PART A: FLORA AND FAUNA SURVEY

3.0 SURVEY METHODS

3.1 GENERAL INFORMATION

Following an initial inspection to determine the threatened species potentially occurring and the appropriate survey techniques, the main survey for this assessment was conducted on the 22-26th of May 2006. A follow up survey of potential frog habitat was undertaken after rain on the 4th of July 2006. Previous survey of portions of the property undertaken in 2005 and 2003 were also incorporated into this assessment.

In addition, the available relevant literature and the NSW Department of Environment and Climate Change (DECC) Atlas of Wildlife, (www.wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas) and Rare or Threatened Plants 2008 (www.plantnet.rbgsyd.nsw.gov.au/search) databases were consulted for records of threatened species on the Bulahdelah, Wingham, Bare Point, Grafton, Coffs Harbour, Dorrigo, Camden Haven, Kempsey, Korogoro, Nambucca and Macksville 1:100 000 topographical maps. The Bionet (www.bionet.nsw.gov.au) website was also searched for records in proximity to the site. Species from this area were considered for those with potential to occur in the sub-region of the mid north coast of NSW, which included the site.

3.2 FLORA

3.2.1 Threatened Flora Records

A search of the DECC Rare or Threatened Plants (ROTAP) database (DECC 2009a), Bionet (2009) and available literature (Biolink 2003, Berrigan and Bray 2002, Parker 2002) indicated that the following Threatened flora species occur within 10km of the site (those in bold are dually listed under the EPBCA 1999):

1. *Melaleuca groveana*: Dooragan NP.
2. ***Melaleuca biconvexa:*** Lake Innes NR.
3. ***Acacia courtii***: Dooragan NP, Yoorigan NP
4. ***Grevillea caleyi****:* Dooragan NP
5. ***Allocasuarina defungens:*** Crowdy Bay NP.
6. ***Thesium australe:*** Kattang NR, Crowdy Bay NP
7. ***Cynanchum elegans****:* Middle Rock
8. ***Phaius tankervilliae:*** Cowarra SF
9. *Maundia triglochinoides*: Innes Ruins
10. *Diuris sp. aff. chrysantha:* Lake Innes Nature Reserve

The following ROTAP species (Rare or Threatened Australian Plants) are also recorded within 10km of the site:

1. *Acacia costiniana* (Kattang NR)
2. *Goodenia fordiana* (Dooragan NP)
3. *Eucalyptus fergusonii subsp. fergusonii* (Queens Lake NR)

3.2.2 Survey Methods

The flora survey routinely consists of two components:

- Identification, description and mapping of the major vegetation communities and any Endangered Ecological Communities.
- Searches for, identification of, and (if found) mapping of any threatened species and their habitat.

3.2.2.1 Vegetation Community Mapping

Biolink (*in preparation*) has previously mapped the vegetation communities of the property (via aerial photography and some limited ground truthing) as well as adjoining land which fell within the jurisdiction of the *Urban Investigation Area 14 – Koala Plan of Management* (UIA 14 KPoM). To ensure consistency with the KPoM, this mapping was, in principle, adopted for this assessment, with formal ground truthing via random meander and plot sampling compiled by this and previous assessments undertaken by this firm, to confirm Biolink's work.

For the purposes of this assessment, sub-formation names for vegetation types are adapted from the classification proposed by Beadle and Costin (1952) and Keith (2004) eg '*Dry Sclerophyll Forest'* to assist the fauna habitat evaluation.

3.2.2.2 Conservation Status Assessment

The conservation significance of the vegetation communities within the property was determined by comparing equivalent phytosociological associations and their conservation significance on the North Coast of NSW as per the CAR Assessment (Northern Zone NPWS 1999) in section 4.2.3.

Biolink (2005c) has previously identified the status of several vegetation communities on the property as Endangered Ecological Communities (see figure 12). This delineation was reviewed to confirm the required floristic associations were present, and compared with soils information to confirm the appropriate geomorphological setting (see section 4.2.2).

3.2.2.3 Species Identification and Recording

Over the course of the various studies of the property by this consultant from 2003-2006, all of the property's vegetation communities have been surveyed utilising random meander transects and plot based sampling. Any opportunistic sightings of plant species on the study site while undertaking other survey procedures were also recorded.

The combination of random meander transects and plot based surveys were considered most suitable for the following reasons:

- Provide the most amount of information for a given input.
- Provide a means to sample vegetation boundaries.
- Provide means for assessing floristic diversity and possible presence of threatened species (Forest Fauna Surveys *et al* 1997).

Species identification was made with the assistance of Bale (1993), Beadle (1982), Chippendale (1981), Harden (1993, 2000), Williams and Harden (1980), 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.

3.2.2.4 Threatened Flora Species Searches and Occurrence Assessment

3.2.2.4.1 Targeted Searches

Searches for locally recorded threatened flora as well as flora recorded in the LGA and/or in regionally similar habitats to those occurring on the property, were carried out during specific targeted searches and routinely during other survey activities (i.e. trapping) over the survey periods in 2003, 2005 and 2006. A total of 5 hours was spent on searches for threatened flora in 2006; 8hrs in 2005 (Darkheart 2005u) in the upper catchment reaches of Duchess Gully; and 20 hours spent on the total property 2003 (Berrigan 2003h). Searches consisted of plot based sampling and random meander transects through potentially suitable habitats within both the proposed development envelope and the remainder of the property.

Due to local records in broadly similar habitat to that on the property, the main targeted plants were:

- *Melaleuca biconvexa.*
- *Phaius tankervilliae*
- *Cynanchum elegans*.

Other targeted threatened species were:

- Aquatic/wetland species: *Asperula asthenes, Maundia triglochinoides* and *Gallium australe*.
- Rainforest/wet sclerophyll climbers: *Cynanchum elegans*, *Parsonsia dorrigoensis* and *Marsdenia longilobia.*
- Rainforest/wet sclerophyll epiphytes: *Psilotum complanatum, Peristeranthus hillii* and *Oberonia titania.*
- Terrestrial orchids: *Phaius australis*
- Sclerophyll forest species: *Eucalyptus tetrapleura* and ROTAP species *Eucalyptus fergusonii ssp fergusonii*.

Other threatened species from the locality (listed above) were not specifically targeted due to lack of suitable habitat on the site.

3.2.2.4.2 Potential Occurrence Assessment

Potential occurrence assessment of threatened flora species is provided in section 3.2 and Appendix 1. This section assesses all threatened species listed as threatened under the TSCA and EPBCA for their potential to occur on the site and the surrounding property, based on the following factors:

- Presence/absence of suitable habitat.
- Condition and disturbance history of habitat.
- Local and regional records.
- Location of site and property within known distribution of the species.

3.3. FAUNA

3.3.1 Threatened Fauna Records

3.3.1.1 Previous Surveys of Property

The following threatened species have been previously recorded on specific sections of the property by previous studies:

- ***Koala***: Recorded in former swamp forest now cleared (Clancy and Ayres 1983). More recently recorded in the Paperbark/Swamp Mahogany/Swamp Oak on the western fringe of the sewage treatment works by Biolink (2003). The DECC Atlas of Wildlife (2009a) also has records in the northwest and southwest.

- ***Eastern Chestnut Mouse****:* Grassland east of Duchess Gully, and in Bladey Grass dominated grassland and associated *Babingtonia pluriflora* dominated drainage line in the west-southwest (Berrigan 2003h).

- ***Common Planigale****: Babingtonia pluriflora* dominated drainage line in the west-southwest (Berrigan 2003h).

- ***Little Bent-Wing Bat***: Along track under dry sclerophyll forest canopy in east-southeast behind the isolated hill (Berrigan 2003h).

- ***Wallum Froglet****:* Two discrete populations. One small population in *Babingtonia pluriflora* dominated drainage line in the west-southwest; and another large population (>50) in the heathy depression north of the eastern lagoon (south-southwest of proposed wetland) (Berrigan 2003h).

- ***Wompoo Fruit-Dove***: Single bird recorded roosting for a short period in the west-southwest patch of dry sclerophyll forest adjacent to Ocean Drive in the west-southwest of property, and four birds observed flying along the littoral rainforest to the east (Berrigan 2003h).

- ***Swift Parrot:*** An unknown observer has added a sighting in the northwest of the property on the 15/8/05 to the DECC Atlas of Wildlife (2009a). Due to limitations of the Atlas, this record could be within 1km of this grid point ie not actually on the property.

3.3.1.2 Other Local Records

The following table lists the species which have been recorded within 10km of the study site (DECC Atlas of Wildlife 2009a, Bionet 2009, Biolink 2003, Parker 2002, ERM Mitchell McCotter 1996, ERM Mitchell McCotter 2002, Berrigan 2003g, 2003h, 2002b, Darkheart 2004q, 2005a, 2005b, 2005v, 2006a, 2006b, 2006e, 2006h, AMBS 1996a, 1996b, Mt King Ecological Surveys 1993, Milledge 1992, Kendall and Kendall 1993, Kendall and Kendall 1991, Hoye 1993, ERM Mitchell McCotter 1994, Engel and Chafer 1994, Laxton and Laxton 1992, Parker 2002, personal observations, Mrs Penny Marshal pers. comm., Mr Tony Bischoff pers. comm.). Those in bold are dually listed as threatened under the EPBCA 1999.

The following species (excluding marine mammals, birds and reptiles as no suitable habitat occurs on-site or is affected by the development) are considered likely to occur in the locality due to suitable habitat and/or regional records (some have been recorded within 20km) (DECC Atlas of Wildlife 2009, Bionet 2009, Strahan 2000, Smith *et al* 1995, Readers Digest 1990, Churchill 1998, Wilson and Knowles 1992, Simpson and Day 1996, Swan 2004, Tyler 1997, personal observations):

1. *Mammals:* **Long Nosed Potoroo**, **Dwyer's Bat,** Yellow-Bellied Sheathtail Bat, Beccari's Freetail Bat, Eastern False Pipistrelle, Eastern Cave Bat, Rufous Bettong, Eastern Pygmy Possum.

2. *Birds*: Grey-Crowned Babbler, White-Browed Woodswallow, Hooded Robin, Flame Robin, Speckled Warbler, Diamond Firetail, Painted Honeyeater, **Red Goshawk,** Spotted Harrier, Rose-Crowned Fruit-Dove, Barred Cuckoo Shrike, Barking Owl, Sooty Owl, Comb-Crested Jacana, **Painted Snipe**, Bush Stone-Curlew.

3. *Frogs:* ***Litoria olongburensis, Litoria aurea*****,** ***Mixophyes balbus, M. iteratus***.

4. *Reptiles*: Stephens Banded Snake, Pale Headed Snake, **Three-Toed Snake-Toothed Skink**.

These species in addition to those considered potential occurrences on the property are assessed in later sections of this report and Appendix 1. They formed the primary target species for survey and assessment.

Table 1: Threatened fauna records in the locality

GROUP	COMMON NAME	SPECIES	LEGAL STATUS	DISTANCE FROM STUDY SITE/GENERAL LOCATION
MAMMALS	Koala	*Phascolarctos cinereus*	V-TSCA	At least one record appears to be on the property, Crowdy Head National Park, Laurieton/West Haven, Lake Innes Nature Reserve, Queens Lake State Forest/National Park, Lake Cathie, Pacific Highway east of Cowarra State Forest, Houston Mitchell Drive, northeast of Kew, Dunbogan, Lake Innes Nature Reserve-north of North Haven, Bonny Hills area, Carnegie Cove, etc
	Spotted-Tailed Quoll	*Dasyurus maculatus*	V-TSCA, E-EPBCA	4km west of Lake Cathie
	Brushtailed Phascogale	*Phascogale tapoatafa*	V-TSCA	Pacific Highway/Houston Mitchell Drive area, Lakewood, Dunbogan, Limeburners Flat
	Common Planigale	*Planigale maculata*	V-TSCA	At least one record appears to be on the property, Bonny Hills area, north of Bonny Hills, Lake Innes Nature Reserve, northeast of Kew, north of North Haven
	Squirrel Glider	*Petaurus norfolcensis*	V-TSCA	Lake Innes Nature Reserve, Lakewood, Bonny Hills Sewerage Works, Carnegie Cove, North Haven, north of North Haven
	Yellow-Bellied Glider	*Petaurus australis*	V-TSCA	Lakewood, West Haven area, Lake Ridge, Pacific Highway east of Cowarra State Forest, Houston Mitchell Drive, northeast of Kew, southwest of Queens Lake State Forest, northeast of Kew, Pacific Highway near Houston Mitchell Drive
	Eastern Pygmy Possum	*Cercartetus nanus*	V-TSCA	Kattang Nature Reserve
	Eastern Chestnut Mouse	*Pseudomys gracilicaudatus*	V-TSCA	At least one record appears to be on the property,, Bonny Hills, Lake Innes Nature Reserve, north of Bonny Hills, north of North Haven, northeast of Kew
	Eastern Freetail Bat	*Mormopterus norfolcensis*	V-TSCA	Bonny Hills – adjacent to the site, Lakewood
	Little Bent-Wing Bat	*Miniopterus australis*	V-TSCA	North Brother, Middle Head area, Lake Innes Nature Reserve, Pacific Highway east of Cowarra State Forest, Lake Innes Nature Reserve north of North Haven, Carnegie Cove, Houston Mitchell Drive, North Haven, Lake Ridge, northeast of Kew, Lake Cathie, Dunbogan
	Common Bent-Wing Bat	*M. schreibersii*	V-TSCA	Lakewood area, Dunbogan, Carnegie Cove
	Eastern Blossom Bat	*Syconycteris australis*	V-TSCA	Middle Head area, Lake Innes Nature Reserve, Dunbogan
	Grey Headed Flying Fox	*Pteropus poliocephalus*	V-TSCA, V-EPBCA	Lake Innes Nature Reserve – north of North Haven and Lake Cathie, Carnegie Cove, Dunbogan, Queens Lake State Forest/National Park, etc
	Southern Myotis	*Myotis macropus*	V-TSCA	Lake Cathie, Lakewood "*probably*" recorded at Carnegie Cove
	Greater Broad-Nosed Bat	*Scoteanax rueppellii*	V-TSCA	Lakewood area, Dunbogan, Lake Innes Nature Reserve
BIRDS	Glossy Black-Cockatoo	*Calyptorhynchus lathamii*	V-TSCA	Carnegie Cove, Pacific Highway east of Cowarra State Forest, Lake Innes Nature Reserve, Queens Lake State Forest, west of Bonny Hills, southwest of Queens Lake State Forest, north of North Haven, northeast of Kew, Dunbogan, Houston Mitchell Drive, Lake Ridge
	Swift Parrot	*Lathumus discolor*	E-TSCA, E-EPBCA and Migratory	At least one record appears to be on the property, Laurieton area, Point Rd
	Little Lorikeet	*X*	pV-TSCA	X
	Brown Treecreeper	*Climacteris picumnus*	V-TSCA	North of Cowarra State Forest
	Powerful Owl	*Ninox strenua*	V-TSCA	Carnegie Cove, Lake Innes Nature Reserve, west of Bonny Hills, northwest of Bonny Hills, West Haven
	Masked Owl	*Tyto novaehollandiae*	V-TSCA	Lake Innes Nature Reserve north of North Haven, Bonny View Estate, Lakewood
	Grass Owl	*Tyto capensis*	V-TSCA	Lake Innes Nature Reserve
	Osprey	*Pandion haliaetus*	V-TSCA, EPBCA-Migratory	Bonny Hills, Lake Cathie, Queens Lake Nature Reserve, Dunbogan, southwest of Queens Lake State Forest, Crowdy Head National Park
	Square Tailed Kite	*Lophoictinia isura*	V-TSCA	At least one record appears to be on the property,, Lake Cathie, Bonny Hills area, Queens Lake State Forest

	Little Eagle	*Hieraaetus morphnoides*	pV-TSCA	Lake Cathie, Herons Creek
	Wompoo Fruit Dove	*Ptilinopus magnificus*	V-TSCA	Lake Innes Nature Reserve, north of Bonny Hills
	Regent Honeyeater	*Xanthomyza phrygia*	E-TSCA, E-EPBCA	Port Macquarie
	Varied Sittella	*X*	pV-TSCA	Northern Lake Innes
	Scarlet Robin	*X*	pV-TSCA	Cowarra State Forest
	Black Bittern	*Ixobrychus flavicollis*	V-TSCA	Laurieton
	Australasian Bittern	*Botaurus poiciloptilus*	V-TSCA	northeast of Kew
	Flesh-Footed Shearwater	*Puffinus carneipes*	V-TSCA	Grants Head
	Sooty Oystercatcher	*Haematopus fuliginosus*	V-TSCA	Diamond Head
	Pied Oystercatcher	*Haematopus longirostris*	V-TSCA	Dunbogan
	Little Tern	*Sterna albifrons*	E-TSCA	Lake Cathie
	Jabiru/Black Necked Stork	*Ephippiorhynchus asiaticus*	E-TSCA	Queens Lake, Dunbogan, North Haven, Lake Cathie, north of Kew
	Brolga	*Grus rubicunda*	V-TSCA	Lakewood
	Blue-Billed Duck	*Oxyura australis*	V-TSCA	Lake Innes Nature Reserve
FROGS	Wallum Froglet	*Crinia tinnula*	V-TSCA	At least one record appears to be on the property, Lake Innes Nature Reserve, north of Bonny Hills, Carnegie Cove, Lakewood, Bonny Hills area, north of North Haven
	Green-Thighed Frog	*Litoria brevipalmata*	V-TSCA	north of Kew

3.3.2 Fauna Survey Methodology

All field surveying was conducted as per the conditions of the consultant's Animal Research Authority and Section 132c Scientific License.

3.3.2.1 Habitat Evaluation

The site was initially inspected 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, eg understorey type and development, crown depth, groundcover density.
- Degree and extent of disturbance, eg fire, logging, weed invasion, grazing, modification to structure and diversity.
- Soil type and suitability, eg for digging and burrowing.
- Presence of water in any form, eg dams, creeks, drainage lines, soaks.
- Presence of rocky foreshores, seacliffs, islands, mangroves, beaches, mudflats, sandspits, etc.
- Size and abundance of hollows and fallen timber.
- Availability of shelter, eg rocks, logs, hollows, undergrowth.
- Wildlife corridors, refuges and proximate habitat types.
- Presence of mistletoe, nectar, gum, seed, sap, sources.

3.3.2.2 Trapping

Trapping was undertaken for the 2006 assessment over one week: 22nd to the 26th of May 2006, with works centred on the proposed filling/excavation area. Overall, the extent of trapping effort was very limited due to the low diversity of potential habitat types in proposed filling/excavation area, and previous survey over the property undertaken by the consultant to identify broad ecological constraints.

Survey of the property in 2003 was undertaken in two periods. The first period involved trapping of the northwest swamp forest, isolated pocket of open forest in the mid-northwest, and other habitat in the southeast (dry sclerophyll forest), east (grassland and Duchess Gully riparian zone) and the Bladey Grass grassland and associated vegetation along the western side of the property. The second period involved further trapping of the southeast, and an area of grassland and coastal scrub east of the Duchess Gully.

3.3.2.2.1 Elliot A

Elliott A traps were not utilised in 2006 due to the lack of suitable habitat for target species in the proposed filling/excavation area.

In 2003, 80 Elliott A traps were placed in transects in the following areas (see figure 6):

- The swamp forest, wet sclerophyll, former nursery and dry sclerophyll in the proposed northern corridor.
- A low rise and associated drains in the southwest (proposed school site and part of east-west corridor).
- A patch of dry sclerophyll in the southeast on a hill adjacent to the Bonny Hills sewage plant (also part of the eastern corridor).
- A patch of sparse shrubby swamp forest regrowth (part of proposed filling area).
- Regrowth swamp forest around the two large lagoons in the southern end of the property.
- The patch of dense groundcover (grassland) east of Duchess Gully.

The target species were Common Planigale and Eastern Chestnut Mouse. The traps were baited with a rolled oats/peanut butter/honey mix. The cold nights experienced during the 2003 survey were considered likely to impair the survival (as demonstrated by hypothermia of trapped Antechinuses) hence bedding material was provided in the traps. A total of 1300 Elliot A trap nights were performed on the entire property in 2003.

3.3.2.2.2 Elliot B

3.3.2.2.2.1 2006

Twenty Elliot B traps were mounted on platforms to trees throughout the Forest Red Gum dominated woodland to the north/northwest of the study area. While most of this community is not to be removed as part of the proposed filling/excavation proposal, this habitat has not been surveyed previously and is identified in the Area 14 Structure Plan and the Concept Plan Application for future residential development.

Traps were baited with apple and a honey soaked rolled oats and peanut butter mixture. The routinely target species were the Eastern Pygmy Possum, Squirrel Glider and Brushtailed Phascogale. All traps were mounted on platforms so as to drain out the entrance. The trunk of arboreal Elliot trap trees and adjacent tree trunks were spayed with a honey-water solution from a pressure sprayer as an attractant. All traps contained bedding material for warmth. A total of 80 trap nights were performed. The trapping area is illustrated in figure 5.

3.3.2.2.2.2 2003

Twenty Elliot B traps were mounted on platforms to trees in the small clump of dry sclerophyll forest in the southwest near Ocean Drive; the small clump of isolated forest (proposed park) in the mid-northwest; the dry sclerophyll on the hill in the southeast; and throughout the swamp forest, small patches of sclerophyll forest and nursery in the proposed northern corridor.

Traps were baited with a honey soaked rolled oats and peanut butter mixture. The target species were the Eastern Pygmy Possum, Squirrel Glider and Brushtailed Phascogale. All traps were mounted on platforms so as to drain out the entrance. The trunk of arboreal Elliot trap trees and adjacent tree trunks were spayed with a honey-water solution from a pressure sprayer as an attractant. All traps contained bedding material for warmth. A total of 160 trap nights over 8 nights were performed.

3.3.2.2.3 Pitfalls

Pitfalls were not utilised in 2006 due to a lack of suitable habitat in the proposed filling/excavation area.

In 2003, pitfalls consisting of 10L buckets and 10m of 50cm high drift fencing was placed in two areas:

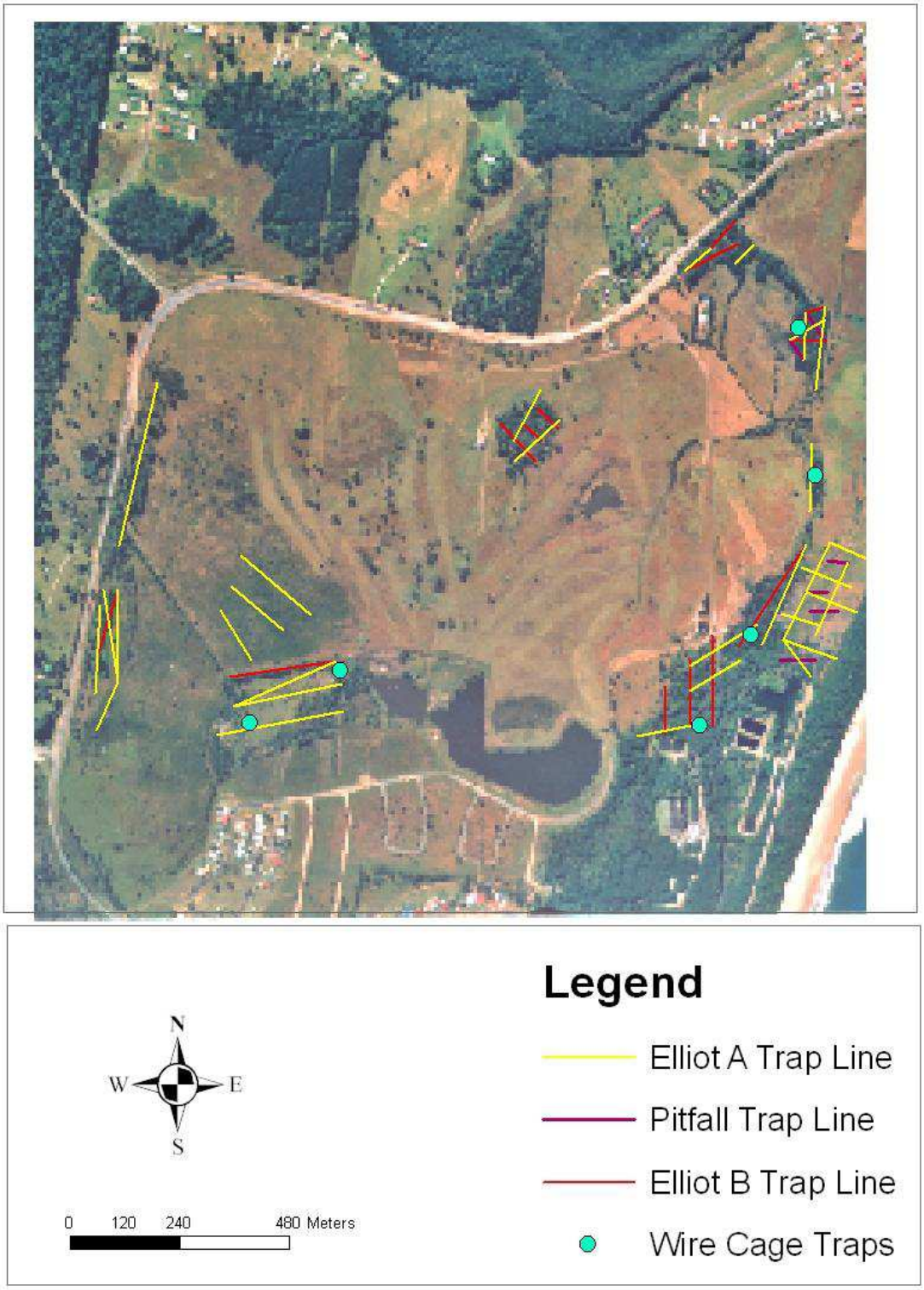
- The extensive area of dense groundcover east of Duchess Gully and adjacent dune scrub regrowth.
- The eastern portions of the Swamp Oak swamp forest in the northern corridor where dense Saw Sedge dominated the groundcover.

A total of 75 pitfall trap nights was performed. The Common Planigale was the primary target species.

Figure 6: 2006 Elliot B trapping area

This mapping is to be considered indicative only and all derivations are at best approximations and subject to errors including individual interpretation and reliance on information provided to Darkheart that were not independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. Darkheart takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification

Figure 7: 2003 trapping locations



This mapping is to be considered indicative only and all are at best approximations and subject to errors including individual interpretation and reliance on information provided to Darkheart that were not independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. Darkheart takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification

3.3.2.2.4 Wire Cages

Cage traps were not utilised in this survey due to a lack of suitable habitat in the proposed filling/excavation area for target species, or minimal potential to occur.

In 2003, six wire cages were set on site over 8 nights (48 trap nights). Four were baited with meat targeting the Quoll, and the remainder baited with rolled oats/honey/peanut butter mix targeting the Long-Nosed Potoroo. Two traps were placed in the northern corridor; two were placed in the regrowth around the large lagoons; and the remainder in the dry sclerophyll in the southeast.

3.3.2.2.5 Harp Trapping

Harp trapping in either survey due to high risk of extreme cold adversely affecting trapped animals (as per ARA requirements) and high proximity to dwellings (hence risk of theft, vandalism, etc).

3.3.2.2.6 Hair Tubes

Hair tubes were not used at any time due to the high success rate of previous trapping on the subject land (Berrigan 2003h), and lack of suitable habitat for target species in the study area.

3.3.2.3 Spotlighting, Den Watches and Torch Searches

3.3.2.3.1 2006

Spotlighting was conducted for 1.5hr per night over the property. It involved driving and walking over property with a hand held 50/100 watt spotlight, with most surveying focussing on pockets of forest. Spotlighting was also periodically conducted during call playback activities to identify target species attracted by calls but not responding. A total of 7.5hrs was spent spotlighting.

Den watches were conducted on 3 occasions. This involved watching a potential denning/nesting/roosting tree for 30 minutes prior to sunset and 60 minutes after sunset, while spotlighting to identify any fauna emerging from hollows. This was conducted under hollow-bearing trees and one stag in the north/northwest of the study area and a Needlebark Stringybark located in the Dry Blackbutt Forest to the east of the site.

Torch searches for frogs were also undertaken during spotlighting. This was carried out around the edges of all dams/lagoons, the disturbed wetland, along drains and drainage lines and Duchess Gully. These areas were searched on four occasions for a total of 6hrs.

Spotlighting and torch search conditions were clear and largely still for all but the first night when slight cloud cover was present.

3.3.2.3.2 2003

Spotlighting was conducted for around 2hrs per night over the entire property in 2003. It involved walking through forested sections of the site with a hand held 50/100 watt spotlight, with most surveying focussing on pockets of forest. Spotlighting was also periodically conducted during call playback activities. A total of 18hrs was spent spotlighting.

Den watches were conducted at dusk on 3 occasions. This involved watching a potential denning/nesting/roosting tree from 30 minutes prior to and 60 minutes after sunset, with spotlighting to identify any fauna emerging from hollows. This was conducted under 3 trees in the patch of dry sclerophyll near the western end of the northern corridor; and under two Blackbutts on the hill in the southeast.

Torch searches for frogs were undertaken around the edges of all dams/lagoons, drain; and Duchess Gully. These were walked each night for 8 nights.

Spotlighting and torch search conditions were consistently clear and largely still. The first quarter moon phase was experienced on the first surveying night, thus conditions were initially dark. However, conditions became slightly brighter by the end of the survey.

3.3.2.4 Microchiropteran Bat Call Detection

3.3.2.4.1 2006

An Anabat II bat call detector was carried during spotlighting to opportunistically record bats. A 2nd detector was also left in various locations overnight on four occasions. Locations for overnight detection were selected to maximise potential identification, with special effort made to identify possible corridors of high bat activity eg the main lagoons. A total of 55.5hrs was spent on call detection.

3.3.2.4.2 2003

An Anabat II bat call detector was carried during spotlighting to opportunistically record bats. The main detector was also left in various locations for 30 minute recording intervals. A second detector was left at fixed positions to record calls for 3hrs (tape length). At dusk, time was also exclusively devoted to Anabat work (ie bat detecting) particularly along the forest edge. A total of 48hrs was spent on Microchiropteran bat call identification.

3.3.2.5 Call Playback

Recorded calls of the following species were routinely played back on the property:

- Koala
- Masked, Barking, Sooty, Grass and Powerful Owls
- Bush-Stone Curlew
- Yellow-Bellied Glider and Squirrel Glider.
- Green-Thighed Frog
- Wallum Froglet
- Wallum Sedge Frog
- Green and Golden Bell Frog.

Calls were played through a laptop computer utilising Windows Media Player via a 30W PA system. The amplifier was positioned at a level approximating natural intensities of the species (i.e. Koala, owls, etc). 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 an initial period of 5-10 minutes of listening and was followed by 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; with the greater part being from dusk to 8.30pm.

Approximately half an hour of call playback was conducted per surveying night, for a total of 2.5 hours in 2006. Approximately 1hr of call playback was conducted per surveying night in 2003, for a total of 22 hours.

3.3.2.6 Reptile, Frog, Bird and Habitat Surveys and Secondary Evidence

Physical habitat searches involving 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, tracks and scratches, was conducted during time especially devoted to this activity, as well as opportunistically during other survey activities. This time was also devoted to searching under

Oaks for chewed cones indicative of the occurrence of the Glossy Black Cockatoo; under preferred forage species for Koala scats; and opportunistically for owl regurgitation pellets.

Birds were generally surveyed by detecting calls and searching by binoculars at dawn and dusk (when call chorus and peak activity occurs); while walking around the entire site; and opportunistically during other activities. Specific attention was made to detect potential presence of the Brown Treecreeper, Grey-Crowned Babbler, etc.

A total of 43 hours was spent on this part of the survey in 2003, and 12hrs in 2006.

Species identification was assisted by Simpson and Day (1996), Swan *et al* (2004), Strahan (1991, 2000), Triggs (1996), Robinson (1996), and Menkhorst and Knight (2001).

3.4 SURVEY 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 this 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).

To counter this limitation, this survey has employed methods recommended in literature (ie from habitat evaluation to actual direct survey of fauna) and known from personal experience to best detect the target species or assess their potential to occur, as per DEC (2004) requirements for flora and fauna surveys. In addition, the consultant's previous studies of the property (Berrigan 2003h, Darkheart 2005u), offer a broader scope of the area's ecology than would be generally gained by a single survey period.

3.4.1 Flora

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 site; fire history; time since disturbance; flowering season (particularly orchids); and presence of reproductive material (DEC 2004).

Surveys of the property have been conducted at similar times of the year which may have potentially limited the species identified to those occurring during the cooler months. For threatened species, this limitation is compensated via objective habitat evaluation and potential occurrence assessment as detailed in Appendix 1.

Identification limitations for species possibly being of conservation significance are routinely dealt with by referring samples to other consultants or the Royal Botanical Gardens Herbarium Identifications Service, however accurate identification of some taxa is not always possible due to the absence of specific features, such as flowers or fruits, at the time of the survey.

3.4.2 Fauna

Fauna detectability is limited by seasonal, behavioural and lifecycle aspects of each species, and dynamic habitats (eg flowering periods), which can vary within a year, between years, decades, etc (DEC 2004). Habitat evaluation is used to counter this limitation by assessing the potential occurrence of threatened species based on potentially suitable habitat in the study area and local records (see Appendix 1).

The survey periods of all studies by this firm on site fell into late Autumn-Winter when general fauna activity is generally expected to be at relatively low levels (DEC 2004). Summer migratory or nomadic birds may be absent, while Microchiropteran bats may be limited in activity (DEC 2004). Hence,

detectability was expected to be reduced for these species. The cold conditions also precluded use of harp traps for Microchiropteran bats due to risk of fatal hypothermia.

Detection of seasonal breeding frogs was also limited for species that breed in Spring or Summer, although the survey period was suitable for the Wallum Froglet. Rainfall occurred after the main survey period in 2006 therefore, frog searches were carried out after this rain to assess potential habitat and to attempt detection of frog species.

4.0 SURVEY RESULTS

4.1 VEGETATION COMMUNITIES

4.1.1 General Overview

Biolink (2005c*)* identify a total of 7 native vegetation communities. The majority of the site is not classed as any vegetation type, and this generally incorporates what is designated in this report as "pasture/pastoral woodland". Biolink (2005c*)* also omit a small patch of regrowth identified in this report as "dune scrub" as it does not fit into any other of Biolink's vegetation community classification. The delineation of the extent of forest communities along Duchess Gully and in the southeast is also incorrect.

Biolink's ground-truthed vegetation map transposed over an aerial photo is shown in Figure 8. Table 2 lists the area of each community on the property.

Table 2: Vegetation communities on St Vincents Foundation land, Bonny Hills

Vegetation Community/Habitat	Total Area (ha)
Blackbutt-Tallowwood-Needlebark Dry Sclerophyll Forest	1.98
Brushbox Wet Sclerophyll Forest	0.72
Blackbutt Dry Sclerophyll Forest	2.11
Grey Ironbark-Grey Gum Dry Sclerophyll Forest	2.39
Paperbark-Swamp Mahogany-Swamp Oak Swamp Forest/Woodland	10.4
Pasture/Pastoral Woodland	150.12
Dune Scrub	1.19
Swamp Oak swamp forest	4.3
Aquatic	5.75
	179ha (Approx)

The following sections details descriptions and location of the communities listed in table 2.