. A further 16 threatened species of mammals and birds (eg a number of Yangochiropteran bats, Square-Tailed Kite, forest owls, Squirrel Glider, Brushtailed Phascogale) were also considered to have varying potential to occur on the site and study area given the presence of suitable habitat and local records. For all these species, the site would only form a small to minute fraction of their wider range.

Previous assessments have found that parts of the site qualify as Potential Koala Habitat, but did not confirm the presence of Core Koala Habitat. Targeted survey for Koalas and Koala scats in this survey also failed to detect a resident Koala population or habitat usage. Consequently the previous finding that site does not contain Core Koala Habitat was reaffirmed, and a Koala Plan of Management is not required.

While the removal/modification of up to about 24ha of native vegetation for the proposed development will have the generic negative effect of removal of some known/potential foraging habitat and reduced carrying capacity of the study area for most of the subject fauna species: in context of the ecology of known and potentially occurring threatened species, and extent of remaining habitat on and adjacent to the site, this action is not considered likely to have an impact of sufficient order of magnitude to place a local population at risk of extinction.

Hence referral to DSEWPC for approval under the EPBCA 1999 or a Species Impact Statement is not considered required.

1.0 INTRODUCTION

This firm has been requested to undertake the required statutory ecological assessments for a proposed staged residential development of Precinct 3, Old Bar.

The impact assessment in this report has been undertaken for this development proposal in accordance with Section 5A of the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Conservation (TSCA) Act 1995* which in turn has been amended by the *Threatened Species Conservation Legislation Amendments Act 2002* (Seven Part Test for Significance); and the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBCAA*) Act 1999* - Matters of National Environmental Significance.

The survey and assessment was performed in consideration of the draft *Threatened Species Survey and Assessment – Guidelines for Developments and Activities* (DEC 2004), and the *Threatened Species Assessment Guidelines – Assessment of Significance* (DECC 2007). The assessment has also been undertaken in accordance with the *Ecological Consultants Association of NSW – Code of Ethics* (2002) available at www.ecansw.org.au.

2.0 BACKGROUND INFORMATION

2.1 LOCATION OF THE STUDY SITE

See Figure 1 for location of the site in the local context. The site is located in the south of Old Bar on the mid north coast of NSW. The site is divided by Forest Lane, and the main street of Old Bar lies approximately 600m northeast. Access is gained from Forest Lane or Blue Haven Drive.

The **study site** is defined as the 57ha development site assessed in this report and shown in Figure 1 & 2. The **study area** consisted of the site and the adjacent land within 100m of the site. The **locality** is defined as land within a 10km radius of the study site. These definitions are consistent with DECC (2007).

2.2 DEVELOPMENT PROPOSAL

The proposal involves the subdivision of the residential portions of Precinct 3 (Figure 2) as part of the Old Bar/Wallabi Point Development Strategy (GTCC 2001). The majority of the development comprises high-density residential with a small number of rural lifestyle blocks in the northwest of the site. A total of 190 Lots are proposed south of Forest Lane contained within two development areas defined as 'Jarberg north' and 'Jarberg west'. A total of 329 Lots are proposed north of Forest Lane spread over the six current Lots (Figure 2). Future development in Precinct 3 will include a nine hole golf course and manufactured home estate (GTCC 2001, GHD 2010). The development footprint falls over areas zoned R2 (Residential) and R5 (Large Lot Residential) under GTCC Local Environmental Plan (LEP) 2010.

Approximately 7ha of open forest in the northwest of the site will be retained as a conservation zone/corridor which provides linkage from retained habitat in Precinct 2B to the north though the site, to Kiwarrak State Forest to the south (Terra 2004, Umwelt 2007). A 30m setback on the north side of Forest Lane is also proposed to be retained as a drainage reserve.

Figure 1: Local position of the site

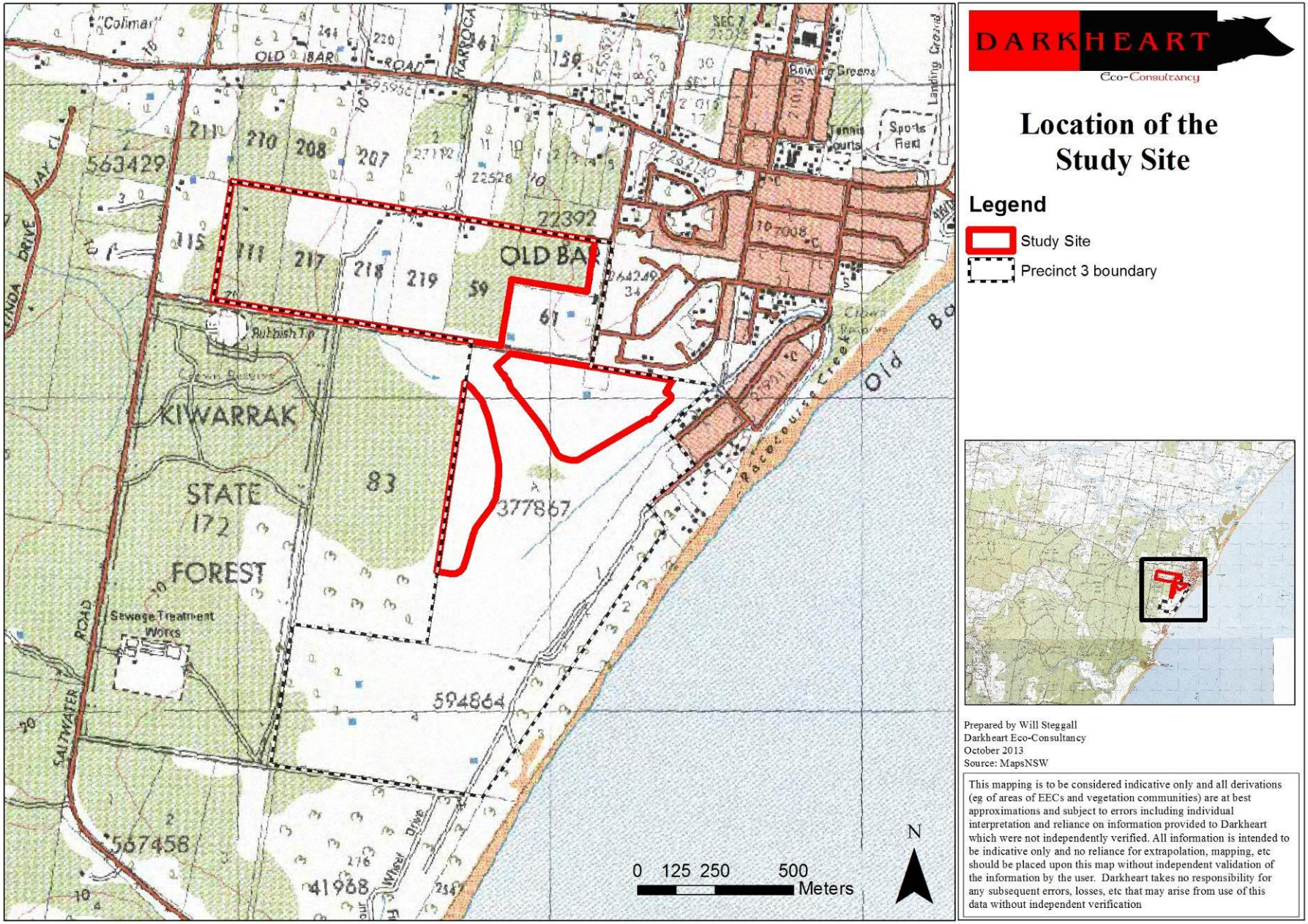
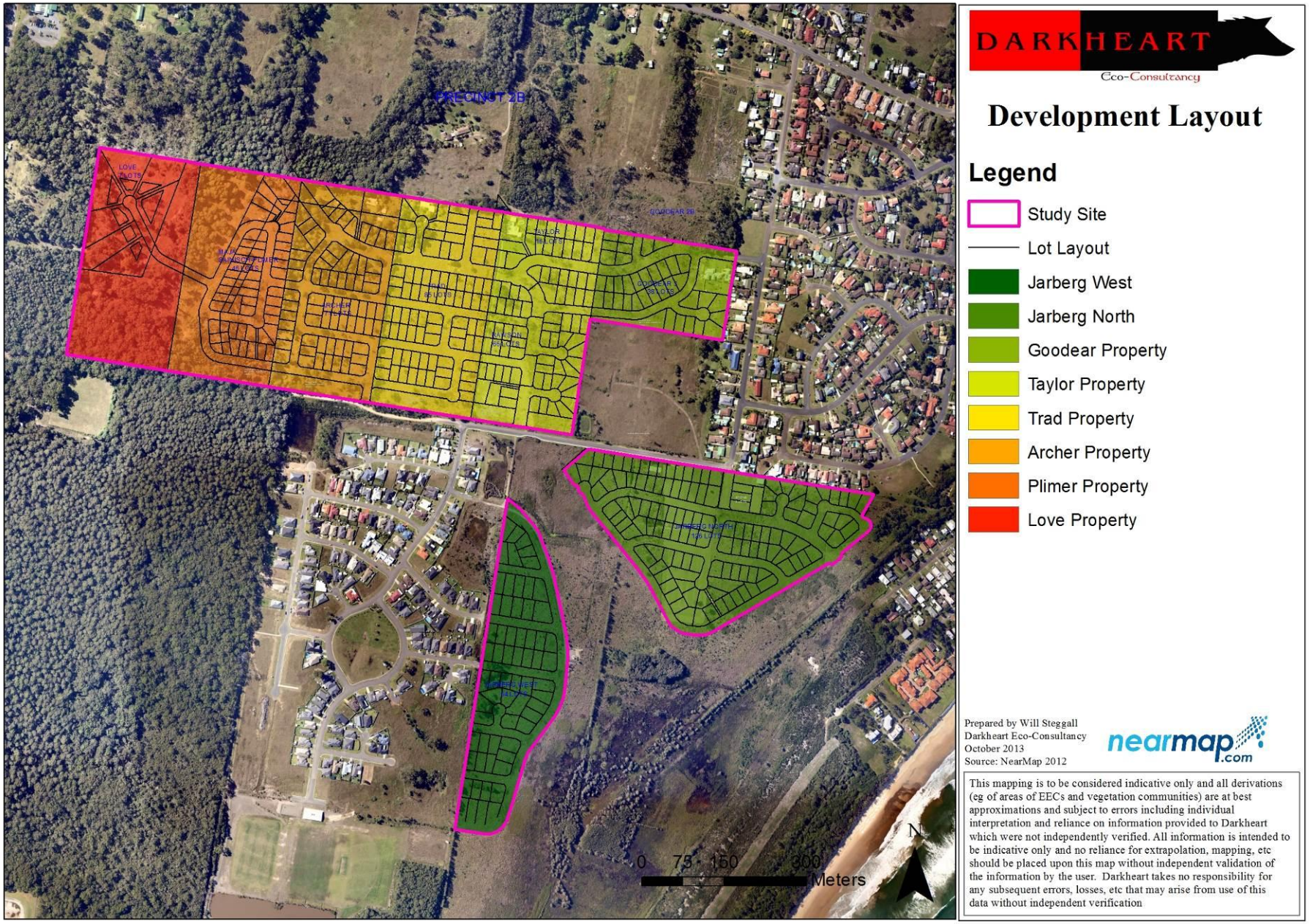


Figure 2: Proposed development layout



The proposed subdivision will involve removal of all vegetation in the development footprint, which is an estimated 48ha. The affected vegetation consists primarily of exotic grassland with patches of regrowth shrubland generally providing only limited habitat values for threatened species eg generic foraging habitat as part of their local range. Approximately 4.6ha of open forest and 14ha of highly modified/regrowth forest will require removal in the north. The highest quality habitat and most of the hollow-bearing trees in the northwest of the site will be largely retained within the proposed corridor which interlinks to substantial areas of potential habitat for the known and potentially occurring threatened species.

2.3 CLIMATE AND WEATHER

2.3.1 Climate of the Bioregion

The climate of the north coast of the North Coast Bioregion from just north of Newcastle to the Queensland border is generally warm temperate. The main influence is the latitudinal position of subtropical anticyclone centres which move easterly across Australia.

In Summer, warm moisture-laden east to south east winds prevail, sometimes bringing rain, with the heaviest in the form of thunderstorms or depressions from subtropical cyclones moving south. In Winter, the northern movement of the anticyclones leads to a dominance of usually dry west to south winds, often leading to fine sunny days and cool nights. Rainfall is usually associated with cold fronts and the coldest temperatures.

Rainfall tends to be distributed more in Summer in the north of the region, to relatively evenly distributed in the south. Annual rainfall is most influenced by distance from the coast and topographic position, with a general decrease from east to west. Annual rainfall in the Greater Taree area is approximately 1178mm pa (Australian Bureau of Meteorology), falling predominantly in Summer and Autumn.

Temperature over the region primarily varies with altitude, decreasing about 5^{o} per 300m rise, and about 2-3^{o}C from north to south in areas of similar altitude. The average annual temperature on the coast is typically 16-20^{o}C, while the annual range is 18-22^{o}C (Australian Bureau of Meteorology, cited in Hager and Benson 1994).

2.3.2 Weather Conditions During Survey

The survey was conducted from the 2nd -13th of September 2013. Weather conditions were generally cool in the mornings and evenings and warm during the day with low to moderate winds. No rain occurred during the survey and only 2.8mm of rainfall was recorded for the previous month.

Minimum temperatures ranged from 6.2-16.1°C with maximums ranging from 23.5-31.2°C (www.bom.gov.au – nearest weather station at Taree airport). The moon phase ranged from one quarter to new moon to half-moon over the survey period.

2.4 SOILS, TOPOGRAPHY AND GEOLOGY

2.4.1 Topography of the Site

The entire study area is low relief, and slopes gradually from 10-20m above sea level (ASL) in the north, to a low-lying basin in the south which is centred on the large swamp adjacent to the site. The low elevation areas lie below the 1:100 flood level and are prone to regular inundation (GHD 2010).

The site and surrounding land form the catchment for Racecourse Creek which flows northeast and

discharges at Old Bar Beach. Several artificial drainage lines occur in the study area which direct flow into Racecourse Creek, often intensifying local flooding (GHD 2010).

2.4.2 Soils and Geology

The elevated parts of the site are underlain by the residual Failford and Diamond Head Soil Landscape Groups. These groups are described as having Yellow Podzolics, Soloths and Lithosols and are generally well-drained and infertile (Terra 2004). Low-lying areas comprise relic beach ridge, estuarine and swamp deposits as discussed below.

The site features a complex geology consisting of alluvial, marine and undifferentiated sediments, as well as sandstone bedrock as seen in Figure 4 (Troedson & Hashimoto 2008). A coastal barrier system underlies the eastern half of Jarberg north and the southeastern portion of Jarberg west, which is comprised predominantly of marine sands along with silt, clay gravel and organic mud. This merges westward into undifferentiated sediments of marine/estuarine/alluvial provenance comprising a mix of marine and fluvial sand, clay and silt. A narrow alluvial fan consisting of fluvial sand, silt, gravel and clay extends between Jarberg west and Jarberg north, just extending onto the Trad and Taylor Lots. Sandstone and siltstone bedrock of the Koorainghat Beds underlies the remainder of the site (Troedson & Hashimoto 2008).

2.5 LANDUSE AND DISTURBANCE HISTORY

2.5.1 General Past and Present Uses

A detailed history of the site was not obtained from the client. As indicated in the literature and noted by residents, the site and general area has been subject to a long disturbance history which has included cattle grazing, sand mining, clearing and slashing.

Almost the entire southern part of the site has been historically cleared for cattle grazing. Fencing, and the cattle ramp and pond adjacent to Forest Lane (Photo 1) are evidence of this. Once cattle were removed, slashing occurred annually up until seven years ago (resident reports) and some vegetation has since regrown.

In the north of the site, some remnant forest still exists, however the majority has been cleared and maintained via underscrubbing and slashing.

2.5.2 Fire

Only old fire scars and some charcoal were noted on canopy trees in the north of the site which indicated fires have not passed through the site in over 5-10 years.

It is unknown if fires have occurred in the southern portions of the site.

2.5.3 Weed Invasion

Weeds are a dominant feature over most of the site however they are primarily limited to the ground layer. Exotic pasture grasses such as Setaria, Whisky Grass, Rats Tail Grass, Carpet Grass and Common Paspalum are the most common. A few patches of Lantana are scattered throughout the north of the site. A number of native and exotic ornamental garden plants also occur around the residences in the north.

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Figure 3: Quaternary geology of the study site

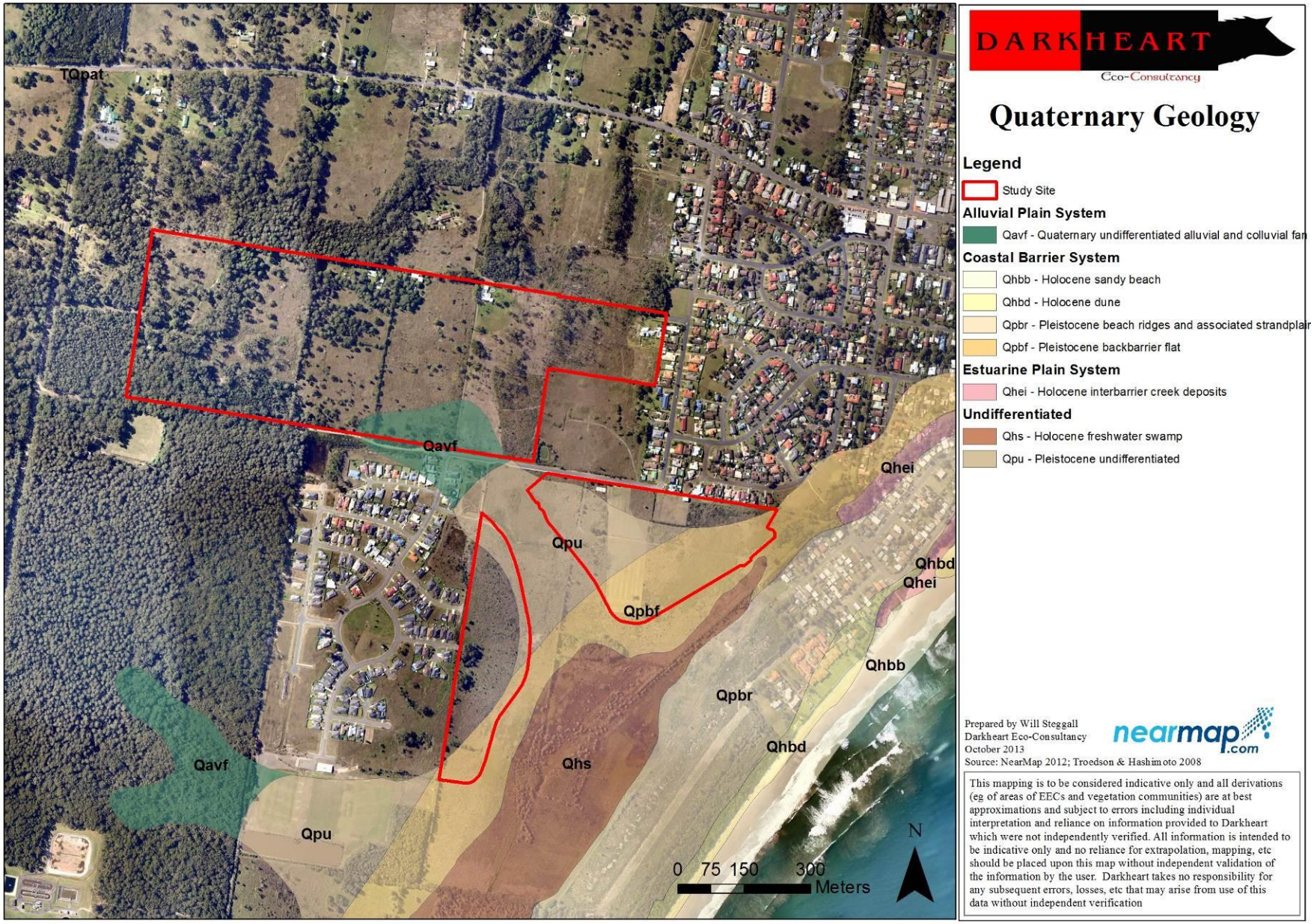


Photo 1: Disused cattle ramp next to driving range

Photo 2: View of Jarberg north from Forest Lane

Photo 3: View of Taylor property from Forest Lane

2.6 ADJACENT DEVELOPMENTS AND ACTIVITIES

The total site is generally surrounded by a mix of residential areas, small rural holdings, vacant private land and State Forest. Ocean Blue estate adjoins Jarberg West and Kiwarrak State Forest occurs beyond here. Recently established Council sports fields adjoin the south of Ocean Blue estate and a driving range occurs in Jarberg north.

Future development land occurs to the north (Precinct 2B) and south as part of Precinct 3. The Old Bar township lies to the northeast

2.7 PREVIOUS RELEVANT ECOLOGICAL INVESTIGATIONS

A summary of previous investigations undertaken over Precinct 3 until 2006 can be found in Umwelt's *Ecological and Bushfire Investigation* (Umwelt 2007), and will not be reproduced here.

Ecological studies undertaken in Precinct 3 post-2006 are outlined below.

2.7.1 Umwelt 2007

Umwelt conducted ecological and bushfire investigations of Precinct 3 in 2007 for Greater Taree City Council. This study involved a literature review, limited flora and fauna survey, SEPP 44 Assessment, bushfire hazard assessment, and ecological constraints assessment.

The flora survey simply consisted of seven random meander transects over the site. This, along with aerial photo interpretation, resulted in the delineation of four main vegetation communities and two variants. The vegetation map produced by this study was accepted by Council for the Precinct 3 Development Control Plan (DCP) and is adopted for this assessment, with some communities updated to reflect changes since the 2007 survey.

No threatened flora species were identified, however 6 were considered potential occurrences (Dwarf Heath Casuarina, Nabiac Casuarina, Leafless Tongue Orchid, White-Flowered Wax Plant, *Asperula asthenes* and Austral Toadflax). The swamp forest community in the centre of the Precinct was considered to qualify as the Endangered Ecological Community (EEC) *Swamp Sclerophyll Forest on Coastal Floodplains*.

The fauna survey did not detect any threatened fauna species on the site, however 2 were listed as recorded during previous surveys (Glossy Black Cockatoo, Grey-Headed Flying Fox); 2 were listed as recorded in or near Precinct 2B (Square-Tailed Kite, Black-Necked Stork); and 17 were considered potential occurrences.

The SEPP 44 assessment found Potential Koala Habitat occurred in the forested areas of the Love, Plimer, Archer, Taylor and Goodear properties. The assessment did not record any evidence of Koala usage, although mentioned an unconfirmed site record from the Terra (2004) report.

The major recommendation of the study was the creation of a conservation zone encompassing the *Swamp Sclerophyll Forest* EEC in the centre and southwest of the Precinct; the entire Love property; and the southern portion of the Plimer property.

2.7.2 Orogen 2009

Orogen was engaged by Midcoast Water to conduct a land use options study of the adjoining Midcoast Water land to the south (Lot 4 DP594864). This involved a detailed vegetation community surveys and habitat assessments, which produced a *Vegetation Management Plan* for the property.

An important finding of this study was the investigation into the Narrow-Leaved Red-Gum (*Eucalyptus seeana*) Endangered Population previously identified on the property. The trees were suspected of being the common Forest Red Gum (*E. tereticornis*) and a sample of each tree was sent to the NSW herbarium. This resulted in the confirmation that the trees were in fact *E. tereticornis* and not the *E. seeana* Endangered Population.

3.0 FLORA

3.1 THREATENED FLORA RECORDS

A search of the OEH Atlas of Wildlife (OEH 2013a) and available literature (Terra Consulting 2004, Hunter 2003, Umwelt 2007, Orogen 2009) indicated that the following threatened flora species occur within 10km of the site:

Table 1: Locally recorded threatened flora species

COMMON NAME/SPECIES	STATUS	GENERAL LOCATION
Dwarf Heath Casuarina (*Allocasuarina defungens*)	E-TSCA E-EPBCA	Records show a large population at a single location near Khappingat Creek. Recorded >20 years ago.
White-Flowered Wax Plant (*Cynanchum elegans*)	E-TSCA E-EPBCA	Single record in littoral rainforest behind Saltwater beach.
Rainforest Cassia (*Senna acclinis*)	E-TSCA	Red Head, Hallidays Point.
Magenta Lilly Pilly (*Syzygium paniculatum*)	E-TSCA V-EPBCA	Red Head, Old bar Public School, Saltwater Reserve.
Austral Toadflax (*Thesium australe*)	V-TSCA V-EPBCA	Old Bar airfield.

3.2 SURVEY METHODS

3.2.1 General

The previous vegetation mapping by Umwelt (2007) was updated and ground-truthed during the ecological survey in September 2013 over the entire site. A total of approximately 20 hours was spent undertaking vegetation sampling.

The objectives of the flora vegetation survey for this assessment were:

- Ground truth and where required, adjust vegetation community boundaries.
- Update previous vegetation community descriptions (floristics and structure).
- Record any additional species
- Searches for threatened flora species.

Information derived from the above was also used to predict the likelihood of occurrence of threatened species recorded in the locality, Local Government Area (LGA) and North Coast Bioregion (see section 3.2.4.1 and Appendix 1).

3.2.2 Vegetation Community Survey Methodologies

The vegetation community mapping undertaken by Umwelt (2007) was ground-truthed and updated following an initial inspection of the site that identified floristic changes since the 2007 survey.

This was undertaken via random meander transects over the entire site. The data collected from the transects was used along with analysis of recent high resolution satellite imagery (NearMap 2012) to produce an updated vegetation map for study site.

Classification of additional communities was based on the *Forest Types Classification Research Note 17* (1989) with sub-formation names for vegetation types adapted from the classification proposed by Beadle and Costin (1952) and Keith (2004) eg '*Dry Sclerophyll Forest'* to assist the fauna habitat evaluation, and the structural classification used by Walker and Hopkins (1990). Crown cover classes are defined by the following:

- **Closed or dense**: crowns touching to overlapping (crown separation ratio <0).
- **Mid-dense:** crowns touching or slightly separated (crown separation ratio 0– 0.25).
- **Sparse** : crowns clearly separated (crown separation 0.25–1).
- **Very Sparse:** crowns well separated (crown separation 1–20).
- **Isolated plants:** trees greater than 100 m apart, shrubs about 25m apart (crown separation >20).
- **Isolated clumps**: clump of two to five woody plants 200 metres apart (crown separation >20).

Species identification was made with the assistance of GTCC (2007), Bale (1993), Beadle (1982), Harden (1990, 91, 92, 93, 2000), Williams and Harden (1984), Williams and Harden (1980), Williams and Harden (unknown), Robinson (1994), and Brooker and Kleinig (1999). Plant species were identified to species or subspecies level and nomenclature conforms to that currently recognized by the Royal Botanic Gardens and follows Harden and PlantNET for changes since Harden (1990-1992, 2000).

3.2.3 Conservation Status Assessment

Identification of possible Threatened Ecological Communities (TECs) was based on the data collected by the survey and review of the relevant listings on the OEH website (www.environment.nsw.gov.au) and Department of Sustainability, Environment, Water, Population and Communities – MNES SPRAT website (DSEWPC 2013a)

3.2.4 Threatened Flora Species Searches and Occurrence Assessment

3.2.4.1 Searches

Searches for the locally recorded threatened flora recorded in the LGA and regionally (OEH 2013a, DSEWPC 2013b) in similar habitats to those occurring on the site (see Appendix 1), were carried out over the survey period in September 2013.

The site was intensively searched over half a day, consisting of undertaking random meanders through the best potential habitat on site. During the vegetation community survey, threatened plants were also targeted during random meanders.

3.2.4.2 Potential Occurrence Assessment

Potential occurrence assessment of threatened flora species is provided in Appendix 1. This section assesses all considered threatened species listed under the TSCA 1995 and EPBCA 1999 for their potential to occur on site based on the following factors (DEC 2004, Forest Fauna Surveys 1997, DECC 2007):

- Presence/absence of suitable habitat.
- Condition and disturbance history of habitat.
- Local and regional records.
- Location of site within known distribution of the species.
- Connectivity with habitat where species is known to occur.

3.3 SITE VEGETATION COMMUNITIES

Umwelt identified four broad vegetation communities and two variants occurring in Precinct 3. See Umwelt (2007) for the full descriptions.

Those communities relevant to this study are:

- *Eucalyptus pilularis – Eucalyptus microcorys Open Forest*: Occurs in the northwest of the site. Highly modified ecotype in central and eastern parts.
- *Melaleuca quinquenervia – Eucalyptus robusta Swamp Sclerophyll Forest*: Two small patches in Jarberg West.
- *Derived Grassland:* Covers almost all of Jarberg west and Jarberg north
- *Derived Grassland with Scattered Trees:* Represents the cleared areas in the north of the site.

3.3.1 Overview of Changes in Vegetation Structure and Floristics

Annual slashing in the south of the site appears to have ended in 2006 and since that time, two distinct shrubland communities have regrown over portions of Jarberg north and the Trad property, which previously consisted of derived grassland and derived grassland with scattered trees. These communities are described below.

Slight changes have occurred in the northern Lots which became apparent upon analysis of high-resolution NearMap satellite imagery from 2012. It can be seen that some additional clearing of open forest has been undertaken on the northern boundaries of the Love and Plimer properties as part of approved works. This loss is however offset by a few areas previously mapped as regrowth that have since regenerated into an open forest structure, leading to an overall increase in open forest.

The regrowth/modified open forest in the northeast of the site has continued to suffer substantial dieback and a number of trees here had died (Photo 7). The exact cause of this is unknown, however it appears likely to be due to changes in local hydrology that have resulted in a higher water table, a pathogen (eg *Phytophora cinnamoni*), or a combination of both.

The table below shows the changes in area of the vegetation communities that have occurred since the Umwelt study in 2007.

Table 2: Changes in Vegetation Community Areas from 2007-2013.
Note: Areas in hectares

	Open Forest	Regrowth Open Forest	Swamp Forest	Derived Grassland	Derived Grassland with scattered trees	Shrubland A	Shrubland B	Total
Umwelt	8	16	0.3	17	12.7	-	-	~54ha
Darkheart	10	16	0.3	13	10	2	3	~54ha

In addition to changes in vegetation community structure, the cessation of slashing has seen some changes in floristics. Large areas that previously consisted of simply slashed pasture grasses now have regenerating shrubland that were found to contain a range of heath/shrub species not recorded by Umwelt in 2007. Mature examples of these communities occur on the edges of the large swamp forest community in the centre of the Precinct and on adjacent land to the south.

The plant diversity of the open forest also appears to have increased over time. A number of additional species were recorded here during the survey, primarily in the shrub and ground layers.

3.3.2 New Vegetation Communities

The new communities recorded on the site are described below. Figure 3 shows the vegetation map produced by Umwelt and Figure 4 is the revised map based on fieldwork cross-referenced with satellite imagery. Photographs of the new communities follow the descriptions and the original Umwelt flora list with additional species identified by this study is provided in Appendix 3.

3.3.2.1 Mid-High Dense Shrubland A

Distribution: This community has a patchy occurrence throughout Jarberg north. It has regrown since slashing ceased in 2006. Area is 2ha.

Equivalent Biometric Community: No equivalent community

Structure and Species Composition:

(a) Canopy:

Canopy height ranged from 1-2.5 metres and cover was generally very dense.

Regrowth Swamp Paperbark (*Melaleuca ericifolia*) was the dominant species and formed a monoculture in most situations. Other species recorded in this layer were Wallum

Bottlebrush (*Callistemon pachyphyllus*), Sweet Wattle (*Acacia suaveolens*), Prickly Tea-Tree (*Leptospermum juniperinum*), emergent Coast Banksia (*Banksia integrifolia*) and Heath-Leaved Banksia (*Banksia ericifolia*).

(b) Understorey/Shrub layer:

The understory and shrub layer was absent in most situations due to the dense canopy cover. Where present, this layer consisted of Hairy Bush Pea (*Pultenaea villosa*) in varying densities, along with canopy juveniles.

(d) Ground layer:

The ground layer ranged from absent to moderately dense, and where present was very basic. Height ranged from 0.3-1.5m.

The only species recorded in this layer were Setaria (*Setaria sphacelata**), Blady Grass (*Imperata cylindrica**), Swamp Selaginella (*Selaginella uliginosa*), *Wurmbea biglandulosa* and Whisky Grass (*Andropogon virginicus**).

(e) Climbers and Scramblers:

Absent

Comments: Mature stands of this community are present on Midcoast Water land to the south of the site (Orogen 2009), and also fringe parts of the wetland in the centre of Precinct 3. These stands reach a height of approximately 4m and form a dense monoculture of *M. ericifolia.* The site occurrences are much less developed and have clearly regenerated since slashing ceased in 2006.

3.3.2.2 Tall to Very Tall Open to Closed Shrubland B

Distribution: This community occurs in the east Jarberg north and in the south of the Trad property. Some stands appear to be remnant and some have regrown since slashing ceased in 2006. Area is 3ha.

Equivalent Biometric Community: *Melaleuca nodosa* closed shrubland on alluvium of the Central Coast, Sydney Basin.

Structure and Species Composition:

(a) Canopy:

Canopy height of this community was found to be variable and ranged from 1-4. Similarly, canopy cover varied from open in the regrowth patches to dense in the mature stands.

Prickly Paperbark (*Melaleuca nodosa*) was the dominant species throughout. Common canopy associates included Swamp Paperbark, Wallum Bottlebrush, Needlebush (*Hakea sericea*) and Coastal Wattle (*Acacia longifolia subsp. sophorae*).

(b) Understorey/Shrub layer:

The understorey and shrub layer was generally sparse, especially where a dense canopy was present. Height ranged from 0.3-1m.

Species recorded in this layer included Hairy Bush Pea, Prickly Tea-Tree, Prickly Beard-Heath (*Leucopogon juniperinus*) and Thyme Honey-Myrtle (*Melaleuca thymifolia*).

(d) Ground layer:

The groundcover density ranged from sparse to dense and was strongly related to canopy density. Height ranged from 0.1-1.5m.

Exotic grasses such as Setaria, Whiskey Grass and Broadleaf Paspalum (*Paspalum mandiocanum**) comprised the groundcover in most situations. Less disturbed stands contained a suite of native species such as Spiny-Headed Matrush (*Lomandra longifolia*), Blue Flax-Lily (*Dianella caerulea*), Kangaroo Grass (*Themeda australis*), *Wurmbea biglandulosa*, Raspwort (*Gonocarpus teucrioides*), Whiteroot *(Pratia purpurascens*) and Wiry Panic (*Entolasia stricta*).

(e) Climbers and Scramblers:

Occasional scramblers were observed such as Appleberry (*Billardiera scandens*) and Devils Twine (*Cassytha pubescens*).

Comments: Some areas of this community were considered to be remnant and are similar in structure and composition to shrubland in the south near Wallabi Point. This shrubland is likely to have extended over large areas of the study site historically. Several stands of this community had obviously regrown since slashing ceased in 2006 eg on the Trad property and areas of Jarberg north.

Photo 4: Shrubland A with derived grassland in the foreground

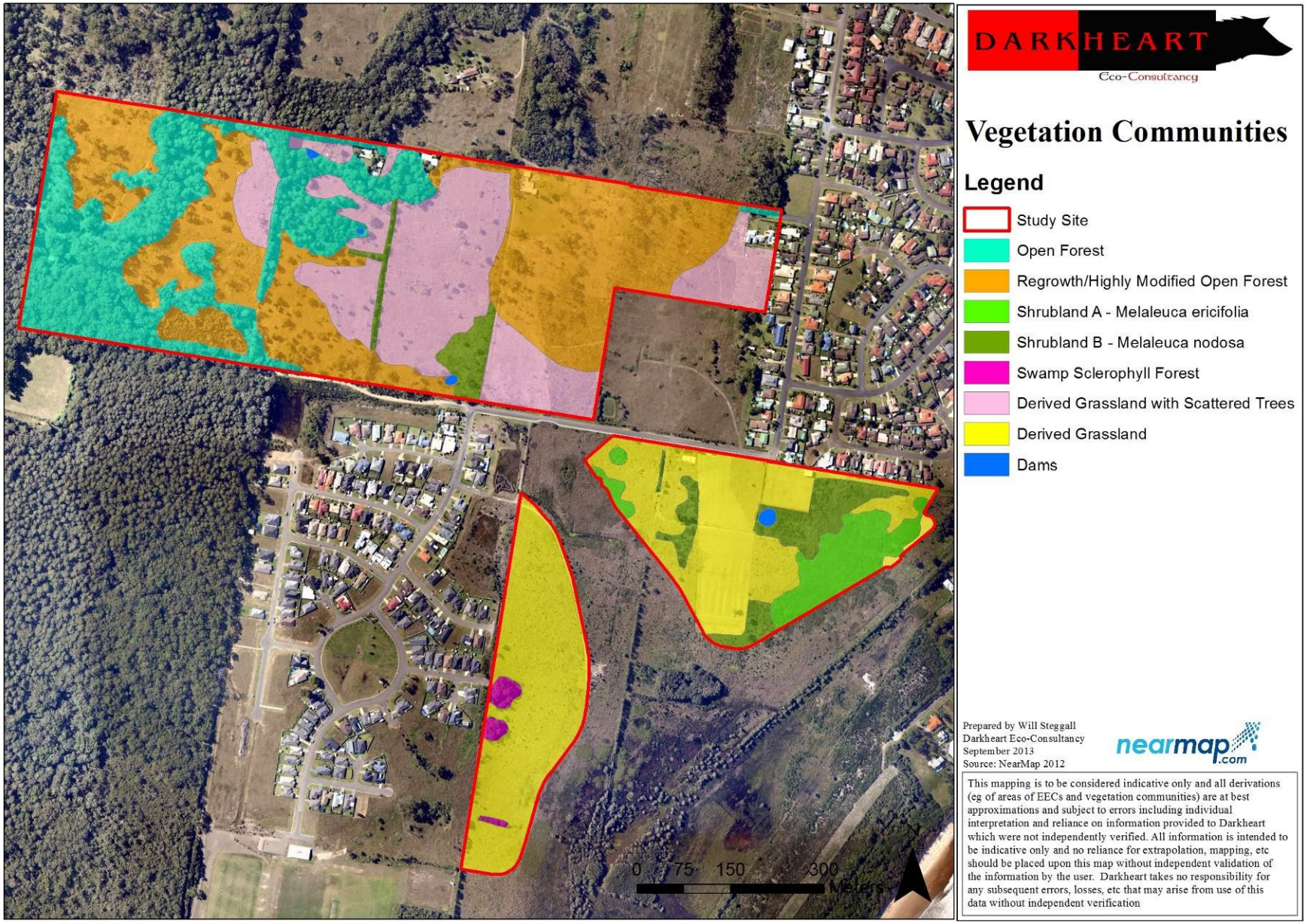
Photo 5: Regrowth shrubland B in Jarberg north

Photo 6: Mature example of shrubland B
This community occurred along the fenceline between the Trad and Archer properties.

Photo 7: Eucalypt dieback on Goodear property

Figure 3: Umwelt (2007) vegetation map

Figure 4: Revised vegetation community map for the study site



3.4 THREATENED ECOLOGICAL COMMUNITIES

Umwelt recorded a single Endangered Ecological Community (EEC) in Precinct 3, this being *Swamp Sclerophyll Forest on Coastal Floodplains.* This EEC was considered to represent the stands of swamp forest in the centre and south of the Precinct. No EECs were recorded north of Forest Lane or in Jarberg north, however the two small patches of swamp forest in the west of Jarberg west were mapped by Umwelt as 'lower quality *Swamp Sclerophyll Forest* EEC'.

Floristically, the swamp forest community observed on site and in the study area would qualify as *Swamp Sclerophyll Forest* EEC, displaying a number of indicative species and typical structure (see description in Umwelt 2007). However, in terms of geology there is some discrepancy with the Umwelt evaluation describing the Precinct as being on a coastal floodplain, which was not qualified in their report in any way ie no review of site geomorphology.

Coastal quaternary geology mapping that became available a year after the Umwelt report (Treodson & Hashimoto 2008) shows that the south of the Precinct is underlain by relic coastal barriers of marine provenance and undifferentiated sediments. This is clearly illustrated in Figure 3.

The coastal barriers, being of marine origin, do not qualify as coastal floodplains (NSWSC 2004, *Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209, Motorplex (Australia) Pty Limited v Port Stephens Council [2007] NSWLEC 74,* Preston and Adam 2004a, 2004b).

Similarly, the undifferentiated formation in between the coastal barriers (Qhs) is described as a freshwater swamp depositional environment receiving mud, peat, silt and clay by organic accumulation and receiving negligible fluvial input (Troedson & Hashimoto 2008). The undifferentiated formation to the west underlying part of Jarberg west and Jarberg north (Qpu) is described as being of uncertain or various provenances including estuarine, backbarrier and alluvial (Troedson & Hashimoto 2008). As per the Scientific Committee determinations and cited Land and Environment Court cases, these formations would not qualify as floodplains as the dominant formation/deposition process is not alluvial.

The patches of swamp forest on site in Jarberg west thus would not qualify as an EEC, as they do not occur on a floodplain, but rather occur on sandstone bedrock of the Koorainghat beds as outlined in Section 2.4 of this report.

No floodplain/alluvial systems occur in the north of the site bar a small alluvial fan covering the south of the Trad and Taylor properties. This area did not contain any native vegetation associations that would qualify as an EEC.

3.4.3 Listed Threatened Ecological Communities and Populations

A summary of TECs and Endangered Populations listed under the TSCA 1995 and EPBCA 1999 which occur in the North Coast Bioregion (OEH 2013b, DSEWPC 2013a) and their potential for occurrence in the study area, is provided in the following table.

Table 3: EEC and Endangered Population potential occurrence assessment

Act	ENDANGERED ECOLOGICAL COMMUNITY (EEC)	OCCURRENCE ASSESSMENT
TSC Act	***Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*"** is a characteristic ecological community listed as Endangered under the TSC Act 2004. This EEC is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Swamp Sclerophyll Forest on Coastal Floodplains (SSFCF) generally occurs below 20m (though sometimes up to 50m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains. The structure of the community is typically open forest (but may be reduced to scattered trees via disturbance), and in some areas the tree stratum is low and dense ie a scrub. The community also includes some areas of fernland and tall reedland or sedgeland where trees are very sparse or absent. The most widespread and abundant dominant trees include *Eucalyptus robusta* and *Melaleuca quinquenervia*.	Although floristically similar, the swamp forest on site does not meet the geomorphological criteria of this EEC.
TSC Act	***"Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion"*** is a characteristic ecological community listed as Endangered. This Endangered Ecological Community (EEC) is associated with clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Subtropical Coastal Floodplain Forest (SCFF) generally occurs below 50 m, but may occur on localised river flats up to 250 m elevation in the NSW North Coast bioregion. While the composition of the SCFF tree stratum varies considerably, the most widespread and abundant dominant canopy trees include *Eucalyptus tereticornis*, *E. siderophloia*, *Corymbia intermedia*, and *Lophostemon suaveolens* (latter only north of the Macleay floodplain).	Forest communities on the site do not meet the floristic and geomorphological criteria of this EEC.
TSC Act	**"*River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*"** is an EEC associated with silts, clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. River-Flat Eucalypt Forest on Coastal Floodplains (RFEF) generally occurs below 50m elevations, but may occur on localised river flats up to 250m above sea level. In the North Coast, the most widespread and abundant dominant trees include *Eucalyptus tereticornis, E. amplifolia, Angophora floribunda, A. subvelutina*, *E. saligna* and *E. grandis*.	Forest communities on the site do not meet the floristic and geomorphological criteria of this EEC.
TSC Act	**"*Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*"** is an EEC associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Swamp Oak Floodplain Forest (SOFF) generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. SOFF has a dense to sparse tree layer in which Swamp Oak (*Casuarina glauca)* is the dominant species. Other trees including *Acmena smithii*, *Glochidion* spp. and *Melaleuca* spp. may be present as subordinate species. The understorey is characterised by frequent occurrences of vines ie *Parsonsia straminea, Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.	Forest communities on the site do not meet the floristic and geomorphological criteria of this EEC.

TSC Act	**"*Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*"** has been listed as an Endangered Ecological Community under the TSC Act 2004. This EEC is associated with periodic or semi-permanent inundation by freshwater, (including areas with minor saline influence). They typically occur on silts, muds or humic loams in depressions, flats, drainage lines, backswamps, lagoons and lakes associated with coastal floodplains ie habitats where flooding is periodic and standing fresh water persists for at least part of the year in most years. Freshwater Wetlands on Coastal Floodplains (FWCF) generally occur below 20m elevations, and the structure of the community varies from sedgelands and reedlands to herbfields. Woody species of plants are generally scarce. The structure and composition of the community varies both spatially and temporally depending on the water regime (Yen and Myerscough 1989, Boulton and Brock 1999).	The site does not meet the geomorphological requirements of this EEC, hence it does not occur.
TSC Act	***"Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregion***" has been listed as an Endangered Ecological Community since December 2006 on Schedule 1 – Part 3 of the TSCA 1995. Lowland Rainforest, in a relatively undisturbed state, has a closed canopy, characterised by a high diversity of trees whose leaves may be mesophyllous and encompass a wide variety of shapes and sizes. Typically, the trees form three major strata: emergents, canopy and sub-canopy which, combined with variations in crown shapes and sizes, give the canopy an irregular appearance (Floyd 1990). The trees are taxonomically diverse at the genus and family levels, and some may have buttressed roots. A range of plant growth forms are present in Lowland Rainforest, including palms, vines and vascular epiphytes. Scattered eucalypt emergents may occasionally be present. In disturbed stands the canopy continuity may be broken, or the canopy may be smothered by exotic vines.	Vegetation meeting the floristic criteria of this EEC does not occur on site or in the study area.
TSC Act	"***Lowland Rainforest on Floodplains on the NSW North Coast Bioregion***" generally occupies riverine corridors and alluvial flats with rich, moist silts often in sub-catchments dominated by basic volcanic substrates. Small, scattered remnants remain on the floodplains of the Tweed, Richmond, Clarence, Bellinger, Macleay, Hastings, Manning, and Hunter Rivers. In its natural state, this community supports a rich diversity of flora and fauna. Tree species often present include Figs, (*Ficus spp*.), Palms (*Archontophoenix cunninghamiana, Livistona australis*), Lilly Pilly's (*Syzygium spp.)* and vines (*Cissus spp., Pandorea pandorana, Flagellaria indica*).	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on site or in the study area.
EPBC Act	***"Lowland Rainforest of Subtropical Australia"*** is found from Maryborough to the Hunter. Predominantly occurs on basalt and alluvial soils, or enriched rhyolitic and metasediments. Generally occurs <300m above sea level but may occur >300m on north-facing slopes, and only in areas with annual rainfall >1300mm. May intergrade with ***Littoral Rainforest and Coastal Vine Thickets*** but usually occurs >2km from ocean. Typically tall (20-30m) closed forest often with multiple tree layers dominated by diversity of rainforest species with emergent non-rainforest species constituting <30%. Emergents are typically figs, Hoop Pine and Brushbox.	Vegetation meeting the floristic and geomorphological criteria of this EEC does not occur on site or in the study area.
TSC Act	***"Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions"*** is typically a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species while emergent Eucalypts or Lophostemons are present in some stands. This community grows only in coastal areas within maritime influence on sand dunes and soil derived from underlying rocks.	Vegetation meeting the floristic criteria of this EEC does not occur on site or in the study area.

EPBC Act	***"Littoral Rainforest and Coastal Vine Thickets of Eastern Australia"*** is a Critically Endangered Ecological Community listed under the EPBC Act 1999, which is generally identical to the TSC Act listing.	Vegetation meeting the floristic criteria of this EEC does not occur on site or in the study area.
TSC Act	A localised population of a distinctive variation of ***Glycine clandestina***, identified as *Glycine* sp. "Scotts Head", has been listed as an Endangered Population. This population is restricted to part of the headland complex at Scotts Head.	The site is well beyond the range of this population.
TSC Act	*"**Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregion**"* has been listed as an Endangered Ecological Community under the TSCA 1995. Coastal Saltmarsh is the ecological community occurring in the intertidal zone on the shores of estuaries and lagoons along the NSW coast. Characteristic species include: *Baumea juncea, Juncus kraussii, Sarcocornia quinqueflora, Sporobolus virginicus, Triglochin striata, Isolepis nodosa, Samolus repens, Selliera radicans, Suaeda australis, Zoysia macrantha.*	The site does not meet the floristic or geomorphological requirements of this EEC, hence it does not occur.
TSC Act	"***White Box Yellow Box Blakely's Red Gum Woodland***" is an EEC predicted to occur in Macksville, Dorrigo, Grafton, Kempsey, Korogoro Part, Nambucca, Coffs Harbour and Bare Part Atlas of Wildlife databases. This community is generally restricted to the tablelands and western slopes.	The site does not meet the floristic requirements of this EEC, hence it does not occur.
TSC Act	***"Hunter Lowland Red Gum Forest in the Sydney Basin and North Coast Bioregions***" is an EEC found on gentle slopes arising from depressions and drainage flats on permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions.	The site does not meet the floristic requirements of this EEC, hence it does not occur.
TSC Act	The "***Population of Eucalyptus seeana in the Greater Taree Local Government Area***" has been listed as an Endangered Population.	*E. seeana* reported to occur to south of site by Umwelt (2007) and listed in Atlas of Wildlife. This was later disproven (see Orogen 2009). *E. seeana* was not recorded on site.
TSC Act	"***White Gum Moist Forest in the NSW North Coast Bioregion***" is an ECC characteristically dominated by White Gum (*Eucalyptus dunnii*) either in pure stands or with *E. saligna, E. microcorys* and/or *Lophostemon confertus* (NSWSC 2008a).White Gum Moist Forest typically occurs on the escarpment slopes and foothills of the north-east NSW, most commonly between 400 and 650 m elevation, where mean annual rainfall exceeds approximately 1000 mm and has a summer maximum (DECC 2007) on fertile soils. It is currently known from the local government areas of Clarence Valley, Coffs Harbour, Kyogle and Tenterfield.	White Gum does not occur on the site, thus the EEC does not occur.
TSC Act	"***Hunter Valley Vine Thicket in the NSW North Coast and Sydney Basin Bioregions***" is a Critically Endangered Ecological Community (CEEC). This CEEC occurs on Carboniferous sediments (often on limestone) mainly on rocky slopes. The community typically forms a low closed forest dominated by low trees, shrubs and vines. The canopy is dominated by both varieties of *Elaeodendron australe* (Red Olive Plum), *Geijera parviflora* (Wilga), *Notelaea microcarpa* var. *microcarpa* (Native olive), and *Alectryon oleifolius subsp. elongatus* (Western Rosewood). Emergent eucalypts are common and include *Eucalyptus albens* (White Box), *E. dawsonii* (Slaty Box), and *E. crebra* (Narrow-leaved Ironbark). Hunter Valley Vine Thicket has been recorded from the local government areas of Muswellbrook, Singleton, and Upper Hunter (NSWSC 2007b).	This community does not occur on the site which is located outside the prescribed range, thus the EEC does not occur.

TSC Act	"***Lower Hunter Valley Dry Rainforest in the Sydney Basin and NSW North Coast Bioregions***" is an EEC which occurs on Carboniferous sediments of the Barrington footslopes along the northern rim of the Hunter Valley Floor, where it occupies gullies and steep hill slopes with south facing aspects. The community usually forms a closed forest 15-20m high with emergent trees 20-30m high. Vines are abundant and there is a dense shrub and ground layer (NSWSC 2007c).	This community does not occur on the site which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	***"Themeda* grassland on seacliffs and coastal headlands in the NSW North Coast, etc"** is an that belongs to the Maritime Grasslands vegetation class of Keith (2004) and its structure is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs.	The site does not meet the floristic or geomorphological requirements of this EEC, hence it does not occur.
TSC Act	***"Carex Sedgelands of the New England Tableland, Nandewar, Brigalow Belt South and NSW North Coast Bioregions***" is a preliminarily listed EEC **in marshy regions d**ominated by sedges, grasses and semi-aquatic herbs. The species dominants are *Carex appressa, Stellaria angustifolia, Scirpus polystachyus, Carex gaudichaudiana, Carex sp. Bendemeer, Carex tereticaulis and Isachne globosa,* either as single species or in combinations. Other common species include *Geranium solanderi var. solanderi, Haloragis heterophylla, Lythrum salicaria, Epilobium billardierianum subsp. hydrophilum and Persicaria hydropiper* (Hunter and Bell 2009).	The site does not meet the floristic requirements of this EEC, hence it does not occur.
TSC Act	'***Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions*'** is an EEC that generally occurs on floodplains and on floodplains and associated floodplain rises along the Hunter River and tributaries.	This community does not occur on the site which is located outside the prescribed range, thus the EEC does not occur.
TSC Act	**'*Coastal Cypress Pine Forest in the NSW North Coast Bioregion*'** is a distinctive vegetation community dominated by Coastal Cypress Pine (*Callitris columellaris*) and is typically found on coastal sand plains, north from the Angourie area on the far north coast of NSW.	The site is far beyond the known range of this EEC and the Coastal Pine does not occur, thus the EEC does not occur.

3.5 THREATENED FLORA

3.5.1 Result of Threatened Flora Survey

No threatened plants were recorded on site by targeted searches.

3.5.2 Potential Occurrence Assessment

Searches of relevant literature (Hunter 2003, Terra 2004, Umwelt 2007, Orogen 2009) and databases (OEH 2013a) found records of 5 threatened flora species in the locality.

Umwelt considered the following species to be potential occurrences. As shown below, after this survey which has followed a 6 year recovery period of most of the site's habitats, none are considered to likely occurrences:

Table 4: Review of Umwelt 2007 potential threatened flora occurrences

Common Name/Species	Status	Umwelt Probability Of Occurrence	Darkheart Review
Dwarf Heath Casuarina (*Allocasuarina defungens*)	E-TSCA E-EPBCA	Moderate.	Not found. Localised distribution and disturbance history suggests unlikely occurrence.
White-Flowered Wax Plant (*Cynanchum elegans*)	E-TSCA E-EPBCA	Low.	No suitable habitat. Unlikely to occur.
Nabiac casuarina *(Allocasuarina simulans)*	V-TSCA V-EPBCA	Moderate.	Not found. Localised distribution and disturbance history suggests unlikely occurrence.
Asperula asthenes	V-TSCA V-EPBCA	Moderate	Generic potential along drains in study area but not found. No proximate records – unlikely to occur.
Austral Toadflax (*Thesium australe*)	V-TSCA V-EPBCA	Low	No proximate records and disturbance history likely to have displaced this plant.

In regards to potential occurrence of most threatened flora, it should be noted that threatened plants often occur in habitats with a precise mix of essential ecological requirements, and not randomly in the landscape or a broad structural form of vegetation (eg dry sclerophyll forest). Such essential requirements may be a complex nexus of position, soil type (which affects fertility, acidity, etc) and climate, but may also include specific (sometimes symbiotic) association with fungi and bacteria (eg Proteaceae), dispersal vectors (eg bats) and disturbance regimes eg *Acacia aprica* will not recruit without a suitable fire regime (Vallee *et al* 2004). Absence of such essential habitat variables or their modification (eg by disturbance such as frequent fire) can thus reduce or negate a site's potential for such plants to occur. These often poorly understood ecological factors are also a major contributor in the reason that many translocations of threatened plants fail (Vallee *et al* 2004).

The study site demonstrates a long history of a range of disturbances in various intensities including clearing, drainage, logging, cattle grazing, pasture improvement and fire. While some vegetation communities on the site may be considered at best broadly suitable in terms of generic habitat type for a handful of threatened species (eg dry sclerophyll forest on clay soils), the extensive disturbances to the site and surrounding land have resulted in habitat changes (eg to microclimates, soil characteristics, etc) that may have effectively precluded threatened flora species from occurring on the site. This and the lack of proximate records of such species strongly suggests threatened flora species are unlikely to occur on the site. Consequently, they are not considered in subsequent statutory assessments.

4.0 FAUNA

4.1 SURVEY METHODS

All field surveying was conducted as per the conditions of the consultant's Animal Research Authority and Section 120 Scientific License.

4.1.1 Habitat Evaluation and Fauna Survey Methodology

The site was surveyed to determine the available potential habitats, and the support value of these habitats for threatened species. Habitats were defined according to parameters such as:

- Structural and floristic characteristics of the vegetation e.g. understorey type and development, crown depth, groundcover density, etc.
- Degree and extent of disturbance e.g. fire, logging, weed invasion, modification to structure and diversity, etc.
- Soil type and suitability e.g. for digging and burrowing.
- Presence of water in any form e.g. dams, creeks, drainage lines, soaks.
- Size and abundance of hollows and fallen timber.
- Availability of shelter e.g. rocks, logs, hollows, undergrowth.
- Wildlife corridors, refuges and proximate habitat types.
- Presence of mistletoe, nectar, gum, seed, sap, etc sources.

In consideration of the threatened species recorded in the locality, available habitats and potentially occurring species, the following survey methods were employed over site:

* Trapping using Elliot B traps and Elliot A traps
* Hair funnels
* Infra-red (IR) trail cameras
* Yangochiropteran bat call detection
* Spotlighting by walking with a 100w hand-held spotlight.
* Dawn and dusk bird census
* Scat, burrow and hollow searches and inspections
* Call playback, detection and recording
* Physical searches of habitat e.g. logs, leaf litter, etc over the site
* Opportunistic sightings over the site

Species identification was assisted by Morcombe and Stewart (2010), Pizzey and Knight (2003), Tyler and Knight (2009), Wilson and Knowles (1992), Strahan (2008), Triggs (1996), Robinson (1996), Swan *et al* (2004) and Schodde and Tideman (1990).

4.1.2 Trapping and Hair Funnels

Trapping and hair sampling was only undertaken within the study site.

4.1.2.1 Elliot A trapping

Elliot trapping was conducted over two weeks. In the first week, a total of 150 Elliot A traps were set for four nights in six lines of 25 across Jarberg west and Jarberg north. In the second week a total of 75 traps were set for four nights in lines of 25 on the Trad, Archer and Love properties. Traps were focused on areas of dense groundcover and around debris where trapping success was more likely.

Traps were placed 5-10m apart and baited with a mixture of rolled oats, peanut butter and sesame oil. Target species were the Eastern Chestnut Mouse, New Holland Mouse and Common Planigale. A total of 900 trap nights were performed over the two weeks.

4.1.2.2 Elliot B (Arboreal) Trapping

Elliot B trapping was undertaken across the site over eight nights. This consisted of one line of 10 traps in the first week on the Taylor property and one line of 10 traps in the second week on the Love property.

Traps were mounted about 20-30m apart on canopy trees and were baited with a mixture of honey-soaked rolled oats, apple and peanut butter. Just before dusk, a honey solution was sprayed above the mounted platform as a further attractant.

The target species were the Squirrel Glider and Brushtailed Phascogale. All traps were mounted on platforms and angled slightly down so as to drain out the entrance. A total of 80 trap nights were performed across the site.

4.1.2.3 Hair Funnels

Hair funnels were mounted on platforms in trees and placed in suitably dense groundcover throughout the site. In total 60 hair funnels were spread over the site. A total of 10 funnels were placed at Jarberg north; 20 at Jarberg west; 10 along the drainage line between Jarberg west and Jarberg north; 10 across the Trad and Archer properties and 10 arboreal funnels on the Love property for 10 nights (600 trap nights). The majority of these were baited with a mixture of peanut butter, oats and honey with 1-2 funnels per line baited with meat.

Target species included the Eastern Chestnut Mouse, Common Planigale, New Holland Mouse Brushtailed Phascogale, Squirrel Glider and Spotted-Tailed Quoll.

All hair samples were sent to nationally recognised hair identification expert, Mrs Barbara Triggs for identification.

4.1.3 Spotlighting and Torch Searches

Spotlighting was conducted for two hours per night for eight nights (a total of 16 hours) over the study area. Spotlighting involved observing all habitat components i.e. understorey/canopy trees for arboreal fauna, the ground and terrestrial strata (e.g. logs, areas with good leaf litter accumulations, etc) for terrestrial fauna, etc. It was also periodically conducted during call playback to detect owls attracted but not calling.

Spotlighting was conducted approximately one hour after dusk. Conditions varied between clear and overcast and wind was generally placid. The moon phase ranged from one quarter to new moon to half-moon over the survey period.

Torch searches were undertaken in conjunction with spotlighting around the dams and drainage lines for frogs, and opportunistically in the swamp forest adjacent to the site. The primary target species were the Green and Golden Bell Frog, Green Thighed Frog and the Wallum Froglet.

4.1.4 Stag watching

Stag watching was undertaken in the north of the site for a total of three nights. This involved watching trees with hollows for about 30mins before and after dusk with binoculars for signs of fauna emerging from the hollows. A total of three hours was spent on this activity.

4.1.5 Yangochiropteran Bat Call Detection

Yangochiropteran bat call detection was undertaken utilising two Anabat II bat call detectors fitted with a ZCAIM. An active Anabat was carried during spotlighting to opportunistically record bats, and two units were set to record from fixed positions overnight facing at 45^{o} angles towards a canopy or flyway or facing over a dam/drain to target Southern Myotis.

Mobile recordings were carried out for approximately one hour per night over eight nights, with seven nights of overnight recording (>126 hours total). The recordings were forwarded to Mrs Anna Lloyd of Eco-Location, a bat call identification consultant, for identification of the bat species.

4.1.6 Infra-Red Trail Cameras

Four infra-red cameras consisting of two Reconyx Hyperfire HC600 and two Scoutguard SG570s were deployed at various locations over the site. The cameras were set for a period of two weeks. Two bait stations consisted of a mixture of oats, peanut butter, honey and apple; and two predator bait stations were rotated with cat food, mince and chicken necks.

Target species were the Eastern Chestnut Mouse, Common Planigale, Spotted-Tailed Quoll and Brushtailed Phascogale.

4.1.7 Call Playback

Recorded calls of the following species were routinely played in the site and study area:

- Masked, Barking, Powerful and Grass Owls
- Bush-Stone Curlew
- Yellow Bellied Glider
- Squirrel Glider
- Koala
- Wallum Froglet

Calls were played through a portable MP3 player via a 30W PA system from the rear of a utility at a level approximating natural intensities of the species. The general methodology involved an initial period of listening and spotlighting; followed by playback of the calls simulating a natural pattern. This was followed by 10 minutes of listening and 10-15 minutes spotlighting for fauna attracted by the calls (but not responding vocally), within 100m radius of the playback point.

Calls were generally played soon after dusk, when such calls are normally heard. Playback was utilised over the area over eight nights for a total of eight hours of this activity.

4.1.8 Diurnal Bird Survey

Birds were generally surveyed by detecting calls and searching by binoculars at point positions or along a transect walked along the forest edges at dawn and dusk (when call chorus and peak activity occurs). Diurnal species such as the Varied Sittella, Brown Treecreeper, Glossy Black Cockatoo, raptors, Scarlet Robin and Little Lorikeet were the main species routinely targetted.

A total of four dedicated hours was spent on this activity consisting eight specific census periods of 0.5 hours each in addition to incidental observations during other activities eg trapping and scat searches. This provided short-term seasonal data on bird occurrences in the area for the particular season (DEC 2004).

4.1.9 Herpetofauna and Secondary Evidence Searches

Physical habitat searches were undertaken opportunistically during other activities, as well as for several hours which were dedicated merely to this task. This involved lifting up of timber and debris, inspection of dense vegetation and leaf litter for frogs and reptiles, binocular inspection of potential hollows, observation of likely basking sites and searches for scats, owl regurgitation pellets, tracks and scratches.

Specific time was also devoted to searching under potential forage species for Koala scats. No formal SAT (Spot Assessment Technique) surveys were undertaken due to lack of evidence of Koalas on site.

4.1.10 Habitat Tree Survey

All hollow-bearing trees within the site and those in close proximity were located and recorded via hand held GPS. Each tree was quantified (number of hollows, location in tree and aperture diameter), marked with yellow biodegradable flagging tape and pink spray paint, and assigned an identifier number.

Hollow-bearing trees were subsequently assigned a fauna habitat value ranking of low, moderate or high based on the following criteria:

- Low: generally contain <2 small hollows or potential hollows, trees with basal cavities, chimneys, fire scars or trunk fissures
- Moderate: generally contain >2 actual hollows with at least 1 medium hollow
- High: large trees with multiple hollows and at least 1 large hollow, or providing known nesting/denning/roosting habitat for a threatened species.

This collated information is considered in Appendix 1 for evaluation of the potential occurrence of threatened species on or adjacent to the site based on cited ecology and personal experience/knowledge of the species.

4.1.11 Survey Methods Not Used

The following survey techniques were not used:

- *Wire cage trapping and sandpads*: Addressed by camera traps and hair funnels

- *Pitfall trapping*: High water table likely to be render impossible in most areas. Compensated by extremely high Elliot A trapping effort.

- *Harp traps and mist nets*: Not used due to lack of flyways suitable for trap location and risk of theft/vandalism/interference. Addressed by Anabat call detection.

- *Triplining*: Anabats were set facing waterbodies to detect bats which may use dams for drinking or foraging.

4.1.12 Limitations

All surveys are limited in their ability to fully document all species of flora and fauna likely or actually occurring on a site. Surveys such as these are merely "snapshots" in time, and can only be expected to provide an indicative not absolutely comprehensive representation of a site's species assemblage (DEC 2004, Forest Fauna Surveys 1997). To counter this limitation, this survey has employed methods recommended in literature and known from personal experience to best detect the target species under the site and weather conditions at the time, or implemented a conservative occurrence assessment, as follows.

4.1.12.1 Flora

The study site was intensively traversed by foot during specific flora surveys and during other survey activities during the survey period in September 2013.

The survey coincided with a peak flowering period of many native species; however weather conditions during the survey and for the previous month were very dry. Consequently, species detection was considered fair.

Regardless, any short-term survey will only provide a list of plants detected during a brief interval of time (DEC 2004). The total species list of an area is usually much greater than can be detected in such a short time and it can be influenced by factors such as: size of the property, fire history, time since disturbance, flowering season (particularly orchids), and presence of reproductive material (DEC 2004). As the focus was on detection of threatened species, a comprehensive inventory of all species present was not obtained.

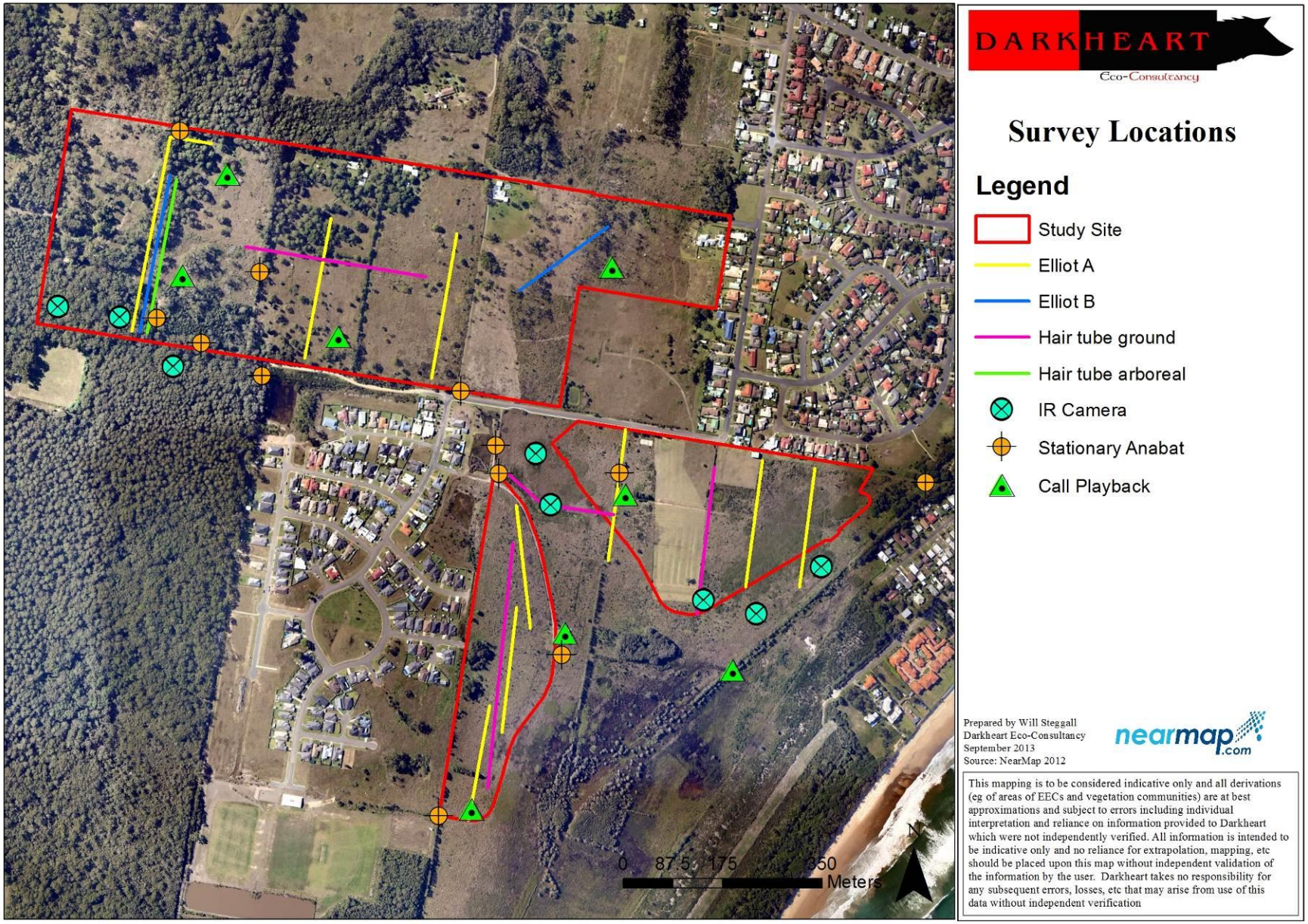
4.1.12.2 Fauna

Fauna detectability is limited by seasonal, behavioural or lifecycle characteristics of each species, and even by habitat variations (e.g. flowering periods), which can occur within a year, between years, decades, etc (DEC 2004).

The fauna survey period fell in early Spring which is a period of increasing activity for most fauna eg breeding of birds, Koalas, arboreal mammals, and reptiles (DEC 2004). Detection of seasonal breeding frogs would be limited for species breeding in late winter to early spring, or year-round. Winter longitudinal and latitudinal migrants such as the Swift Parrot are also unlikely to be present at this time of year. Lack of rainfall during the survey and in the previous month is likely to have limited frog detection.

To counter these limitations, qualitative and quantitative habitat evaluation was used as well as a standard ecological field survey to assess the site's significance to threatened species. Habitat evaluation conservatively assesses the potential occurrence of threatened species based on potentially suitable habitat and local records, providing a prediction of the likelihood of a particular threatened species occurring in the study area (DEC 2004, DECC 2007, Forest Fauna Surveys 1997).

Figure 5: Fauna survey locations on the study site



4.2 CORRIDORS AND KEY HABITATS

See Figure 6 for the map showing the following.

4.2.1 Regional and Sub-Regional Corridors

Regional corridors are typically >500m wide and provide a link between major and/or significant areas of habitat in the region. Ideally they are of sufficient size to provide habitat in their own right and at least twice the width of the average home range area of fauna species identified as likely to use the corridor (OEH 2013c, Scotts 2003). Sub-regional corridors connect larger landscaped features and are of sufficient width to allow movement and dispersal (generally >300m), but may not provide substantial species habitat (OEH 2013c, Scotts 2003).

No regional or sub-regional corridors are mapped in the study area.

4.2.2 Local Corridors and Habitat Links

Local corridors provide connections between remnant patches of habitat and landscape features. Due to their relatively small area and width (they may be <50m), these corridors are subject to edge effects (OEH 2013c, Scotts 2002). Habitat links are evaluated in this report as links from habitat on-site directly to similar habitat on adjacent land. These would be used by fauna, which depend solely or at least partially on the site for all of their lifecycle requirements, and/or dispersal (Lindenmayer and Fisher 2006).

The site is adjunct to a large remnant which extends far to the west, south and southwest. This remnant is fragmented by rural-residential estates and rural land adjacent to the site and further west around Metz Road and Kooraingha Creek, but is nonetheless well connected to extensive forest in Khappinghat Nature Reserve and Kiwarrak State Forest. The most important local corridor for forest fauna is thus to the west, south and southwest.

In a habitat linkage context, only the northwest of the site has connectivity to adjacent forest south and west for gliders and other arboreal species such as the Koala due to the relatively even forest cover. Connectivity for small terrestrials here is somewhat limited due to the barriers posed by Forest Lane and Saltwater Road.

In the south of the site, the relatively even cover of dense grasses and shrubs extends south into the swamp forest and eventually into undisturbed heathland and shrubland and would provide good connectivity for small terrestrials.

To the north, small rural properties containing pasture and regrowth forest patches and the residential areas of Old Bar occur. These extend further north to the largely cleared Manning River floodplain and the extensive mud flats and sand bars of Farquhar Inlet. These would be a barrier for small terrestrials dependant on dense cover, and arboreals.

Beyond the pasture and residential areas to the east, a narrow coastal corridor occurs tentatively linking Mudbishops Reserve in the north to Saltwater Reserve. This is fragmented at Racecourse Creek outlet and Wallabi Point, hence would only provide connectivity for more mobile species such as birds and those able to cross open land eg macropods.

Forest Lane which divides the site is a partially sealed road with a 60kph speed limit, hence is expected to only pose a minor mortality risk to fauna attempting to cross. Some motorists were however noted driving at excessive speeds along the unsealed section during the survey, hence the risk of road strike here would be higher, especially given the dense forest cover either side. Forest

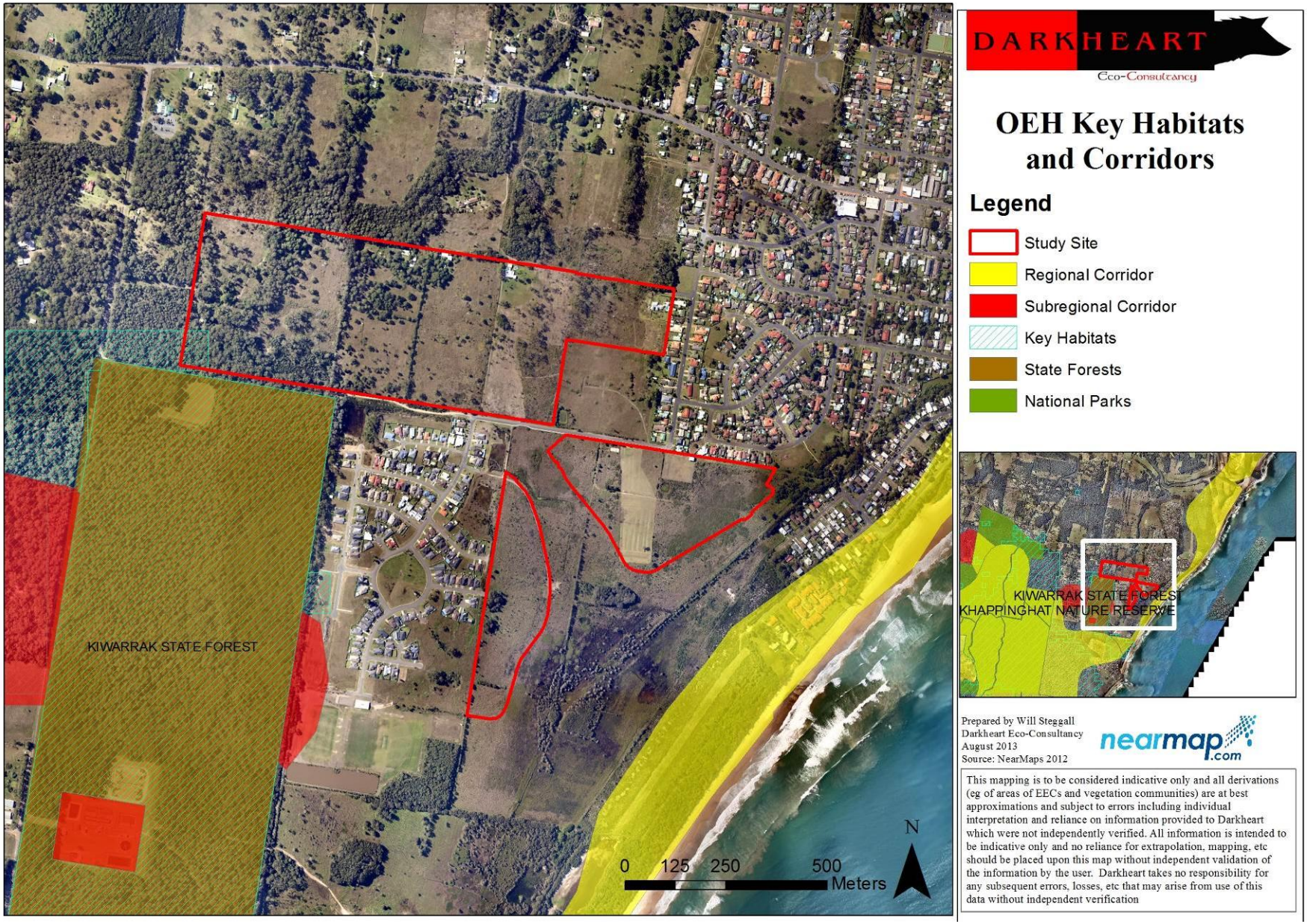
Lane would also be a behavioural barrier (eg break in the continuous forest and ground cover) to less mobile fauna.

4.2.3 Key Habitat

Key Habitats are areas of predicted high conservation value for forest faunal assemblages, endemic forest vertebrates or endemic invertebrates; spatially depicted as a merging of mapped assemblage hubs, assemblage hot spots and centres of endemism (OEH 2013c, Scotts 2003).

The site is not mapped as Key Habitat.

Figure 6: OEH Key Habitats and Corridors



4.3 SURVEY RESULTS

4.3.1 Habitat Evaluation

The following table summarises the survey findings:

Table 5: Habitat evaluation summary

HABITAT ATTRIBUTE/ TYPE	SITE HABITAT VALUES	POTENTIAL THREATENED SPECIES HABITAT VALUES
Aquatic/wetland habitat: Breeding and foraging habitat for frogs, waterfowl, fish and Southern Myotis.	The only aquatic habitat present on site consists of a few small farm dams fringed with sedges and rushes, and an ephemeral drainage line in the northern road reserve of Forest Lane. These were considered poor aquatic habitat due to their limited size and depth, and presence of Plague Minnow. Notwithstanding, they would provide a reliable source of water for animals during drought. Two drainage lines and a large stormwater detention pond with permanent water occur adjacent to the site in the south with slightly better aquatic habitat values, although would be unlikely to support any threatened frog species.	Aquatic habitat unlikely to support threatened amphibians due to pollution, exposure/edge effects and limited extent of habitat. Swamp forest and wetlands to the south of the site provide better potential. Potential to support threatened ducks was considered minimal due to unsuitable habitat, high human presence and insufficient extent of habitat. The Jabiru was considered a low potential using farm dams but dense cover on the edges and proximity to dwellings was a limitation.
Marine/estuarine habitats eg estuarine, rocky foreshores, open beaches, open ocean. Habitat for marine birds and estuarine birds (eg waders), mammals, reptiles and fish	Absent	N/A
Caves, Cliffs, Culverts, Overhangs, etc: At times key roosts for some species of Yangochiropteran bats; refuge for some snakes; and sometimes forest owl roosts and Quoll dens.	Limited to a box culvert under Forest Lane and a few small stormwater pipes.	Box culvert would be marginally suitable for Yangochiropteran bat roosting, however no evidence of bats found upon inspection.

Logs, Debris and Stumps. Provides refugia for small to medium terrestrial vertebrates; and foraging habitat ie invertebrates, vertebrates and fungi.	Logs and stumps are common in the forested areas of the site, especially in the south of the Love property. A few here contained large hollow cavities. Debris occurred around some dwellings in the west, offering cover for common reptiles, small dasyurids and rodents, as well as common frogs.	A few logs on site large enough to possibly support denning by the Spotted-Tailed Quoll.
Groundcover: Provides forage for macropods and rodents; seeds for birds and rodents; prey habitat for small dasyurids; cover/refugia for small terrestrials eg Common Planigale.	Dense groundcover is present in west and north Jarberg due to cessation of slashing in 2006. It is comprised chiefly of Setaria with sedges and rushes in depressions. Cleared sections of the northern Lots have a fairly dense to open groundcover depending on time since slashing. Groundcover in open forest is generally sparse and comprised of native grasses and herbs.	Suitable refuge for small mammals and reptiles (i.e. rodents, Sun Skinks, etc) over most of site. Overall considered poor habitat for Eastern Chestnut Mouse and Common Planigale due to lack of diversity in the groundcover vegetation (ie limited food sources) and competition with common rodents.
Leaf Litter: Provides cover/refugia for small terrestrials eg frogs and reptiles (especially decorticating bark); and foraging habitat for invertebrates and fungi	Shallow cover of leaf litter in open forest with thick layer of shed bark under canopy trees. Only leaf litter in south of site occurs under tea-trees growing along fencelines.	Observed to support low numbers of Sun Skinks, and some generic fungi and invertebrate habitat. Disturbance history, isolation and lack of records indicate Long-Nosed Potoroo and Three-Toed Snake-Toothed Skink unlikely to occur. The value of this habitat component is not significant and is unlikely to support any threatened fauna.
Wattles, Melaleucas, Callistemons and Banksias (shrub layer): May support threatened honeyeaters and Pygmy Possum, provide insect attractant (prey) or support passerine prey species.	Patches of Coastal Wattle occur in regrowth open forest in the north but are uncommon overall. Prickly Tea-Tree is a common occurrence in Jarberg north and in the south of the Trad and Archer properties.	Generic non-preferred forage components for nectar/pollen dependant threatened species eg Squirrel Glider and the Little Lorikeet. Tea-Trees are mostly young and isolated from other habitat, hence have limited value.
Passerine Bird Habitat: Potental prey species for raptors. Threatened passerines may require specific structure eg grassy woodland, seed producing plants, fallen timber, flowering trees.	Vegetation contains a few nectar sources and fruiting species. Good shrub layer cover in some parts of the site eg. Love and Plimer properties but sparse overall. No grassy woodland habitats. Limited fallen timber.	Passerine habitat generally limited to northwest of site where a reasonable abundance of birds were noted.
Fruiting Species: Food species for frugivorous birds and Grey-Headed Flying Fox.	Occasional Cheese Trees and native Raspberries in open forest. Overall, very few fruiting species present on site.	Site habitat contains no significant foraging resources for frugivorous birds eg Wompoo Fruit-Dove, Rose-Crowned Fruit-Dove and Barred Cuckoo Shrike.

Allocasuarinas: Two species are the sole food of Glossy Black Cockatoo.	Forest Oak and Black Oak are common in the Forest Lane road reserve and in the northwest of the site.	Minor foraging resource for Glossy Black Cockatoo. No evidence of foraging (chewed cones) found by survey.
Tree Hollows: Critical habitat component required by almost all arboreal mammals, many birds, many Yangochiropteran bats, some reptiles and frogs. Used for breeding and refugia. Apart from birds, all others use multiple hollows for various purposes eg breeding, water, winter torpor, etc. Select entrance to match body size but internal dimensions and configuration are primary influence on habitation.	Hollows were a relatively uncommon feature on the site and were primarily found in the wooded parts of the northeast and northwest. A total of 23 were recorded over the site which is well below the preferred abundance and density of this key habitat component (Gibbons and Lindenmayer 2002). Hollow sized ranged from small (<5cm) to large (>20cm) and some may provide suitable roosting/nesting/denning habitat for a wide range of fauna, including forest owls (Photo 9), depending on the actual internal cavity size and extent of formation (Gibbons and Lindenmayer 2002, pers. obs.). The details of the recorded hollow-bearing trees are provided in Appendix 4 and their location is shown in Figure 7.	Limited number of hollows over most of site, with most in the modified woodland which is dying back and lacks undergrowth, and hence is a significant constraint for hollow-obligate threatened fauna such as gliders, Yangochiropteran bats and forest owls. More suitable roosting and denning opportunities for these species are largely confined to the northwest of the site. Nearly all hollows in the northeast of the site were found to be occupied by Rosellas, Lorikeets and Galahs, indicating competition would be high with these more aggressive species.
Flowering Trees: Flowering trees used for foraging by most arboreal mammals, 2 species of bats, and many birds. Also an insect prey attractant. Winter flowering species most critical.	Range of eucalypts and paperbarks on site offer a good variety of potential nectar source for gliders, Grey Headed Flying Fox and Little Lorikeet (OEH 2013b, Smith *et al* 1995, Eby 2000a, 2000b). White Mahogany was flowering during the survey which attracted numerous Flying Foxes.	Generic potential foraging habitat components for Squirrel Glider. Generically suitable for Grey Headed Flying Fox and Little Lorikeet and common nectivorous passerine birds; using it as a minute part of their foraging range. Flowering paperbarks would attract insect prey for Yangochiropteran bats.
Sap Trees: Sap used by gliders as food source, with usage depending on habitat quality and abundance of other resources.	Bloodwood present in northwest of site. Species such as Blackbutt, Tallowwood and Grey Gum are less preferred by gliders.	Old and active incisions were noted on several Bloodwoods adjacent to Forest Lane (Photo 10). These are likely to be from Sugar Gliders detected during the survey.
Mistletoe: Preferred food source (mainly *Amyema* spp) of Painted and Regent Honeyeater	Very rare.	Not a significant area for dependant species.

Yangochiropteran Bat Habitats: These bats use habitats defined by structure and their flight adaptations (eg high clutter or clutter free), and also by target species eg large slow flying insects or spiders in webs.	In general, the site forms part of a wider area characterised by large patches of intact forest surrounded by residential areas and cleared rural land. The varied landscape is considered suitable for species that prefer open canopy or capable of foraging along the forest/urban interface. Artificial lighting however may be an influence both adverse and beneficial to some species near the urban fringe and along Forest Lane. A reasonable number of potential roosts occur in forested habitat in the northwest of the site.	Greater Broad-Nosed Bat, Yellow Bellied Sheathtail Bat and marginally so the Eastern False Pipistrelle are considered to have a low to moderate chances to use site/study area as minute portion of their wider local range. Little and Eastern Bent-Wing Bats and East Coast Freetail Bat recorded during survey.
Prey Species: Food sources for Spotted Tail Quoll, forest owls, snakes, raptors.	Arboreal prey mammals are present on site, but in low numbers and diversity, and limited to the northwest. High populations of native and exotic rodents along with common Dasyurids occur which may supported a number of raptors. Common frogs heard calling at various locations on site. Large variety of birds present on site due to the diversity of habitats present; abundance would vary with food availability and season.	Terrestrial and arboreal prey species in study area mostly limited to the northwest. This area has the potential to support foraging by forest owls and Quoll as a small part of their range. Likely to be sufficient abundance of passerine birds for site/study area to form minute fraction of habitat used by the Square-Tailed Kite.

Figure 7: Hollow-bearing trees recorded on the site

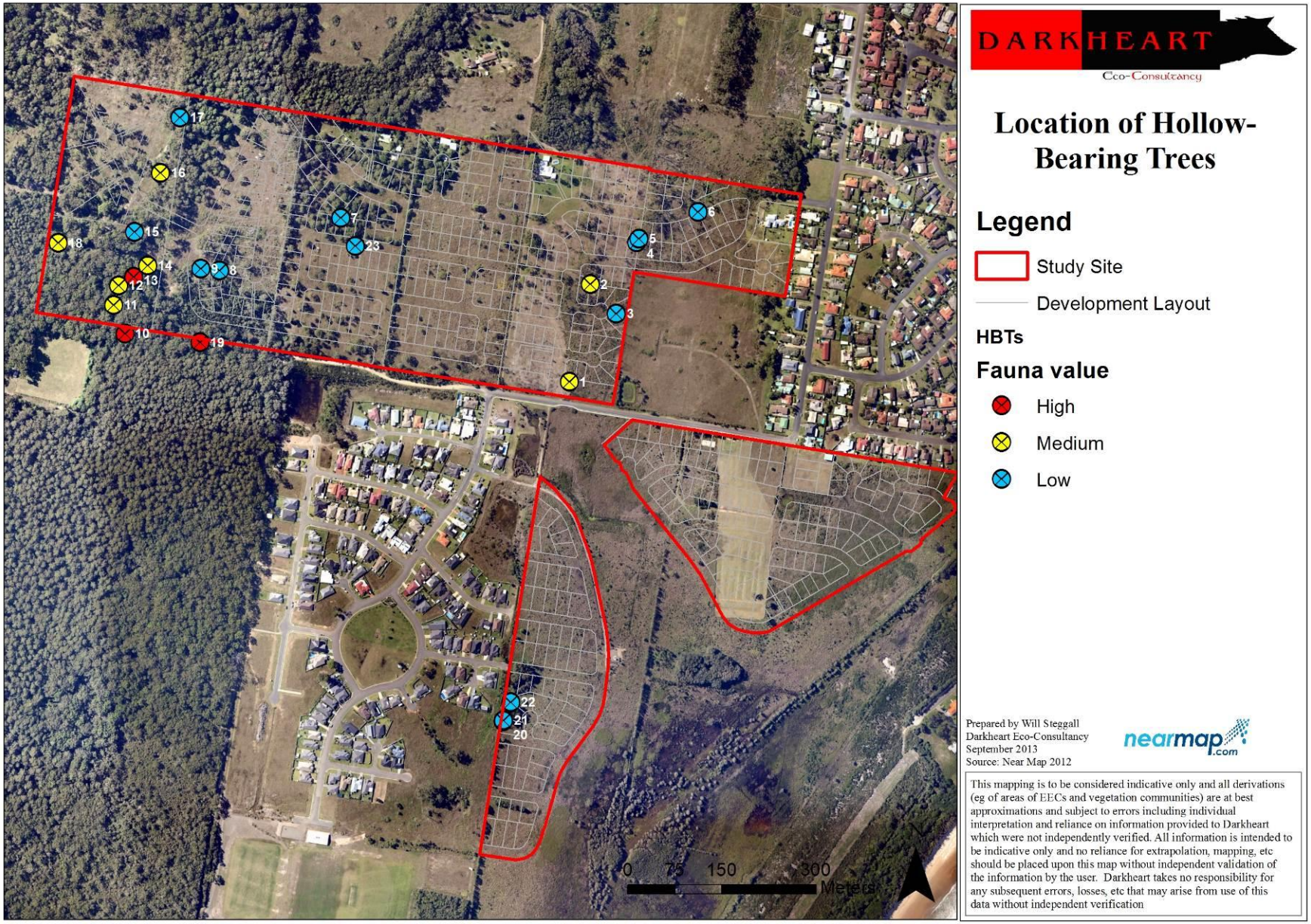


Photo 8: Large hollow tree (H10) in Forest Lane road reserve

Photo 9: Recent sap incisions in Bloodwoods on Love property

4.3.2 Call Playback, Identification and Recording

4.3.2.1 Birds

Call playback resulted in the detection of the Powerful Owl (*Ninox strenua*), listed as Vulnerable under the TSC Act. This occurred on the third night of the survey where call playback was conducted from the south of the Plimer property. The owl was faintly heard responding to call playback from the northwest and did not approach the survey site, hence was not directly sighted.

A number of common birds were detected by call identification (see Table 6).

4.3.2.2 Frogs

Frogs were heard calling in relatively low abundance from the dams, drainage lines and low-lying areas in the grassland. Only the following common species were heard:

- Common Eastern Froglet (*Crinia signifera*).
- Dwarf Tree Frog (*Litoria fallax*)
- Laughing Tree Frog (*Litoria tyleri*)
- Emerald Spotted Tree Frog (*Litoria peronii*)
- Dusky Toadlet (*Uperoleia fusca*)

4.3.2.3 Mammals

4.3.2.3.1 Arboreal Mammals

No mammal responded to call playback during the survey.

4.3.2.3.2 Bats

Ultrasonic Yangochiropteran bat calls recorded during the survey were sent to Ms Anna Lloyd of Eco-Location, a recognised Yangochiropteran bat ecologist for identification. The results are shown in the table below.

Table 6: Yangochiropteran bat call identification

Note: **bold** indicates species listed as Vulnerable on Schedule 2 of the TSCA Act 1995

SCIENTIFIC NAME	COMMON SPECIES NAMES	NO. OF DEFINITE PASSES	NO. OF PROBABLE PASSES	NO. OF POSSIBLE PASSES
Chalinolobus gouldii	Gould's Wattled Bat	61	9	6
Chalinolobus morio	Chocolate Wattled Bat	5	10	17
Miniopterus australis	**Little Bent-Wing Bat**	215	-	7
Miniopertus schreibersii oceanensis	**Eastern Bent-Wing Bat**	41	-	17
Mormopterus norfolcensis	**East-Coast Freetail-Bat**	1	-	29
Mormopterus sp.2	Undescribed Freetail Bat	-	-	26
Nyctophilus spp.	Large-Eared Bat	18	-	-
Scotorepens orion	Eastern Broad-Nosed Bat	2	-	-
Tadarida australis	White-Striped Free-Tailed Bat	6	-	-
Vespadelus darlingtoni	Large Forest Bat	-	1	16
Vespadelus pumilus	Eastern Forest Bat	36	2	338
Vespadelus regulus	Southern Forest Bat	-	-	10
Vespadelus troughtoni	**Eastern Cave Bat**	-	-	429
Vespadelus vulturnus	Little Forest Bat	-	-	415

Those species listed as "*definite*" are most likely to be the species occurring on the subject land. As shown above, three threatened Yangochiropteran bat species were confirmed as occurring by this survey: the Little Bent-Wing Bat (V-TSCA), the Eastern Bent-Wing Bat (V-TSCA) and the East-Coast Freetail Bat (V-TSCA).

The Eastern Cave Bat (*Vespadelus troughtoni*) is considered to be a precautionary "*possible*" occurrence on the subject land by the bat consultant. The call of the Eastern Cave Bat is virtually indiscernible from its common related *Vespadelus* species (Reinhold *et al* 2001), hence the presence of this species is described as a marginally "*possible*" occurrence given the lack of potential roosts on the site or known to occur nearby. Regional records of this species are scant (OEH 2013a, Churchill 2009, Smith *et al* 1995), and hence its actual potential to occur is considered at best low.

4.3.3 Trapping, Hair Funnel and IR Camera Results

4.3.3.1 Elliot B Traps

Elliot B trapping did not result in any captures.

4.3.3.2 Elliot A Traps

Elliot A trapping resulted in the capture of the House Mouse (*Mus musculus**), Bush Rat (*Rattus fuscipes*), Swamp Rat (*Rattus lutreolis*), Brown Antechinus (*Antechinus stuartii)* and Blue-Tongue Lizard (*Tiliqua scincoides*).

Brown Antechinus was the most common capture, especially in Jarberg West and North where over 15 were typically captured each day. Swamp Rat and House Mouse were also very common in these areas.

Less captures were made in the trap lines north of Forest Lane where the House Mouse was the most common capture.

4.3.3.3 Hair Funnels

Hair samples obtained from the hair funnels were sent for identification by Barbara Triggs (recognised hair specialist), who identified the samples according to techniques developed by Brunner and Coman (1974).

Hair funnels (terrestrial) recorded the Swamp Wallaby *(Wallabia bicolor*), Northern Brown Bandicoot (*Isoodon macrourus*), House Mouse, Black Rat (*Rattus rattus*), Bush Rat, Swamp Rat and Brown Antechinus. The arboreal tubes only recorded Brown Antechinus.

4.3.3.4 Infra Red/Trail Cameras

No threatened species were recorded with the IR cameras.

Those baited with meat only recorded an Antechinus (*Antechinus sp.*). Those baited with rolled oats recorded the Northern Brown Bandicoot, Water Rat (*Hydromys chrysogaster*), Swamp Rat and Red-Belly Black Snake (*Pseudechis porphyriacus*). Sample photos are provided in Appendix 5.

4.3.4 Spotlighting, Stag Watching, Secondary Evidence, and Opportunistic Observations

4.3.4.1 Spotlighting and Stag Watching

The Grey-Headed Flying Fox (*Pteropus poliocephalus*) was the only threatened fauna species recorded during spotlighting/torch searches in the study area. Several Flying Foxes were observed foraging in flowering White Mahogany adjacent to Forest Lane and in the north of the Plimer property.

Common species recorded included a number of sleeping birds, Red-Necked Wallaby, Brushtail Possum (*Trichosurus vulpecula*) and Ringtail Possum (*Pseudocheirus peregrinus*).

Stag watching resulted in the sighting of a pair of Sugar Gliders (*Petaurus breviceps*) emerging from a hollow in a large old tree adjacent to Forest Lane (identified as H10).

4.3.4.2 Secondary Evidence

4.3.4.2.1 Scratches

Examination of tree trunks showed variable levels of arboreal activity depending on species. Scratches were relatively common and easily detected on smoothed barked trees (i.e. Grey Gum), though these were generally restricted to the mature trees (>40cm trunk DBH).

Scratches varied in size, with some large scratches readily attributed to Lace Monitors (*Varinus varius)* while some of the other scratches were attributed to other arboreal mammals (eg Brushtailed Possums).

4.3.4.2.2 Scats and Tracks

Scats from several species were encountered on the site and throughout the site. Macropod scats and tracks were regularly observed, and were identified as Red Necked Wallaby and Eastern Grey Kangaroo. Feral Deer tracks were noted in regenerating shrubland in the west of Jarberg north. Other scats encountered included dog/fox, Brushtailed Possum and *Rattus* species.

No Koala scats were observed during scat searches over the site.

4.3.4.2.3 Feeding Signs

(i) ***Sap Sucking - Arboreal Mammals***

Incisions made into tree trunks for sap sucking were observed on several trees bordering Forest Lane and in the north of the Love property. The incisions were of various ages, ranging from well healed and scared over, to freshly weeping. All incisions were quite small (3-10cm) and narrow. Such incisions are considered typical of Squirrel or Sugar Gliders (e.g. Smith and Murray 2003, Berrigan 1999a, Darkheart 2004f, 2006i, 2006j, 2005b, etc).

"L" or "V" shaped incisions and rectangular excisions of patches of bark are often typical of the Yellow-Bellied Glider, which characteristically makes bigger incisions than the Squirrel or Sugar Glider. Some trees are sampled for their sap-exuding properties, and not used again (NPWS 2003a, Mackowski 1988, Goldingay 1992). Key trees used by Yellow-Bellied Gliders are habitually used (trees often bear many incisions evident of various ages), which when found, may usually be surveyed with high probability of detection of this species (NPWS 2003a, 2004, Smith *et al* 1995,

Mackowski 1988, Goldingay 1992). No distinctive Yellow-Bellied Glider incisions were detected, strongly suggesting that this species does not occur.

(ii) ***Digging and Burrowing***

Diggings were commonly encountered throughout the site, particularly within areas with dense groundcover. These were attributed to bandicoots (eg Long-Nosed and Northern Brown Bandicoot).

(iii) ***Chewed Allocasuarina Cones***:

No chewed cones indicative of foraging by the Glossy Black Cockatoo were found on site during the survey. This species has been previously observed in the open forest north of Forest Lane (Terra 2004).

4.3.5 Opportunistic Observations

4.3.5.1 General

Table 6 lists all the species (with the exception of Yangochiropteran bats) detected by this survey on and adjacent to the study site. A total of 102 species were recorded, comprising 75 birds, 18 mammals, 4 reptiles and 5 frogs.

4.3.5.2 Birds

Two threatened birds listed as Vulnerable under the TSCA 1995 were directly observed during the survey, namely the Eastern Osprey (*Pandion cristatus*) and the eastern subspecies of the Brown Treecreeper (*Climacteris picumnus victoriae*). The location of these species is shown in Figure 8.

The Osprey was observed flying over the south of the site on the first and second day of the survey. On the second day, an adult female was seen flying overhead heading south carrying a recently caught fish. It subsequently attempted to land on a short power pole/transformer at the Midcoast Water pump station adjacent to Jarberg west, where it was electrocuted and killed (Photo 11). It appeared that the Osprey had used this pole as a perch before, but the added weight of the fish had set it off balance when landing and it had come into contact with a live wire. Midcoast Water and Essential Energy were contacted and asked if the pole could be modified to prevent birds perching. A second Osprey was observed flying over the north of the site during the second week of the survey.

A small group of 3-4 Brown Treecreepers were observed in the second week of the fauna survey. They were initially observed foraging in rough-barked trees on the Love property, then flew across to a patch of trees on the adjacent property to the east. This is the first record of this species in the locality (OEH 2013a).

A variety of common birds were observed during bird surveys over the site. The grassland and shrubland communities of the site were found to support low numbers of a few species including Brown and Stubble Quail, Golden-Headed Cisticola, Chestnut-Rumped Heathwren, Little Grassbird and Chestnut-Breasted Manikin. Swamp Hens and Masked Lapwings were commonly observed on the edges of these communities. The open habitats of the site also supported a number of raptor species, namely the Black-Shouldered Kite, Whistling Kite, Nankeen Kestrel and Collared Sparrowhawk. A nest of the Whistling Kite was observed in a large Stringybark on the Goodear property.

The site's forested habitats were found to have a good diversity and abundance of small passerines and medium sized woodland/forest birds. The highest bird activity was found to be in the south of the Love and Plimer properties and in the road reserve of Forest Lane. Birds recorded here included Scarlet Honeyeater, White-Naped Honeyeater, Spotted Pardalote, Shining Bronze-Cuckoo, Spangled Drongo and Brown Gerygone.

Several waterbirds were recorded in the dams, drainage lines and stormwater ponds on and adjacent to the site such as Intermediate Egret, Latham's Snipe, Pacific Black Duck and Dusky Moorhen.

Migratory birds recorded during the survey were limited to the Rainbow Bee-Eater, Latham's Snipe, White-Bellied Sea-Eagle and Osprey.

4.3.5.3 Reptiles

Reptiles were scarce over the site and only a few species were observed. Sun Skinks were the most common and were regularly seen in leaf litter. A young Lace Monitor was observed in the open forest and a Red-Belly Black Snake was found near a dam in Jarberg west.

No threatened species were detected.

4.3.5.4 Mammals

Common macropods were regularly observed on the site during spotlighting and other activities.

4.3.5.5 Frogs

Frogs were heard calling during other survey activities, as listed previously.

Table 7: Fauna recorded during the survey

Bold indicates Threatened species under TSC Act; ^Indicated Threatened species under EPBC Act; # Indicates migratory species under EPBC Act; * Indicates introduced species.
Observation Key: Obs – Observation; HC – heard calling

GROUP	COMMON NAME	SCIENTIFIC NAME	OBSERVATION TYPE
BIRDS	Australian Wood Duck	*Chenonetta jubata*	Obs
	White-Faced Heron	*Egretta novaehollandiae*	Obs
	White-Necked Heron	*Ardea pacifica*	Obs
	White Ibis	*Threskiornis molucca*	Obs
	Straw-Necked Ibis	*Threskiornis spinicollis*	Obs
	Latham's Snipe#	*Gallinago hardwickii*	Obs
	Intermediate Egret	*Ardea intermedia*	Obs
	Purple Swamphen	*Porphyrio porphyrio*	Obs, HC
	Dusky Moorhen	*Gallinula tenebrosa*	Obs
	Pacific Black Duck	*Anas superciliosa*	Obs
	Masked Lapwing	*Vanellus miles*	Obs
	Australian Pelican	*Pelecanus conspicillatus*	Obs
	Black-Shouldered Kite	*Elanus axillaris*	Obs
	Whistling Kite	*Haliastur sphenurus*	Obs, HC
	White-Bellied Sea Eagle#	*Haliaeetus leucogaster*	Obs
	Eastern Osprey#	*Pandion cristatus*	Obs
	Nankeen Kestrel	*Falco cenchroides*	Obs
	Collared Sparrowhawk	*Accipiter cirrocephalus*	Obs
	Powerful Owl	*Ninox strenua*	HC
	Crested Pigeon	*Ocyphaps lophotes*	Obs
	Pheasant Coucal	*Centropus phasianinus*	HC
	Eastern Rosella	*Platycercus eximius*	Obs
	Galah	*Cacatua roseicapilla*	Obs, HC

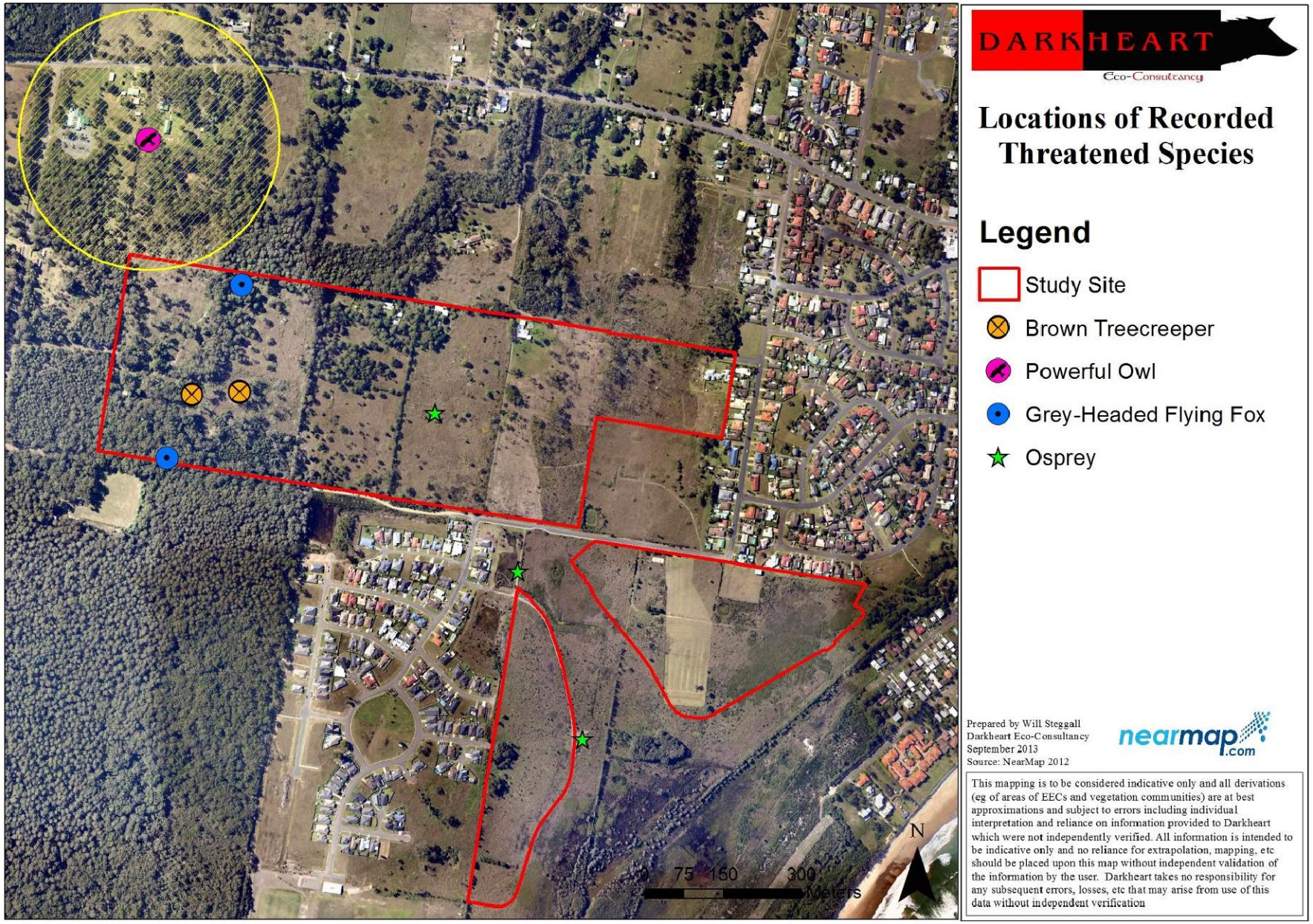
	Rainbow Lorikeet	*Trichoglossus haematodus*	Obs, HC
	Scaly-Breasted Lorikeet	*Trichoglossus chlorolepidotus*	Obs, HC
	Lewin's Honeyeater	*Meliphaga lewinii*	Obs, HC
	White-Naped Honeyeater	*Melithreptus lunatus*	Obs
	Scarlet Honeyeater	*Myzomela sanguinolenta*	Obs
	Laughing Kookaburra	*Dacelo novaeguineae*	Obs
	Yellow-Faced Honeyeater	*Lichenostomus chrysops*	Obs, HC
	White-Cheeked Honeyeater	*Phylidonyris niger*	Obs
	Brown Honeyeater	*Lichmera indistincta*	Obs
	Little Wattlebird	*Anthochaera chrysoptera*	Obs, HC
	Noisy Friarbird	*Philemon corniculatus*	Obs, HC
	White-Throated Treecreeper	*Cormobates leucophaeus*	Obs, HC
	Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	Obs
	Superb Fairy Wren	*Malurus cynaeus*	Obs
	Variegated Fairy Wren	*Malurus lamberti*	Obs
	Silvereye	*Zosterops lateralis*	Obs
	Chestnut-Rumped Heathwren	*Hylacola pyrrhopygia*	Obs
	Chestnut-Breasted Manikin	*Lonchura castaneothorax*	Obs
	Little Grassbird	*Megalurus gramineus*	Obs
	Brown Gerygone	*Gerygone mouki*	HC
	White-Throated Gerygone	*Gerygone albogularis*	HC
	Yellow Thornbill	*Acanthiza nana*	Obs
	Brown Thornbill	*Acanthiza pusilla*	Obs, HC
	Spotted Pardalote	*Pardalotus punctatus*	HC
	Striated Pardalote	*Pardalotus striatus*	HC
	Golden Whistler	*Pachycephala pectoralis*	Obs, HC
	Rufous Whistler	*Pachycephala rufiventris*	Obs, HC
	Eastern Yellow Robin	*Eopsaltria australis*	Obs
	Welcome Swallow	*Hirundo neoxena*	Obs
	Grey Shrike-thrush	*Colluricincla harmonica*	Obs, HC
	Willie Wagtail	*Rhipidura leucophrys*	Obs
	Grey Fantail	*Rhipidura fuliginosa*	Obs, HC
	Red-Browed Finch	*Neochmia temporalis*	Obs
	Golden-Headed Cistocola	*Cisticola exilis*	Obs
	Rainbow Bee-Eater[#]	*Merops ornatus*	HC
	Unidentified Flycatcher	*Myiagra sp.*	HC
	Black-Faced Cuckoo Shrike	*Coracina novaehollandiae*	Obs, HC
	Fan-Tailed Cuckoo	*Cacomantis flabelliformis*	HC
	Shining Bronze-Cuckoo	*Chrysococcyx lucidus*	HC
	Horsfields Bronze-Cuckoo	*Chalcites basalis*	HC
	Pied Butcherbird	*Cracticus nigrogularis*	Obs
	Grey Butcherbird	*Cracticus torquatus*	Obs
	Magpie Lark	*Grallina cyanoleuca*	Obs
	Australian Magpie	*Gymnorhina tibicen*	Obs
	Torresian Crow*	*Corvus orru*	Obs
	Spangled Drongo	*Dicrurus bracteatus*	Obs, HC
	Figbird	*Sphecotheres vieilloti*	Obs
	Dollarbird	*Eurystomus orientalis*	Obs
	Noisy Miner	*Manorina melanocephala*	Obs
	Satin Bower Bird	*Ptilonorhynchus violaceus*	Obs
	Brown Quail	*Coturnix ypsilophora*	Obs, HC
	Stubble Quail	*Coturnix pectoralis*	Obs
MAMMALS	Common Brushtail Possum	*Trichosurus vulpecula*	Obs, scats
	Ringtail Possum	*Pseudocheirus peregrinus*	Obs
	Sugar Glider	*Petaurus breviceps*	Obs
	Fox*	*Vulpes vulpes*	Scats
	Red-Necked Wallaby	*Macropus rufogriseus*	Obs, scats
	Swamp Wallaby	*Wallabia bicolor*	Obs, hair funnel

	Eastern Grey Kangaroo	*Macropus giganteus*	Obs, scat
	Unidentified Deer*	-	Tracks, scats
	European Hare*	*Lepus europaeus*	Obs
	Long-Nosed Bandicoot	*Perameles nasuta*	Diggings
	Northern Brown Bandicoot	*Isoodon macrourus*	IR camera, hair funnel, diggings
	Brown Antechinus	*Antechinus stuartii*	Elliot A, hair funnel, IR camera
	Swamp Rat	*Rattus lutreolis*	Elliot A, hair funnel, IR camera
	Black Rat*	*Rattus rattus*	Hair funnel
	Bush Rat	*Rattus fuscpes*	Elliot A
	Water Rat	*Hydromys chrysogaster*	IR camera
	House Mouse*	*Mus musculus*	Elliot A, hair funnel
	Grey-Headed Flying Fox^	*Pteropus poliocephalus*	Obs
REPTILES	Red-Belly Black Snake	*Pseudechis porphyriacus*	IR camera, obs
	Eastern Blue-Tongue Lizard	*Tiliqua scincoides*	Elliot A
	Lace Monitor	*Varanus varius*	Obs
	Sun Skink	*Lampropholis guichenoti*	Obs
FROGS	Common Eastern Froglet	*Crinia signifera*	HC
	Dwarf Tree Frog	*Litoria fallax*	HC
	Laughing Tree Frog	*Litoria tyleri*	HC
	Dusky Toadlet	*Uperoleia fusca*	HC
	Emerald Spotted Tree Frog	*Limnodynastes peronii*	HC

Photo 10: Location of Osprey death

Osprey was electrocuted on power pole and can be seen at base.

Figure 8: Locations of recorded threatened species on the site



4.4 LOCALLY RECORDED THREATENED FAUNA

The following table lists threatened species known to occur in the locality (OEH 2013b, Terra 2004, Umwelt 2007).

Table 8: Locally recorded threatened fauna

GROUP	COMMON NAME	SPECIES	LEGAL STATUS	DISTANCE FROM STUDY SITE/GENERAL LOCATION
MAMMALS	Koala	*Phascolarctos cinereus*	V-TSCA	Forest Lane, Old Bar, Old Bar Road, Kiwarrak State Forest, Old Soldiers Road , Bishops Road, Diamond Beach, Redhead.
	Spotted-Tailed Quoll	*Dasyurus maculatus*	V-TSCA, E-EPBCA	North of Old Bar, Mitchells Island, Rainbow Flat
	Brushtailed Phascogale	*Phascogale tapoatafa*	V-TSCA	Pacific Highway service centre, Khappinghat Nature Reserve, Tallwoods, Rainbow Flat, Diamond Beach, Crows Nest Road
	Common Planigale	*Planigale maculata*	V-TSCA	1.1km northeast of Purfleet
	Long-Nosed Potoroo	*Potorous tridactylus*	V-TSCA, V-EPBCA	1km southeast of Purfleet
	Squirrel Glider	*Petaurus norfolcensis*	V-TSCA	Red Gum Road Old Bar, Diamond Beach, Saltwater Reserve
	Yellow-Bellied Glider	*Petaurus australis*	V-TSCA	Single record near Kolinda Drive
	Little Bent-Wing Bat	*Miniopterus australis*	V-TSCA	Recorded on site, Old Bar Public School, Red Gum Road, Pacific Highway service centre,
	Common/Eastern Bent-Wing Bat	*Miniopterus schreibersii oceanensis*	V-TSCA	Recorded on site, Pacific Highway service centre, Warwiba Road
	Eastern Freetail Bat	*Micronomus norfolkensis*	V-TSCA	Recorded on site, Pacific Highway service centre, Warwiba Road
	Common Blossom-Bat	*Syconycteris australis*	V-TSCA	Khappinghat Nature Reserve
	Grey Headed Flying Fox	*Pteropus poliocephalus*	V-TSCA, V-EPBCA	Recorded on site, Red Gum Road, Hallidays Point, Redhead, Manning Point Road, Diamond Beach
BIRDS	Glossy Black-Cockatoo	*Calyptorhynchus lathamii*	V-TSCA	North of Forest Lane, Mitchells Island, south of Bohnock, Khappinghat Nature Reserve
	Powerful Owl	*Ninox strenua*	V-TSCA	North of Forest Lane, Kiwarrak State Forest, Mudbishops, Diamond Beach
	Masked Owl	*Tyto novaehollandiae*	V-TSCA	Old Soldiers Road
	Sooty Owl	*Tyto tenebricosa*	V-TSCA	Half Chain Road
	Little Lorikeet	*Glossopsitta pusilla*	V-TSCA	Wallabi Point
	Eastern Osprey	*Pandion cristatus*	V-TSCA	Recorded on site, Old Bar, Saltwater, Diamond Beach, Mitchells Island, Mudbishops Reserve, Manning River
	Square Tailed Kite	*Lophoictinia isura*	V-TSCA	Old Soldiers Road
	Little Eagle	*Hieraaetus morphnoides*	V-TSCA	South of Taree
	Brown Treecreeper	*Climacteris picumnus*	V-TSCA	Recorded on site
	Speckled Warbler	*Chthonicola sagittata*	V-TSCA	Pampoolah
	Painted Honeyeater	*Grantiella picta*	V-TSCA	Historic record from Mitchells Island
	Black-Chinned Honeyeater	*Melithreptus gularis gularis*	V-TSCA	Mitchells Island
	Little Tern	*Sternula albifrons*	E-TSCA	Farquhar Inlet, Old Bar Beach, Saltwater, Wallabi Point, Diamond Beach
	Comb Crested Jacana	*Irediparra gallinacea*	V-TSCA	Old bar, Koorainghat Creek, Mudbishops Reserve, Oxley Island, Manning River,Half Chain Road, Cundletown, Dumeresq Island
	Terek Sandpiper	*Xenus cinereus*	V-TSCA	Mudbishops Point
	Magpie Goose	*Anseranas semipalmata*	V-TSCA	Oxley Island
	Jabiru/Black Necked Stork	*Ephippiorhynchus asiaticus*	E-TSCA	Oxley Island, Mitchells Island
	Beach-Stone Curlew	*Esacus magnirostris*	E-TSCA	Farquhar Inlet
	Australasian Bittern	*Botaurus poiciloptilus*	E-TSCA E-EPBCA	Mitchells Island

The study area is located on land and does not encompass any ocean or estuarine areas, thus sea birds, etc, are not considered in this assessment. The following species are considered likely to occur in the locality (excluding sea birds, etc) due to suitable habitat and regional records (some

have been recorded within 20km). Those marked with * are dually listed under the EPBCA 1999:

Table 9: Threatened fauna potentially occurring in the locality

Animal Group	Potentially Occurring Species
Mammals	Eastern Pygmy Possum, Eastern Chestnut Mouse, New Holland Mouse, Eastern False Pipistrelle, Eastern Cave Bat, Yellow-Bellied Sheathtail Bat, Golden-Tipped Bat, Southern Myotis, Beccari's Freetail, Rufous Bettong, *Dwyer's Bat.
Birds	Eastern Grass Owl, Barking Owl, *Red Goshawk**,** Spotted Harrier, Bush-Stone Curlew, Varied Sittella, Scarlet Robin, Flame Robin, Barred Cuckoo Shrike, Wompoo Fruit-Dove, Rose-Crowned Fruit Dove, Superb Fruit Dove, Olive Whistler, Diamond Firetail, Grey-Crowned Babbler, Hooded Robin, White-Fronted Chat, Brolga, *Australasian Bittern, *Swift Parrot, *Regent Honeyeater**.**
Reptiles	*Three-Toed Snake-Tooth Skink**,** Pale Headed Snake, Stephens Banded Snake
Frogs	*Wallum Sedge Frog**,** Green-Thighed Frog, Wallum Froglet, *Giant Barred Frog, *Stuttering Frog, *Green and Golden Bell Frog.

4.5 POTENTIAL OCCURRENCE ASSESSMENT

Each of the species listed above have been evaluated in Appendix 1 for their potential to occur on the site, as well as their potential to occur in the study area and hence be affected by the proposal (and thus require Seven Part Test assessment). From this assessment, the following species are considered to potentially occur on the site at varying capacities and probabilities:

Table 10: Threatened species potentially occurring on the site.

SPECIES	OCCURRENCE TYPE	OCCURRENCE LIKELIHOOD *See Appendix 1 for key
Square-Tailed Kite	Potential to form minute portion of large foraging territory. Generic potential nest trees.	Moderate chance as periodic forager.
Little Eagle	Potential to form minute portion of large foraging territory. Generic potential nest trees.	Low to fair chance as periodic forager.
Masked Owl	Site/study area contains broadly suitable foraging habitat that may form small part of a territory. No nesting hollows on site but few in study area.	Fair chance as periodic forager.
Barking Owl	Site/study area contains broadly suitable foraging habitat that may form small part of a territory. No nesting hollows on site but few in study area.	Low chance (due to sparse distribution and rarity) as periodic forager.
Grass Owl	Site and study area contains foraging and nesting habitat of varying quality that may form small part of territory.	Low chance of foraging due to lack of local records and disturbance history of site had led to suitable habitat only recently developing.
Little Lorikeet	Site/study area contains broadly suitable foraging habitat that may be used seasonally. Potential nesting hollows present in north of site.	Low to fair chance seasonally foraging. Nesting unlikely due to competition for hollows with observed common Lorikeets and Rosellas.
Varied Sittella	Northwest of site and adjoining forest offers suitable foraging and breeding habitat.	Fair chance of occurrence using northwest of site as small to large part of family group's territory.
Scarlet Robin	Northwest of site and adjoining forest offers suitable habitat that may be used as part of seasonal range.	Low to fair chance of occurrence seasonally foraging.
Jabiru/Black-Necked Stork	Dams on site offer marginal potential. Drains adjacent to site offer better potential but enclosed in dense vegetation.	Low chance of opportunistic forager as part of non-breeding range.
Koala	Potential Koala Habitat in north but no evidence of usage on site. Northwest of site may form part of individual's territory or be used as movement corridor.	Low chance of occurrence given reported sightings within range of site and suitable food trees.
Spotted-Tailed Quoll	Site/study area offers potential foraging habitat and may form part of movement corridor. Some potential denning habitat in northwest of site.	Low to fair chance of occurrence using northwest of site as small part of foraging territory.

Squirrel Glider	Site/study area offers marginally fair potential foraging and denning habitat. Probably in low density due to mostly low quality habitat on site.	Low to fair chance of occurrence foraging and denning in northwest of site but would be in competition with recorded Sugar Glider.
Brushtailed Phascogale	North of site and adjacent forest offers good potential foraging and denning habitat. Probably in low density due to competition of suitable hollows and evident disturbance history.	Low to fair foraging and denning in north of site.
Yellow-Bellied Sheathtail Bat	Site/study area offers potential foraging and roosting habitat. Potentially breeding locally.	Low chance of foraging and roosting due to lack of local records.
Greater Broad-Nosed Bat	Site/study area offers potential foraging and roosting habitat as part of large seasonal range. Potentially breeding locally.	Low to fair chance of foraging and roosting.
Eastern False Pipistrelle	Site/study area offers potential foraging and roosting habitat as part of large seasonal range. Marginal potential to breed locally.	Low chance of foraging and roosting.

The Eastern Chestnut Mouse was considered a potential occurrence by Umwelt (2007). This species was a potentially significant constraint on the proposal, and hence a very intensive targeted survey (eg 9 times the minimum DEC effort for Elliot A traps) was implemented to detect this species if it was present. The survey did not detect this species, and the exceptional intensity of survey as well as lack of local records strongly evidence this species is not likely to occur on site.

The New Holland Mouse was listed under the EPBCA 1999 since Umwelt (2007). Some generic potential habitat for this species occurs in the dune system east of the site. As noted above, this species was also a priority target, but only the exotic House Mouse was recorded. Consequently, the failure to detect this species and lack of local records strongly suggest it is not likely to occur on site.

Umwelt (2007) also considered the following species as potential occurrences:

- *Regent Honeyeater and Swift Parrot*: Most of the potential habitat identified by Umwelt for these species occurs off-site. On-site habitat is at best marginal. Given the low quality of site habitat and extreme rarity of these birds, neither are considered potential occurrences.

- *Eastern Pygmy Possum*: Again most of the potential habitat for this species occurs off-site in swamp forest. On-site habitat is at best marginal, and this species has not been recorded locally. Its preference for high quality nectar producing habitats and the intensive disturbance history of the site strongly suggest it not a potential occurrence.

- *Wallum Froglet*: Again most of the potential habitat for this species occurs off-site in swamp forest, but several surveys have failed to detect it in these areas. This and a lack of local records strongly suggest it is not a potential occurrence.

- *Yellow-Bellied Glider*: This species is relatively conspicuous due to its distinctive incisions and territorial vocalising, and readily responds to call playback. Failure to detect any evidence of its presence and only a single local record strongly suggests it is unlikely to occur.

- *Comb-Crested Jacana*: Again the large wetlands/waterbodies offsite offer the best potential habitat for these species, with a small dam adjacent to the new residential estate and associated drains offering some marginal potential. The marginal habitat and the bird's sensitivity to anthropogenic disturbances strongly suggest this bird is not a likely occurrence.

5.0 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

5.1 THREATENED AND PROTECTED FAUNA

A significant number of pelagic seabirds, marine turtles, fish and mammals listed as Threatened and/or Migratory under the EPBCA 1999 (some are also listed as threatened under the TSCA) are known (OEH 2013a) or may occur on rare occasion within the locality (eg Green Turtle).

However, the site itself does not offer suitable habitat for these species (OEH 2013b, Strahan 2000). Furthermore, no aspect of this proposal has potential to impact to any significance upon these species. Consequently, these migratory/threatened marine fish, turtles, mammals and seabirds are not considered in the following assessment due to the lack of significant habitat, occurrence likelihood/potential impacts these species.

5.1.1 Vulnerable and Endangered Fauna Species

One threatened species listed as Vulnerable was detected on the site by the survey: the Grey Headed Flying Fox.

A search of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) - *Matters of National Environmental Significance* (MNES) website was taken to generate a list of threatened species potentially occurring in the locality of the site. These are shown in the following table, with other species previously recorded or considered by the consultant as potential occurrences in the locality due to suitable habitat. An evaluation of their likelihood of occurrence on the subject land is also provided from the evaluation table in Appendix 1.

Table 11: EPBCA threatened fauna species potential occurrence assessment

Note: Likelihood of occurrence derived from opinions of consultants in consideration of known ecology of each species (see Appendix 1); and quality of habitat on-site. * indicates listed on DSEWPC website search.

GROUP	COMMON NAME	SCIENTIFIC NAME	LISTING STATUS	RECORDED IN LOCALITY (10km radius)	SUITABLE HABITAT ON SITE	LIKELIHOOD OF OCCURRENCE ON SITE
BIRDS	*Regent Honeyeater	*Xanthomyza phrygia*	E	N	Marginal at best as very few Forest Red Gums or Swamp Mahogany that would offer potential forage for non-breeding transients.	Unlikely
	*Australian Painted Snipe	*Rostratula australis*	V	N	Marginal potential in some parts of grassland but not preferred habitat types.	Unlikely
	*Australasian Bittern	*Botaurus poiciloptilus*	E	N	No suitable habitat.	Unlikely
	*Red Goshawk	*Erythrotriorchis radiatus*	V	N	Generic foraging habitat on site but outside known range.	Unlikely
	*Eastern Bristlebird	*Dasyornis brachypterus*	E	N	No suitable habitat.	Unlikely
	*Swift Parrot	*Lathumus discolor*	E	Y	Very few potential forage species for non-breeding transients. Swamp Mahogany common in nearby swamp forest.	Unlikely chance of occurrence on site due to rarity of this bird and lack of suitable foraging resources.
MAMMALS	*Long-Nosed Potoroo	*Potorous tridactylus*	V	Y	Marginal at best in broad generic sense in southern study area, but foxes and lack of proximate records suggest unlikely.	Unlikely
	*Spotted-Tail Quoll	*Dasyurus maculatus*	E	Y	Suitable habitat on forested areas of site as larger area of potential habitat.	Low to fair
	Koala	*Phascolarctos cinereus*	V	Y	All open forest and woodland north of Forest Lane, which forms part of larger area of potential habitat.	Reported to occur near Forest Lane. Moderate chance of occurrence on site.
	*Grey Headed Flying Fox	*Pteropus poliocephalus*	V	Y.	All open forest and woodland north of Forest Lane, which forms part of larger area of potential habitat.	**Recorded**

	*Dwyer's/Large Pied Bat	*Chalinobus dwyeri*	V	N	Generic foraging. No roosting	Unlikely due to rarity and lack of records.
	*New Holland Mouse	*Pseudomys novaehollandiae*	E	N	Site contains some areas of possibly generically suitable habitat however has been subject to long history of disturbances.	Unlikely: no local records, sparse national distribution and not recorded by survey.
FROGS	*Green and Golden Bell Frog	*Litoria aurea*	V	N	Marginal habitat in some dams and drains but Plague Minnow present.	Unlikely due to urban runoff, presence of Plague Minnow and lack of local records.
	Stuttering Frog	*Mixophyes balbus*	E	N	No potential habitat	Unlikely
	Giant Barred Frog	*M. iteratus*	E	N	No potential habitat	Unlikely

5.1.2 Migratory Species

A total of four migratory bird species were recorded during the survey: Eastern Osprey, White-Bellied Sea-Eagle, Rainbow Bee-Eater and Latham's Snipe.

A significant number of additional EPBCA listed migratory bird species are known (OEH 2013a) or considered potential occurrences in the locality. A search of the MNES website and literature review (Readers Digest 1990, Priest *et al* 2002, Sandpiper 2004, Rogers *et al* 2006, Antos and Weston 2006, Antos 2005, WWF 2005, Nebel *et al* 2008, Shorebirds 2020 2008) also produced a list of likely occurrences. All of these species plus some considered by the consultant as potential occurrences in the LGA in similar habitat to that on the property are also shown in the following table, with an evaluation made on likelihood of occurrence based on cited ecology. Note this list excludes seabirds, etc as detailed above.

Table 12: EPBCA migratory fauna species potential occurrence assessment

* indicates listed in the Protected Matters report.

COMMON NAME	SCIENTIFIC NAME	PREDICTED TYPE OF OCCURRENCE	RECORDED IN LOCALITY	HABITAT ON SITE	LIKELY TO OCCUR ON SITE
*White-Bellied Sea-Eagle	*Haliaetus benghalensis*	Species and/or habitat likely to occur within area	Y	Dams on site too small to offer foraging habitat. Wetlands and Beach to east offer suitable foraging habitat.	**Recorded** as fly-over. No nest on site
Osprey	*Pandion cristatus*	-	Y	Generally as for White-Bellied Sea-Eagle.	**Recorded.** No nest on site
*Latham's Snipe	*Gallinago hardwickii*	Species or habitat may occur in area	N	Potential to occur foraging along drainage lines and rank grassland during wetter periods.	**Recorded**

*Painted Snipe	*Rostratula benghalensis (australis)*	Species and/or habitat may occur in area	N	Marginal potential in some parts of grassland but not preferred habitat types.	Unlikely
*Cattle Egret	*Egretta ibis*	Species/habitat may occur in area	Y	No stock on site. Might use dam edges for foraging.	Low chance of occurrence.
*Great Egret	*Egretta alba*	Species/habitat may occur in area	Y	May occasionally forage around dams and drains in study area.	>Fair chance of occurrence
*Rainbow Bee-Eater	*Merops ornatus*	Species/habitat may occur in area	Y	Suitable habitat in woodland and over grassland.	**Recorded**
*Regent Honeyeater	*Xanthomyza phrygia*	Species/habitat may occur in area	N	Marginal at best as very few Forest Red Gums or Swamp Mahogany that may offer potential forage for non-breeding transients.	Unlikely
*Swift Parrot	*Lathumus discolor*	Species/habitat may occur in area	Y	Very few potential forage species for non-breeding transients. Swamp Mahogany common in nearby swamp forest.	Unlikely chance of occurrence on site due to rarity of this bird and lack of suitable foraging resources.
*Rufous Fantail	*Rhipidura rufifrons*	Breeding or breeding habitat may occur in area	Y	No preferred habitat.	Unlikely
*Satin Flycatcher	*Myiagra cyanoleuca*	Breeding or breeding habitat likely in area	Y	Some potential habitat in forested areas.	Fair
*Black Faced Monarch	*Monarcha melanopsis*	Breeding or breeding habitat may occur in area	Y	Marginal habitat in open forest	Low
*Spectacled Monarch	*M. trivirgatus*	Breeding or breeding habitat likely in area	Y	Marginal habitat in open forest	Low
*Oriental Cuckoo	*Cuculus saturatus*	Species/habitat likely in area	Y	Potential habitat in open forest	Fair
*White-Throated Needletail	*Hirundapus caudacutus*	Species/habitat likely to occur in area	Y	Yes as part of a broader area	Moderate-high, as transient, between Dec-April
*Fork-Tailed Swift	*Apus pacificus*	Species/habitat may occur in area	Y	Yes as part of a broader area	Fair potential, as transient, between Oct-April

5.2 THREATENED FLORA

No EPBCA listed threatened plants were recorded during the survey. The following table assesses the occurrence potential of species derived from the MNES search tool and Bionet (DSEWPC 2013a, OEH 2013a) for the locality:

Table 13: EPBCA threatened flora species potential occurrence assessment

Note: Likelihood of occurrence derived from opinions of consultant in consideration of local records, known ecology of each species; and quality of habitat on-site.

COMMON NAME	SCIENTIFIC NAME	LISTING STATUS	RECORDED IN LOCALITY (10km radius)	SUITABLE HABITAT ON-SITE	LIKELIHOOD OF OCCURRENCE ON SITE
Dwarf Heath Casuarina	*Allocasuarina defungens*	V	Y	Marginal potential habitat in shrubland but probably too disturbed and not recorded by this or previous surveys.	Unlikely
Tuncurry Midge Orchid	*Corunastylis littoralis*	E	N	No potential habitat	Unlikely
Leafless Tongue Orchid	*Cryptostylis hunteriana*	V	N	Poor potential habitat with long disturbance history	Unlikely
White-Flowered Wax Plant	*Cynanchum elegans*	E	Y	No potential habitat occurs on site	Unlikely
-	*Euphrasia arguta*	E	N	No potential habitat	Unlikely
Macadamia Nut	*Macadamia integrifolia*	V	Y	No potential habitat	Unlikely
Biconvex Paperbark	*Melaleuca biconvexa*	V	N	No potential habitat	Unlikely
Lesser Swamp Orchid	*Phaius australis*	V	N	No potential habitat	Unlikely
Siah's Backbone	*Streblus pendulinis*	E	N	No potential habitat	Unlikely
Magenta Lilly Pilly	*Syzygium paniculatum*	V	Y	No potential habitat	Unlikely
Austral Toadflax	*Thesium australe*	V	Reported to occur at Old Bar airfield (Isaac Mamott pers.comm.)	Poor potential habitat with long disturbance history	Unlikely

5.3 THREATENED ECOLOGICAL COMMUNITIES

The following EPBC listed communities are listed as known to occur in the locality:

- *Littoral Rainforest and Coastal Vine Thickets of Eastern Australia*
- *Lowland Rainforest of Subtropical Australia*

No vegetation matching these TECs occurs in the study area.

6.0 SEPP 44 – KOALA HABITAT ASSESSMENT

Umwelt (2007) conducted an assessment to determine if the site contained Potential Koala Habitat (PKH) as per the SEPP 44 definition. Two preferred food trees listed on Schedule 2 were recorded on the site: Tallowwood and Swamp Mahogany. The assessment determined that the open forest in the northeast and northwest of the site contained sufficient quantity of Tallowwood to qualify as PKH.

Umwelt undertook scat searches for Koalas, however did not find any evidence of Koala usage on the site. The assessment concluded that the site did not constitute Core Koala Habitat (CKH) under SEPP 44.

As previously mentioned, dedicated Koala scat surveys were undertaken during this survey, primarily in the areas of PKH mapped by Umwelt. Koalas were also targeted during call playback and spotlighting surveys.

No Koala scats were detected during the scat searches (hence no areas of major activity were detected), and no Koalas were observed during spotlighting or responded to call playback. This is in line with Umwelt's results in 2007. A resident in the north of the site reported seeing a Koala cross Forest Lane (date unknown), indicating that the western fringe of the site may be infrequently used as movement corridor by Koalas between local Koala habitats. This is in line with Koala ecology (DECC 2008).

Consequently, the Potential Koala Habitat on site is again not considered to qualify as Core Koala Habitat due to lack of any direct evidence of resident Koalas, and failure to detect an area of major activity. Consequently, a Koala Plan of Management is not considered required.

7.0 IMPACT IDENTIFICATION AND ASSESSMENT

7.1 DIRECT IMPACTS

7.1.1 Establishment of the subdivision

As mentioned previously, the proposed development is to establish a new subdivision on Precinct 3 that will consist of 519 Lots along with new roads and services. A corridor will be retained in the northwest of the site and a drainage reserve is proposed to the north of Forest Lane. The footprint for the development is approximately 48ha. The development will proceed in stages.

This will ultimately result in the loss of an estimated:

- 4.6ha of open forest
- 14ha of highly modified/regrowth open forest
- 0.3ha of swamp sclerophyll forest
- 5ha of shrubland
- 13ha of derived grassland
- 10ha of derived grassland with scattered trees

A total of 13 hollow-bearing trees are likely to be removed as a result of the proposed subdivision. Most of these are located in areas where threatened species have limited potential to access them, and are currently occupied by common and competitive native species eg Rainbow Lorikeets.

7.2 INDIRECT IMPACTS

Indirect impacts typically associated with residential development are identified and assessed for significance in the table below:

Table 14: Indirect threats associated with the proposal.

THREAT	LITERATURE REVIEW	ASSESSMENT OF PROPOSAL
Fragmentation and landscape change	Fragmentation and the associated landscape changes at all scales is major factor in the decline of biodiversity, the modification of ecosystems, and alteration of ecosystem processes. Its effects vary with factors such as distance of fragments from similar habitat, their position in the landscape, the forms of habitat modification of isolates that occurs (eg due to edge effects), and types of surrounding landuses in the matrix, the ecology of the species affected, and how these factors influence the movement of organisms between the isolates and larger areas of habitat (Lindenmayer and Fisher 2006, OEH 2013b).	The proposed development will result in some minor fragmentation in the north of the site. This is unlikely to affect the movements of any of the subject species as they are all highly mobile. Further, the dedication of a conservation zone/corridor in the site's northwest will allow the site to continue to provide corridor function, linking retained habitat in Precinct 2B to the north to Kiwarrak State Forest to the south.
Direct mortality via clearing	A recent literature review of the impacts of land clearing in NSW (Johnson *et al* 2007) and a review of habitat fragmentation and landscape change (Lindenmayer and Fisher 2006) state that studies have demonstrated that most fauna are not displaced to adjacent habitat but perish during or as a direct result of land clearing via: • Direct injury or death during vegetation removal eg destruction of refugia while resident. • Loss of home range and social environment resulting in starvation, stress, disease, breeding failure (eg inability to maintain lactation demands), predation, exposure, etc. • Insufficient carrying capacity of retained habitat to support viable populations, breeding, etc. • Inability to secure alternative habitat eg due to lack of connectivity or inter/intra specific competition. • Insufficient carrying capacity of alternative habitat to support resident and displaced fauna. • Inability to support young, disruption of socio-ecological relationships, etc. • Increased access and success by predators.	As detailed above, 13 hollow-bearing trees are likely to be removed for the development. Any fauna potentially within these hollows thus will be at risk of direct mortality during felling, or increased predation risk after felling until they can locate alterative shelter. Fauna sheltering in dense groundcover on the site will also be at risk of mortality during clearing eg small terrestrial mammals, frogs and reptiles. Appropriate hollow-bearing tree removal protocol and clearing supervision must be implemented to minimise this risk (see Section 7).

Road Kills	Wildlife and particularly Koala road kills and injuries predominantly occur on high volume, high speed (60-100km/hr) streets and roads with poor visibility through sight interference (eg crests and corners) or poor visibility (eg inadequate street lighting) (Wilkes and Snowden 1998, Connell Wagner 2000, Port Stephens Council 2001, Lunney *et al* 1999, DECC 2008, AKF 2007). Furthermore, habitat adjacent to black spots (road sections characterised by high wildlife mortality) may also act as "sinks" to surrounding populations ie constant loss of recruits replacing previously killed individuals (Jones 2000, Gibbons and Lindenmayer 2006, Lindenmayer and Fisher 2006, AKF 2007, DECC 2008b, Goldingay and Taylor 2005, Rhodes *et al* 2008).	Establishment of a subdivision on the site with new internal and perimeter roads will introduce a new risk of road strike where habitat lies adjacent. Traffic volumes along Forest Lane will also significantly increase, and escalate the risk of road kills along this road. This will pose a significant threat to the potentially occurring threatened fauna species, especially the Koala and will require effective ameliorative measures to ensure risk is minimised.
Erosion and sedimentation	Sedimentation and erosion impacts can occur at both the construction and establishment phases. Erosion/sedimentation may occur via erosion of fill material and disturbed soils, scouring of exposed soil, earthen banks and habitats adjacent to the development area via directed flow (eg stormwater), or where runoff is concentrated.	Standard mechanisms and controls should ensure the prevention of erosion and sedimentation during construction and post-development and ensure such impacts do not extend beyond the development footprint.
Fencing	Fences have potential to obstruct the movement of threatened fauna across the site. Some threatened fauna can be injured by collision with wire fences or become entangled and die from exposure and predation. The Yellow-Bellied Glider, owls, bats and Squirrel Glider have been recorded being injured and killed by barbed wire fences (Lindenmayer 2002, Berrigan 2001c, Woodford 1999).	The northern Lots are mostly unfenced at present and an old wire fence surrounds parts of Jarberg west and north. Establishment of the subdivision will see new fences created which may pose a barrier to terrestrial species. However, as minimal native habitat is likely to be contained within the subdivision and sufficient linkage will remain around it, the barrier effect created is likely to be minimal.
Edge Effects	The fragmentation and/or isolation of currently intact vegetation via partial/mosaic clearing and establishment of pastures, fences, buildings, trails, roads, etc, can have the following effects which are generally referred to as edge effects (Lindenmayer and Fisher 2006, Andrews 1990, Goosem 2002, May and Norton 1996, Catterall 2004, Dickman 1996, NPWS 2001, Kelly *et al* 2003, Cropper 1993, Downy 2003, Brown *et al* 2003): • Increased ingress and success of feral species such as cats, foxes and dogs. • Ingress of weeds into areas not previously found, resulting in alterations to structure, floristics, bush fire regime, microclimate, etc. • Alterations to microclimate ie drying, altered humidity levels, increases light penetration, etc.	In general, edge effects have already manifested in the study area due to the previous and current landuse and fragmentation, and location on the urban fringe. The establishment of the subdivision will see an incremental and cumulative increase to the current status of these threats. Edge effects such as weed invasion are expected to manifest along the new forest edges created in the northwest of the site. Birds potentially nesting close to the new edge could be placed at greater risk of predation eg by pet cats.

	• Increased exposure to wind resulting in dieback, premature attrition of senescent trees, etc. • Increased competition eg introduction of conspecific native and endemic species due to creation of new habitats. • Alteration to fauna assemblages via altered ecosystem processes, creation of niche/edge habitats, altered predator relationships, competition, etc eg medium sized woodland birds displacing smaller passerines, increased nest predation, disturbance specialists, presence of exotic rodents, etc.	
Weed Invasion	Disturbance of soil provides the opportunity for weed invasion via removing competition, releasing nutrients, and increasing solar radiation. Weeds may also be transported to a site from vehicle, people (eg on clothing), etc, who visit the development area, and via introduced fill material. This allows establishment and subsequent invasion. Some horticultural species can also disperse from ornamental landscaping to establish on disturbed edges or be transported via green waste into bushland, where they establish and modify vegetation and habitat. Roads are not only a primary weed vector, but runoff from gravel and bitumen road creates an elevated nutrient zone on the shoulders of the road. This area is usually dominated by edge-specialist weeds which are spread via wind, water, and animal vectors, and may potentially spread into openings in the forest or along watercourses eg *Setaria* spp.	Lawns are likely to be maintained over the future Lots. Given that exotic pasture species are common over much of the site, no new weeds are expected from lawns. It is possible that some plants introduced as garden ornamentals may escape and become weeds in adjacent bushland, but this should be limited by the low fertility soils and high water table in the south. Conversely, any planted fruit trees or flowering trees/shrubs may attract flying foxes, provide structures for Yangochiropteran bats to forage around and/or provide habitat for passerine birds and/or insect prey, or possibly foraging habitat for Squirrel Gliders.
Noise and Physical Disturbance	Noise effects on fauna in Australia are relatively poorly studied (Clancy 2001, Berrigan 2001d). Most evidence presented is anecdotal, but suggests most fauna have a fair degree of tolerance and adaptation at least to residential noise depending on species, situation, habitat/lifecycle stage affected, habitat significance, etc. Most change is often short term (eg avoidance), but long term changes can include range contraction, alterations to migration routes, and altered behaviour (Radle 1999). Disturbance can also lead to abandonment of young.	Currently, noise is derived from traffic on Forest Lane and from the adjoining Ocean Blue estate. During the development's establishment, noise will be highest during construction, but limited to day time hence will only impact diurnal birds and mammals. Post-development, noise will be typical of a residential development ie peaks in morning and afternoon, with generally low levels at night.

Artificial Lighting	Lighting may potentially discourage particularly nocturnal native species from foraging near areas of development (ie Squirrel Gliders), especially given light may travel significant distances and it can have a similar effect to a full moon on the hunting success of predators such as owls, or a behavioural avoidance impact by potential prey species (DEC 2004a, Andrews 1990, Grayson and Calver 2004). Wallabies, kangaroos, Tawny Frogmouth Owls, Kookaburras, Magpies and possums have been noted foraging under artificial lighting in residential areas eg around Lake Innes, Port Macquarie and Kendall (personal observations). Artificial lighting may also be beneficial to Yangochiropteran bats by localised aggregation of insects, with these animals being observed foraging under streetlights, and even landing on lit footpaths in Horton St Port Macquarie to scamper for insects (personal observations). Artificial lighting can also have the positive impact of increasing sight detection of fauna on roads, thus reducing risk of road kills eg Koalas (Wilkes and Snowden 1998, AKF 2007, Connell Wagner 2000, Port Stephens Council 2001, Lunney *et al* 1999, OEH 2013b).	Artificial lighting will be provided as typical of residential areas, with lighting likely to be established around dwellings and along roads. Given no species considered sensitive to artificial lighting is present or likely to have a significant association with the site, this issue is not considered a substantial threat.
Alteration to Bushfire Regimes	Altered fire frequency can also ultimately simplify or alter the character of vegetation communities by removing fire sensitive species (eg convert wet sclerophyll to dry, or eliminate Allocasuarinas), and even develop fire-prone communities (eg promote development of a grassy groundcover). This has consequences for the fauna assemblage as well as species dependant on specific resources eg Glossy Black Cockatoo, Common Planigale and Green Thighed Frog (NSWSC 2000d).	Currently the main fire risk occurs in the northwest of the site from adjacent vegetation to the north, west and south. Low intensity grass fires are also a risk in the south of the site given the amount of fuel that has built up since slashing has ceased. The risk of increased bushfires in the retained or directly adjacent native vegetation as a result of the development is considered unlikely given the high level of exposure of the retained vegetation to residents, hence any arson is likely to be readily detected.

Eutrophication and pollution	Eutrophication and pollution of waterbodies can occur at both the construction and establishment phases, from on site effluent for dwellings, and from exudates and residues on bitumen roads which contaminate soil and water. Contaminants and nutrients can escape via improper storage of petrochemicals and other chemicals, refuelling areas, surface runoff from on-site sewerage treatment areas and improper effluent disposal design, runoff from car washing and cement washdowns, and use of fertilisers and herbicides on gardens.	Establishment of the subdivision will see increased stormwater volumes discharged faster off-site into detention basins, and eventually the wetland adjacent to the site and Racecourse Creek. If uncontrolled or inadequately treated, this could lead to water quality impacts of surrounding aquatic areas. Addition of nutrients and sediment could also lead to floristic and habitat changes. Stormwater should be managed to ensure contaminated runoff is directed away from sensitive aquatic habitat, and treated sufficiently before draining off-site.
Introduction of feral/introduced species	Urban, industrial and rural developments are often associated with the introduction of non-native species ie rodents, cats and dogs accidentally and intentionally eg via creating habitat for such species (eg rats, Indian Myna) or as pets. Feral cats and foxes are significant predators of native species (NSWSC 2000a, Dickman 1996, May and Norton 1996, OEH 2013b), and domestic dogs are significant threats to species such as the Koala (Wilkes and Snowden 1998, Port Stephens Council 2001, Connell Wagner 2000b, OEH 2012b). The mere presence of these predators has also been shown to affect fauna behaviour eg avoidance and range contraction. Rodents compete with native species but also form component of native species prey (OEH 2013b, Debus 1993).	The introduction of dogs on the site has the potential to increase the risk of attack on Koalas. However given that Koalas have not been found to have a significant association with the site and that dogs are currently present on the site and the adjacent estate, this risk is unlikely to be significantly increased. This survey has shown that exotic rodents are currently present on the site, hence any impacts posed by these species are likely to have already manifested. Rodents also provide a prey source for native reptiles and raptors. The introduction of cats poses a predation risk to Phascogales and Squirrel Gliders and could elevate potential mortality rates. Restrictions on cat ownership are difficult to enforce, hence this is not recommended, especially given adjacent rural and residential areas are not bound by such restrictions, hence cats may roam the site from adjoining land. Absence of both species from the site indicated by the survey results also suggest the actual risk is low.

8.0 RECOMMENDATIONS

8.1 PRIMARY RECOMMENDATIONS

The following major recommendations/ameliorative measures are made to reduce potentially significant impacts. These recommendations are integral to the basis of later assessment and conclusions, as it is assumed these recommendations will largely be implemented in some form.

8.1.1 Habitat Removal and Vegetation Clearance

The following measures are to be implemented to ameliorate possible impacts during clearing associated with construction:

- Prior to commencement of tree clearing in and adjacent to the northwest corridor, the boundary of the corridor is to be clearly designated with fencing eg paramesh or helicopter tape.

- All associated vehicles and machinery are only to be parked in the designated areas and not under the drip line of trees in the corridor. Similarly, any construction materials are to be stored outside the corridor. Machinery to be stored overnight at the site is to be located on existing clearings or tracks and must not be parked in vegetation non-designated for removal.

8.1.2 Animal Welfare Considerations

8.1.2.1 General

The following is recommended to be implemented to minimise risk of direct mortality of fauna during clearing works:

- The area of clearing work is to be inspected for Koalas and other fauna by an ecologist or approved FAWNA/WIRES representative immediately prior to commencement of any vegetation removal involving machinery and/or tree-felling. Pre-clearing checks will include searches of habitat eg lifting and destruction of logs, searches for bird nests, and raking of leaf litter. Other than Koalas, any detected fauna is to be relocated off-site. Any bird nest considered active is to be removed in a manner that allows retrieval of eggs/young, and these are to be taken into care by FAWNA/WIRES or euthanized humanely.

  Ideally, removal of the Whistling Kite nest would be undertaken in the non-breeding season (preferably at the end of a breeding event to encourage nesting elsewhere in the next season) to avoid mortality of nestlings.

- If a Koala is present in the proposed clearing envelope, works are to be suspended until the Koala moves along on its own volition. If the Koala is located in a position that a 25m buffer may be established, works may proceed outside this buffer.

- The ecologist/animal welfare representative is to remain on site to supervise tree clearing activities (predominantly only the open forest areas in the west where fauna are most at risk) to retrieve any fauna detected during works, undertake appropriate action (eg euthanize severely injured animals), and ensure Koalas do not enter the area during clearing works.

8.1.2.2 Hollow-Bearing Trees

Hollow bearing tree removal must be undertaken via a method that will minimise the risk of injury/mortality of potentially denning/roosting fauna within the limitations of Occupational Health and Safety (OH&S) Guidelines. Undertaken with due care, this practice can demonstrably avoid mortality of common and threatened species during felling of hollow-bearing trees, thereby substantially reducing the potential significance of development impacts.

Prior to felling, the tree should be bumped by the machine at least 3-5 times at approximately ten second intervals to initiate evacuation of any residents. Caution will be required not to risk personal injury via falling branches.

An ecologist or member of FAWNA/WIRES must be present during felling of the hollow bearing trees to monitor clearing, capture any resident animals injured or not evacuating, and undertake appropriate emergency actions if required e.g. transport animal to veterinary treatment (care at proponent's cost) or care by FAWNA/WIRES (with a donation by proponent to cover costs).

Hollows are to be immediately inspected once the tree is felled (within OH&S guidelines) for injured individuals or abandoned offspring, and appropriate measures undertaken. All rehabilitated animals are to be released in the retained habitat directly adjacent to the site (likely to form part of their home range).

If hollows cannot be cleared of fauna, the fallen tree must either be allowed to sit overnight in a location safe from tree felling activities, or may be sectioned by chainsaw to allow the ecologist/animal welfare person to clear hollows of fauna.

8.1.3 Sedimentation and Erosion Control

Standard soil and sedimentation control measures will be required by Council in the construction stage of the proposal to ensure that habitats on the site and in the study area, as well as subsequent wetlands/aquatic habitats nearby are not substantially affected by the proposed development.

Similarly, proposed drainage systems need to be adequately designed and effectively established to prevent the risk of any substantial impacts (eg erosion and sedimentation) as per statutory obligations.

8.1.4 Effective Speed Abatement Measures

The establishment of roads through the northwest corridor for the subdivision will introduce a new risk of road strike. Higher volumes of traffic are also likely to access the subdivision from the west via Forest Lane and this will increase the road kill threat along this unsealed section of road.

Speed control measures should be implemented where the access road passes through the northwest corridor eg signage. If Forest Lane is ever upgraded to formalise linkage to Saltwater Way, Council will need to consider similar measures in the western end of Forest Lane.

8.1.5 Artificial Lighting

To ensure anthropogenic impacts to retained habitat in the northwest corridor are minimised, it is recommended that if any streetlighting is installed here, Council consider implementing measures (eg hoods) to direct light away from the corridor.

8.2 SECONDARY RECOMMENDATIONS

8.2.1 Gardens and Landscaping

The proponent has advised that any landscaping proposed as part of the development will give due consideration to the establishment of native plants as ornamental species to maintain and/or increase biodiversity, provide replacement habitat, and maximise water efficiency. Planting opportunities occur in the streetscaping and along the edge of the water quality management structures.

Recommended species for planting should include locally indigenous Eucalypts, Angophoras, Grevilleas, Banksias, Melaleucas, Acacias, Allocasuarinas and Callistemons (especially Winter-flowering species which are useful for the Little Lorikeet, gliders, honeyeaters and Grey- Headed Flying Fox eg *Banksia integrifolia);* and fruiting rainforest species such as Brush Cherry (*Syzygium australe*), figs, *Acronychia spp*, *Cryptocarya* spp, etc.

9.0 SEVEN PART TESTS ASSESSMENT

9.1 GENERAL OVERVIEW

The 7 Part Tests are used to determine whether a proposed development is likely to have a significant effect on threatened species, Endangered Ecological Communities, Endangered Populations and Critical Habitat listed under schedules of the *Threatened Species Conservation Act 1995* known or considered reasonably likely to occur in the area influenced by a development proposal. Considerations must be given to the possible significant impacts a proposed development may have on threatened species, populations, ecological communities, and their habitats (DECC 2007).

The content of the 7 Parts are specified by Section 5A of the *Environmental Planning and Assessment Act 1979*, as amended by the *Threatened Species Act 1995,* which in turn has been amended by the *Threatened Species Conservation Amendments Act 2002*.

The following threatened species were recorded on the site by this survey:

- **Mammals**: Grey-Headed Flying Fox, Little Bent-Wing Bat, Eastern Bent-Wing Bat, East-Coast Freetail-Bat, Eastern Cave Bat (provisional call identification).
- **Birds**: Osprey, Powerful Owl, Brown Treecreeper.

The Glossy Black Cockatoo was recorded on site during previous surveys (Terra 2004).

These species thus automatically require assessment.

The following species (see Appendix 1) are subject to the 7 Part Tests as they are considered to have at least a low potential to use some habitat on the site at some time (eg now or if they were to potentially recover and expand):

- **Mammals:** Koala, Spotted-Tail Quoll**,** Brushtailed Phascogale, Squirrel Glider, Greater Broad-Nosed Bat, Eastern False Pipistrelle, Yellow-Bellied Sheathtail Bat.

- **Birds:** Square-Tailed Kite, Little Eagle, Barking Owl, Masked Owl, Grass Owl, Little Lorikeet, Varied Sittella, Scarlet Robin, Jabiru.

No Endangered Ecological Communities or threatened flora occur on site or are considered to occur on the site, hence none are considered further.

9.1.2 Local Populations Occurrence

The guidelines associated with the revised factors have provided definitions for key terms with the most significant being that of the "*local population*" and "*local occurrence*" as follows (DECC 2007):

> **"Local population**: the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions.
>
> - The *local population* of a threatened *plant* species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.
>
> - The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.
>
> - The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time…."

The local population of the potentially occurring threatened species is thus defined as follows:

Table 15: Definition of Local Populations

SPECIES	LOCAL POPULATION
Square-Tailed Kite Little Eagle Osprey Jabiru	Any individuals known or potentially using habitat within site/study area depending on prey abundance as part of larger range. Local population requires much more habitat that found within study area to meet lifecycle requirements.
Powerful Owl Masked Owl Barking Owl Grass Owl	Local pair of birds which may include site/study area as small portion of large foraging territory. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.
Glossy Black Cockatoo	The local breeding pair for which the study site/area constitutes a minute portion of larger potential foraging territory. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.
Little Lorikeet	Any individuals potentially using habitat within the site/study area depending on flowering incidences. Local population requires much more habitat that found within study area to meet lifecycle requirements.
Varied Sittella Scarlet Robin	The family group/s which use the site and adjoining habitat in the study area for foraging and breeding.
Brown Treecreeper	Local family group/s known to be using habitat within the study area for foraging and potentially breeding.
Koala	No scats found by survey but reportedly seen near site by resident. Site may be subject to very low usage by single animals, or infrequent use by transient Koalas. Hence local population would be any Koalas potentially using study area as part of larger home range.
Squirrel Glider	Colonies potentially occurring within the site/study area, and using both adjacent habitat and the study area.
Brushtailed Phascogale	All potentially occurring individuals within the study area both resident on the site and occurring in adjacent habitats, given ecology of the species.
Spotted-Tail Quoll	The local breeding individuals for which the study site/area constitutes a minute portion of larger potential foraging territory. Local population thus requires much more habitat that found within study area to meet lifecycle requirements.

Grey-Headed Flying Fox	Any individuals using habitat within the site/study area depending on lifecycle stage/seasonal range and flowering/fruiting incidence. Due to its ecology, local population requires much more habitat that found within study area to meet lifecycle requirements.
Bent-Wing Bats East-Coast Freetail Bat, Greater Broad-Nosed Bat, Yellow-Bellied Sheathtail Bat, Eastern False Pipistrelle	Any individuals known/ potentially using habitat within site/study area depending on lifecycle stage/seasonal range and time of year (ie season). Due to the ecology of these species, the local population requires much more habitat that found within study area to meet lifecycle requirements.

9.2 SEVEN PART TEST ASSESSMENT

To minimise repetition and superfluous information, the responses to the 7 Part Tests are structured as follows:

- In Part (a), species are grouped together based on broadly common ecology (i.e. mobile bird species such as the owls or species with similar habitats such as the Yangochiropteran bats) or similar impacts, and subject to a common 7 Part Test response to part (a).
- Parts (d) and (f) are collectively depending. Part (b) deals with Endangered Populations of which none are relevant to the proposed development. Part (c) applies specifically to EECs, and recorded EECs on site or in the study area are assessed here. Part (e) deals with Critical Habitat, which is not relevant to the subject proposed development.

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

As detailed in section 6.1, the proposal is the staged establishment of a new subdivision eventually over about 48ha of the 57ha site. This will involve the removal of most of the vegetation occurring on site, along with habitat components such as 13 hollow-bearing trees.

The impact of the proposal will vary in significance and context per species/species groups as follows:

Little Eagle, Square-Tailed Kite, Osprey:

The Little Eagle and Square-Tailed Kite were not recorded by the survey, however the Square-Tailed Kite has been reported to occur near Precinct 2B to the north (Umwelt 2007, Terra 2004).

The Osprey was recorded flying over the site during the survey and a female was fatally electrocuted. However the site does not offer any potential foraging habitat or nests for this bird and may only be used occasionally for perching or roosting.

These raptors require very large territories, or seasonably variable ranges that far exceed the site/study area/Precinct overall (OEH 2013b, Debus 2012, NSWSC 2009). Hence the site only has potential to form a small to minute part of their range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the site and study area.

The proposal will impact the Square-Tailed Kite and Little Eagle via a relatively minute but incremental and cumulative loss of potential foraging habitat within their territory. The territories of these species is measured in terms of square kilometres (Debus 2012), hence the relatively minute loss of carrying capacity to their territories, while a negative impact, is not sufficient to undermine the local pair's ability to obtain sufficient forage to raise young to fledging.

No foraging habitat for the Osprey occurs on site, hence the proposal will not result in the loss of foraging habitat or decline in prey species for this bird. No significant feeding perch of the Osprey will be removed.

No known nest sites will be removed, hence there is negligible risk of direct mortality. Alternative nest sites are considered relatively abundant given the extent of similar forest within range of the site/study area.

Overall, due to the ecology of the subject species; that no critical habitat will be removed; and the presence of extensive areas of forest adjacent and within range of the site: the proposal will essentially constitute a relatively minute contraction of their wider foraging range.

Given this; that no barrier to connectivity for these species will be created; that the subject species are also known to forage in rural areas and in retained habitat within or adjacent to rural-residential and urban areas (hence are likely to occur in the study area post-development), and that the local populations of the subject species would extend well beyond the confines of the site to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline (i.e. reduce viability) of the local population of any of the subject species.

***Jabiru*:**

This species is only considered an incidental potential occurrence using a dam on site and the drains in the study area for opportunistic foraging as part of its non-breeding range.

The dam habitat is likely to be modified or removed. The drains will largely be retained, but will have residential areas adjacent to them. Increased human presence/activity may deter this bird from foraging on site, although individuals have demonstrated at times high tolerances eg foraging on urban fringes and at dams being cleaned by an excavator.

Regardless, as nesting habitat is not impacted, and the bird's occurrence in the study area would at most only be opportunistic, it is clearly evident that the proposal is unlikely to have an impact of sufficient order of magnitude to place a local viable population at risk of extinction.

***Masked Owl, Powerful Owl, Grass Owl, Barking Owl*:**

The Powerful Owl was recorded during the survey via call playback. It was heard calling offsite to the northwest. Records also exist in Kiwarrak State Forest and on Mitchells Island (OEH 2013a). The Masked Owl, Grass Owl and Barking Owl were not recorded during this or previous surveys, and records in the locality only exist for the Masked Owl (OEH 2013a).

The subject owls require very large territories, or seasonably variable ranges that far exceed the site/study area/Precinct overall (OEH 2013b, Smith *et al* 1995, DECC 2006a, Debus 1994, 1995, NPWS 2003). Hence the site/study area/Precinct only has potential to form a small to minute part of a local pair's range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the study area/Precinct.

The proposal will impact the forest owls via a relatively minor but incremental and cumulative loss of habitat within their territory. The proposal will remove potential habitat for prey species of *Antechinus*, rodents (mice, rats, rabbits and hares), bandicoots, medium-sized birds, and arboreal mammals. Up to 13 hollow-bearing trees may also be lost, reducing the abundance of this key habitat component for many of the forest owl's preferred prey species (gliders and possums), which may impact prey abundance, although most of the habitat in which these hollows occur in offers very poor prey habitat ie underscrubbed or dying.

However, the territories of these species is measured in terms of hundreds to thousands of hectares (DECC 2006), hence the relatively minor loss of carrying capacity to their territories, while a negative impact, is not sufficient to undermine the local pair's ability to obtain sufficient forage to raise young to fledging.

Potential nest trees for the Masked, Powerful and Barking Owls do not occur on site, however a few were noted in the Forest Lane road reserve. These trees and surrounding habitat will be retained as part of a conservation zone/corridor, and will continue to provide potential breeding sites for these species.

For the Grass Owl, the proposal will remove some generally low-quality potential nesting habitat in the grassland and shrubland. Due to the presence of large areas of higher quality habitat in the Precinct and adjoining land, and apparent local absence of the bird: the loss of this habitat component on site is unlikely to affect the breeding cycle of a local population.

Overall, due to the ecology of the subject species and the presence of extensive areas of forest adjacent and within range of the site: the proposal will essentially constitute a relatively minor contraction of their wider foraging range.

Given this; that no barrier for these species will be created; that the subject forest owls are also known to forage in rural areas and in certain instances within retained habitat within or adjacent to rural-residential and urban areas (hence are likely to occur in the study area post-development); and that the local populations of the subject species would extend well beyond the confines of the site/study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline (i.e. reduce viability) of the local population of any of the subject species.

Spotted-Tail Quoll:

Spotted-Tailed Quolls require very large territories that far exceed the site/study area/Precinct overall (OEH 2013b, Smith *et al* 1995, Belcher 2000, WWF 2002, Claridge *et al* 2005, Kortner *et al* 2004). Hence the site/study area/Precinct only has potential to form a small to minute part of a local breeding group's range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the site/study area.

The proposal will impact the Quoll via a relatively minor but incremental and cumulative loss of habitat within its territory. The proposal will remove habitat for potential prey species such as birds and small mammals. Up to 13 hollow-bearing trees may also be lost, reducing the abundance of the key habitat component for many preferred prey species, which may also influence prey abundance (although most of the affected hollows occur in marginal habitat for the Quoll).

A few trees and large hollow logs in the study area contain potential den sites for the Quoll and these will be retained in the proposed conservation zone/corridor. This corridor will also ensure connectivity between remnant patches of forest are retained post development.

The proposal may incrementally increase risk of road kill to the Quoll via increasing the volume and frequency of traffic along Forest Lane, though the gravel status of this road may limit this risk. Other potential indirect impacts of the proposal such as edge effects, noise and artificial lighting will be of little consequence to the Quoll, though cat predation/competition could be a risk due to increased numbers of cats kept at pets in the Old Bar urban interface.

Overall, due to the ecology of the Quoll and the presence of extensive areas of forest adjacent and within range of the site (eg to the west, which are likely to be core part of a local Quoll's territory): the proposal will essentially constitute a relatively minor contraction of the outer margins of the Quoll's wider foraging range.

Given this; that no impenetrable barrier to connectivity for this species will be created; that the Quoll is also known to forage in rural areas and in retained habitat within or adjacent to rural-residential and urban areas (hence still likely to occur in the study area post-development); other proximate parts of their range also has the current (and higher) threat of road kill and cat predation/competition; and that the local population would extend well beyond the confines of the site/study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline (i.e. reduce viability) of the local population of the Quoll.

***Grey-Headed Flying Fox*:**

The Grey-Headed Flying Fox was recorded in the north of the site both during this survey and a previous survey (Terra 2004). Its occurrence would coincide with the flowering periods of eucalypts on site. No roosts occur in the study area and the closest known roosting areas are likely to be Taree (Coocumbac Island) and Wingham Brush.

This bat traverses over a very large range according to seasonal flowering and fruiting, and lifecycle stage eg maternity season (OEH 2013b, Eby 2002, 2000a, 2000b). Hence the site/study area/Precinct would form a small to minute part of a local breeding colony's seasonal range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the site/study area/Precinct.

The proposal will remove about 18.6ha of seasonal foraging habitat for this species in the north of the site. While no critical wintering habitat is impacted, many of the tree species flower in spring-summer, which coincides with breeding. Hence the proposal will also result in an incremental and cumulative loss of potential maternity foraging habitat. Such habitat within the bat's local range however is still locally extensive, hence the ability of the local colony to raise young is considered unlikely to be directly undermined by habitat loss associated with the proposal. Furthermore, no maternity sites are known to occur in the study area, and roosting habitat is not impacted.

Overall, due to the ecology of the subject species and the presence of extensive areas of forest adjacent to and within range of the site: the proposal will essentially constitute a relatively minor contraction of its seasonally variable but extensive seasonal foraging range.

Given this; that no barrier to connectivity for the Grey-Headed Flying-Fox will be created; that the species is well known to forage in retained habitat within or adjacent to rural-residential and urban areas (hence likely to occur in the study area post-development); and that the local population of the species would extend well beyond the confines of the site/study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline (i.e. reduce viability) of the local population of the subject species.

Yangochiropteran Bats: East-Coast Freetail Bat, Eastern Bent-Wing Bat, Little Bent-Wing Bat, Greater Broad-Nosed Bat, Yellow-Bellied Sheathtail Bat, Eastern False Pipistrelle, Eastern Cave Bat.

All of the subject bats require home ranges or seasonably variable ranges that far exceed the site/study area/Precinct, at least seasonally or due to their ecology eg summer migrants in the south of the bioregion eg Dwyer 1966, 1968, OEH 2013b, ABS 2013, Smith *et al* 1995, Churchill 2009, etc). Hence ecologically, while an individual/s may use the site/study area/Precinct for foraging or possibly roosting in tree hollows (latter excluding the Eastern Cave Bat) at some time, any known/potentially occurring local population of these species would extend well beyond the site/study area to meet their full lifecycle requirements.

The proposal will result in loss of at least 24ha of known/potential foraging habitat for these bats (some such as the Yellow-Bellied Sheathtail may also forage over the grassland communities). Given the seasonal movements of these bats and extent of potential habitat within the local range, this could be considered to constitute a relatively minor but incremental and cumulative loss of habitat which is insufficient to prevent the bat from obtaining sufficient prey.

Associated with the proposal will be the loss of up to 13 hollow-bearing trees, most of which may offer generic potential roosts (depending on extent of hollow-formation, depth, etc) for all but the Eastern Cave Bat. This loss will increase competition for this critical habitat component in the locality given the increasing rarity of hollow-bearing trees (NSWSC 2007) and factors influencing roost selection (Gibbons and Lindenmayer 2002). The best hollow-bearing trees will however be retained in the conservation zone and on adjacent land, hence local roost options will remain.

Given the above; the ecology of the subject species and the presence of extensive areas of forest adjacent and within range of the site/study area; that no barrier to connectivity for these species will be created; that the species are well known to forage in retained habitat within or adjacent to rural-residential and urban areas (hence likely to occur in the study area post-development); and that the local populations of the species would extend well beyond the confines of the site/study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline of the local populations of the subject species.

***Glossy Black Cockatoo*:**

The Glossy Black Cockatoo was not recorded on site during the survey, however has been observed in the north of the site during a previous survey of the Precinct (Terra 2004).

The Glossy Black Cockatoo feeds exclusively on Allocasuarinas such as *A. littoralis* and *A. torulosa* in the North Coast bioregion (Clout 1989, Smith *et al* 1995, OEH 2013b). Due to variable fruiting, it requires very large home ranges (Clout 1989, Smith *et al* 1995, OEH 2013b). Allocasuarinas are limited to small areas in the northwest of the site, hence a local population needs to fulfil its lifecycle requirements well beyond the site/study area.

The proposal will impact this species via loss of some patches of Allocasuarinas in the northwest of the site, however the far majority will be retained in the proposed corridor and drainage/road reserve. Allocasuarinas were also noted to be abundant in the adjacent Kiwarrak State Forest.

This minor loss of foraging habitat on site, while a negative impact, is not likely to disrupt the bird's lifecycle given the ecology of the bird and limitations of its preferred food require relatively large ranges ie hundreds of hectares. Further, no potential breeding hollows will be removed as these occur in the proposed conservation zone, road reserve and adjacent land.

Overall, due to the ecology of the bird and the presence of extensive areas of forest adjacent and within range of the site with Allocasuarinas: the proposal will essentially constitute a relatively minor contraction of the bird's wider foraging range.

Given this; that no impenetrable barrier to connectivity to the species will be created; that the bird is also known to forage in rural areas and in retained habitat within or adjacent to rural-residential and urban areas (hence still likely to occur in the study area post-development); and that the local population would extend well beyond the confines of the site/study area to meet the majority of their life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline (i.e. reduce viability) of the local population of the Glossy Black Cockatoo.

Little Lorikeet:

This bird traverses over a very large range according to seasonal flowering (OEH 2013b, NSWSC 2009). Hence the site/study area/Precinct only has potential to form a small to minute part of a local pair's seasonal range, and consequently, a local population needs to fulfil its lifecycle requirements well beyond the site/study area/Precinct.

The proposal will remove about 18.6ha of varying quality potential foraging habitat, which will result in a relatively minor but incremental and cumulative loss of potential foraging habitat within their seasonal range. Given the seasonal range of this bird, quality of habitat affected (eg significant portion currently subject to dieback) and extent of other habitat remaining locally, this is not considered likely to directly affect breeding success.

Associated with the proposal will be the loss of up to 13 hollow-bearing trees, most of which may offer potential nest sites(depending on extent of hollow-formation, depth, etc), but are likely to be subject to high levels of competition with other species eg common lorikeet species. This loss will increase competition for this key habitat component in the locality. The best hollow-bearing trees on site will however be retained, hence local nesting options will remain on site and in adjacent habitat, albeit at an incrementally higher level of competition.

Given the above; the ecology of the subject species and the presence of extensive areas of forest adjacent and within range of the site/study area; that no barrier to connectivity for this species will be created; that the species are known to forage in retained habitat within or adjacent to rural-residential and urban areas (hence likely to occur in the study area post-development); and that the local populations of the species would extend well beyond the confines of the site/study area to meet life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline of a local population of the Little Lorikeet.

Squirrel Glider and Brushtailed Phascogale:

These species were not detected by this survey or previous surveys on the site. A few records of these species exist in the locality but only one record of the Squirrel Glider is in close proximity to the site (just north of Old Bar Road). The Phascogale has been recorded to the south near Wallabi Point and Diamond Beach, and further west (OEH 2013a).

On site, only the forested and regenerating areas north of Forest Lane contain varying quality generic potential habitat for these species, which comprises about 27ha. However, the majority of this habitat is either regenerating from past clearing, or lacks an understorey (especially in the east, where dieback is also prevalent), and is subject to a high level of edge effects.

For the Squirrel Glider, this vegetation is not a preferred floristic assemblage due to lack of preferred trees in the understorey (gum and nectar) and scarcity of Bloodwoods (preferred sap species). The northwest of the site is however well connected to large areas of higher quality potential habitat to the west and south, and hence this part of the site may form the outer margins of these species territory.

Potential den sites for these species do occur on site (based on aperture size), however would be subject to high competition with the recorded Sugar Glider, along with Lorikeets, Rosellas and Galahs which were observed to occupy most of the hollows on the Taylor and Goodear properties.

Given the above, it is reasonable to deduce that the local populations would extend well beyond the study site to meet their lifecycle needs.

The proposal will see loss of an estimated18.6ha of varying quality potential foraging and denning habitat. While at least most of this habitat currently appears to be vacant and low quality, this will incrementally and cumulatively contribute to the historical habitat losses.

Associated with the proposal will be the loss of up to 13 hollow-bearing trees, some of which may offer potential den sites for these species (depending on extent of hollow-formation, depth, etc and competition with other species). A number of the hollow-bearing trees on site will however be retained in the proposed conservation zone/corridor in the northwest, which also contains the highest quality habitat on site. Therefore the site will continue to provide denning habitat for these species, however hollows may be subject to higher competition.

Some minor fragmentation of potential habitat on site will occur as a result of the proposal, however sufficient connectivity for these species to move through the site and into adjacent habitat will remain post development given the dedication of the corridor in the northwest.

Indirect impacts associated with the proposal which may affect the subject species include predation by cats, edge effects and higher human presence. While some of these impacts already pose a threat to the subject species, ameliorative measures are provided to minimise the net impact.

Given the above; the ecology of the subject species and the presence of extensive areas of forest adjacent and within range of the site/study area; low quality habitat generally impacted by the proposal; that no barrier to connectivity for this species will be created; that the species are known to forage in retained habitat within or adjacent to rural-residential and urban areas (hence likely to occur in the study area post-development); and that the local populations of the species would extend well beyond the confines of the site/study area to meet life cycle requirements: the order of magnitude of the proposal's sum negative effect is not considered sufficient to result in a direct decline of a local population of these species.

Koala:

The Koala was not detected on site during the survey, nor has it been confirmed to occur by previous surveys of the Precinct (Umwelt 2007, Terra 2004). An unconfirmed record from a resident was provided for the Forest Lane area. The Bionet database (OEH 2013a) shows the Koala has been recorded in the Old Bar area in recent years, and in the State Forest to the west.

The north of the site contains areas of Potential Koala Habitat where Tallowwoods are common. The Greater Taree City Council *Draft Comprehensive Koala Plan of Management* (AKF 2002) identified two areas of primary koala habitat in the Precinct, these being in the southwest corner and the northeast corner. Terra (2004) however noted that the area in the northwest had been cleared and the southwest area did not correspond with Potential Koala Habitat under the SEPP 44 definition.

Targeted survey for the Koala was undertaken without result in this assessment, confirming that the site does not contain Core Koala Habitat. Consequently, the site is unlikely to be significant to the Koala for foraging, but it may occur infrequently in the northwest as part of a low density population in the wider area or as a transient during specific lifecycle stages eg breeding season dispersal of sub-adults. Thus the local population would extend well beyond the confines of the site/study area and home ranges would be largely centred on adjacent habitat.

The proposal will see loss of primary (Tallowwood and Forest Red Gum) and secondary (Small-Fruited Grey Gum, Grey Ironbark) Koala food trees mostly in the affected part of the identified Potential Koala Habitat in the north. While this is a generic negative impact, it is unlikely to undermine the ability of the local population given Core Koala Habitat is not affected, no areas of major activity are impacted, and adjacent habitat is of similar to higher quality. Hence the proposal will essentially contribute incrementally to the cumulative loss of potential Koala habitat in the locality.

The proposal will introduce the risk of road kill to the site, and the increased traffic that will result along Forest Lane will pose a higher risk of road strike here. This risk could be mitigated by speed zoning, targeted speed abatement measures and awareness (eg signage). This is especially recommended if the remaining unsealed section of Forest Lane is upgraded to a sealed road permitting higher speeds, and residents are inclined to access the Precinct from the west.

Dog attack may also pose a risk due to the increased number of pet dogs that may eventuate, however dogs already exist in the north of the site and in the adjacent estate.

Overall, the proposal will see a loss of apparently unused potential Koala habitat, and generally a minor increase in other threats. Given neither Core Koala Habitat or an area of major activity is impacted; connectivity is not effectively prevented between proximate habitat; and other impacts are relatively mitigable: the proposal is considered unlikely to result in impacts of sufficient order of magnitude to place a local viable population at risk of extinction due to loss of viability.

Varied Sittella, Scarlet Honeyeater, Brown Treecreeper:

A family group of Brown Treecreepers were sighted during the survey in the northwest of the site in the area nominated for conservation zoning as a wildlife corridor. This is the first record of this species in the locality (OEH 2013a). The forested habitat on site would not solely support a population of Brown Treecreepers due to its limited extent and ecology of the species, and the local population would extend well beyond the site.

Although the northwest of the site and adjacent forest offer generic potential foraging and breeding habitat, the Varied Sittella was not recorded by the survey, and has not been detected in the locality to date (OEH 2013a). This species has territories around 9-20ha, hence the most intact forested areas of the site (approx. 11ha) are barely large enough to support a breeding pair or family group given their modified state. Hence a local population would extend beyond the site to meet its lifecycle requirements.

The Scarlet Honeyeater was not recorded during the survey, nor has it been recorded locally (OEH 2013a). The intact forested habitats of the site and study area contain potential foraging and nesting habitat for this bird, with adjacent habitat incorporated into its territory.

The proposal will result in the loss of an estimated 4.6ha of open forest habitat for these species and several potential nesting hollows for the Brown Treecreeper, although a number of these are likely to be unsuitable due to insufficient size and competition with common birds, and location in marginal habitat. The best potential hollows on site will be retained in the proposed corridor in the northwest, which will also protect approximately 7ha of the highest quality habitat on site and allow connectivity from retained habitat in Precinct 2 to Kiwarrak State Forest.

A number of indirect impacts associated with the proposal such as cat predation, edge effects and higher human presence have the potential to negatively affect these birds, however most of these are already present on the site and in the study area, and the proposal would only incrementally add to such impacts.

Overall, while the proposal will have a negative impact on the current habitat potential of the site and contribute to the threatening processes responsible for the decline of the species, it is unlikely to place a local population at risk of extinction as:

- The development footprint predominantly impacts marginal/low quality habitat on the outer fringe of known/potential habitat for these species.
- The majority of known/potential habitat on site will be retained in the corridor in the northwest.
- While some fragmentation will eventuate, sufficient connectivity should remain to allow natural dispersal, foraging, etc.

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

No relevant populations are currently listed under the TSCA.

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

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

As detailed in Section 3.4, no EECs were recorded on the study site.

(d) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified fragmented or isolated to the long-term survival of the species, population or ecological community in the locality;

The proposal will result in the loss/modification of an estimated 48ha of vegetation on site, the majority of which consists of derived grassland with limited to no habitat value to the known/potentially occurring threatened species. This loss will include some generic foraging habitat for a number of the subject species (i.e. flowering eucalypts for the Grey-Headed Flying Fox and Little Lorikeet, potential sap sources for the Squirrel Glider, etc). Up to 13 hollow-bearing trees will also require removal.

Fragmentation as a direct result of the proposal will be relatively minimal in significance due to the dedication of a corridor in the northwest containing most of the open forest (and higher quality habitat) on site. This will result in current connectivity to the adjacent habitat west, north and south being maintained post development. Thus no area of habitat is likely to become isolated as direct result of the proposal.

As noted in part (a), for all of the subject species, the portions of the site proposed to be developed may only form a small to minute or insignificant part of their local range due to the limited extent of suitable habitat and extent of disturbance/modification. Within this context and the ecology of these species, the removal of vegetation on the site is generally of relatively minimal significance given the retention of the highest quality habitat on site and that local populations are not considered likely to be placed at risk of extinction. Habitat adjacent to the site is of similar or higher ecological value and large areas of State Forest and OEH estate exist to the west and south, hence the site is not of any specific significance to these species in the locality.

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

No relevant areas of critical habitat have been declared, as yet, under Part 3 of the TSCA.

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

Draft/final recovery plans have only been prepared for the Koala, Barking Owl and Forest Owls (NPWS 2003b, DEC 2006, DECC 2008). Priority actions have been identified for all of the other species (OEH 2012b).

The *Recovery Plan for the Barking Owl* (NPWS 2003d) outlines the loss of habitat as a major threatening process for the Barking Owl, hence the proposal will incrementally and cumulatively contribute to this process. While this is adverse to the species' recovery, this loss only constitutes a miniscule fraction of the local pair's territory, does not remove a known nest site, and is insufficient to significantly impact prey diversity and abundance. Hence only via strict definition is the proposal inconsistent with objectives of the plan as a small area of potential habitat will be lost/modified.

The *Recovery Plan for Forest Owls* (DEC 2006) has been exhibited for the Masked and Powerful Owl. As for the Barking Owl, the proposal will remove a minute area of potential foraging habitat

and only via strict definition is the proposal inconsistent with objectives of the plan.

The *Recovery Plan for Koalas* (DECC 2008) specifies actions considered to be key threats to Koalas. This plan specifies habitat loss, fragmentation and degradation as the most important threats to Koalas throughout their range. The proposal is thus by strict definition inconsistent with this plan as it will remove potential browse species and contribute to these threats. Dogs and traffic are also key threats, and the proposal will incrementally add to these impacts. While negative, as no Koala population has been found to have an association with the site, the conflict with the objectives of the recovery plan is relatively limited.

For all other species, as the proposal will remove or modify habitat, and contribute to secondary impacts, in a strict sense it will not be considered directly consistent with objectives of a recovery plan, threat abatement plan or priority action now or in the future. The retention of the best habitat on site and connectivity to adjacent habitat should however retain the potential for these species to occur in the future.

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

The TSCA 1995 defines a "*threatening process*" as "*a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities*". Loss and fragmentation of habitat due to urban, residential and rural development is a recognised threat to these species (Smith *et al* 1995, Lindenmayer and Fisher 2006, Johnson *et al* 2007, Smith *et al* 1995, Gibbons and Lindenmayer 2002, DECC 2009b, NPWS 1999b, Watson *et al* 2003, Gilmore and Parnaby 1994, NPWS 2003b, etc). The proposal thus qualifies as a class of activity that is considered a threatening process.

For all of the subject species, the proposal will or may contribute (to varying extents) to the following Key Threatening Processes:

Table 16: Contribution to Key Threatening Processes

KTP	EXTENT/MANNER WHICH PROPOSAL AFFECTS KTP	MITIGABLE?
Clearing of native vegetation (NSWSC 2001c	Removal of up to 24ha of varying quality native vegetation.	Best habitat retained in northwest. Some recommendations will assist ie marking out clearing area.
Human induced climate change (NSWSC 2000d).	As above and use of fossil-fuelled vehicles, machinery, etc, during construction and operation.	As above.
Removal of dead wood, dead trees and logs (NSWSC 2004f).	Some small timber and dead trees will be removed.	No. Will be removed during clearing. Presents safety hazard if left.
*Invasion of native plant communities by exotic perennial grasses (*NSWSC 2004g)	The removal of vegetation on site and the creation of new forest edges provides habitat for these species. Positive impact of removing 23ha of pasture species.	Standard weed invasion measures are to be undertaken on site to ensure weeds do not establish within retained vegetation.
Loss of hollow-bearing trees (NSWSC 2007)	Up to 13 hollow bearing trees will be required to be removed.	While the loss of hollow bearing trees is considered negative, the highest value hollow-bearing trees will be retained and protected in the corridor. Hollow-bearing tree removal protocol to be implemented to minimise risk of mortality.

10.0 EPBCA 1999 – MNES SIGNIFICANCE ASSESSMENT

10.1 GENERAL ASSESSMENT OVERVIEW

The provisions of the EPBCA 1999 require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance"*. These matters are listed and addressed in summary as follows:

1. **World Heritage Properties**: The site is not listed as a World Heritage area nor does the proposal affect any such area.

2. **Ramsar Wetlands of International Significance**: A Ramsar wetland does not occur on the site, nor does the proposal affect a Ramsar Wetland.

3. **EPBCA listed Threatened Species and Communities**: The Grey-Headed Flying Fox (Vulnerable) has been recorded on the site and the Spotted-Tailed Quoll (Endangered) and Koala (Vulnerable) are considered to have some limited potential to utilise specific parts of it. As detailed in section 10.2, none are considered at risk of a significant impact.

4. **Migratory Species Protected under International Agreements**: No Migratory species is likely to be significantly affected by the proposal as assessed below.

5. **Nuclear Actions**: The proposal is not a nuclear action.

6. **The Commonwealth Marine Environment (CME)**: The site is not within the CME nor does it affect such.

7. **National Heritage**: The site is not listed as National Heritage

The proposal thus is not considered to require referral to Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) for approval under the EPBCA.

10.2 PROTECTED SPECIES ASSESSMENTS

10.2.1 Threatened Fauna: Spotted-Tail Quoll (E), Koala (V), Grey-Headed Flying Fox (V)

10.2.1.1 Factors to be Considered for a Vulnerable/Endangered Species

The guidelines to assessment of significance to this Matter, define an action is as likely to have a significant impact on a Vulnerable and/or Endangered species, if it will:

a) Lead to a long-term decrease in the size of an important population (Vulnerable) or population (Endangered) of a species, or:
b) Reduce the area of occupancy of an important population (Vulnerable) or population (Endangered), or:
c) Fragment an existing important population (Vulnerable) or population (Endangered) into two or more populations, or:
d) Adversely affect habitat critical to the survival of a species, or:
e) Disrupt the breeding cycle of an important population (Vulnerable) or population

(Endangered), or:

f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or:

g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable or Endangered species, becoming established in the Vulnerable and/or Endangered species' habitat, or:

h) Introduce a disease that may cause a species to decline, or:

i) Interferes substantially with the recovery of the species.

An *important population* is one that is necessary for a species' long-term recovery. This includes such populations as:

- Key populations either for breeding or dispersal.
- Populations that are necessary for maintaining genetic diversity, and or:
- Populations that are near the limit of the species range:

10.2.1.2 Assessment of Significance

This section addresses each of the previous points listed.

For the purposes of discussion, the "*important population*" of Grey-Headed Flying Foxes is defined as that population of the species likely to depend on colonial roosts in the locality or within foraging range of the site.

For the Quoll, given its large territories, a "*population*" for the purpose of the following assessment is difficult to define especially considering the extent of habitat modification in the general area. Given the extent of forest in the locality, it is considered the local population is those Quolls that reside generally within at least a 10km range which form an interbreeding set of individuals.

For the Koala, given the limited records in the immediate area, the important population would be the population of Koalas in the adjacent State Forest environs (DSEWPC 2013).

a) Lead to a long-term decrease in the size of an important population (Vulnerable) or population (Endangered) of a species, or:

Grey-Headed Flying Fox

In the context of the species ecology, the site provides a relatively minor area of potential foraging habitat. It is not known nor considered suitable as roosting habitat for the species, thus no such areas are affected by the proposal.

The proposal will require the removal/modification of up to 18.6ha of open forest and regrowth on the site, removing trees which offer potential foraging resources. While a negative impact on the current potential of the site, this loss will relatively negligibly impact the local Grey Headed Flying Fox population as the site in total only has potential to form a minute fraction of this species wider opportunistic foraging range. The site is also not known or considered suitable as a roost (Eby 2000) and better quality alternative foraging habitat in the locality is extensive (eg Kiwarrak State Forest Khappinghat Nature Reserve etc). The proposal will thus not lead to a long-term decrease in the size of an important population.

Spotted-Tail Quoll

Potential habitat for this species on site is limited to the northwest portion where a mosaic of open forest and woodland occurs. Reasonable prey abundance was noted here but denning opportunities

are limited and foxes are likely to be present. Due to the large areas of more optimum habitat occurring to the west and south, the site would only experience infrequent usage by this species as part of its local range.

The removal/modification of vegetation on the site is acknowledged to be a negative impact in a cumulative and incremental sense on potential habitat of this species in the locality. However, given that only low-quality habitat will be affected; the best tree hollows and logs potentially suitable for this species will remain; the extent of habitat which will be retained on the site and on adjacent land; and the ecology of the Quoll: the impacts induced by the proposal, while placing incremental and cumulative pressure on the local population of the Quoll, are not capable of significantly undermining the viability of any locally occurring population of the species. Thus the proposal should not be significantly detrimental to the potential presence of this species within the area.

Koala

While some habitat in the north of the site qualifies as Potential Koala Habitat under SEPP 44, no direct evidence of the Koala has been found during this or previous surveys. Given the larger areas of higher quality habitat to the west and southwest, the site is only likely to form the disturbed fringe of a Koalas territory or its western edge used to move between areas of preferred habitat in the locality.

The removal of vegetation on site, including some primary and secondary browse species will reduce the current habitat potential of the site for this species and contribute to secondary impacts. However as the Koala has not been found to have an association with the site and the best potential habitat on site will be retained with linkages to adjacent habitats, the proposal would not be capable of leading to a long term decrease of an important population.

b) ***Reduce the area of occupancy of an important population (Vulnerable) or population (Endangered),*** **or:**

For the Grey-Headed Flying Fox, the proposal will not result in the loss of any roosting habitat, as the site is not known or suitable to be a roost site. Foraging habitat of this species is measured in terms of hundreds of thousands of hectares, hence the loss of habitat on site is insignificant relative to the area of occupancy.

For the Quoll, the loss is also only a fraction of a potential territory of a single animal, let alone a population (Belcher 2000, 1994, NPWS 1999a, WWF 2002, OEH 2012b), and as noted above, the overwhelming majority of any individual/population's area of occupancy will not be affected as a result of the proposal.

No evidence of a resident population of Koalas was found on site and the affected vegetation does not represent Core Koala Habitat or an Area of Major Activity. Given the current limitations of the site, it only offers some minor potential forage and linkage values for the Koala. These values will be largely retained in the proposed conservation zone. Given this, the proposal is highly unlikely to reduce the area of occupancy of an important population.

c) ***Fragment an existing important population (Vulnerable) or population (Endangered) into two or more populations*****, or:**

The Grey Headed Flying Fox is highly mobile and known to be capable of crossing human-modified habitat. The proposal will offer no barrier to movement. Thus it will not fragment an existing important population.

The Quoll is highly mobile and known to be capable of crossing human-modified habitat including rural land and peri urban areas (Smith *et al* 1995). As mentioned above, the only the north of the site offers potential habitat and this area is not a key habitat link due to the extent of forest adjoining. Given that current linkage within the study area will remain, the proposal will not result in the fragmentation an existing important population.

The site is unlikely to form a key linkage for the Koala due to the extent of habitat adjoining. Post development, most of the current connectivity values of the site will remain and the local movements of the Koala are unlikely to be disrupted. Consequently, the proposal will not fragment an important population.

d) *Adversely affect habitat critical to the survival of a species*, or:

"*Critical habitat*" refers to areas critical to the survival of a species or ecological community may include areas that are necessary for/to:

- Activities such as foraging, breeding, roosting or dispersal.
- Succession.
- Maintain genetic diversity and long term evolutionary development, or
- Reintroduction of populations or recovery of the species/community.

The vegetation on the study site/area is not considered potential roosting habitat for the Grey-Headed Flying Fox. A few trees and logs on the site and study area offer generic potential den sites for the Quoll. For both species, the site would/may be used for foraging (and for the Quoll – denning as well), but only as a minute part of their wider local range. These values will be largely retained as the area of potential foraging habitat to be removed by the proposal is relatively insignificant compared to their range. Hence the proposal will not remove areas critical to the survival of the species.

The site contains limited areas of Potential Koala Habitat as per SEPP 44 guidelines which match the definition of Critical Habitat in the interim assessment guidelines (DSEWPC 2013c). As previously mentioned, the vegetation to be removed on site is unlikely to support the Koala and thus would not be critical for the local population.

e) *Disrupt the breeding cycle of an important population (Vulnerable) or population (Endangered* or:

The proposal is unlikely to disrupt the breeding cycle of an important population/population given that:

- The site does not represent potential breeding habitat for the Grey-Headed Flying Fox and only marginally suitable breeding habitat for the Quoll, with higher quality habitat more likely to support breeding in the adjoining State Forests and Reserves;
- The site is not Core Koala Habitat, and no area of major activity is affected.
- The Quoll and Grey-Headed Flying Fox have very large ranges that far exceed the site,
- The potential for these species to occur within the study area will be retained post-development; and
- Alternative potential habitat in the locality is extensive.

f) *Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline,* or:

As detailed previously, the site and the degree of vegetation/habitat loss is not significant enough to affect the local population of the subject species to the point it could cause a decline of the species.

g) *Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable and/or Endangered species, becoming established in the Vulnerable and/or Endangered species' habitat*, or:

No new species that affects any of the subject species is likely to be introduced as a direct result of the proposed works.

h) Introduce disease that may cause a species to decline; or

No disease that affects either of the subject species is likely to be introduced as a direct result of the proposed works.

Koalas are naturally infected with Chlamydia which can become pathogenic when Koalas are stressed (nutritionally and/or psychologically). Such stress can result when key habitat (ie Core Koala Habitat and areas of major activity) are removed, and threats such as dogs and barriers are introduced. As the proposal does not affect any significant Koala habitat, remove food trees from an area of major activity, or significantly exacerbate current threats: it is unlikely to induce significant stress on Koalas and risk inducing disease.

i) Interferes substantially with the recovery of the species.

Ideally, the goal in threatened species recovery is to increase the number and extent of the threatened species, so that it is not in risk of becoming extinct. As detailed previously, the proposal will result in the modification of a relatively minute area of potential foraging habitat that is not significant enough to interfere with the recovery of either of the subject species.

10.2.1.3 Conclusion

The proposal will not have a significant impact on the Grey Headed Flying Fox, Spotted-Tailed Quoll or Koala.

10.2.3 Migratory Species

The survey recorded four migratory bird species on site: the White-Bellied Sea-Eagle, Osprey, Latham's Snipe and Rainbow Bee-Eater.

The variety of habitats on the site also provide potential habitat for a number of listed migratory species including the Spectacled Monarch, White-Throated Needletail and Fork-Tailed Swift. These species are collectively assessed below.

10.2.3.1 Factors To Be Considered

The guidelines to assessment of significance to this Matter, define an action as likely to have a significant impact on a migratory species, if it will:

a) Substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or;

b) Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or;

c) *Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.*

An *important area of habitat* is:

1. Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or:
2. Habitat utilised by a migratory species which is at the limit of the species range, or;
3. Habitat within an area where the species is declining.

10.2.3.2 Assessment of Significance

This section addresses each of the previous points listed.

The site is not considered likely to constitute an *important area of habitat* on the basis of the following:

1. The site does not contain sufficient habitat, in extent or diversity, to support an ecologically significant proportion of the population of any these species. Occurrence of the subject species on site is considered most likely to be as vagrants or potentially as a short term seasonal forager with the site constituting a small part of their large seasonal nomadic range. The value of habitat on the site/property is as a minor fraction of the significant area of potential habitat in the LGA and the North Coast Bioregion.
2. While some migratory species occurring in the locality may be at the limits of their range, no such species were recorded in the survey area. Additionally, similar habitat is known to occur both north and south of the LGA.
3. If the site was located at the limits of a species whose abundance and range is declining, it would not be considered significant as such habitat is locally abundant in the area, and habitat with greater capability occurs within 10km eg State Forest, conservation reserves, etc.

In regards to point (**a**): The proposal does not affect important habitat (as detailed above).

In regards to point (**b**): An invasive species is one that may become established in the habitat, and harm the migratory species by direct competition, modification of habitat, or predation. The proposal will not introduce any such invasive species.

In regards to point (**c**): No disruption of the lifecycle of any migratory bird is likely as:

- Habitat affected is either only marginally suitable, and/or locally abundant.
- No nesting/breeding habitat is affected.
- No substantial foraging habitat will be affected.

In view of the above, no migratory bird is considered likely to be significantly affected by the proposal.

11.0 CONCLUSION

This report has assessed the impact of clearing the vegetation on the site and establishment of a residential subdivision on locally occurring threatened species, populations and ecological communities.

The survey and assessment has identified that the study site and study area has known and/or potential value for a number of threatened fauna species. The Powerful Owl, Brown Treecreeper, Osprey, Grey-Headed Flying-Fox, Little and Eastern Bent-Wing Bats and East-Coast Freetail Bat were recorded by the survey, and the Glossy Black-Cockatoo has been previously recorded. In addition, a further 16 threatened fauna species were considered to have varying potential to occur due to potential habitat on site and presence of local records in similar habitat. No threatened flora species or EECs were recorded on site or considered potential occurrences.

The proposal will incrementally and cumulatively result in the reduction of foraging and nesting/denning capacity of the site due to loss/modification of about 24ha of native vegetation and up to 13 hollow-bearing trees. The proposal will also increase some threats (eg road strike, predation); and introduce a higher human presence with its associated impacts e.g. noise and lighting.

Overall, while having a net negative impact, the proposal is not expected to significantly impact upon any of the known or potentially occurring threatened species on site or in the study area due to the retention of the highest quality habitat on site in the conservation zone and linkages to adjacent habitat; presence of extensive alternative habitat adjacent and/or within range of the site; no impact on critical habitats; and ecology of the species (eg requiring home ranges that far exceed the study area).

Consequently, no currently viable population of any threatened species is likely to be placed at risk of extinction.

This conclusion is made on the provision that the final design and implementation of the proposed development is in accordance with the recommendations and ameliorative measures proposed in this assessment (for the express purpose of ensuring ecological impacts are significantly reduced if not avoided).

Consequently, the proposal is not considered to require a Species Impact Statement, or referral to the DSEWPC for approval under the EPBCA 1999.

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APPENDIX 1: Potential Occurrence Assessment and Seven Part Test Eligibility

A1.0 POTENTIAL OCCURRENCE ASSESSMENT

The following tables are used as a summary to address threatened species (as detailed below) in terms of potential occurrence, and likelihood of being significantly affected by the proposal, and hence requiring formal 7 Part Test assessment. Threatened species have been assessed if it is:

a) Recorded on-site;

b) Not recorded on site, but recorded within a 10km radius (the locality), and may occur to some degree on-site or in the study area (land within 100m of site) due to potential habitat, key habitat component, etc;

c) Not recorded in the locality as yet, but recorded in the bioregion, and thus may occur in the locality, and possibly to some extent, may occur on the site, due to potential habitat.

The "*habitat requirements*" column is derived from the previously listed references. Likelihood of occurrence is based on the probability of occurrence in terms of:

- Habitat extent (eg sufficient to support an individual or the local population; comprises all of home range; forms part of larger territory, etc); quality (ie condition, including an assessment of threats, historical land uses on and off-site, and future pressures); interconnectivity to other habitat; and ability to provide all the species life-cycle requirements (either the site alone, or other habitat within its range);

- Occurrence frequency (ie on-site resident; portion of larger territory; seasonal migrant or transitory opportunist and thus when and how often, etc)

- Usage ie breeding or non-breeding; opportunistic foraging (eg seasonal, migratory or opportunistic); marginal fringe of core range; refuge; roosts; etc.

An indicative 1-5 scale used by the author to indicate the likelihood of the species to potentially occur in the habitat on the study sites (if they have not been recorded in the locality) is as follows:

- 0: *Unlikely* (<1% probability) - no potentially suitable habitat; too disturbed; or habitat is very poor. No or few records in region or records/site very isolated eg by pastoral land, urbanisation, etc.
- 1: *Low* (1-10%)- few minor areas of potential habitat; highly modified site/habitat; or few habitat parameters present, but others absent or relatively insignificant (sub-optimum habitat). Usually very few records in locality.
- 2: *Fair* (11-25%) - some significant areas of potential habitat, but some habitat parameters limited. Potential for occasional foraging eg from nearby more optimal areas or known habitat. Records at least within 10-15km radius of site.
- 3: *Good* (26-50%) - significant abundance of habitat parameters/areas of habitat, and more locally eg adjacent. Potential part of larger territory, but probably unable to support breeding in isolation. Recorded within 10km in similar habitat/environs.
- 4: *Moderate* (51-75%) - quite good potentially suitable habitat on and adjacent to the site, and/or good quality and abundance of some vital habitat parameters. Records within <10km, or adjacent to site, or adjacent to high quality habitat where species likely to occur.

- 5: *High* (>75%) - very good to optimum habitat occurring on or adjacent to the site (support breeding pair or population). Recorded within 5-10km of site in same or similar habitat.

The "*Assessment of Significance*" column is based on consideration of the habitat on-site, likelihood of occurrence, and consideration of the DECC guidelines for assessment under the 7 Part Tests (DECC 2007). Recognising that some species with very large ranges or varying tolerances to habitat modification, some species which may have low potential to occur in the study area and will obviously not be significantly affected by the proposal will not be formally assessed to avoid production of superfluous information. Rather these species are assessed in the final column with justification for this assessment. However, recognising that significance is open to interpretation, the decision on whether a species is formally assessed or not by the 7 Part Tests in this assessment is based on the following rules:

a) If there is *any* justifiable risk, based on consideration, of a significant impact as a result of direct or indirect impacts, a 7 Part Test is required (ie the Principle of Uncertainty is applied).

b) Any threatened species recorded on-site or in the study area, or of at least fair chance of occurrence on-site in terms of potential habitat, is **automatically** selected for the 7 part Tests, unless the proposal has no effect (justification provided).

A1.1 FLORA

As mentioned previously, no threatened flora species were detected on site by the survey. Searches of relevant literature and databases (OEH 2013a) found records of 5 threatened flora species in the locality. In the table below, these species are evaluated for their potential to occur on the site; significance of the proposal to this potential occurrence; and thus their eligibility/requirement for Seven Part Test assessment. Those species marked in bold are dually listed under the EPBCA 1999.

Table 17: Eligibility for Seven Part Test Assessment - Flora

SPECIES	NUMBER OF RECORDS IN LOCALITY	HABITAT REQUIREMENT	LIKELIHOOD OF OCCURRENCE	SIGNIFICANCE OF IMPACTS/ FULL 7 PART TESTS REQUIRED?
Dwarf Heath Casuarina (*Allocasuarina defungens*)	23	A straggly oak about 2m high with blue-green foliage found in heath on sand (sometimes clay and sandstone soils), and swamp sclerophyll forest margins. This plant has been recorded in at Limeburners Creek Nature Reserve. Recorded on Hastings LGA, Kempsey, Bare Point, Coffs Harbour, Greater Taree City Council LGA, Bulahdelah and Camden Haven databases	Lack of preferred habitat on site. Disturbance history and failure to detect this species during this and previous surveys suggest this species is not a likely occurrence.	Unlikely to occur, thus no significant impact likely. Seven Part Test not required.
White-Flowered Wax Plant (*Cynanchum elegans*)	1	A twiner occurring predominately in dry rainforest, littoral rainforest and the ecotone between dry rainforest and open forest, however it has been found in the Manning Valley and Hastings in Open Forest types on specific geologies eg limestone and serpentine respectively (Garry Germon pers. comm. 2004, personal observations). It occurs on a variety of lithology's and soil types. It has been found between the altitudinal ranges of 0 to 600 metres ASL and rainfall >760mm annually (NPWS 1999). Common associated species include *Geijera parviflora, Notelaea microcarpa, Banksia integrifolia, Ficus spp., Guioa semiglauca, Melia azedarach, Streblus brunonianus* and *Pittosporum revolutum*. Recorded in Camden Haven, Hastings LGA, Grafton, Kempsey, Wingham, and Bulahdelah databases	Lack of suitable habitat on site. Disturbance history and failure to detect this species during this and previous surveys suggest this species is not a likely occurrence.	Unlikely to occur, thus no significant impact likely. Seven Part Test not required.
Rainforest Cassia (*Senna acclinis*)	4	A shrub found in or on the edges of subtropical and dry rainforest. Variable geology and soils are favoured. Recorded in Kerewong SF and Lorne SF in the Hastings LGA and also in Bulahdelah, Great Lakes, and Coffs Harbour LGA databases.	Lack of suitable habitat on site. Disturbance history and failure to detect this species during this and previous surveys suggest this species is not a likely occurrence.	Unlikely to occur, thus no significant impact likely. Seven Part Test not required.

Magenta Lilly Pilly (*Syzygium paniculatum*)	4	A type of Lilly Pilly, which has a shrub to small tree habit and grows in subtropical and littoral rainforest on sandy soils or stabilised dunes on the coast. It is also widely cultivated as an ornamental.	Lack of suitable habitat on site. Disturbance history and failure to detect this species during this and previous surveys suggest this species is not a likely occurrence.	Unlikely to occur, thus no significant impact likely. Seven Part Test not required.
Austral Toadflax (*Thesium australe*)	1	A parasitic herb commonly associated with Kangaroo Grass, and has been recorded on coastal headlands at Coffs Harbour, Hat Head, Crescent Head, Diamond Head and Perpendicular Point in Kangaroo Grass areas. Recorded on Hastings LGA, Kempsey, Bare Point, Coffs Harbour, Korogoro and Camden Haven databases.	Suitable habitat in a very broad sense may occur in areas with a higher native grass component but poor habitat overall and long disturbance history. This, along with failure to detect and lack of proximate records suggest the species does not occur on the study site.	Unlikely to occur, thus no significant impact likely. Seven Part Test not required.

A number of other species (see table below) are known or considered potential occurrences within the locality. However due to a number of factors, these species were not considered potential occurrences on site. Thus the proposal is not considered to have a significant impact on the viability of any local population of the subject species and Seven Part Test evaluation was not required. Those species marked in bold are dually listed under the EPBCA 1999.

Table 18: Threatened flora species considered unlikely to occur on site

Preferred Habitat	Species	Site considered unsuitable habitat	Disturbance history likely to have excluded this species	Lack of local records
Dry Sclerophyll Open Forest Woodland	***Acacia ruppii***	X	X	X
	Acacia courtii			X
	Ancistrachne maidenii	X		X
	Angophora inopina			X
	Angophora robur	X		X
	Babingtonia prominens	X	X	X
	Banksia conferta subsp. Conferta	X		X
	Bertya sp. (Chambigne NR, M Fatemi 24)	X	X	X
	Bertya ingramii	X	X	X
	Bertya sp. Cobar-Coolabah	X	X	X
	Boronia hapalophylla	X	X	X
	Callistemon linearifolius		X	X
	Diuris venosa	X	X	X
	Diuris pedunculata	X	X	X
	Dillwynia tenuifolia		X	X
	Grevillea banyabba	X	X	X
	Grevillea beadleana	X	X	X
	Grevillea caleyi	X	X	X
	Grevillea quadricuada	X	X	X
	Hakea archaeoides	X	X	X
	Hakea trineura	X	X	X
	Lindsaea incisa	X	X	X
	Macrozamia johnsonii		X	X
	Melaleuca groveana		X	X
	Melichrus hirsutus	X	X	X
	Olax angulata	X	X	X
	Philotheca obovatifolia	X	X	X
	Polygala linariifolia	X		X
	Pomaderris queenslandica		X	X

	Corybas dowlingii	**X**	**X**	**X**
	Melaleuca tamariscina ssp irbyana	**X**		X
	Tetratheca juncea	**X**	**X**	**X**
	Dracophyllum macranthum	**X**	**X**	**X**
	Acacia chrysotricha	**X**	**X**	**X**
Rainforest Wet Sclerophyll Forest Riparian	***Acalypha eremorum***	**X**	**X**	**X**
	Acronychia littoralis	**X**		**X**
	Archidendron hendersonii	**X**	**X**	**X**
	Arthropteris palisotii	**X**		**X**
	Asperula asthenes	**X**	**X**	**X**
	Boronia umbellata	**X**	**X**	**X**
	Calophanoides hygrophiloides	**X**		**X**
	Corynocarpus rupestris subsp. Rupestris	**X**	**X**	**X**
	Dendrocnide moroides	X	**X**	**X**
	Desmodium acanthocladum	**X**	**X**	**X**
	Diospyros mabacea	**X**	**X**	**X**
	Diploglottis cambelli	X	**X**	**X**
	Eidothea hardeniana	**X**	**X**	**X**
	Endiandra floydii	X	**X**	**X**
	Endiandra hayesii	X	**X**	**X**
	Gingidia montana	**X**	**X**	**X**
	Grammitis stenophylla	**X**	**X**	**X**
	Grevillea guthrieana	**X**	**X**	**X**
	Harnieria hygrophiloides	**X**		**X**
	Hicksbeachia pinnatifolia	**X**	**X**	**X**
	Lindsaea brachypoda	**X**		**X**
	Macadamia tetraphylla	**X**		**X**
	Marsdenia longiloba	**X**		**X**
	Olearia flocktoniae	**X**	**X**	**X**
	Parsonsia dorrigoensis	**X**		**X**
	Peristeranthus hillii	**X**	**X**	**X**
	Phyllanthus microcladus	**X**		**X**
	Plectranthus nitidus	**X**		**X**

	Psilotum complanatum	**X**		**X**
	Quassia sp. Moonee Creek	**X**	**X**	**X**
	Sarcochilus dilatatus	**X**		**X**
	Sarcochilus fitzgeraldii	**X**		**X**
	Sarcochilus hartmannii	**X**		**X**
	Tinospora smilacina	**X**		**X**
	Tinospora tinosporoides	**X**		**X**
	Triplarina imbricata (formerly Baeckea camphorata)	**X**	**X**	**X**
	Tylophora woolsii			**X**
	Uromyrtus australis	**X**		**X**
	Alexfloydia repens	**X**		**X**
	Cyperus aquatilis	**X**		**X**
	Eleocharis tetraquetra	**X**		**X**
Swamp Forest Aquatic Freshwater Wetland Estuarine	*Babingtonia silvestris*	**X**	**X**	**X**
	Centranthera cochinchinensis	**X**		**X**
	Lindernia alsinoides	**X**		**X**
	Maundia triglochinoides			
	Melaleuca biconvexa	**X**	**X**	**X**
	Phaius australis	**X**	**X**	**X**
	Rotala tripartita	**X**		**X**
	Chamaesyce psammogeton	**X**		**X**
Heathland Shrubland Grasslands	*Diuris sp. aff. chrysantha*	**X**	**X**	**X**
	Elyonurus citreus	**X**		**X**
	Eucalyptus approximans	**X**		**X**
	Glycine clandestina (Broad leaf form)	**X**		**X**
	Pimelea spicata	**X**	**X**	**X**
	Rutidosis heterogama	**X**		**X**
	Sophora tomentosa subsp. australis	**X**		**X**
	Zieria prostrata	**X**		**X**
	Pultenaea maritima	**X**		**X**
	Zieria prostrata	**X**		**X**
	Hibbertia hexandra		**X**	**X**

	Neoastelia spectabilis	**X**		**X**
	Oberonia titania	**X**	**X**	**X**
	Zieria lasiocaulis	**X**		**X**
Various Miscellaneous Other	***Prostanthera spnosa***	**X**		**X**
	Senecio spathulatus	**X**		**X**
	Styphelia perileuca	**X**		**X**

A1.2 FAUNA

As previously noted in section 4.3.3, a significant number of threatened fauna have been recorded in the locality, and a number of others are considered potential occurrences by the consultant. In the table below, these species are evaluated for their potential to occur on the site; significance of the proposal to this potential occurrence; and thus their eligibility/requirement for Seven Part Test assessment.

Table 19: Eligibility for Seven Part Test Assessment – Fauna

NAME	NUMBER OF RECORDS	HABITAT REQUIREMENTS	LIKELIHOOD OF OCCURRENCE	SIGNIFICANCE OF IMPACTS/ FULL 7 PART TESTS REQUIRED?
Masked Owl (*Tyto novaehollandiae*)	2	Eucalypt forest and woodlands with sparse understorey. Nests in tree hollows. Requires high diversity and abundance of prey 200-600g weight. Large territory.	Some generic potential foraging habitat on site with medium sized arboreal prey present. Site would form a minute portion of a much larger forging range for this species. 1-2 trees in study area may have hollows large enough for breeding but subject to high competition. Likelihood to occur on site is considered fair.	Loss/modification of a small area of generic foraging habitat on site considered unlikely to significant impact. However considered a fair chance of occurrence thus **Seven Part Test** required as per Uncertainty Principle.
Barking Owl (*N. connivens*)	0	Well-forested hills and flats, eucalypt savannah (especially), and riverine woodland in coastal and subcoastal areas. Prefers hunting in more open country for mammals (rabbits, rats, mice, small bats and small marsupials) and birds (small up to Frogmouths and Magpies). Large territories. Nest in hollows.	Generally as per Masked Owl but not recorded in locality, and records in LGA few and sparse. Considered low potential occurrence in study area.	As for Masked Owl. **Seven Part Test** required

Grass Owl (*Tyto longimembris*)	0	Inhabit coastal and inland grasslands, coastal heath, agricultural crops and swamp margins. Dependant on good numbers of rodent prey. Highly mobile.	Derived grassland and shrubland on site offers mainly low quality potential habitat with better potential habitat to south. Suitable prey species reasonably abundant. Recorded just outside locality at Hallidays Point and Harrington. Low chance of occurrence in study area using site as small part of larger range.	Loss of potential habitat in south of site unlikely to impact given large areas of suitable habitat adjacent to site that will remain. **Seven Part Test required** as low chance of occurrence.
Sooty Owl (*Tyto tenebricosa)*	1	Rainforest and tall, moist, diverse eucalypt forest. Roosts in dense foliage, tree hollows & caves/overhangs. Nests in hollow in tall forest tree. Requires high diversity and abundance of medium-sized arboreal and/or terrestrial prey. Large territory.	Site does not contain suitable habitat and no proximate records. Considered unlikely to occur.	No loss of potential habitat. No risk of significant impact and unlikely to occur. Seven Part Test not required.
Square-Tailed Kite (*Lophoictinia isura*)	2	Open forests and woodlands in coastal and subcoastal areas. Forages low over, or in, canopy for eggs, nestlings, passerines, small vertebrates and invertebrates. Large home range (>100km^2). Observed foraging in residential areas of Port Macquarie. Large stick nest in high fork of living tree. Breeds July-December. Probably migrates to northern Australia in Winter. (Debus 1998, NSW NPWS 2000)	No nest observed. Limited abundance of passerine birds in south of site but northern Lots offer good foraging potential with preferred structure. Site represents a small area of generic foraging habitat as part of a wider area. Only two records within 10km radius of site but reported sighting near Precinct 2B to north. Moderate chance of occurrence as wide-ranging forager.	Loss/modification of small area of potential foraging habitat and nest trees considered insignificant relative to range of species. Observed foraging in rural to urban areas locally, hence potential to occur on site post development. No risk of significant impact but as moderate chance of occurrence - **Seven Part Test required.**
Little Eagle (*Hieraaetus morphnoides*)	1	Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland, sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. It eats birds, reptiles and mammals, occasionally adding large insects and carrion (Marchant and Higgins 1993; Aumann 2001b; Debus et al. 2007). It is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW.	Some generic potential foraging habitat present on site but sparse records in LGA. Considered low to fair chance of occurrence on site as part of very large foraging range.	Modification of habitat on site considered insignificant but fair chance to occur foraging hence **Seven Part Test required.**

Spotted Harrier (C*ircus assimilis*)	0	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe (e.g. chenopods) (Marchant and Higgins 1993; Aumann 2001a). It is found mostly commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. The species builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Diet includes terrestrial mammals, birds and reptiles, occasionally large insects and rarely carrion (Marchant and Higgins 1993; Aumann 2001b). Many of the remaining key prey species (e.g. terrestrial grassland birds such as quail, button-quail, pipits, larks and songlarks) require ground cover and are sensitive to habitat degradation from grazing (Marchant and Higgins 1993).	Some very marginal potential foraging habitat present on site, however no local records exist and species was not recorded on site. Considered very low to unlikely chance of occurrence on site– more likely to occur in hinterland of LGA.	Modification of habitat on site considered insignificant, given lack of local records and amount of similar habitat available locally. Seven Part Test not required.
Little Lorikeet (*Glossopsita pusilla*)	1	Gregarious, usually foraging in small flocks, often with other species of lorikeet feeding primarily on nectar and pollen in the tree canopy, particularly on profusely-flowering eucalypts, but also on a variety of other species including, melaleucas and mistletoes. Mostly occurs in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. In south-east Queensland (Smyth *et al*. 2002), were more likely to occupy forest sites with relatively short to intermediate logging rotations (15–23 years) and sites that have had short intervals (2.5– 4 years) between fires.	Only single record in the locality. Site may offer some broadly suitable habitat for the species with a variety of flowering eucalypts and melaleucas, and potential nesting hollows (depending on local flowering incidence). Considered a low to fair chance of occurrence as part of a wider foraging range.	Loss/modification of a small area of generic foraging habitat on site considered insignificant relative to range and best potential nesting hollows on site can be retained. Significant impact unlikely however **Seven Part Test required** due to fair potential to occur.
Swift Parrot (*Lathumus discolor*)	0	Breeds in Tasmania and winters in Victoria with some dispersal northwards. Feeds mostly on pollen and nectar of winter flowering eucalypts, but also feeds on fruit, seeds, lerps and insect larvae (Schodde and Tideman 1990). Also favours profusely flowering banksias. Favoured species are *E. robusta*, *Corymbia gummifera*, *E. globulus, E. sideroxylon, E. leucoxylon, E. labens, E. ovata, C. maculata, Banksia serrata* and *B. integrifolia*	Not recorded in locality. Very few Winter flowering species present on site - more optimum habitat to east and south where swamp forest and *B. integrifolia* occur. Unlikely chance of occurrence on site.	No loss/modification of potential foraging habitat and unlikely chance of occurrence. Seven Part Test not required.

Grey-Crowned Babbler (*Pomatostomus temporalis temporalis*) eastern subspecies	0	Occupies open woodlands dominated by mature eucalypts, with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs. Builds conspicuous dome-shaped nests and breeds co-operatively in sedentary family groups of 2-13 birds (Davidson and Robinson 1992). Insectivorous and forage in leaf litter and on bark of trees. Occurs on the western slopes and plains but less common at the higher altitudes of the tablelands. Isolated populations are known from coastal woodlands on the North Coast, in the Hunter Valley and from the South Coast near Nowra (Blakers *et al.* 1984, Schodde & Mason 1999).	Site lacks suitable habitat for this species. Not recorded in locality or on site by survey. Very low to unlikely to occur.	Loss of habitat on site considered insignificant given it is largely unsuitable and this species is unlikely to occur. Seven Part Test not undertaken as evidently no risk of significant impact.
Hooded Robin (*Melanodryas cucullata cucullata)* southeastern form	0	Occupies a wide range of Eucalypt woodlands, *Acacia* shrublands and open forests, favouring open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover. Live in small family groups of pairs or trios, with relatively large home ranges (average 18ha in New England Tableland). Feeds on the ground on insects, and forages in areas with a mix of bare ground, ground cover and litter.	Northwest of site at best contains broadly suitable habitat of no specific significance given local extent of such. Not recorded in locality or on site by survey. Very low to unlikely to occur.	Loss/modification of a small area of only broadly generic foraging and nesting habitat on site considered insignificant. Substantial amount of higher quality habitat available locally. Seven Part Test not undertaken as evidently no risk of significant impact.
Diamond Firetail (*Stagonopleura guttata*)	0	Occupies eucalypt woodlands, forests and mallee where there is a grassy understorey. Build bottle-shaped nests in trees and bushes, and forages on the ground, largely for grass seeds and other plant material, but also for insects (Blakers *et al.* 1984, Read 1994). Distributed through central and eastern NSW, extending north into southern and central Queensland and south through Victoria to the Eyre Peninsula, South Australia. In NSW, the species occurs predominantly west of the Great Dividing Range, although populations are known from drier coastal areas such as the Cumberland Plain of western Sydney and the Hunter, Clarence, Richmond and Snowy River valleys (Blakers *et al.* 1984, Schodde & Mason 1999).	As for Hooded Robin. Very low to unlikely to occur.	As for Hooded Robin. Seven Part Test not required.
Speckled Warbler (*Pyrrholaemus sagittata*)	1	Inhabits mostly inland woodlands (some drier coastal areas) with grassy understorey often on ridges and gullies. Sedentary in pairs or trios, and nests on ground in grass tussocks, dense litter and fallen branches. Forages on ground or understorey for arthropods and seeds within home range of 6-12ha. Remnants <100ha not suitable.	As for Hooded Robin but recorded locally. Very low to unlikely to occur.	As for Hooded Robin. Seven Part Test not required.

Regent Honeyeater (*Xanthomyza phrygia*)	0	Nomadic. Inhabits temperate eucalypt woodlands and open forest, including forest edges, woodland remnants on farmland and urban areas. Also uses *Casuarina cunninghamiana* gallery forests. Requires reliable and ample nectar supplies to support semi-permanent (core breeding) habitat. Favoured nectar sources are *E. sideroxylon, E. albens, E. melliodora, E. leucoxylon, E. robusta, E. planchoniana*, and heavy infestations of mistletoe. Also take insects and orchard fruits. Breeds in pairs or small colonies in open woodland/forest and occasionally more disturbed woodland near housing and farmland, depending on food availability, from August-January. Breeding less likely to occur if nectar flows are low or unreliable, or heavy competition with more aggressive honeyeaters eg Noisy Miner, Red Wattlebirds and Noisy Friarbirds.	Only a few young Swamp Mahogany present on site and very little mistletoe. No records in locality. Unlikely chance of occurrence given lack of local records and key habitat components.	No critical habitat to be modified, potential to forage in study area and adjacent habitat will remain post development. No significant impact likely thus Seven Part Test not required.
Bush Stone Curlew (*Burchinus grallaris*)	0	Nocturnal, sedentary and territorial (when breeding) species generally inhabiting open grassy woodlands with few or no shrubs. Abundant leaf litter and fallen debris such as tree branches required for foraging and roosting. Nests in more open areas with very little groundcover (even recorded on mown lawns and golf courses). Coastally, often associated with Swamp Oak groves, saltmarsh, mangroves, *Melaleuca quinquenervia* woodlands and even golf courses, etc. May travel as far as 3km from roost site to foraging grounds.	Site at best contains marginally suitable habitat of no specific significance given local extent of such. Disturbance history and presence of predators would reduce potential. Unlikely to occur.	No critical habitat to be modified, potential to forage in study area and adjacent habitat will remain post development. No significant impact likely thus Seven Part Test not required.
Varied Sittella (*Daphoenositta chrysoptera*)	0	Sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett *et al.* 2003). It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy. It builds a cup-shaped nest of plant fibres and cobweb in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Forested parts of site offer generically suitable habitat of no specific significance given local extent of such. Considered fair potential for family group to occur in northwest of site and adjacent habitats.	Loss of small area of generic habitat with key linkages over site retained. No significant impact likely but as fair chance to occur, **Seven Part Test required**.

Flame Robin (*Petroica phoenicea*)	0	Found in south-eastern Australia. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). There may be two disjunct breeding populations in NSW on the Northern Tablelands and the Central–Southern Tablelands (Barrett *et al.* 2003 and the NSW Wildlife Atlas). Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobweb, which is often near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	Northwest of site at best contains generically suitable habitat of no specific significance given local extent of such, and outside preferred range. Not recorded on site during this or previous surveys. Unlikely chance of occurrence.	Loss/modification of a small area of only broadly generic foraging and nesting habitat on site considered insignificant given amount of similar habitat adjacent to site that will remain with linkages. Seven Part Test not undertaken as evidently no risk of significant impact.
Scarlet Robin (*Petroica boodang*)	0	Found in southeastern Australia and southwest Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Some dispersing birds may appear in Autumn or Winter on the eastern fringe of the inland plains. It breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The robin builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground (Higgins and Peter 2002; Debus 2006a,b).	Potential habitat mainly in northwest. Low to fair potential to occur.	Loss of small area of generic habitat with key linkages over site retained. No significant impact likely but as fair chance to occur, **Seven Part Test required**.
Black-Chinned Honeyeater (Eastern subspecies) *(Melithreptus gularis gularis)*	1	Eastern subspecies widespread in NSW with most records centred in the Clarence and Richmond areas. Prefers drier forests and woodlands where it mostly occupies the upper levels feeding in pairs and groups of up to 12 birds. Nests in the upper crown of a tree hidden by foliage (Pizzey and Knight 2003, OEH 2013b.)	Some marginal generic habitat on site, but well outside core range. Only single local record. Given this, very low to unlikely to occur on site.	Loss of small area of low quality generic potential foraging habitat relative to range and extent of suitable habitat adjoining site outside of core range considered insignificant given no breeding habitat impacted. Seven Part Tests not undertaken.

Black-Necked Stork (*Ephippiorhynchus asiaticus*		Usually occurs alone or in pairs. Inhabits lakes, swamps, freshwater pools, mudflats and mangroves. Wary, shuns cover and forages in extensive open shallows for fish, frogs and invertebrates (Lindsey 1992). Occasionally forages in grassy woodland. Breeds in a large stick nest in a tree, usually near water or in a secluded swamp (NSW NPWS 2000).	Dams and drains on site and in study area offer some low quality generic habitat for a non-breeding opportunistic foraging bird. More suitable habitat to south and in locality. Locally recorded but only low chance to occur in study area.	Modification of general area will result in indirect impacts adverse to this species, hence Seven Part Test required.
Comb-Crested Jacana (*Irediparra gallinacean*)	2	This species occurs in coastal and subcoastal regions of northern and eastern Australia, however is much less common south of the Queensland border. It occurs in deeper permanent freshwater swamps, ponds and billabongs with a good cover of surface vegetation, especially water lilies. Forages over floating vegetation on insects and invertebrates, seeds and occasionally aquatic plants (OEH 2013b, Pizzey and Knight 2003).	A few of the dams on site along with drainage line and stormwater ponds in study area have a good cover of floating aquatic vegetation, but overall insufficient habitat to support species which requires larger permanent wetlands. Site also too exposed. Recorded in locality at Mitchell Island to north, however unlikely to occur on site.	Loss/modification of a few small dams highly unlikely to impact. Seven Part Test not required.
Koala (*Phascolarctos cinereus*)	84	A large arboreal marsupial to 12kg for males and 8kg for females. Spends most of its time in trees and has large claws adapted for climbing. Largest populations in NSW occur on the central, mid-north and north coast with scattered populations on the south coast, tablelands and western districts. Koalas inhabit eucalypt forests and woodlands where they feed on the leaves of a wide range of eucalypts and will select preferred browse species in an area. Home range size varies depending on quality of habitat, ranging from two to several hundred hectares in size (DECC 2008, Van Dyck and Strahan 2008).	Potential Koala habitat occurs in north of site where Tallowwoods are common. Adjacent habitat to west and south also likely to be suitable. Recorded within 500m of site and reported crossing Forest Lane by resident. Considered low to fair chance of occurrence using habitat in north of site as fringes of territory or as transient.	The proposal will see loss of potential habitat and browse species on site and an increase in threats. Potential to occur on site should be retained given best habitat to be left as corridor. **Seven Part Test undertaken** to evaluate.
Common Planigale (*Planigale maculata*)	0	Wide variety of habitats. Preference for areas of dense groundcover due to heat/dehydration problems. May prefer ecotones of dry/wet habitats (Denny 1982). Preys on arthropods, small vertebrates, shelters in nest under/in fallen timber or rock (Strahan 1995). Home range about 0.5ha. Breeds Oct-Jan (NSW NPWS 2000).	Broad habitat preferences suggest most of the site where dense groundcover present would qualify as potential habitat. The long disturbance history, lack of records, high competition from native and exotic rodents/dasyurids and presence of predators would significantly reduce potential to occur. Consequently it is considered an unlikely chance of occurrence.	Loss of potential habitat on site unlikely to impact given unlikely occurrence and presence of higher quality habitat connected to site. Seven Part Test not required.

Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)	0	Appears to prefer heathland especially dense wet heath and swampy areas usually occupied by Swamp Rat (AMBS,1996). Also recorded from mid-elevation grasslands, open dry and wet sclerophyll woodland. In the Port Macquarie area, associated with heathland with dense shrub layer of *Banksia ericifolia*, *B. serratifolia, Xanthorrhoea* spp, *Dillwynia floribunda, Boronia spp*, *Leptospermum flavescens* and *Melaleuca nodosa*. Requires specific fire regime, greatest density 3-4 years after fire. Omnivorous, seeds, fungi, green stem, arthropods. Home range <0.5ha (NSW NPWS 2000).	Not recorded locally or on site despite targeted survey. The grassland habitats on site are considered marginal as they are low diversity and are dominated by exotic species, hence offer very limited foraging resources. The long disturbance history in the area, especially cattle grazing and slashing and competition from other rodents/dasyurids would also reduce potential to occur. Subsequently, it is given an unlikely chance of occurrence on site. Better habitat occurs to the southeast on the fringes of the swamp forest.	Loss of potential habitat on site unlikely to impact given unlikely occurrence and presence of higher quality habitat connected to site. Seven Part Test not required.
New Holland Mouse *(Pseudomys novaehollandiae)*	Predicted (MNES)	Swamp forest, heath, open forest on sand. Depends on a specific fire regime.	Preferred habitat type absent and unsuitable bushfire regime. No local records. Unlikely to occur.	No loss of preferred habitat and unlikely to occur. No risk of impact, Seven Part Test not required.
Eastern Pygmy Possum (*Cercartetus nanus*)	0	Found in rainforest, sclerophyll forest, woodland and tree heath. Predominantly nectarivorous (opportunistically insectivorous and also eats fruits during flowering lulls) feeding on Banksias, Leptospermum, Melaleucas, Eucalypts and Callistemons. Nest in very small hollows, or within bark/leaf nests in tree forks (eg Melaleucas and Banksias), Myrtaceous shrubs, abandoned bird nests or under loose eucalypt bark. Often Winters in torpor.	Site habitat is largely unsuitable due to lack of flowering understorey and high threat level – more optimal habitat occurs in heathland and shrubland to the east and south. Not recorded in locality and unlikely to occur on site.	No loss of preferred habitat and unlikely to occur. No risk of impact, Seven Part Test not required.
Brushtailed Phascogale (*Phascogale tapoatafa*)	9	Range of forest habitats but prefers drier sclerophyll forest with sparse ground cover. Forages on large rough-barked trees for small fauna, also utilises eucalypt nectar. Rests in tree hollows, stumps, bird nests. Requires tree hollows for nesting. (NPWS, 2000) Breeds May-July. Occupies territory of 20-100ha. Has been recorded in swamp forest.	Species has been recorded within locality but not in the Old Bar area. Small areas of suitable foraging and denning habitat occur site and are connected to larger expanses of suitable habitat. Considered a low to fair chance of occurrence foraging and denning on site as part of a wider home range.	Proposal overall has limited effect – only low quality potential foraging habitat and hollows are likely to be affected. Considered a low to fair chance of occurrence hence **Seven Part Test required** to assess significance.
Spotted-Tail Quoll (*Dasyurus maculatus*)	2	Various forested habitats with preference for dense forests. Requires tree hollows, hollow logs or caves for nesting. Large home range (>500ha) and may move over several kilometres in a few days. Tends to follow drainage lines.	Northwest of site is on eastern fringe of large body of forest considered to provide some generic structurally suitable foraging habitat. A few larger hollow logs and trees offer potential denning here. Considered low to fair chance of occurrence as part of a wider foraging range.	Considered low to fair potential occurrence using parts of site as part of larger area of habitat. Proposal overall has minimal effect – only contraction of marginal fringe. However, **Seven Part Test required** to demonstrate no risk of significant impact on Precautionary Principle.

Yellow-Bellied Glider (*Petaurus australis*)	1	This arboreal species feeds on honeydew, arthropods, pollen and sap of eucalypts (depending on the phenology of the forest), which generally restricts it to mature, tall eucalypt forests in temperate and sub-tropical regions with high rainfall. Occurrence is significantly influenced by the presence of a mosaic of species with overlapping flowering periods and bark shredding into long strips to provide foraging habitat for arthropods. Territory is large, around 35-65ha, being occupied by small family groups. Multiple large hollows are required for nesting and roosting. Suitable sap species and smooth-barked eucalypts with bark that peel in strips are considered most important for foraging for arthropods.	Limited range of potential hollows and limited understorey is a key constraint. Very low to unlikely as not recorded in the area to date and large areas of adjoining forest offer better potential. If present, site would only form small part of large home range of a colony.	Loss of some potential forage trees (sap, nectar, insects) but no potential hollows. Best potential habitat on site will be retained and protected. Recorded in peri urban areas, hence potential to occur retained. No risk of significant impact, hence 7 Part Tests considered superfluous.
Squirrel Glider (*Petaurus norfolcensis*)	4	Dry, open forest and woodland, and occasionally wet eucalypt and rainforest. Most common in floriferous sub-coastal and coastal forests with abundant Winter flowering trees and shrubs. Coastal populations apparently rely heavily on Acacia sap and flowering Banksias.	Species has been recorded locally with one proximate record 500m to north. Lack of preferred understorey and preferred sap species over most of site is a major constraint. Given local records and presence of broadly suitable foraging and denning habitat in northwest of site, species considered a low to fair chance of occurrence foraging on fringes of site as part of a wider foraging range.	Proposal overall has relatively limited effect – only minor loss of generic potential habitat with best foraging habitat and hollows retained. However considered fair chance of occurrence hence **Seven Part Test required** to assess significance.
Long-Nosed Potoroo (*Potorous tridactylus)*	1	Coastal heath and shrublands; paperbark forest; woodland with dry heathy understorey; high elevation rainforest or moist hardwood forest; moist shrublands with dense or moderately dense understoreys and sedge-dominated groundcover; wet or dry sclerophyll forests where average annual precipitation exceeds 760mm. Requires thick groundcover for refuge, while foraging in open areas on ridges, slopes or gullies, typically on ecotones, and prefers sandy soils for digging. Eats roots, tubers, fungi, fleshy fruits, leaves, insects and other soil invertebrates. Optimum habitat generally considered a mosaic of regenerating dense understorey vegetation as result of patchwork of periodic low to medium intensity fires. Home range 2-5ha (NSW NPWS 2000).	Parts of site may qualify as broadly suitable habitat but disturbance history, exposure to feral predators and high threat level likely to have excluded species. Recorded in locality but considered unlikely occurrence on site.	No loss of preferred habitat and unlikely to occur. No risk of impact, Seven Part Test not required.
Rufous Bettong (*Aepyprymnus rufescens*)	0	Inhabits well-grassed open woodland/forest on flat/undulating ground. Not usually in rainforest or moist forest. Typically with *Poa* and Bladey Grass cover. Nests in dense grasses or under logs. Nocturnal. Diet of grasses, sedges, herbs, tubers. Not social, but may aggregate to feed in pasture. Breeding may be continuous. (Strahan, 1995; Mt King, 1993).	As for Long-Nosed Potoroo but not recorded locally. Unlikely to occur.	No loss of preferred habitat and unlikely to occur. No risk of impact, Seven Part Test not required.

Common Blossom-Bat (*Syconycteris australis*)	1	Found in well timbered habitats. Roosts in rainforest and wet sclerophyll forest. Feeds in heathlands and paperbark swamps up to 4km from roost. Key food species include Banksia, Melaleucas, Callistemons and Bloodwoods.	Site contains some potential nectar sources, but nearest roosting habitat likely to be at Saltwater Reserve to the south where this species has been recorded. Unlikely to occur due to abundance of higher quality foraging habitat and lack of nearby roosting habitat.	Loss of potential habitat on site unlikely to impact foraging success due to large areas of higher quality habitat locally. No potential roosting habitat affected. Seven Part Test not required.
Greater Broad Nosed Bat (*Nycticeius rueppellii*)	0	Forages over range of habitats including rainforests and moist forests, but prefers ecotones between riparian forest, woodland and cleared land. Requires sparse understorey and will forage over water. Roosts in tree hollows. Feeds on larger insects, small vertebrates and perhaps other bats.	Site has generically suitable structure for foraging. Presence of small hollows on site offer potential roosts. Considered low to fair chance of occurrence foraging over site as part of wider foraging range.	Loss of a small area of potential foraging habitat. **Seven Part Test required** to assess significance as low to fair potential to occur
Beccari's Freetail Bat (*Mormopterus beccarii*)	0	Wide range of habitats from rainforest, floodplains, tall open forest, savannah woodlands, arid shrublands and grasslands. Commonly caught along watercourses, over water and over canopy as prefers areas free of obstructions due to low manoeuvrability. Feeds above canopy in fast flight but agility on ground suggests ability to forage on flightless insects. Very few records in NSW – sporadic and possibly Summer nomadic.	Potential roosts in tree hollows. Northwest of site forms disturbed part of a large body of forest considered to providing some generic structurally suitable foraging habitat. Not recorded in the locality and considered very low to unlikely chance of occurrence as nearest confirmed record in Clarence.	Site expected to retain potential support for rare occurrences. No barriers to access. No risk of significant impact and unlikely to occur. Seven Part Test not required.
Dwyer's Bat/Large Eared Pied Bat (*Chalinobus dwyeri*)	0	Found in moderately wooded habitats such as dry sclerophyll forest, tall open eucalypt forests, woodlands, sub-alpine woodlands, edge of rainforest and wet sclerophyll forest. Roosts in caves, mines and abandoned bottle-shaped mud nests of Fairy Martins. In caves and mines, tend to roost in twilight sections near entrance. Insectivorous but habits poorly known. Fly relatively slowly, direct and manoeuvrable, low to ground or 6-10m above ground.	General foraging preferences of this poorly known species suggests site and locality potentially generically structurally suitable foraging habitat. No cave, mines, etc on or near site for roosting though occur in locality. Not recorded within 10km radius of site (or LGA, and very few regional records). Likelihood to occur considered very low to unlikely.	Modification of very marginal structurally suitable potential habitat. Considered a very low to unlikely chance of occurrence. Seven Part Test not taken as no risk of significant impact.
Hoary Bat (*Chalinolobus nigrogriseus*)	0	Occurs in a range of habitats, such as monsoon forest, tall open forest, open woodland, vine thickets, coastal scrub, sand dunes, grasslands, floodplains, watercourses and dams. Roosts in eucalypt tree hollows, as well as rock crevices. Breeding colonies have been recorded in roofs of buildings. Preferred prey is beetles and moths, but also spiders, mantids, crickets, grasshoppers, cicadas, bugs, diving beetles, flies and ants (thus may land and forage).	Potential foraging habitat in northwest of site and tree hollows offer potential roosting sites however not recorded in locality and site falls outside of known range. Considered unlikely chance of occurrence on site.	Site outside known range hence proposal will have little consequence. Seven Part Test not taken as no risk of significant impact.
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	0	Occupies sclerophyll forest from the Great Dividing Range to the coast, typically wet tall forest at high elevations and is more common in northern NSW. It may migrate to coastal areas in Winter. Roosts typically in tree hollows, but also in caves, buildings. Roosts as single sex colonies of 3-36 bats. Forages in and below tree canopy on moths, beetles, bugs, flies & ants, up to 12km from roost site. Breeds in Summer (Churchill 1998, Smith *et al* 1995).	Northwest of site forms disturbed part of a large body of forest considered to providing some generic structurally suitable foraging habitat but is not typical habitat for the species. Potential to roost in tree hollows. Overall considered a low potential occurrence flying over site as part of large extent of forest in locality.	Site expected to retain potential support for rare occurrences. No barriers to access. No risk of significant impact. **Seven Part Test required** however on precautionary basis as low potential to occur.

Southern Myotis (*Myotis macropus*) .	0	Tunnel, cave, bridges, old buildings and dense foliage roosting bat which prefers riparian habitat over 500m long with nearby roosting habitat. Key habitats are streams, rivers, creeks, lagoons, lakes and other water bodies. Feeds on aquatic insects and small fish.	The few small waterbodies on site and study area may be suitable but overall lack of potential foraging and roosting habitat in area. Given this and the lack of records, species considered an unlikely chance of occurrence.	Study area would retain potential to support rare occurrences . No risk of significant impact and unlikely to occur. Seven Part Test not required.
Yellow-Bellied Sheathtail Bat (*Saccolaimus flaviventris*)	0	Ecology poorly known. Found in almost all habitats, particularly wet and dry sclerophyll forests and woodlands below 500m altitude, and also open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts mainly in tree hollows, but also under bark, under roof eaves and in other artificial structures. Fast flying species, believed to forage above the canopy or closer to the ground in open areas. Insectivorous. May be Summer migrant.	Potential roosts in tree hollows. Northwest of site forms disturbed part of a large body of forest considered to providing some generic structurally suitable foraging habitat, and may also forage over shrubland. No local records. Considered a low to fair potential occurrence.	Site expected to retain potential support for rare occurrences. No barriers to access. No risk of significant impact. **Seven Part Test required** however on precautionary basis as low potential to occur.
Green Thighed Frog (*Litoria brevipalmata*)	0	Poorly known. Found in range of habitats such as warm temperate open forest, rainforest, and forestry dams in dry, open forest; breeding aggregations around oxbow lakes, ditches, flooded paddocks, overflows and grassy semi-permanent ponds. Males call only for few days after spring and early summer rains. Possibly a lowland forest ground-dweller.	Somewhat generalist habitat requirements suggest forest communities may offer some potential habitat for this species, however lack of suitable breeding habitat nearby. Not recorded on site or in locality. Unlikely chance of occurrence.	Loss/modification of chiefly potential foraging and non-breeding habitat unlikely to impact given unlikely occurrence. Seven Part Test not required.
Wallum Froglet (*Crinia tinnula*)	0	Predominantly confined to acidic paperbark swamps of coastal areas (Cogger 1992). Also found in wet heathland and Melaleuca sedgelands. Breeds in late Winter.	Site habitat largely unsuitable, with better potential in swamp and heath offsite to southeast. Not recorded on site during this or previous surveys which suggests unlikely occurrence as expected to be readily detected if present.	No loss of preferred habitat and unlikely to occur. Seven Part Test not required.

A number of other species (see table below) are known or considered potential occurrences within the locality. However due to a number of factors, these species were not considered potential occurrences in the study area. Thus the proposal is not considered to have any impact on the viability of any local population of the subject species and Seven Part Test evaluation was not required.

Table 20: Threatened fauna species considered unlikely to occur on site

Preferred Habitat	Species	Site considered unsuitable habitat	Presence of predators likely to have excluded this species	Disturbance history likely to have excluded this species	Lack of local records
Dry Sclerophyll Forest/Woodland	**Red Goshawk (*Erythrotriorchis radiatus*)**				**X**
	Painted Honeyeater (*Grantiella picta*)	**X**			**Recorded in locality**
	Golden-Tipped Bat (*Kerivoula papuensis*)	**X**			**X**
	Pale-Headed Snake (*Hoplocephalus bitorquatus*)	**X**			**X**
	Stephen's Banded Snake (*H. stephensii)*	**X**			**X**
Rainforest/ Wet Sclerophyll Forest	Marbled Frogmouth (*Podargus ocellatus*)	**X**			**X**
	Wompoo Fruit Dove *(Ptilinopus magnificus)*	**X**			**X**
	Rose-Crowned Fruit Dove *(Ptilinopus regina)*	**X**			**X**
	Superb Fruit Dove *(Ptilinopus superbus)*	**X**			**X**
	Barred Cuckoo-Shrike *(Coracina lineata)*	**X**			**X**
	Golden-Tipped Bat (*Kerivoula papuensis*)	**X**		**X**	**X**
	Three-Toed Snake-Tooth Skink (*Coeranoscincus reticulatus*)	**X**		**X**	**X**
Aquatic/ Freshwater Wetland/ Marine/ Riparian	**Giant Barred Frog *(Mixophyes iteratus)***	**X**			**X**
	Stuttering Frog *(Mixophyes balbus)*	**X**			**X**
	Black-Necked Stork *(Ephippiorhynchus asiaticus)*	**X**		**X**	**Recorded in locality**

Brolga (*Grus rubicunda*)	**X**			**X**
Magpie Goose *(Anseranas semipalmata)*	**X**			**Recorded in locality**
Black Bittern *(Ixobrychus flavicollis)*	**X**			**X**
Australasian Bittern (*Botaurus poiciloptilus*)	**X**		**X**	**Recorded in locality**
Painted Snipe (*Rostratula benghalensis*)	**X**			**X**
Green and Golden Bell Frog (*Litoria aurea*)	**X**	**X**	**X**	**X**
Olongburra Sedge Frog (*Litoria olongburensis*)	**X**			**X**

APPENDIX 2: Precinct 3 Flora List (Umwelt 2007)

Appendix 2 – Flora Species List

The following list was developed from surveys of the Study Area detailed in **Section 2.3.1** of the main report. It includes all species of vascular plants observed during fieldwork. Not all species are readily detected at any one time of the year, therefore the list will not necessarily include all plant species likely to occur in the Study Area. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp.	specimens that are identified to genus level only;
?	specimens for which identification was uncertain;
prob.	specimens for which identification was considered highly likely but not definite;
poss.	specimens for which identification was considered likely but not definite;

The following abbreviations or symbols are used in the list:

asterisk (*)	denotes species not indigenous to the study area;
subsp.	subspecies;
var.	variety;
f.	forma; and
X	hybrid.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler et al. (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2007), the on-line plant name database maintained by the National Herbarium of New South Wales. Common names used follow Harden (1992, 1993, 2000 & 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Where the identity of a specimen was unknown or uncertain, it was lodged with the National Herbarium of New South Wales at the Royal Botanic Gardens Sydney.

Family/Sub-family	Scientific Name	Common Name
Filicopsida (Ferns)		
Dennstaedtiaceae	*Hypolepis muelleri*	harsh ground fern
Dennstaedtiaceae	*Pteridium esculentum*	bracken
Dicksoniaceae	*Calochlaena dubia*	common ground fern
Gleicheniaceae	*Gleichenia dicarpa*	pouched coral fern
Lycopsida (Club Mosses)		
Selaginellaceae	*Selaginella uliginosa*	
Magnoliopsida (Flowering Plants) – Liliidae (Monocots)		
Arecaceae	*Archontophoenix cunninghamiana*	bangalow palm
Arecaceae	*Livistona australis*	Cabbage tree palm
Asparagaceae	**Asparagus aethiopicus*	asparagus fern
Commelinaceae	*Commelina cyanea*	native wandering Jew
Cyperaceae	*Bolboschoenus caldwellii*	
Cyperaceae	*Eleocharis equisetina*	
Cyperaceae	*Fimbristylis dichotoma*	common fringe-sedge
Cyperaceae	*Gahnia clarkei*	tall saw-sedge
Cyperaceae	*Lepidosperma laterale*	
Iridaceae	**Gladiolus gueinzii*	
Juncaceae	*Juncus continuus*	
Juncaceae	*Juncus kraussii* subsp. *australiensis*	sea rush
Juncaceae	*Juncus planifolius*	
Luzuriagaceae	*Eustrephus latifolius*	wombat berry
Philydraceae	*Philydrum lanuginosum*	frogsmouth
Phormiaceae	*Dianella caerulea* var. *caerulea*	blue flax lily
Phormiaceae	*Dianella caerulea* var. *producta*	blue flax lily
Poaceae	**Chloris gayana*	Rhodes grass
Poaceae	*Cynodon dactylon*	common couch
Poaceae	*Echinopogon caespitosus* var. *caespitosus*	tufted hedgehog grass
Poaceae	*Entolasia marginata*	bordered panic
Poaceae	*Entolasia stricta*	wiry panic
Poaceae	**Hyparrhenia hirta*	Coolatai grass
Poaceae	*Imperata cylindrica* var. *major*	blady grass
Poaceae	*Oplismenus aemulus*	basket grass
Poaceae	**Paspalum mandiocanum*	
Poaceae	*Phragmites australis*	common reed
Poaceae	*Pseudoraphis paradoxa*	slender mudgrass
Poaceae	**Setaria sphacelata*	South African pigeon grass
Poaceae	*Themeda australis*	kangaroo grass
Smilacaceae	*Smilax australis*	sarsaparilla

Family/Sub-family	Scientific Name	Common Name
Magnoliopsida (Flowering Plants) – Magnoliidae (Dicots)		
Aizoaceae	*Carpobrotus glaucescens*	pigface
Apiaceae	*Centella asiatica*	pennywort
Apiaceae	**Hydrocotyle bonariensis*	
Apiaceae	*Hydrocotyle laxiflora*	stinking pennywort
Apiaceae	*Hydrocotyle peduncularis*	
Apocynaceae	*Parsonsia lanceolata*	
Apocynaceae	*Parsonsia straminea*	common silkpod
Araliaceae	*Polyscias sambucifolia*	elderberry panax
Asteraceae	**Ageratina adenophora*	crofton weed
Asteraceae	**Hypochoeris radicata*	catsear
Asteraceae	*Ozothamnus diosmifolius*	white dogwood
Asteraceae	*Vernonia cinerea* var. *cinerea*	
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	wonga vine
Casuarinaceae	*Allocasuarina littoralis*	black sheoak
Casuarinaceae	*Casuarina glauca*	swamp oak
Clusiaceae	*Hypericum gramineum*	small St John's wort
Convolvulaceae	*Dichondra repens*	kidney weed
Convolvulaceae	**Ipomoea cairica*	coastal morning glory
Dilleniaceae	*Hibbertia scandens*	climbing Guinea flower
Dilleniaceae	*Hibbertia villosa*	
Epacridaceae	*Monotoca elliptica*	tree broom-heath
Euphorbiaceae	*Breynia oblongifolia*	coffee bush
Euphorbiaceae	*Glochidion ferdinandi* var. *ferdinandi*	cheese tree
Fabaceae (Faboideae)	**Erythrina* X *sykesii*	coral tree
Fabaceae (Faboideae)	*Desmodium gunnii*	
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*	
Fabaceae (Faboideae)	*Glycine tabacina*	a love creeper
Fabaceae (Faboideae)	*Gompholobium pinnatum*	pinnate wedge pea
Fabaceae (Faboideae)	*Hardenbergia violacea*	false sarsaparilla
Fabaceae (Faboideae)	*Kennedia rubicunda*	red kennedy pea
Fabaceae (Faboideae)	*Pultenaea retusa*	
Fabaceae (Faboideae)	*Pultenaea villosa*	
Fabaceae (Mimosoideae)	*Acacia falcata*	sickle wattle
Fabaceae (Mimosoideae)	*Acacia sophorae*	coastal wattle
Fabaceae (Mimosoideae)	*Acacia ulicifolia*	prickly Moses wattle
Goodeniaceae	*Dampiera stricta*	
Goodeniaceae	*Goodenia paniculata*	
Haloragaceae	*Gonocarpus teucrioides*	raspwort
Lamiaceae	*Westringia fruticosa*	coastal rosemary
Lauraceae	*Cassytha glabella*	devil's twine
Lauraceae	*Cassytha pubescens*	devil's twine

Family/Sub-family	Scientific Name	Common Name
Lauraceae	**Cinnamomum camphora*	camphor laurel
Lobeliaceae	*Pratia purpurascens*	whiteroot
Loganiaceae	*Mitrasacme polymorpha*	
Menispermaceae	*Stephania japonica* var. *discolor*	snake vine
Menyanthaceae	*Villarsia exaltata*	yellow marsh flower
Myrsinaceae	*Myrsine variabilis*	muttonwood
Myrtaceae	*Callistemon pachyphyllus*	wallum bottlebrush
Myrtaceae	*Corymbia intermedia*	pink bloodwood
Myrtaceae	*Eucalyptus globoidea*	white stringybark
Myrtaceae	*Eucalyptus microcorys*	tallowwood
Myrtaceae	*Eucalyptus pilularis*	blackbutt
Myrtaceae	*Eucalyptus propinqua*	small-fruited grey gum
Myrtaceae	*Eucalyptus resinifera*	red mahogany
Myrtaceae	*Eucalyptus robusta*	swamp mahogany
Myrtaceae	*Eucalyptus seeana*	narrow-leaved red gum
Myrtaceae	*Leptospermum juniperinum*	prickly tea-tree
Myrtaceae	*Leptospermum laevigatum*	coast teatree
Myrtaceae	*Leptospermum polygalifolium*	
Myrtaceae	*Lophostemon confertus*	brush box
Myrtaceae	*Melaleuca ericifolia*	swamp paperbark
Myrtaceae	*Melaleuca linariifolia*	snow in summer
Myrtaceae	*Melaleuca nodosa*	ball honeymyrtle
Myrtaceae	*Melaleuca quinquenervia*	broad-leaved paperbark
Myrtaceae	*Melaleuca sieberi*	Sieber's paperbark
Myrtaceae	*Melaleuca thymifolia*	thyme-leaved paperbark
Myrtaceae	*Syncarpia glomulifera*	turpentine
Nymphaeaceae	*Nymphaea gigantea*	giant waterlily
Onagraceae	*Ludwigia peploides* subsp. *montevidensis*	water primrose
Oxalidaceae	*Oxalis exilis*	
Oxalidaceae	*Oxalis perennans*	
Pittosporaceae	*Hymenosporum flavum*	native frangipani
Pittosporaceae	*Pittosporum undulatum*	sweet pittosporum
Polygonaceae	*Persicaria praetermissa*	
Proteaceae	*Banksia integrifolia* subsp. *integrifolia*	coastal banksia
Proteaceae	*Hakea salicifolia* subsp. *Salicifolia*	willow-leaved hakea
Proteaceae	*Lomatia silaifolia*	crinkle bush
Proteaceae	*Persoonia lanceolata*	lance-leaved geebung
Proteaceae	*Persoonia linearis*	narrow-leaved geebung
Rosaceae	*Rubus hillii*	native raspberry
Rosaceae	*Rubus parvifolius*	native raspberry

Family/Sub-family	Scientific Name	Common Name
Rutaceae	*Boronia parviflora*	swamp boronia
Santalaceae	*Exocarpos cupressiformis*	native cherry
Sapindaceae	*Alectryon subcinereus*	wild quince
Sapindaceae	*Cupaniopsis anacardioides*	tuckeroo
Sapotaceae	*Planchonella australis*	black apple
Scrophulariaceae	*Gratiola pubescens*	hairy brooklime
Solanaceae	*Duboisia myoporoides*	corkwood
Solanaceae	**Solanum mauritianum*	wild tobacco bush
Thymelaeaceae	*Pimelea linifolia*	slender rice flower
Verbenaceae	**Lantana camara*	lantana
Verbenaceae	**Verbena bonariensis*	purpletop
Violaceae	*Viola hederacea*	ivy-leaved violet

APPENDIX 3: Additional Flora Species Recorded by Darkheart

Community Key:
OF: Open Forest
SF: Swamp Forest
SL: Shrubland
DG: Derived Grassland
D: Dam

Frequency:
D: Dominant
C: Common
O: Occasional
U: Uncommon
R: Rare

Common Name	Scientific Name	Community	Frequency
Canopy Trees			
Rough-Barked Apple	*Angophora floribunda*	OF	R
Red Bloodwood	*Corymbia gummifera*	OF	O
Spotted Gum	*Corymbia maculata*	OF	R
Blackbutt – White Stringybark hybrid	*Eucalyptus globoidea x E. pilularis*	OF	R
Grey Ironbark	*Eucalyptus siderophloia*	OF	O
Forest Red Gum	*Eucalyptus tereticornis*	SF	U
Radiata Pine	*Pinus radiata**	OF	R
Understorey Trees			
Sydney Golden Wattle	*Acacia longifolia subsp. longifolia*	OF	O
Maidens Wattle	*Acacia maidenii*	OF	O
Forest Oak	*Allocasuarina torulosa*	OF	U
Willow Bottlebrush	*Callistemon salignus*	OF	U
Cadagi Gum	*Corymbia torelliana**	OF	R
Prickly-Leaved Tea Tree	*Melaleuca styphelioides*	OF, SL	O
Shrubs			
Two-Veined Hickory	*Acacia binervata*	OF	U
Sweet Wattle	*Acacia suaveolens*	OF, SL	O
Heath-Leaved Banksia	*Banksia ericifolia*	SL	R
Hairpin Banksia	*Banksia spinulosa*	OF	U
Dwarf Boronia	*Boronia polygalifolia*	OF	R
Large-Leaf Hop Bush	*Dodonaea triquetra*	OF	C
Needlebush	*Hakea sericea*	OF, SL	U
Dagger Hakea	*Hakea teretifolia*	SL	U
Wedge Guinea Flower	*Hibbertia diffusa*	OF	U
-	*Hibbertia obtusifolia*	OF	U
Dogwood	*Jacksonia scoparia*	OF	U
Prickly Beard-Heath	*Leucopogon juniperinus*	SL	O
-	*Notelaea ovata*	OF	R
Broad-Leaved Geebung	*Persoonia levis*	OF	R
Handsome Flat Pea	*Platylobium formosum*	OF	O
Senna	*Senna pendula var. glabrata**	DG	U
Black-Eyed Susan	*Tetratheca thymifolia*	OF	U
Native Broom	*Viminaria juncea*	DG	U
Grasses			

Carpet Grass	*Axonopus fissifolius* *	DG	O
Brown's Lovegrass	*Eragrostis brownii*	OF	O
Common Paspalum	*Paspalum dilatatum* *	DG	O
Vasey Grass	*Paspalum urvillei* *	DG	U
Kikuyu Grass	*Pennisetum clandestinum* *	DG	U
Buffalo Grass	*Stenotaphrum secundatum**	DG	R
Groundcovers			
Billygoat Weed	*Ageratum houstonianum**	DG	U
Cobblers Pegs	*Bidens pilosa**	DG	O
Bitou Bush	*Chrysanthemoides monilifera* subsp. *rotundata**	OF	R
Flaxleaf Fleabane	*Conyza bonariensis**	DG	O
-	*Drosera peltata*	DG, SL	U
-	*Drosera spatulata*	DG, SL	U
Creeping Raspwort	*Gonocarpus micranthus*	OF	U
Forest Goodenia	*Goodenia hederacea*	OF	O
Silky Purple Flag	*Patersonia sericea*	OF	U
Lambs Tongue	*Plantago lanceolata**	DG	U
Fireweed	*Senecio madagascariensis**	DG	U
White Clover	*Trifolium repens* *	DG	U
Showy Violet	*Viola betonicifolia*	OF	R
-	*Wurmbea biglandulosa*	OF, SL, DG	C
-	*Xanthorrhoea macronema*	OF	U
Orchids			
Pink Fingers	*Caladenia carnea*	OF	U
Snake Orchid	*Cymbidium suave*	OF	R
Sun Orchid	*Thelymitra sp.*	DG, SL	O
Sedges, Rushes, Aquatics			
Jointed Twig-Rush	*Baumea articulata*	D	U
-	*Baumea juncea*	DG, D	O
-	*Eleocharis equisetina*	D	U
Red-Fruit Saw-Sedge	*Gahnia sieberiana*	OF	U
-	*Juncus prismatocarpus*	D	R
Pithy Sword-Sedge	*Lepidosperma longitudinale*	SL	R
Wattle Mat-Rush	*Lomandra filiformis*	OF	O
Spiny-Headed Mat-Rush	*Lomandra longifolia*	OF, SL, DG	C
Water Snowflake	*Nymphoides indica*	D	O
Pondweed	*Potamogeton sp.*	D	U
Broadleaf Cumbungi	*Typha orientalis*	D	C
Lianas, Scramblers and Twiners			
Appleberry	*Billardiera scandens*	OF	O
Scrambling Lily	*Geitonoplesium cymosum*	OF	C
-	*Glycine clandestina*	OF	O
Molucca Bramble	*Rubus moluccanus var. trilobus*	OF	O
Sweet Sarsaparilla	*Smilax glyciphylla*	OF	U

Appendix 4: Hollow-Bearing Tree Data

Table 21: Hollow-bearing trees recorded on the site

Number	Species	Height	DBH	Easting	Northing	Hollow type/size/comments	Fauna value
1	Stag	15	50	459885	6462391	2 medium, 2 small trunk cavities, 2 poor chimneys. Rosella nesting	Medium
2	Red Mahogany	25	75	459918	6462547	1 small, 2 medium trunk hollows, rotten trunk section. Senescent	Medium
3	Stag	23	45	459960	6462500	Large termitaria with lorikeet nesting	Low
4	Tallowwood	23	35	459992	6462614	Small worn trunk hollow. Senescent	Low
5	Stag	25	90	459996	6462620	2 medium branch stubs. Lorikeets nesting	Low
6	Stag	20	50	460090	6462663	Trunk rot with cavity, medium branch stub	Low
7	Tallowwood	22	90	459520	6462653	Large termitaria with cavity	Low
8	Red Mahogany	23	70	459326	6462569	1 medium, 3 small branch stubs, poorly formed	Low
9	White Stringybark	23	60,25	459296	6462572	2 small hollows in dead branches	Low
10	Red Mahogany	25	120	459175	6462468	3 large trunk hollows, 5 medium branch hollows + chimney. Sugar gliders denning	High
11	Red Mahogany	22	120	459157	6462514	2 large, 3 medium hollows in dead upper trunk section	Medium
12	Tallowwood	23	100	459165	6462545	3 medium hollows in dead branch stubs + large basal hollow	Medium
13	Blackbutt	23	150	459189	6462559	2 small, 4 medium branch hollows, 1 medium trunk hollow + large basal cavity	High
14	Red Mahogany	20	60	459211	6462577	1 well formed medium branch stub with worn edges	Medium
15	Red Mahogany	27	80	459190	6462631	At least 2 small branch hollows	Low
16	White Stringybark	25	80,30	459232	6462725	2 well formed branch hollows	Medium
17	Tallowwood	27	120	459263	6462814	Small hollow in dead upper branch. Large tree, good future potential for hollows	Low
18	Bloodwood	23	75	459068	6462613	3 medium, 2 small branch hollows	Medium
19	Red Mahogany	25	150	459295	6462454	Large trunk cavity, at least 5 medium and 2 small branch hollows	High
20	Tallowwood	20	40	459779	6461848	3 small well formed trunk hollows. Senescent	Medium
21	Forest Red Gum	22	45	459780	6461850	Termitaria with cavity	Low
22	Forest Red Gum	23	40	459791	6461879	Poorly formed medium trunk hollow	Low
23	Rough-Barked Apple	15	50	459539	6462611	Medium upper trunk hollow. Senescent	Low

APPENDIX 5: Additional Site Photos

Photo 11: Regrowth open forest on Plimer property

Photo 12: Potential Koala habitat on Archer property

Photo 13: Regrowth shrubland on Trad property

Photo 14: Derived grassland in Jarberg west

Photo 15: Northern Brown Bandicoot captured on IR camera

Photo 16: Water Rat captured on IR camera

Photo 17: Red-Belly Black Snake captured on IR camera

Photo 18: Antechinus captured on IR camera