North Byron Parklands

Technical Paper

E

Ecological Assessment

Ecological Assessment
and response to
Director-General's Environmental
Assessment Requirements

Application Number: 09_0028

North Byron Parklands

Prepared for
North Byron Parklands
a project of Billinudgel Property Pty Ltd
(Billinudgel Property Trust)

by
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June 2010

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CERTIFICATION

In accordance with recommendations provided in the DECCW's Guidelines for Threatened Species Assessment (2005) and Threatened Species Assessment– Guideline for Developments and Activities, I confirm that:

- the results as presented are true and accurate in the opinion of the author;
- threatened biodiversity surveys and assessment have been carried out generally in accordance with the above guidelines, and:
- that all species records have been provided to DECC.

Author: Mark Fitzgerald signed 

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Copies of current Animal Research Authority and ACEC certificate of approval are provided with my CV in Appendix D.

Acknowledgements

The following people have contributed to ecological investigations at the Parklands site since 2006: Steve Phillips of Biolink Ecological Consultants for Koala surveys and preparation of an initial Koala Plan of Management; Robert Kooyman of Earth Process Ecological Consultants for threatened flora searches and vegetation plot sampling and reporting. David Newell and Tom Fitzgerald provided assistance during fauna survey effort. David Milledge and Hank Bower worked on an early rapid fauna assessment survey. Ray Williams of Ecotone Ecological Consultants for analysis of Anabat call files.

GLOSSARY

Application area: that portion of the Parklands property identified as subject to this application.

Bump-in: period of time in which temporary infrastructure for an event is transported into the site and set up.

Bump-out: dismantling and removal of temporary event infrastructure and equipment.

Event: any activity conducted for the public

Event area: any areas of the property used for staging of events or related activities

Full habitat: existing native forest, or pasture areas to be replanted to native forest.

Locality: study area.

Local viable population: a population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references.

Managed parklands: pasture areas to be planted with native trees, but which may be used for camping or event related activities.

Property: North Byron Parklands ("Parklands")

Region: bioregion as defined under the TSC Act.

Significant effect: such that an otherwise viable local population is placed at risk of extinction.

SITG: Splendour in the Grass musical event

Subject site: the area to be directly affected by the proposal

Study area: the subject site and any additional areas which are likely to be affected by the proposal either directly or indirectly

Relevant Statutes and Planning Instruments

- Byron Local Environmental Plan 1988
- North Coast Regional Environmental Plan 1988
- Byron Biodiversity Conservation Strategy 2004
- Byron Flora and Fauna Study 1999
- *EP&A Act* 1979
- NSW *Threatened Species Conservation Act* 1995
- NSW *Threatened Species Conservation Act Amendment* 2002
- Federal *Environment Protection and Biodiversity Conservation Act* 1999

1.0 Introduction

This Ecological Assessment report accompanies a concurrent Concept Plan and Project Application Environmental Assessment Report (EAR) for the North Byron Parklands (Parklands) project. The project is to establish a sustainable cultural events site within an enhanced ecological setting.

This application is submitted to the Minister for Planning pursuant to Part 3A of the Environmental Planning and Assessment Act (EP&A Act).

Ecological matters addressed in the NSW state Department of Planning Director-General's Environmental Assessment Requirements for the North Byron Parklands project are as follows:

1.0.1 Director-General's Requirements

Part A: Concept Plan Application

6. Consideration of impacts, if any, on matters of National Environmental Significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999.

Part B: Project Application

9.1 Assess the potential direct and indirect impacts of the development on flora and fauna taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and any relevant recovery plan in accordance with DECCW's *Guidelines for Threatened Species Assessment (2005*) and *Threatened Species Assessment–Guideline for developments and Activities*.

9.2 Assess any potential direct or indirect impacts of the development on any wetland areas within or surrounding the site. Particular consideration should be given to SEPP 14 wetland no. 57.

9.3 Assess any potential direct or indirect impacts of the development on any endangered ecological communities within or surrounding the site.

9.4 Describe any actions that will be taken on order to avoid or mitigate impacts the proposal may have on any threatened species.

9.5 Given the presence of core koala habitat across the site a comprehensive Koala Plan of Management is to be prepared.

9.6 Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land.

9.7 Address measures to protect and manage the riparian corridor both within and adjacent to the site. Any proposed works within the riparian areas should be outlined in the EA.
9.8 The proposed car parking area to the south of the site is in close proximity to the Billinudgel Nature Reserve. Indicate what measures will be undertaken to prevent weed infestation and toxic runoff into the reserve. An appropriate buffering distance should be identified between the Reserve and proposed southern car park.

9.9 Outline measures to protect and manage proposed habitat areas and managed parklands.

9.10 Provide details on any proposed offset measures for the loss of biodiversity. Biodiversity offsets should be consistent with DECCW's *Principles for the use of Biodiversity Offsets in NSW*.

11. Off site impacts

11.1 The concept plan is located adjacent to the Billinudgel Nature Reserve. Address any direct and/or indirect impacts of the project where it adjoins this land.

1.1 Structure of the Ecological Assessment report

The ecological matters described in the DGR's listed above are addressed in the following ecological assessment report. The structure of the report includes sufficient information to demonstrate practicability and compliance. Further details (*e.g.* vegetation plot data, species lists, survey reports, seven part tests, precedent documents, monitoring methodology, and mapping) are provided separately in various Appendices (see Directory of Appendices in the Table of Contents).

This format is undertaken to simplify communication and reduce the volume of the written application. The following sections 2-4 provide an introduction to the North Byron Parklands site and the proposal.

1.2 Assessment limitations

While the project application describes ongoing use of the Parklands site, this ecological assessment addresses the first year of operation and events, proposed for July 2011 to June 2012.

This is done because evidence needs to be acquired from monitoring operations at the site to support or modify predictions of the nature of impacts from proposed events and related activities on biodiversity of the site. Prior assessments of likely impacts from staging the Splendour in the Grass event at Parklands have relied on predictions concerning a single event. The current proposal describes ongoing staging of various sized events at the site.

The number of fauna species and individuals present and the seasonal availability of important ecological resources (*e.g.* rainfall, blossoms and fruit) have been observed to vary considerably during the previous four years at the Parklands site. Threatened fauna species recorded from the Parklands site also exhibit substantial variation in patterns of presence, absence and abundance. Dynamics of tolerance, habituation, sensitisation and/or avoidance by fauna species in relation to event activities cannot be reliably described without evidence-based monitoring data.

1.3 Fauna Monitoring and Surveys

A program of monthly fauna monitoring recommended leading up to the first proposed event (Splendour in the Grass 2011) will add to existing survey data. Collectively this will provide information on the numerical ecology of target fauna groups to determine 'normal' or pre-event levels of variation in abundance and community composition.

These data will enable the recognition of variations in faunal abundance associated with operation of the site. Results of monitoring may also enable the identification of unpredicted impacts. The validity of assumptions and predictions of impact phenomena at the site can be tested through analysis of faunal variation. Results of before- during- and after-event monitoring will be used to modify event management where necessary to mitigate impacts on fauna and or habitats of subsequent activities at the site. Monitoring methods are described in Appendix F.

2.0 Ecological attributes of the location—Landscape context

Parklands is located at the northern extremity of Byron Shire on the edge of coastal floodplains ~2 kms from the coast. The low (to ~30m AHD) Jones Road ridge divides the property, separating the Marshall's Creek floodplain in the south from the larger northern Crabbe's Creek floodplain. Billinudgel Nature Reserve (BNR) adjoins to the east and southeast and, together with the Marshall's Creek NR, conserves coastal floodplain, riparian and littoral ecosystems between the Parklands property and the residential landscapes of South Golden Beach, New Brighton and Ocean Shores to the south.

To the north, in Tweed Shire, the coastal floodplain is dominated by sugar cane cultivation for ~8kms until SEPP 14 wetlands west of Pottsville. Wooyung Nature Reserve occupies a narrow coastal strand bisected by the Tweed Coast Road.

To the west the landscape in Yelgun, and the Pocket is a mosaic of various agricultural land uses at lower elevations, with fragmented remnant and regenerating forests, until at higher elevation lies the Inner Pocket Nature Reserve and beyond, the more extensive forested landscapes of Mt Jerusalem National Park.

While the Jones Road ridge was recognised by the Cleland Commission (1997) as having important wildlife corridor values, the construction and operation of the four lane Yelgun to Chinderah freeway (YTOC) through Marshall's Ridges to the near west of Parklands has changed habitat connectivity in the location for terrestrial fauna. The freeway includes ~19km of fauna exclusion fencing. Combined with the

presence of the closely parallel Tweed Valley Way, immediately west of the site, this landscape clearly affects habitat connectivity for terrestrial fauna.

Fauna exclusion fencing associated with the Brunswick to Yelgun freeway does not connect to the YTOC fencing, leaving a gap where fauna can access the freeway. Roadkills of Koalas are known from this gap (pers. comm. R. Kooyman; Dr. S. Phillips). Thus a combined effect of barriers and a very high roadkill risk affects habitat connectivity for terrestrial fauna in this area.

Studies of fauna tracks in sandtraps in underpasses and an overpass (cut-and-cover tunnel) west of the Parklands site over the first three years of operation of the freeway (2002-2005) recorded a wide range of both native and exotic vertebrate species and groups using the crossings, but did not record the Koala (Fitzgerald 2005, unpubl report to RTA). Local Koala populations at Yelgun and those of the Tweed Coast to the north are regarded as having significantly declined over the past two decades (pers. comm.: Dr. S Phillips, Biolink Consultants, Murwillumbah).

2.1 Surveys and other information relied on

Surveys of fauna at the site have concentrated upon locating threatened species in areas north of Jones Road and particularly in areas potentially likely to be affected by the staging of events. The grazed pastoral area south of Jones Road was searched for threatened plant species, and was subject to habitat assessments and reconnaissance, but fauna surveys have not been carried out in this area due to generally low habitat values.

Two systematic fauna surveys (August 2007 and February 2009) were aimed at researching cross-seasonal patterns of faunal occurrence north of Jones Road. This was done so that strategies could be developed to ameliorate impacts for fauna likely to occur in habitats nearest to events and event-related activities. Targetted surveys have also taken place on the site for Koalas, and for threatened Owl species.

A series of timed transect surveys (n=46) censussing forest birds of the central swamp sclerophyll forest blocks was conducted separately from the systematic fauna surveys. Timed point surveys of water birds at the large northern dam were also carried out (n=20). This was done to establish baseline data on the abundance of bird species in these areas, because they are close to proposed event activities. Further samples will assist in establishing pre- and post-disturbance data on patterns of species occurrence and individual abundance.

Other sources of information consulted include: the Byron Shire Threatened flora and fauna databases, NSW NPWS Wildlife Atlas, YTOC sand track monitoring data (Fitzgerald 2005), a study of fauna movement at Marshall's Ridges (Hayes and Goldingay 2009). Local ecologists (David Milledge, Andrew Benwell, Mark Robinson, Steve Phillips) also provided records of fauna at the site.

2.2 Ecological attributes of the site—vegetation

Vegetation of the Parklands site (256ha), is dominated by a large area of exotic pasture (60% of the site), with remnant trees and forest blocks as illustrated in Figure

1. Present patterns of vegetation on Parklands reflect past clearing and management practices, and different prior ownership and management regimes. Aerial photography from 1947 reveals that much of the site was at that time cleared of forest and that most forest vegetation of the site has developed since that date. Current patterns of native forest with sclerophyll forest on north-facing slopes and rainforest in gullies and southern-facing slopes and swamp sclerophyll forest at lowest elevations on floodplains provide an indication of the likely original vegetation, prior to clearing.

For vegetation mapping, vegetation classification and ecological descriptions, see Appendix A in the Supplementary Materials document. See Appendix G for R.M. Kooyman vegetation report. Spreadsheets with floristic data from vegetation plots are available on request.

2.2.1 Vegetation south of Jones Road

South of Jones Road the Parklands site is dominated by an extensive level exotic pasture. Remnant sclerophyll forest patches (Brush Box *Lophostemon confertus*-Pink Bloodwood *Corymbia intermedia*- Camphor Laurel *Cinnamomum camphora*) are present on the south facing slopes of the Jones Road ridge, with a small area of regenerating rainforest, also with Camphor Laurel *Cinnamomum camphora*. These forest remnants have since 2006 been supplemented by extensive native plantings, continuing in 2009, and Camphor Laurel removal has taken place under Parklands ownership. Adjoining vegetation of the surrounding Billinudgel Nature Reserve (BNR) is swamp sclerophyll forest dominated by Broad-Leaved Paperbark *Melaleuca quinquenervia.*

2.2.2 Vegetation north of Jones Road

North of Jones Road Parklands is also dominated by pasture, especially on the lower portions of the land, but diverse native forest vegetation is present. Swamp sclerophyll and floodplain forests form a fragmented peninsula extending east-west across a low central area. Forest in the northwest of the Parklands property on slopes and ridges includes drier sclerophyll communities with canopy species including Brush Box *Lophostemon confertus*, Forest Red Gum *Eucalyptus tereticornis*, Blackbutt *E. pilularis* and Northern Grey Ironbark *E. siderophloia.* Rainforest occurs in gullies with Brush Box and Hoop Pine *Araucaria cunninghamii*.

While most forest on site appears to be regenerating, occasional old growth trees are present and forest communities are in relatively good condition, except for impacts of cattle, and variable Camphor Laurel infestation.

Isolated remnant trees and clumps of trees are present in the pasture matrix, with small (<2ha) blocks of forest. Forest blocks are identified by letters in Figure 1, below. Blocks G, H, I & J in the centre of the site have been fenced to exclude cattle. Others with unrestricted cattle access are grazed and trampled and smaller blocks, and those close to water sources have significantly degraded groundlayer vegetation. Cattle occasionally breach fences to gain access to fenced forest blocks.

2.2.3 Habitat values

Large hollow-bearing trees and large logs are scarce on the site, and groundlayer vegetation is generally affected by a long history of cattle grazing. Habitat values of local importance include blossom resources from eucalypt and paperbark species; extensive forest canopies, fruits from native figs, vines and laurels, including Camphor Laurel. Epiphytes, arboreal termitaria and some tree hollows are present. The large (1.8ha) northern dam supports a variety of waterbirds, and extensive pasture of the site provides habitat for grassland fauna species. For more details on habitat values of the site see Appendices: E (fauna survey reports) and I (seven part tests).

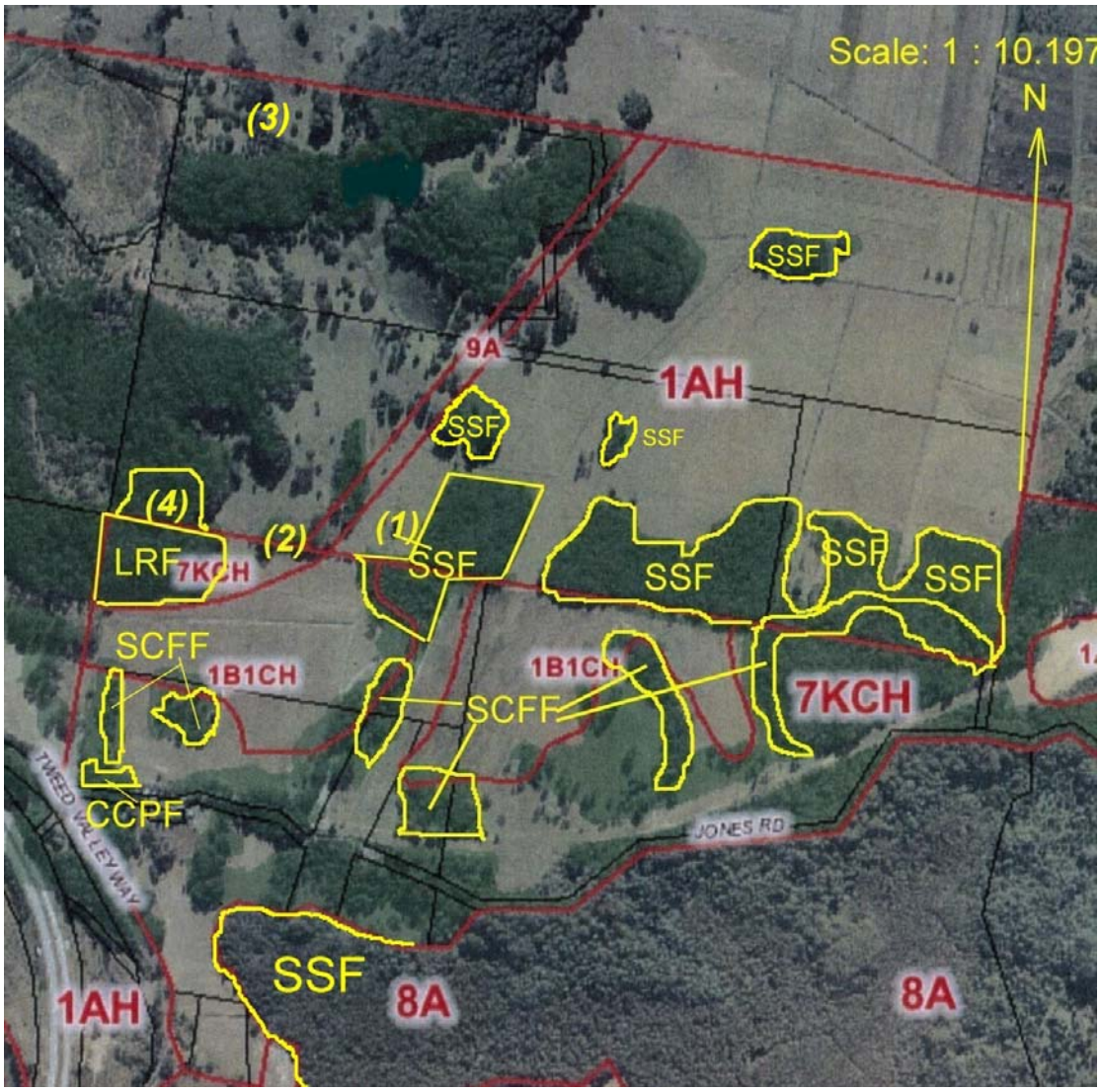
Figure 1: Parklands site

2.2.4 Threatened flora and endangered ecological communities

Six Threatened flora species are recorded on the Parklands site (all north of Jones Road). These are: Davidson's Plum *Davidsonia jerseyana*, Durobby or Coolamon *Syzygium moorei*, Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata*, Stinking Cryptocarya *Cryptocarya foetida*, and White Laceflower *Archidendron hendersoni*. One Stinking Cryptocarya and one Green-leaved Rose Walnut occur within the application area, remaining threatened plants are in forests of the northwest

of the site. The sixth species: Rough-shelled Bush-nut *Macadamia tetraphylla* was only recently discovered (June 5th 2010) and is located well outside the footprint of the proposal considered here. Impacts on this species from a proposed water management system are considered in a seven part test in Appendix K.

Figure 2: Endangered ecological communities and threatened flora of the site



Numbers 1, 2, 3 and 4 depict the locations of threatened flora; SSF = swamp sclerophyll forest; LRF = lowland rainforest; SCFF =sub-tropical coastal floodplain forest; CCPF = Coastal Cypress Pine Forest endangered ecological communities. Location (1) = Stinking Cryptocarya *Cryptocarya foetida*; (2) = Green-leaved Rose Walnut *Endiandra muelleri ssp bracteata*; (3) = Rough-shelled Bush-nut *macadamia tetraphylla* and (4) = Durobby or Coolamon *Syzygium moorei*, White Laceflower *Archidendron hendersoni*, Green-leaved Rose Walnut and Davidson's Plum *Davidsonia jerseyana*.

Also recorded outside the application area are three (3) Rare or Threatened Australian Plant species (ROTAP: Briggs and Leigh 1996). These are: Black Walnut *Endiandra globosa*, Smooth Scrub Turpentine *Rhodamnia maideniana* and Veiny Laceflower

Archidendron muellerianum. An additional occurrence of note is that of Pinkheart *Medicosma cunninghamii* which is regarded as a locally significant species (R. Kooyman, pers. comm.). It is described as "rare in NSW" (plantnet.rbgsyd.nsw.gov.au). See Appendix A for vegetation mapping and descriptions.
The following communities listed as endangered under the NSW *Threatened Species Conservation Act* 1995 also occur on the Parklands property:

Swamp Sclerophyll Forest,
Sub-tropical Coastal Floodplain Forest,
Coastal Cypress Pine Forest, and:
Lowland Rainforest of the NSW north coast bioregion.

2.3 Ecological attributes of the site—fauna and habitats

A total of 175 vertebrate fauna species have been so far recorded for the Parklands site, and more species will be recorded over time. Appendix B lists the vertebrate fauna of the site. Koala survey reports (Biolink 2007 & 2008) are also provided in Appendix H. Threatened fauna species recorded from the site in the period 2006-2010 are listed in Table 1.

Table 1: Threatened fauna species recorded from the site

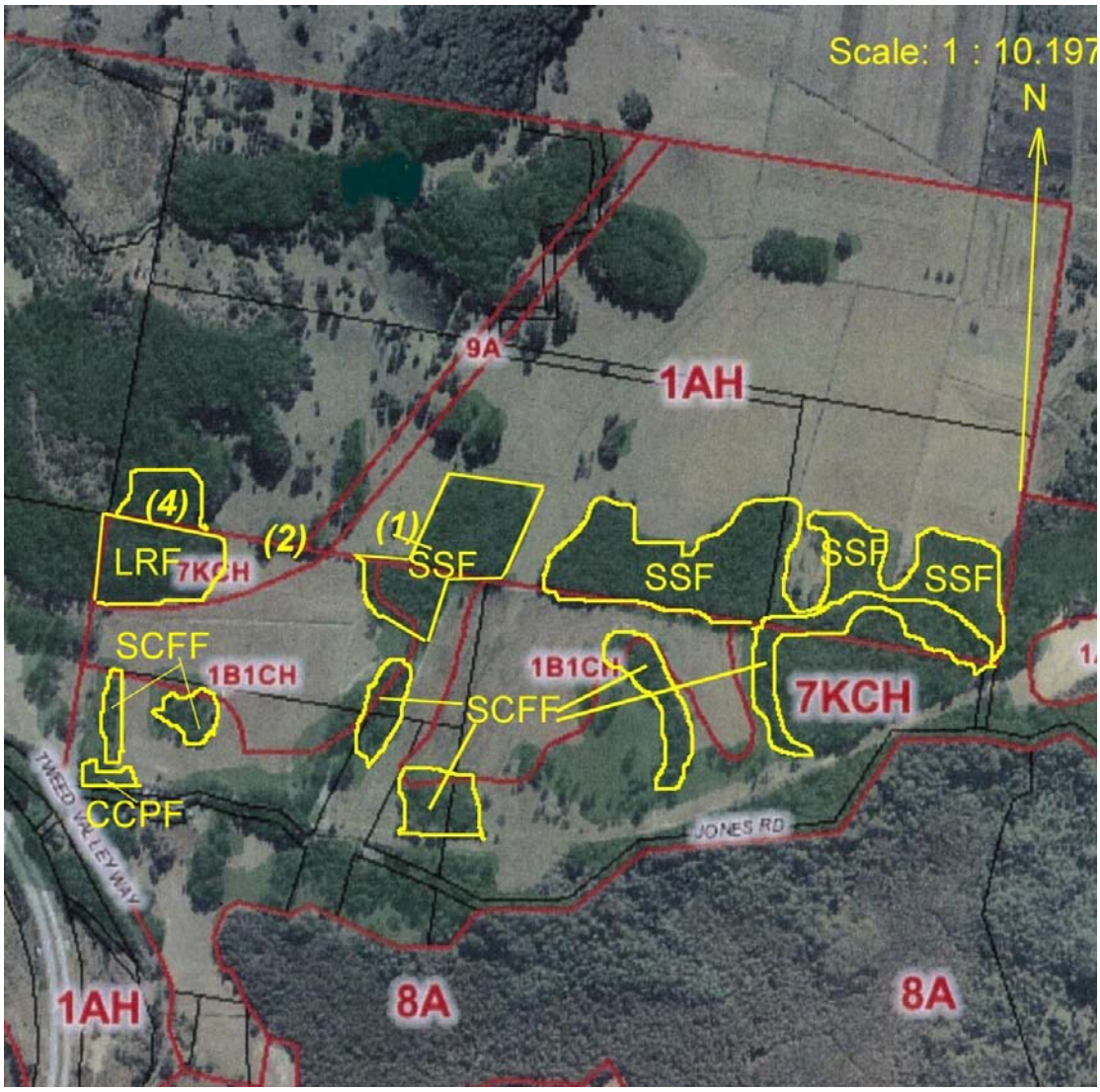
Common Name	**Scientific Name**	**Status TSC/EPBC**
Koala	*Phascolarctos cinereus*	V/-
Eastern Bent-wing Bat	*Miniopterus orianae oceanensis*	V/-
Little Bent-wing Bat	*Miniopterus australis*	V/-
Northern Long-eared Bat	*Nyctophilus bifax*	V/-
Blossom Bat	*Syconycteris australis*	V/-
Grey headed Flying-fox	*Pteropus poliocephalus*	V/V
Comb-crested Jacana	*Irediparra gallinacea*	V/-
Masked Owl	*Tyto novaehollandiae*	V/-
Grass Owl	*Tyto capensis*	V/-
Rose-crowned Fruit-dove	*Ptilinopus regina*	V/-
White-eared Monarch	*Carterornis leucotis*	V/-

With the exception of Comb-crested Jacanas recorded at the large dam and the Grass Owl recorded over pasture, all other threatened fauna species records are from forested habitats.

While fauna characteristic of cattle pasture is present (*e.g.* Masked Lapwings *Vanellus miles*, Cattle Egrets *Ardeola ibis*, Magpies *Gymnorhina tibicen*, Pied Butcherbirds *Cracticus nigrogularis*, Ibis *Threskiornis spp.*, Black-faced Cuckoo-shrike *Coracina novaehollandiae*), the fauna and biodiversity of the parklands site is largely located within the forest habitats.

However, the fragmentation of the forest landscape does not prevent movement between forest patches, even of smaller terrestrial fauna, and the total overall amount of forest, pasture and ecotones present contributes significantly to the 'carrying capacity' or biodiversity capacity of the site. See Appendix E(i) and E(ii) for fauna survey reports.

Figure 3: Threatened fauna record locations (2006-2010)



Key to Threatened fauna species records: * = Grey-headed Flying-fox *Pteropus poliocephalus*;1 = Little Bent-wing Bat *Miniopterus australis;* 2 = Large Bent-wing Bat *Miniopterus orianae oceanensis*; 3 = Eastern Long-eared Bat *Nyctophilus bifax*; 4 = Rose-crowned Fruit-dove *Ptilinopus regina; 5* = Grass Owl *Tyto capensis*; 6 = Masked Owl *Tyto capensis;* 7 = Blossom Bat *Syconycteris australis*; 8 = Comb-crested Jacana *Irediparra gallinacea*; 9 = White-eared Monarch *Carterornis leucotis;* 10 = Koala *Phascolarctos cinereus*.

2.4 Watercourses, flooding, elevation

The Parklands site mainly comprises floodplains, and episodes of inundation of low-lying areas are known both from recent observations and historically. A network of agricultural drains is present. Small ephemeral watercourses are present in the west of

the site and Yelgun Creek in the southern part of the property has been severely altered by a previous landowner (and is the subject of a restoration order: See Appendix J for creek rehabilitation plan).

Several constructed dams are present, the largest of which is a 1.8ha structure in the northwest of the property. Elevation of the site ranges from ~ <10m to ~100m AHD.

2.5 Disturbance history, landuse, pest species

Most of the Parklands site appears to be pasture in a 1947 aerial photo of the site and the site is currently grazed by cattle. Sugar cane and bananas were cultivated in the central and southern portions of the property. Bee-keeping is a continuing activity on the property. The northern third of the property has historically been managed for cattle grazing and all forest there is accessible to cattle. A small regenerating slope at the highest elevation appears to have been used for banana cultivation.

While smaller forest blocks and areas close to water sources have been trampled and degraded by cattle, large forest areas on the steeper northwest slopes are less disturbed and cattle may play a role in preventing the development of Lantana there. Central and southern areas of the property include several fenced blocks of forest, where Lantana has developed as a significant understorey plant.

Camphor Laurel is present across the property, more so in the central forest blocks, as is evident in the aerial photograph of the site (flushes of yellow foliage in Figure 1). Over fifty exotic plant species are recorded from the site, including noxious and environmental weeds *e.g.* Bitou Bush *Chrysanthemoides monilifera ssp. rotundata*, Lantana *Lantana camara*, Small-leaved Privet *Ligustrum sinense*. See Appendix A.

A prolonged peat fire in central swamp sclerophyll forest in 2004 (prior to purchase of the property by the proponents) has caused the death of mature paperbarks over ~1.5ha, however dense regeneration of this community has subsequently taken place.

Exotic fauna species recorded on the Parklands site since 2006 include Cane Toads *Bufo (Rhinella)marinus*, feral dogs and dingoes *Canis familiaris*, the Common or Indian Mynah *Acridotheres tristis* and Black Rats *Rattus rattus*. Feral cats are recorded from sand traps in fauna crossings of the nearby freeway (Fitzgerald 2005) and are very likely to be present on the Parklands property.

3.0 The proposal summarised

North Byron Parklands (Parklands) is proposed to be developed as a cultural events site. Within the Parklands property, an "Application Area" is identified which includes all areas likely to be directly affected by the proposal. Areas outside the "Application area" are outside the direct footprint of the proposal, although may experience indirect impacts from *e.g.* noise from large scale events.
Areas outside the "Application Area" include approximately 35ha of land to be dedicated to DECCW; hill slope forests in the northwest of the property; lands zoned 7KCH in the centre of the property; as well as lands with aboriginal heritage significance; and a 30m buffer to Billinudgel Nature Reserve.

Events proposed will involve event perimeter security fencing, music and performances, the provision of parking, of camping and, at times, managed bonfires.

Vehicle movements within, to and from the property will occur in proportion to the size and duration of each event. Temporary infrastructure and facilities will be provided to event patrons, service personnel and campers, initially including portable toilets and showers, temporary food stalls, bars, and solid waste management.

A land budget is presented in the Town Planning report.

Extensive security fencing (Australian Standard Fencing ~ 3.5km for SITG) will be erected and dismantled for particular events, both to separate patrons from back-of-stage areas; and to protect areas of vegetation. Fencing will be patrolled by security personnel. Smaller scale events may require less or no such fencing.

Native vegetation clearing is not required for the periodic conduct of events at the site.

Vehicular and pedestrian access between the southern car parking area and the northern events area is essential to operation of the site. For the spine road to traverse across Jones Road areas of vegetation will be cleared to provide either: an 'at grade' vehicular crossing (~950 square metres) over the top of Jones Road; or to provide: a culvert underpass (320 square metres) beneath Jones Road. Vegetation clearing for each proposal is predominantly Camphor Laurel but includes a small area of regenerating lowland rainforest EEC. Existing plantings compensate for tree loss as stipulated in the Byron Biodiversity Conservation Strategy (2004) No Nett Vegetation Loss Policy".

For the underpass crossing 59(> 10cm dbh) are to be removed; 27 of these (45.8%) are Camphor Laurel. For the 'at grade' crossing, 65 trees are to be removed, of which 21 are camphor laurel (32%) and 39 are native species.

Internal roads and event laneways will be built, and the western 350m of Jones Road will be widened, resulting t in the loss of 19 trees (10 of which are camphor Laurel).

An on-site wastewater treatment plant is proposed for the site. This is assessed separately in Appendix K.

Some agricultural activities will continue at the site. These include bee-keeping, and cattle grazing. Cattle will be removed from event areas at times to enable temporary uses of large areas of grazing land for events. In the longer term cattle will be excluded from forested habitats of the site, necessitating a reduction in the overall number of cattle on Parklands. An on-site sewage and wastewater treatment plant, gatehouse, cultural centre/administration building and conference centre are also proposed, transportable buildings may also be deployed *e.g.* in the resource / waste management centre. The project is described in more detail in the Town Planning report.

3.0.1 Management principles for the site

The various proposed uses of the Parklands property as a cultural events site are unprecedented for the location and the combination of activity regimes demands careful assessment and consideration in order to develop favourable management. While ~60% of the site is currently dominated by grazed exotic pasture species, much vertebrate species biodiversity of the site is closely associated with the existing forest vegetation. Valuable principles for native forest management are described in a Rural Industries and Research Development Corporation document, "Management Principles and Strategies to Guide Biodiversity Conservation in Private Native Forests" prepared by Prof David D. Lindemayer (RIRDC 2009).

Basic principles for the management of native forest from this document include key considerations for the development of the VMBP, namely:

The overarching goal for conserving forest biodiversity is the maintenance of suitable habitat. Five general principles can help meet this goal:

• *the maintenance of connectivity*

• *the maintenance of landscape heterogeneity*

• *the maintenance of stand structural complexity*

• *the maintenance of aquatic ecosystem integrity*

• *the use of natural disturbance regimes to guide human disturbance regimes.* (RIRDC 2009)

Further important considerations from this document include the following:

"Each species responds differently to the same spatial scale of landscape change and human disturbance. Hence no single measure adequately reflects change for all biota".

Further: species loss is driven by habitat loss.

"*Therefore the overarching goal of conservation management must be to prevent habitat loss.*

In the Parklands context much needs to be done to restore stand complexity and/ or to allow this to develop naturally (through forest stand maturation) and through management (*e.g.* by installation of nestboxes to supplement a scarce shelter resource; and by staged exclusion of cattle to allow groundlayer habitats to recover). Aquatic ecosystems have been drastically altered by drainage works, and an emphasis on restoration is an essential addition to the need for maintenance identified in the above principles.

3.0.2 Vegetation Management and Biodiversity Plan

A Draft Vegetation Management and Biodiversity Plan for Parklands will direct management of habitats and vegetation of the site generally in accordance with

principles listed above. The Draft Vegetation Management and Biodiversity Plan will be updated to incorporate results of fauna monitoring and surveys through 2010-2011, up-to date koala surveys, and provisions of the Koala Plan of Management. This draft plan is included as Appendix M.

3.0.3 Environmental Health and Safety Management Manual

An Environmental Health and Safety Management Manual has been developed for the site which identifies environmental risks and management responses. Standard parameters for environmental management at Parklands are listed below.

- All staff and contractors to undertake Parkland's Environmental induction prior to accessing the site. Documented records shall be maintained covering the environmental induction process;
- No dogs allowed on site;
- No activities (including slashing) to occur within the 30m buffer surrounding the Billinudgel Nature Reserve;
- All temporary drain crossings shall be managed to minimise sedimentation and potential discharge of contaminants;
- No illumination of forest blocks or their edges, or trees. Implement a suitable buffer between edge of forest blocks and any event lighting wherever possible;
- Direct all event lighting downwards;
- Use low pressure sodium vapour lights which are less attractive to insects or bats, where possible;
- Any installations which rely on artificial lighting should be located in open areas away from forest or trees;
- Minimise or avoid lighting throughout the entire night i.e. once performances cease, lighting should be reduced or eliminated to allow a dark period for fauna to use or traverse the site. Where lighting is required for safety purposes provide the minimum necessary and avoid illuminating forest habitats;
- No use of fireworks;
- Use footlights instead of overhead lights where possible;
- Overhead lighting should be shielded and directed downwards to minimise light spill;
- All internal traffic not to exceed 30 km/h;
- Minimise the time that temporary fencing is erected to reduce barriers to fauna and conduct fauna search prior to securing fenced area;

- Experienced fauna management crew to be onsite for the duration of the event;

3.1 Event calendar year 1 (2011-2012)

Events proposed in year 1 include: Splendour in the Grass in July-August 2011, another event in October 2011 and another in January 2012. Patronage for the three nominated events is estimated to be 35 000 (SITG10), 30 000 and 22 500. In each case up to 2000 support staff are also required on site to manage event activities.

Year 1 will involve a maximum of 8 large event days, and a maximum of 12 large event days is proposed for the site subsequently.

4.0 Ecological Impacts from the proposal

Some ecological impacts from the proposal are easily identified and quantified (*e.g.* traffic, human presence, noise); other impact processes and risks are more complex (fauna responses to disturbance) and unpredictable impacts may arise. Impacts from events vary temporally and spatially and for particular species and ecosystems, so that the 'footprint' of the proposal varies across the three proposed events and non-event times. The episodic nature of event-related disturbances punctuated by longer periods of inactivity makes impact assessment particularly complicated. Whether particular fauna will, tolerate, become habituated or sensitised to elements of the disturbance regime is unpredictable.

Underpass or at grade access construction across Jones Road will require a small area of vegetation removal. Road construction, upgrading and use will produce barrier effects and roadkill risks for particular terrestrial fauna, which will vary according to levels and the timing of use, especially diurnal vs. nocturnal use and road use in wet conditions. Roadkill and barrier effects depend in part on the level of use. Other fauna may derive an advantage from roads (Woinarski and Ash 2002), or exploit roads for dispersal (Seabrook and Dettman 1996; Brown *et al* 2006) or for foraging opportunities (pers. obs.).

Variable patterns of resource abundance strongly influence biodiversity phenomena at the site, for example: during flowering or fruiting events numbers of nectivorous and frugivorous fauna, including threatened species, forage widely on the Parklands site. In the absence of such seasonal resources, some of these fauna species are present at lower levels of abundance or are entirely absent.

When abundance of fauna food resources coincides with the staging of an event at the Parklands site, impacts will vary according to: distribution of event elements over the diel cycle, the location and duration of the event, and the intensity of disturbance near fauna habitats and food resources. Some alteration of behaviour is predicted to occur to *e.g.* disruption of flying-fox foraging patterns if and when nocturnal disturbance from an event coincides with a large scale flowering or fruiting phase at the site.

However, the likelihood also exists that flying-foxes will become habituated, and/or return to the site once activities cease for the night, and will resume normal foraging behaviour once the event is completed.

Conduct of events will require erection of security fencing; produce elevated vehicular traffic levels and increased risk of roadkill. High levels of human presence on the site with associated lighting and noise are likely to disturb shy fauna species. A risk of arson may arise in connection with larger events and/or human presence at the site. Artificial lighting has the capacity to trap and kill invertebrate fauna (*e.g.* moths, beetles) and attract insectivorous vertebrate fauna (*e.g.* bats, frogmouths).

Potential impacts include the disturbance of foraging and/or movement regimes for particular fauna, trampling of vegetation through illegal attempts to access the site, and unspecified alteration to fauna communities from episodic disturbance. For example, scavenging bird species may increase in abundance through exploitation of food scraps, while shy bird species may move away from disturbance.

Because the range of activities proposed is variable in scale, duration and location, so will the ecological consequences also vary. Unpredictable synergistic and interactive effects between events and other activities at the site may also occur, if and when these overlap in time. Conversely the time between events (up to several months) will allow time both for recovery and for 'normal' ecological functions to occur at the Parklands site relatively undisturbed, and ultimately enhanced by habitat plantings and weed removal. Table 2 lists activities, impacts, their intensity and duration.

Table 2: Ecological impacts from the proposal; Year 1 only

Activity	**Impacts**	**Intensity / Time**
Construct underpass or at grade access across Jones Rd.	Vegetation removal, noise, human presence; vehicular traffic	Moderate-high, temporary, diurnal
Operate underpass or at grade crossing	human presence; vehicular traffic	Low, throughout most of the year, then high levels of use during three major events; day and night
Construction of new roads and drain crossings	human presence; vehicular traffic; water quality	Low key use throughout the year, to high levels of use during events, day and night
Bump-in for events	human presence; vehicular traffic; noise	Low to high, three times annually, mainly diurnal
Conduct of events	human presence; vehicular traffic; risk of arson	Moderate-high; three times annually, day and night;
Event noise	Event music, crowd noise	Moderate-high; three times annually, day and night
Event lighting	Access ways, security, vehicle lights	Moderate-high; three times annually; nocturnal
Event wastewater disposal	Vehicle movements initially	Moderate-high; three times annually; day and night
Event security fencing	Vehicle movements, noise, human presence, barrier effect	Low-moderate; three times annually, day and night

Bump-out for events	human presence; vehicular traffic; noise	Low-high; three times annually, mainly diurnal
Parking	Trampling of pasture; risk of fuel or oil leaks, littering	Low-moderate, three times annually, day and night

4.1 Amelioration of impacts

Establishment of plantings of local native forest vegetation and of 'managed parklands' at the Parklands site will over time restore habitat connectivity, furnish significant new resources for fauna and contribute to local ecosystem processes (*e.g.* pollination, seeding and fruit dispersal). An Environmental Health and Safety Management Manual specifying a range of mitigation and management measures designed to minimise particular impacts has been developed, and monitoring of the effects of events will provide feedback concerning impacts for fauna and habitats from particular event processes. Mitigation measures will be modified where appropriate, following consideration of information acquired from monitoring.

Impacts discussed are listed above in Table 2, and mitigation measures below in Table 3.

Table 3: Impacts and mitigation measures

Impact	**Mitigation measures**
Construct underpass beneath Jones Rd., or at grade crossing; Remove vegetation	Environmental induction for all construction workers barrier fence retained vegetation, environmental induction for all construction workers. Supervise tree removal; salvage biomass. Compensatory plantings.
Operate underpass or at grade crossing	Establish and maintain plantings to restore local connectivity of vegetation
Construction of new roads and drain crossings; roadkill, sediment movement into drain system	Signage; low vehicle speed, monitor roadkill; install and maintain sediment interception structures
Conduct of events	*See event table below*
Noise from events	Control noise levels during events, monitor and report, reduce noise where indicated
Event lighting	*Implement lighting principles listed below*
Wastewater disposal	Low vehicle speeds, signage, monitor roadkill; develop on-site treatment plant
Security fencing	*See event table below*
Parking	Barrier fence all sensitive vegetation establish buffer to BNR, environmental audit.

4.1.1 Lighting principles for the site

Lighting principles below were developed for the Parklands site based on analysis of the reported effects of artificial light on fauna in Rich and Longcore (2006): "Ecological Consequences of Artificial Night Lighting".

- No illumination of forest blocks or their edges, or trees: implement a suitable buffer between edge of forest blocks and any event lighting wherever necessary;
- Direct all lighting downwards; floodlights that point upwards are potentially harmful to fauna;
- Use low pressure sodium vapour lights which are less attractive to insects or bats, where possible.
- Any installations which rely on artificial lighting should be located in open areas away from forest or trees and be monitored for effects on fauna.
- Minimise or avoid lighting throughout the entire night: *i.e.* once performances cease, lighting should be reduced or eliminated to allow a dark period for fauna to use or traverse the site. Where lighting is required for safety purposes provide the minimum necessary and avoid illuminating forest habitats.
- No use of fireworks.
- Use footlights instead of overhead lights where possible.
- Overhead lighting should be shielded and directed downwards to minimise light spill.

Monitoring of the effects of lights from events should contribute to the further development of a specific lighting plan for Parklands to avoid, minimise and/or mitigate adverse effects for fauna.

4.1.2 Event impact mitigation

Based on analysis of the proposal to stage Splendour in the Grass at the site in 2008 the following event-specific mitigation strategies were adopted. Mitigation measures will be incorporated in an Event Management manual to be prepared for the site.

Table 4: Event-specific mitigation measures and benefits

Measure	**Benefit**
An Environmental Health and Safety Plan specifies measures for mitigation of impacts	All event related activities are directed by the EH&SMM

Comprehensive environmental induction for all site workers No dogs to be brought on site by personnel	Familiarise all personnel with particular risks for fauna and habitats on the site; alert all vehicle users to the risk of roadkills, and the need for low vehicle speeds on site; reduce dog predation on site
Manage drain crossing constructions to ensure no adverse impacts on water quality	Prevent sedimentation and eutrophication of downstream riparian and wetland habitats
Avoid slashing or encroaching on tall groundlayer vegetation in 30m buffer to BNR fringing southern car park area	Minimise impacts upon potential habitat for Pale-vented Bush-hen, Bitterns, Potoroos and small mammal prey for Grass Owls.
Avoid unnecessary illumination of forest and forest canopy vegetation, especially of flowering paperbarks, eucalypts and bottlebrushes, and fruiting figs	Foraging resources for Flying-foxes and Blossom Bats may remain available during events
Traffic control: effectively limit vehicle speeds throughout the site; and on local roads; see traffic report for details	Reduce the risk of roadkill for Koalas, Swamp Wallabies, Bandicoots, Carpet Pythons.
Install signage on roads warning of the presence of Koalas, especially at night	Reduce the risk of roadkill for Koalas and other fauna
Install fencing on western edge of forest block "A" before any event	Reduce the risk of incursions in the Stinking Cryptocarya area
Minimise time that fences are in place	Minimise the duration of the barrier effect of fences for Koalas and other large terrestrial vertebrate fauna
Have an experienced fauna management crew on site (wildlife rescue personnel)	Rapid response to any fauna problem; *e.g*. rescue any fauna trapped inside event fencing
Develop and update Vegetation Management and Biodiversity Plan	Rehabilitation and habitat connectivity plantings continue; reduction of weeds in native ecosystems; contemporary survey data used to improve management
Plant trees to sequester carbon produced by bonfires: 100 trees for every bonfire	Contribute in part to countering the effect of CO_2 emissions from burning timber for bonfires
Manage fire risk; human exclusion fencing, security patrols fire fighting equipment; fire safety officers; fire management plan	Proactively counter the risk of arson and bushfire
Include Koala food trees in planting	Improve habitat for local Koalas
Include forest oak *Allocasuarina torulosa* in planting	Improve habitat for local Glossy Black-cockatoos
Include local native figs in plantings *e.g.F obliqua, F macrophylla*	Improve habitat for Flying-foxes, Fruit-doves, Barred Cuckoo-shrikes and common fauna
Fence sensitive vegetation	Preserve large figs, hollow-bearing trees;

	reduce effects of cattle in forest habitat; protect Stinking Cryptocarya
Maintain stock fencing around existing fenced forest blocks	Facilitate assisted regeneration of native forest ecosystems
Install bat-boxes in forest areas outside the event footprint	Improve the availability of roost and shelter sites for local microbats
Targetted fauna surveys for threatened fauna	Identify patterns of use; location of significant resources; and influence event layout to minimise impacts
Perform an ecological audit following completion of the event.	Identify any unpredicted or focal impacts in order to develop optimal management for future events

5.0 Specific responses to the DGRs

Part A: Concept Plan Application

6. Consideration of impacts, if any, on matters of National Environmental Significance under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999.

5.1 Impacts on matters of national environmental significance (Section 6)

Assessment of impacts on matters of NES is based on consideration of the first year of operation described in the Project and Concept Plan Application. This is because the prediction of impacts for subsequent years of operation is dependent on gathering information on the nature of impacts observed in year 1 of operation. While it is considered reasonable to predict impacts for the operation of year 1, the cumulative, interactive and potentially synergistic effects for fauna and ecosystems of increased patronage, diverse activities and cumulative number of events over time cannot be reliably assessed without feedback from monitoring.

An assessment of the impact of the operation of year 1 of the proposal on matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) follows, using criteria provided by the Australian Government Department of the Environment, Water and Heritage follows.

A search was undertaken of the DEWHA protected matters database. The report is provided in full as Appendix C in the Supplementary Materials document.

5.1.1 Search parameters

A point search was undertaken for an area based upon the following coordinates: -28.466, 153.516 with a 5km buffer. This area has the event site at its approximate centre: the search was carried out in October 2009.

5.1.2 Search results

Search results indicate the presence within the search area of the following
Matters of national environmental significance:

Threatened Ecological Community	1
Threatened species	50
Migratory species	30

Other matters protected by the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) include:

Commonwealth Lands	2
Commonwealth Heritage Places	none
Places on the RNE*	none
Listed marine species	52
Whales and other cetaceans	12
Critical Habitats	none
Commonwealth Reserves	none

*Register of the national Estate

Extra Information

State and Territory Reserves	3
Other Reserves	none
Regional Forest Agreements	1

5.1.3 Guidelines on determining the significance of impacts

DEWHA have recently produced an updated policy statement describing Significant Impact Guidelines which provides criteria for determining the significance impacts of a proposal on particular matters of national environmental significance.

5.1.4 Threatened species

Fifty (50) threatened species are listed in the EPBC search results. Species known from the site and considered potentially likely to be affected by the proposal include the following:

Grey-headed Flying-fox	*Pteropus poliocephalus*	V
Stinking Cryptocarya	*Cryptocarya foetida*	V
Davidson's Plum	*Davidsonia jerseyana*	E
Durobby or Coolamon	*Syzygium moorei*	V

One threatened fauna species, the Long-nosed Potoroo *Potorous tridactylus* is considered a possible occurrence in habitats of Billinudgel Nature Reserve adjacent to the site. Davidson's Plum is listed as Endangered; other species above are listed as Vulnerable under the EPBC Act.

5.1.5 Significant Impact Criteria—Vulnerable species

Guidelines provided by DEWHA for Vulnerable species include the following Significant Impact Criteria:
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

Definitions
An 'important population of a species' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;
- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

5.1.6 Application of significant impact criteria to vulnerable species

Long-nosed Potoroo
The operation of the proposal in year 1 as described is not expected to have any adverse impact on the Long-nosed Potoroo *Potorous tridactylus* or its habitats. A 30m buffer around Billinudgel Nature Reserve (BNR) inside the southern car parking area will assist in preventing impacts on habitats of BNR. The species is listed from a single post-1980 record in the NSW NPWS Atlas of NSW wildlife data base, from the interior of BNR. It has not been recorded from the Parklands site, where cattle grazing has kept groundlayer vegetation sparse in all areas but a few small and isolated fenced forest patches.

Durobby or Coolamon
The operation of the proposal in year 1 as described is not expected to have any adverse impact on this species, because plants are located in a rainforest gully remote from any disturbance associated with the proposal, and outside the application area.

Stinking Cryptocarya
The operation of the proposal in year 1 as described is considered unlikely to adversely impact on this species, which is currently known from one sapling in a swamp sclerophyll forest block in the centre of the site, provided that appropriate management and mitigation is applied. It is recommended that for any event which is

located within 30m of this plant, that a barrier fence be erected to exclude vehicles, machinery and people from its vicinity.

Grey-headed Flying-fox

Grey-headed Flying-foxes *Pteropus poliocephalus* have been recorded on the Parklands site foraging on the blossoms of Forest Red Gum, Pink Bloodwood, Broad-leaved Paperbark and on Camphor Laurel fruit. They are also likely to use other food trees at the site *e.g.* when figs are fruiting. Estimates of from 30-200 Grey-headed Flying-foxes have been made in census samples of this species, from within the central proposed event areas, and many more flying-foxes overfly the site when moving to other feeding areas.

Grey-headed Flying-foxes may be temporarily alienated from parts of the site by event-related noise and/or by unprecedented illumination and/or human presence in the vicinity of food plants. Given the behaviour of this species in urban and agricultural landscapes it appears likely that some habituation to disturbance is likely to occur, both in the short and longer term. Any disturbance effect is predicted to be localised, temporary and non-fatal.

No roost sites or camps for Grey-headed Flying-foxes are known from the Parklands site or nearby, and the nearest known communal roost is located ~ 6kms to the south at Brunswick Heads Nature Reserve. There are abundant foraging resources seasonally available for this species across the overall site and in its immediate vicinity.

5.1.7 Importance of populations

It is not possible to accurately assess the "importance" of local populations for any of the vulnerable species considered above without detailed demographic data. It is possible that significant elements of the local Grey-headed Flying-fox population may at times be present in the vicinity of the site. The single Stinking Cryptocarya is a sapling and not likely to be an important population of this species.

None of the vulnerable species populations present are described as important in any recovery plan, and none of the species populations present are considered to match the listed criteria for important populations:

- *key source populations either for breeding or dispersal;*
- *populations that are necessary for maintaining genetic diversity; and/or*
- *populations that are near the limit of the species range.*
-

5.1.8 Vulnerable species criteria and response

Table 5: Vulnerable species criteria and response

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criteria	**Response**

lead to a long-term decrease in the size of an important population of a species;	There is no evidence to suggest that the proposal will cause a long-term decrease in the size of the local populations of any of the 4 vulnerable species considered.
reduce the area of occupancy of an important population;	Operation of Parklands in year 1 will likely affect the area available for foraging for the Grey-headed Flying-fox if blossom or fig resources are abundant in the event footprint, and close to sources of noise, or crowds of people. This effect is temporary, and will vary in scale according to the patterns of resource availability on the site.
fragment an existing important population into two or more populations;	It is considered unlikely that the proposal will cause any fragmentation effect for local populations of the 4 vulnerable species assessed.
adversely affect habitat critical to the survival of a species	Habitat effects are limited and localised and considered insufficient to affect the survival of any of the 4 vulnerable species considered
disrupt the breeding cycle of an important population;	The proposal is not likely to disrupt the breeding cycle of any local population of the 4 vulnerable species considered
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	Some localised foraging habitat may be rendered temporarily unavailable for foraging for the local Grey-headed Flying-fox population. This is considered insufficient to cause the species to decline.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	The proposal will involve the removal of invasive plants from the site; rehabilitation plantings will also occur as part of an overall vegetation management strategy for the site
introduce disease that may cause the species to decline	The proposal is not likely to introduce diseases to the site
interfere substantially with the recovery of a species	The proposal will not interfere with the recovery of the 4 vulnerable species considered

5.1.9 Endangered species—Davidson's Plum *Davidsonia jerseyana*

Background information

Found in rainforest at elevations below 300m, Davidson's Plum produces large edible fruits and has been widely cultivated. The species is known from at least 50 locations in Byron Shire, but is considered inadequately reserved as many of the occurrences are on private land. Threats listed for the species include land clearing, roadworks,

damage by stock and low population numbers. (BSC 1999: Byron Flora and Fauna Study).

5.1.10 Significant Impact Criteria—Critically endangered and endangered species

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

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

Definitions

A population of a species

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species occurrences include, but are not restricted to:

- A geographically distinct regional population or collection of local populations; or
- A population, or collection of populations, that occurs within a particular bioregion.

Invasive species

An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or endangered ecological communities by direct competition, modification of habitat or predation.

Table 6: Application of significant impact criteria to endangered and critically endangered species

EPBC criteria for significant impact on endangered species	**Assessment for Davidson's Plum *Davidsonia jerseyana***
lead to a long-term decrease in the size of a population;	Several mature Davidson's Plums are present on a rainforest gully outside the application area and outside the physical footprint of the proposal.

	No aspect of the proposal is likely to lead to a long term decrease in the size of a population.
reduce the area of occupancy of the species;	The proposal is considered unlikely to reduce the area of occupancy of Davidson's Plum.
fragment an existing population into two or more populations;	The proposal is considered unlikely to fragment an existing population of Davidson's Plum into two or more populations
adversely affect habitat critical to the survival of a species;	Habitats important to the survival of the Davidson's Plums will not be adversely affected by the proposal.
disrupt the breeding cycle of a population;	The breeding cycle of the population of Davidson's Plum will not be disrupted by the proposal.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	The proposal is considered unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Davidson's Plum is likely to decline.
result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat;	The proposal will not result in the introduction or establishment of invasive species that are harmful to Davidson's Plum habitat.
introduce disease that may cause the species to decline; or	The proposal is considered unlikely to introduce disease that may cause Davidson's Plum to decline.
interfere with the recovery of a species	The proposal is considered unlikely to interfere with the recovery of Davidson's Plum.

5.1.11 Migratory species

Thirty (30) migratory species are listed in the search results. These include eleven (11) migratory marine mammals, reptiles and shark species: none of these taxa have habitats likely to be affected by the proposal and these are considered no further. Of the remaining nineteen (19) migratory species listed, nine (9) are known from or considered likely occurrences on the site these are:

Seven (7) migratory terrestrial bird species, including:

White-bellied Sea-eagle *Haliaeetus leucogaster*, White-throated Needletail *Hirundapus acutus*, Rainbow Bee-eater *Merops* ornatus, Black-faced Monarch *Monarcha melanopsis*, Spectacled Monarch *Monarcha trivirgatus* Satin Flycatcher *Myiagra cyanoleuca* and Rufous Fantail *Rhipidura rufifrons*.

Two (2) migratory wetland birds: Great Egret *Ardea alba* and Cattle Egret *Ardeola ibis* are also listed as migratory marine species, and are known from the site. Guidelines provided by DEWHA for Migratory species include the following Significant Impact Criteria:

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- *substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles) destroy or isolate an area of important habitat for a migratory species;*

- *result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species, or;*

- *seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.*

Definition: Important habitat for a migratory species

- an area of 'important habitat' for a migratory species is: habitat utilised by a migratory species occasionally or periodically within a region that supports and ecologically significant proportion of the species, and/or;

- habitat that is of critical importance to the species at particular life-cycle stages, and/or;

- habitat utilised by a migratory species which is at the limit of the species range, and/or;

- habitat within an area where the species is declining.
-

Definition: ecologically significant population

Listed migratory species cover a broad range of species with different life-cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species (each circumstance will need to be examined). Some factors that should be considered include the species' population status, genetic distinctiveness and species-specific behavioural patterns (for example, site fidelity and dispersal rates).

Definition: population of a migratory species

'Population' in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries including Australia.

5.1.12 Application of criteria to migratory species

Table 7: Migratory species criteria and response

Criteria	Response
substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles) destroy or isolate an area of important habitat for a migratory species;	The proposal will not substantially modify destroy or isolate an area of important habitat for any of the migratory species considered
result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for a migratory species, or;	The proposal will not result in an invasive species becoming established in an area of important habitat for any of the migratory species considered
seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	The proposal will not seriously disrupt the lifecycle of an ecologically significant proportion of a population of any of the migratory species considered

5.1.13 Impacts of the proposal

Neither various construction activities nor conduct of three events at the site in year 1, are likely to produce significantly adverse impacts at the site for fauna or habitats, provided that impacts are properly managed (see mitigation measures listed in Tables 4 & 5).

The presence of numbers of people in the event site and camping areas will temporarily alienate some areas of grassland habitat for some migratory species *e.g.* Cattle Egret. Only minor adverse effects in terms of spatial extent and intensity are expected during setting up and dismantling phases. These disturbance factors are predicted to operate for a few individuals and not at the population scale for any of the migratory species considered. The temporary alienation of foraging or sheltering habitat is not likely to be significant even for individuals, because no nest sites for migratory species are likely to be affected, these are mobile species, and because the local landscape includes much other available habitat, including foraging and shelter resources. Considering a total event footprint of ~97 ha, with 155ha of grassland currently present on the Parklands site this leaves ~ 58ha of grassland habitat remaining outside the event footprint.

There is no evidence to suggest that for any of the migratory species listed above, that important habitat or ecologically significant populations exist within the event

footprint. Therefore, and considering criteria in Table 7, there is no significant adverse effect considered likely from the proposal on any of these species.

5.1.14 Other matters protected by the EPBC Act

Search results include the listing of 13 Whales and other cetaceans; 58 Listed marine species; 3 places on the Register of the National Estate (RNE), and: 3 Commonwealth lands.

No adverse effect is likely from the proposal on whales or other cetaceans, places on the RNE or commonwealth lands.

Of the listed marine species the following birds are known or likely to occur on the site:

Great Egret *Egretta alba*, Cattle Egret *Ardeola ibis*, White-bellied Sea-eagle *Haliaeetus leucogaster*, White-throated Needletail *Hirundapus acutus*, Rainbow Bee-eater *Merops ornatus*, Black-faced Monarch *Monarcha melanopsis*, Spectacled Monarch *Monarcha trivirgatus*, Satin Flycatcher *Myiagra cyanoleuca* and Rufous Fantail *Rhipidura rufifrons*.

Two (2) migratory wetland birds: Great Egret *Ardea alba* and Cattle Egret *Ardeola ibis* are also listed as migratory marine species, and are known from the site

Adverse effects from the proposal include the temporary alienation of areas of habitat for these species during larger scale events. For example the Great Egret and Cattle Egret are known from the site and forage in open pasture and along drains of the site. The presence of large numbers of people during events will alienate some areas of habitat for these species for the duration of the event. Some habitats may also be affected by human presence during the setting up and dismantling stages.

However, this disturbance effect is short-lived and unlikely to jeopardise the survival of any individual Egret or Egret population. The Monarchs and Fantail are species of the interior of forest blocks, of which only the Black-faced Monarch has been recorded from the site. Monarchs and fantails may experience adverse effects from noise during the event if sheltering in habitats close to any of the stages. At the worst this disturbance effect might cause nesting birds in the close vicinity of the stages to temporarily abandon eggs. However this risk is considered low as Black-faced Monarch is represented by only 6 records in 46 transect bird samples in the central forest blocks, closest to event stages.

The Rainbow Bee-eater is present throughout the site. For this species a minor effect of alienation of some shelter and forage habitats is possible during events. Such effects will generally cease when events are completed, and are not considered likely to seriously adversely affect any individuals or populations of the species discussed.

5.1.15 Conclusion

While minor and temporary adverse effects are likely to arise for some of the listed fauna, the disturbance phenomena are likely to be of limited duration and are most

intense (in terms of noise and light) at a few specific locations during the conduct of larger scale events. Effects from construction activities are similarly temporary, localised and limited in scale.
Camping and parking areas which currently are potential habitats for some of the species considered will be to some extent unavailable during events. At other times of the year (~70% of the time) habitats for these species will be unaffected by the proposal.

No significant adverse effects as defined according to criteria provided by DEWHA are likely for any of these species examined in this assessment.

6.0 Part B: Project Application responses

9.1 Assess the potential direct and indirect impacts of the development on flora and fauna taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and any relevant recovery plan in accordance with DECCW's Guidelines for Threatened Species Assessment (2005) and Threatened Species Assessment–Guideline for developments and Activities.

6.1 Fauna and habitats—limitations of survey

Any inventory of biodiversity is unavoidably incomplete because of ongoing variations in faunal occurrences and abundance. Flora species dormant in the seedbank or seasonally absent are also under-represented in or missing from survey inventories.

Survey effort at Parklands in 2007 focussed specifically upon areas identified as likely to experience impacts, both direct and indirect, from the proposed staging of the Splendour in the Grass festival. This footprint is essentially similar to event areas in the current application. A systematic fauna survey in February 2009 expanded the search area to investigate hill slope forests in the northwest of the Parklands which are outside the current "Application Area". The southern car parking area has received less fauna survey attention because it is dominated by an extensive exotic pasture, which has relatively low habitat values for native or threatened fauna or flora species.

Cattle have adversely affected survey activities in areas where they have access; notably kicking over drift fences and trampling pitfall traps, pulling the plastic bags off and thus setting off Elliott traps, and kicking over hair funnels. Thus, unattended operation of expensive survey equipment in cattle areas (*e.g.* Anabat, Harp Traps) was constrained.

6.1.1 Fauna and habitats—precedent surveys

Acquisition of information specifically concerning fauna and habitats of the Parklands site has been ongoing since 2006. Prior to this (2000-2) useful background information on the local fauna, flora and ecosystems was derived from pre-clearing surveys along the 28km Yelgun to Chinderah Pacific highway upgrade; and later fauna data gathered from sand traps in the nearest dedicated fauna crossings under the Yelgun to Chinderah freeway(2002-5: Fitzgerald 2005). Fauna habitat assessments

along a proposed fence line on the boundary of Billinudgel Nature Reserve (2003) provided additional fauna data for the location.

Fauna surveys on the Byron Shire coastal floodplain since 2000, and on the Tweed coastal plain from 1993-2009 have also provided useful background information on fauna ecology of the region. See Appendix D.

Recent surveys of flora and fauna of the Parklands site are listed as follows:

- Targetted survey for threatened flora November 2006;
- Koala scat searches May-June 2007;
- Property-wide surveys for Koalas June 2007 & September 2008 (Biolink Consultants, Murwillumbah);
- Targetted rapid assessment surveys for threatened fauna February 2007;
- Targetted call playback surveys for forest owls June 2007,
- Systematic fauna survey in August 2007;
- Bird and flying-fox surveys July-September 2008;
- Vegetation plot surveys in January 2009, and:
- Systematic fauna survey in February 2009.

The August 2007 and February 2009 systematic fauna survey reports, and Biolink Koala survey reports are provided as Appendices E(i) and E(ii). A vegetation report based on plot surveys is provided in Appendix G.

6.1.2 Fauna and habitats—database records

In order to increase understanding of biodiversity patterns at the site, database records were interrogated for the Parklands property, and for the adjacent Billinudgel Reserve. Sources consulted include:

- Byron Shire Council threatened flora and fauna species databases;
- NSW NPWS Atlas of NSW Wildlife database;
- EPBC Act matters of national environmental significance database;
- Billinudgel Nature Reserve Plan of Management.

In addition, local ecologists (Andrew Benwell, Robert Kooyman, David Milledge and Steve Phillips) were consulted in relation to their personal records of fauna and flying-fox camps of Billinudgel Nature Reserve and the vicinity.

6.1.3 Fauna of the Parklands site

Currently 175 vertebrate species are known from the Parklands property. These include:

Amphibians 14 species (1exotic);

Birds 121 species (1 exotic);

Mammals 26 species (3 exotic), and:

Reptiles 14 species.

A fauna species list is provided in Appendix B

6.1.4 Threatened fauna of the Parklands site

Table 8 lists Threatened fauna species recorded from Parklands since 2006.

Table 8: Threatened fauna species recorded from the site 2006-2010

Common Name	**Scientific Name**	**Status TSC/EPBC**
BIRDS		
Comb-crested Jacana	*Irediparra gallinacea*	V/-
Masked Owl	*Tyto novaehollandiae*	V/-
Grass Owl	*Tyto capensis*	V/-
Rose-crowned Fruit-dove	*Ptilinopus regina*	V/-
White-eared Monarch	*Carterornis leucotis*	V/-
MAMMALS		
Koala	*Phascolarctos cinereus*	V/-
Eastern Bent-wing Bat	*Miniopterus orianae oceanensis*	V/-
Little Bent-wing Bat	*Miniopterus australis*	V/-
Northern Long-eared Bat	*Nyctophilus bifax*	V/-
Blossom Bat	*Syconycteris australis*	V/-
Grey headed Flying-fox	*Pteropus poliocephalus*	V/V

Additional threatened fauna species are known from the property earlier (*e.g.* Square-tailed Kite *Lophoictinia isura*: 2003) and are considered likely or possible occurrences at times within the application area or nearby. These are listed in Table 9.

Table 9: Threatened fauna species—possible occurrences

Common Name	**Scientific Name**	**Status TSC/EPBC**
BIRDS		
Australasian Bittern	*Botaurus poiciloptilus*	V/-
Barred Cuckoo-shrike	*Coracina lineata*	V/-

Black-necked Stork	*Ephippiorhynchus asiaticus*	E/-
Black Bittern	*Ixobrychus flavicollis*	V/-
Brolga	*Grus rubicundus*	V/-
Bush Stone-curlew	*Burhinus grallarius*	
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V/-
Little Lorikeet	*Glossopsitta pusilla*	V/-
Magpie Goose	*Anseranas semipalmata*	V/-
Osprey	*Pandion haliaetus*	V/-
Pale-vented Bush-hen	*Amaurornis olivaceus*	V/-
Red-backed Button-quail	*Turnix maculosa*	V/-
Square-tailed Kite	*Lophoictinia isura*	V/-
Superb Fruit-dove	*Ptilinopus superbus*	V/-
Sooty Owl	*Tyto tenebricosa*	V/-
Wompoo Fruit-dove	*Ptilinopus magnificus*	V/-
MAMMALS		
Common Planigale	*Planigale maculata*	V/-
Greater Broad-nosed bat	*Scoteanax rueppelli*	V/-
Large-footed Myotis	*Myotis macropus*	V/-
Long-nosed Potoroo	*Potorous tridactylus*	V/V
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	V/-

6.1.5 Flora of the Parklands site

Vegetation of the Parklands site is described in Section 2.0. Vegetation mapping and plot data are provided in Appendix A.

6.1.6 Threatened flora species of the Parklands property

Table 10: Threatened flora species of the site & ROTAP plants

Common Name	**Scientific Name**	**Status TSC/EPBC**
Davidson's Plum	*Davidsonia jerseyana*	E/E
Durobby or Coolamon	*Syzygium moorei*	V/V
Green-leaved Rose Walnut	*Endiandra muelleri ssp. bracteata*	E/-
Stinking Cryptocarya	*Cryptocarya foetida*	V/V
White Laceflower	*Archidendron hendersoni*	V/-
Rough-shelled Bush-nut	*Macadamia tetraphylla*	V/-
RARE OR THREATENED	AUSTRALIAN PLANTS	(ROTAP)
Black Walnut	*Endiandra globosa*	2RC-
Smooth Scrub Turpentine	*Rhodamnia maideniana*	2RC-
Veiny Laceflower	*Archidendron muellerianum*	3RCA

6.1.7 Endangered Ecological Communities of the Parklands site

The following communities listed as endangered under the NSW *Threatened Species Conservation Act* 1995 also occur on the Parklands property:
Swamp Sclerophyll Forest,
Sub-tropical Coastal Floodplain Forest,
Coastal Cypress Pine Forest, and:
Lowland Rainforest of the NSW north coast bioregion.

Swamp sclerophyll forest EEC in Billinudgel Nature Reserve dominated by Broad-leaved Paperbark *Melaleuca quinquenervia* surrounds the southern car parking area.

6.2 Impacts on Fauna

Proposed activities on the site which will generate impacts for fauna can be summarised into two broad categories, namely: the construction and upgrading of infrastructure, and the conduct of events. Construction phase includes widening of the western 350m of Jones Road, construction of the spine road and underpass or at grade crossing, construction of internal roads and construction of project buildings. The operation of events involves multiple activities described below. The background agricultural activities of the site are not considered here. Both categories of activities produce temporary impacts by introducing human presence to the site, but the scale, duration, location and nature of impacts vary. Some impacts from road construction may be permanent.

6.2.1 Construction phase impacts

In the construction phase a small area of Camphor Laurel dominated forest including some lowland rainforest EEC vegetation will be removed to allow construction of the underpass (320 square metres) or at grade crossing (~950 square metres). This loss of vegetation and disturbance from the construction process will likely temporarily disrupt forage and movement patterns of local fauna *e.g.* Swamp Wallabies *Wallabia bicolor* and Carpet Pythons *Morelia spilota mcdowelli* in the vicinity. Removal of Camphor Laurels entails a loss of fruit for those species which eat these fruits *e.g.* flying-foxes, *Pteropus spp.*, pigeons, Pied Currawongs *Strepera graculina*, Figbirds *Sphecotheres vielloti*, however the Camphor Laurel resource is extremely abundant and widespread in this location.

Construction of the spine road will create a greater local barrier effect for terrestrial fauna if an 'at grade' crossing is used, because of the requirement to fill both northern and southern approaches to Jones Road. This can be ameliorated by provision of culverts beneath the road. The underpass alternative creates less of a barrier effect, and the width of the road, combined with infrequent patterns of use mean that the barrier effect will be relatively minor. That is, at times between cultural events or festivals when levels of use are low or non-existent, the spine road will offer no serious barrier to fauna movement.

The construction of the spine road north of Jones Road and the upgrade of existing farm tracks within the application area will produce disturbance by human presence the noise from operation of machinery. Local risks of roadkill will be increased for the duration of the construction process. However such disturbance will be diurnal

and relatively short-lived. All personnel working or volunteering on the site will be required to undergo an environmental induction and to comply with speed limits on the site or be banned from the location. Construction operators will not be permitted to bring dogs or cats on to the site.

All construction, bump-in bump-out and event related activities on the Parklands site will be directed by an Environmental Health and Safety Management Manual.

Table 11 below lists construction phase impacts and mitigation measures.

Table 11: Construction phase impacts and mitigation

Action	**Impact**	**Nature of Impact**	**Mitigation**
Vegetation removal	Loss of forage resources and habitat	Direct	Supervise tree removal; retain biomass on site;, compensatory plantings
Vegetation removal	Disrupt forage and movement patterns of local fauna	Indirect	compensatory plantings
Underpass construction	Barrier effect for terrestrial fauna	Direct	compensatory plantings
Road construction	Barrier effect for terrestrial fauna	Direct	Culverts beneath road for 'at grade' option
Underpass construction	Disturbance from human presence operation of machinery	Direct temporary	Temporary duration

6.2.2 Operational phase impacts—'bump in' phase

The process of setting up required infrastructure to stage the event is termed 'bump-in'. Operation of the event site requires no vegetation removal beyond the occasional pruning of overhanging branches to permit erection of security fencing. Staging of events is likely to involve the following impacts for fauna; increased vehicular activity at the site will elevate the risk of roadkill on both internal roads and those used to provided access from outside the property (Tweed Valley Way and Brunswick Valley Way). This will be primarily diurnal, and all personnel working or volunteering on the site will be required to undergo an environmental induction and to comply with speed limits on the site or be banned from the location.

Personnel will not be permitted to bring dogs or cats on to the site (exception for trained security dogs if used).

Security fencing and barrier fencing will be used to separate event patrons from back-of-stage and from sensitive vegetation/habitat areas. The transport and erection of

fencing, tents, marquees, food stalls, portable toilets and showers, waste management equipment, fire fighting equipment, lighting and related materials will produce a steadily increasing disturbance regime at the site. Installation of this infrastructure will primarily be diurnal, and fences will be left incomplete until immediately prior to opening the gates to patrons, to minimise constraints on fauna movement.

Security fencing will not be completely linked until thorough searches of the site to ensure that no fauna re trapped inside the event area. Cattle will have been moved away from the event area. Table 12 lists bump-in and bump-out phase impacts and mitigation

Table 12: Bump-in and bump-out phase impacts and mitigation

Action	**Impact**	**Nature of Impact**	**Mitigation**
Prune overhanging branches	Minor vegetation loss	Direct	Supervision; retain biomass on site
Vehicle movements	Disturbance; potential roadkill	Direct	Environmental induction & mgt systems; speed limits
Install fencing	Barrier to movement of larger terrestrial fauna	Direct	Search enclosed areas before late connection of fencing. Dismantle fencing soonest
Installation of infrastructure	Disturbance	Direct	Environmental induction & mgt systems; speed limits
Dismantle infrastructure	Disturbance	Direct	Environmental induction & mgt systems; speed limits

6.2.3 Impacts for fauna and habitats of staging events

Staging of events involves a steady inflow of patrons and staff on opening days. Vehicular access for all participants is from the Tweed Valley Way into the southern car park area. The southern car park will be used for day visitors to leave their cars and then walk north along a generally unformed pedestrian pathway, delineated by flagging and sections of barrier fencing. A limited number of people will be able to drive vehicles either across or beneath Jones Road into the event camping areas north of Jones Road. Buses and those dropping off patrons will be able to drive north to a drop off and turn around point near the gated entry to the event area.

As this inflow of people increases, the level of noise and human presence will likely alienate the event area for shy fauna. Mobile species such as Swamp Wallabies will leave the vicinity, other fauna will tend to also leave or to take shelter. For example Masked Plovers, White-faced and Pacific Herons, Ibis and Egrets of the pasture habitats will likely leave the car parking, event and camping areas in response to increasing human presence, or move into the southern 30m perimeter buffer or other available grassland habitats (~50 ha of grassland will remain outside the event, camping and parking areas). Conversely some fauna, like Butcherbirds, Crows, Ibis and Magpies will likely exploit the availability of food scraps.

Once amplified music commences and nightfall produces the need to illuminate car parking areas, roads and other areas, then a noise and lighting influence will operate within particular spaces. A gradient for reception of such stimuli from intense to imperceptible will vary for different species, focussed on the point of origin at various stages, and influenced by the prevalent climatic conditions. Effects of noise on fauna are extremely complicated and variable (Larkin, undated), see seven part tests in Appendix I.

For example, if blossoms and/or fruits are present in forest vegetation then flying-foxes which normally forage on these resources may avoid areas affected by noise. If flying-foxes land to feed prior to the onset of performance or during an interval, they then may be disturbed off the forage when music resumes. This effect will vary according to distance from the point where noise originates, and will likely cease when the noise ceases, *i.e.* at the end of the night's activities.

The Parklands site experiences a variable level of background noise emanating from the adjacent freeway and Tweed Valley Way, local aviation training, as well as from the Pacific Ocean. However the staging of any large scale musical event at the suite will bring unprecedented noise levels and a novel disturbance regime.

At the Woodford Festival in Queensland, it is observed that some native fauna are interfered with by patrons when they are encountered (Geoff Smith pers. comm. 2007). Some patrons have tendency to handle wildlife so that an Echidna or python which wanders into a camping area or event site or roadway gets picked up. While this is undoubtedly stressful to the animal, provided a fauna crew is available, or the animal is simply released into the nearest habitat, this need not be a fatal or problematic occurrence.

Principles for the use of lighting at the site are designed to minimise disturbance to habitats and fauna from lighting. Fauna impacts from artificial lighting are varied and may include avoidance (Law 1997) and exploitation of insects attracted to lights by microchiropteran bats (Rydell, in Rich and Longcore 2006). Artificial lighting has the capacity to trap and kill large numbers of nocturnal invertebrates (Frank, in Rich and Longcore 2006).

Cessation of the amplified music performance will allow the site to return to lower, near-background noise levels and presumably foraging on arboreal resources may resume. For example, flying-foxes were observed to return following noise disturbance to feed on Swamp Mahogany blossoms near a performance stage at the

Belongil Fields site during staging of the Splendour in the Grass 2008 event (Mark Robinson, Byron Shire Ecologist, pers. comm.).

During daylight hours, similar effects may operate for frugivorous and nectivorous birds. That is, wherever human presence, vehicle movements or amplified music produce disturbance effects, the resources normally exploited by these fauna may be unavailable. These effects are likely to operate for the central swamp sclerophyll forests and adjacent subcoastal floodplain forest habitats. It is not possible to precisely predict the severity of such disturbance, as species exhibit varying degrees of tolerance to humans and of habituation. At best birds will manage to find resources outside the disturbance area, or become habituated. At worst birds will leave their normal home ranges.

Birds attempting to nest close to the event areas may abandon their nests, eggs or fledglings, or may persist regardless. This is unpredictable because species and individual responses vary.

Wompoo Fruit-doves *Ptilinopus magnificus* are reported to readily abandon nests when disturbed by humans (D. Pugh, pers. comm.) while a Black-faced Cuckoo-shrike *Coracina novaehollandiae* clung to her nest and chicks while the tree was pushed over by a bulldozer (pers. obs.).

Movements of herbivorous Swamp Wallabies in pasture will be affected by the security fencing. Swamp Wallabies will likely avoid areas of high human presence in the short term, but can also become habituated over time. Movements of vehicles in and out of the site will increase the risk of roadkill for fauna, again varying according to climate and management of traffic behaviour.

Following the cessation of the event, vehicle movements will constitute both a barrier effect and a high risk of roadkill as patrons leave the site. Security fencing will be dismantled within 48-72 hours following completion of an event, and temporary infrastructure will be removed over a ~10 day period. Table 13 lists operation event phase impacts and mitigation

Table 13: Operation event phase impacts and mitigation

Action	Impact	Nature of Impact	Mitigation
Patron arrival	noise and human presence, vehicle movements, parking	Direct & indirect	Environmental induction & mgt systems; speed limits
Patron occupation of event and camping areas	noise and human presence; vehicle movements alienates grassland resources for fauna	Direct	50ha of grassland elsewhere on site remains available for fauna use.
Lighting and noise	Disturbance; avoidance; habituation; sensitisation	Direct & indirect	Environmental induction & mgt

			systems; light management; Monitoring and reporting; management response to adjust lighting and noise where problematic
Musical performances, noise light	Disruption of fauna activity near stages	Direct	Reduction /modification of noise characteristics;
Patrons handle fauna	Stress to fauna	Direct	Wildlife rescue personnel and green corps provide notification, rescue and advice
Fencing	Barrier effects	Direct & indirect	Monitor fences; dismantle ASA practicable.
Patron departure	noise and human presence, vehicle movements, parking	Direct & indirect	Environmental induction & mgt systems; speed limits

6.2.4 Impacts on threatened fauna species

The complex and variable disturbance regime described above is likely to affect fauna in different ways and to varying extents of severity. In part this depends upon the seasonally available resources at the site, but also on fauna behaviour and patterns of presence at the site. The predicted impacts for threatened fauna species known from the site are summarised in the following table. Detailed analyses of impacts for threatened fauna species are presented in 7 part tests in Appendix I. Table 14 lists impacts on threatened fauna species recorded from the site 2006-2010.

Table 14: Impacts on threatened fauna species recorded from the site 2006-2010

Common Name	**Likely Impact**	**Severity**
BIRDS		
Comb-crested Jacana	Recorded on the northern dam in 2007 and 2010. If present may be disturbed by noise & human presence at the dam	Unpredictable and time dependent: If breeding, could interfere with breeding success; otherwise likely minor disturbance causing flight behaviour and concealment.
Masked Owl	Prevent foraging in or near	Event nights only, minor

	event areas	because the species has a large range, and may forage elsewhere; no roost trees or nest trees known from the property.
Grass Owl	Prevent foraging in grassland	Alienation of the event and car park pasture areas for event nights; moderate severity; 30% of grassland (~50ha) remains outside event areas.
Rose-crowned Fruit-dove	Prevent foraging in central swamp forest	Minor; alienation of food resources in the central swamp forest
White-eared Monarch	Disturb foraging in forest adjacent to the event	Minor disturbance to foraging area
MAMMALS		
Koala	Noise and human presence may affect movement patterns in forest adjacent to the event; elevate stress levels; risk of roadkill	Low-severe. Occupied Koala habitat is outside the event area, but koala movement may involve increased risks of roadkill.
Eastern Bent-wing Bat	Disturb foraging in forest adjacent to the event	Low severity; Minor disturbance to foraging area; because forest is largely outside the event footprint
Little Bent-wing Bat	Disturb foraging in forest adjacent to the event	Low-moderate-unpredictable; Minor disturbance to foraging area; because forest is largely outside the event footprint; but a frequently used watering point is located within ~200m of a stage.
Northern Long-eared Bat	Disturb foraging in forest adjacent to the event	Low severity; Minor disturbance to foraging area; because forest is largely outside the event footprint
Blossom Bat	Disturb foraging in forest adjacent to the event if blossom crop is present	Low-unpredictable response to noise; Minor disturbance to foraging area; because forest is largely outside the event footprint
Grey headed Flying-fox	Disturb foraging in forest adjacent to the event; if blossom or fruit crops are present	May alienate resources in forest near event phenomena, but following cessation of activities nocturnal foraging may resume during the event, and immediately after.

Additional threatened fauna species are known from the property earlier (*e.g.* Square-tailed Kite *Lophoictinia isura* 2003) and species considered likely or possible occurrences at times within the application area or nearby. These are listed in Table 15.

Table 15: Impacts on threatened fauna species considered likely or possible.

Common Name	Likely Impact	Severity
BIRDS		
Australasian Bittern	Potential occurrence at the northern dam; if present may be disturbed by noise & human presence at the dam & may leave; so disruption of foraging and roost behaviour	Very low likelihood of presence, moderate severity operating for an individual or pair
Barred Cuckoo-shrike	Potential occurrence in any fruiting fig; some of which are within the event footprint; foraging may be disrupted	Low-unpredictable response to noise; known from suburban habitats; resources are present outside of but proximate to the event footprint
Black-necked Stork	Occasional potential for occurrence in large northern dam or pasture areas; therefore disruption of roost and forage behaviour	Low; resources are available elsewhere and nearby
Black Bittern	Potential occurrence at the northern dam; if present may be disturbed by noise & human presence at the dam & may leave; so disruption of foraging and roost behaviour	Moderate likelihood of presence, moderate severity operating for an individual or pair
Brolga	Potential occurrence in grassland or at the northern dam	Low; resources are available elsewhere and nearby
Bush Stone-curlew	Potential occurrence in open habitats of the site; disruption of roost and forage behaviour	Moderate severity; but not likely to be recorded on the site under the present cattle regime.
Glossy Black-cockatoo	Disruption of foraging behaviour due to human presence	Minor; food trees are present in a small area of the site , distant from the disturbance regime
Little Lorikeet	Disruption of foraging	Low; resources are

	behaviour due to human presence	available elsewhere and nearby, and lorikeets feeding high in trees by day are unlikely to be adversely affected by disturbance regime
Magpie Goose	Disruption of foraging behaviour due to human presence	Minor; low likelihood of occurrence
Osprey	Disruption of foraging behaviour due to human presence	Minor; resources of the site for osprey are minor and abundant resources available in the locality.
Pale-vented Bush-hen	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Moderate: the 30m buffer to BNR may protect the habitat potentially likely to be used by this species.
Red-backed Button-quail	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low; largely unsuitable habitat and none within the event area
Square-tailed Kite	Areas of forest habitat potentially suitable for foraging will be alienated during the festival	Low; birds have a very large home range and can resume foraging after bump-out is complete
Superb Fruit-dove	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low severity; suitable habitat is largely outside the event footprint and the species occurrence is unlikely.
Sooty Owl	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low severity; marginally suitable habitat is largely outside the event footprint and the species occurrence is unlikely.
Wompoo Fruit-dove	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low severity; suitable habitat is largely outside the event footprint
MAMMALS		
Common Planigale	Barrier effects from use of roads and presence of people; risk of roadkill; temporary for duration of the event	Low-Moderate; if the species is present then large areas of grassland will be alienated by the event and risk of roadkill is present.
Greater Broad-nosed bat	Disturbance of foraging behaviour due to human presence, noise and	Low: preferred habitat is largely outside the event footprint and lighting

	lighting	should be managed to limit impacts on microchiropteran bats.
Large-footed Myotis	Possible presence foraging at the large northern dam; potential for disturbance of foraging	Low; not yet recorded and minor probability of occurrence; large dam may be sufficiently distant from the event disturbances to remain available for foraging
Long-nosed Potoroo	Disturbance to foraging and movement behaviour from noise, human presence and traffic	Low: buffer to BNR and fencing should protect potential habitat for this species in BNR east of the car parking area.
Yellow-bellied Sheathtail Bat	Disturbance to foraging and movement behaviour from noise, human presence and traffic	Low: species occurrence is moderately probable but suitable forage habitat is abundant outside the event area

6.3 Event impacts on vegetation

Vegetation removal is not required for the conduct of events at the Parklands site. The erection of security fencing may require minor pruning of horizontal branches, and movement of fallen trees, but this will be closely monitored, quantified and reported. Security fencing will separate patrons from vegetation so that within the event area patrons cannot enter, trample or walk though most native forest blocks. Impacts on forest vegetation are therefore minor.

Even if breaches occurred where patrons littered, urinated or defecated in remnant forest within the site, the ecological significance of this effect is minor. While a risk of arson exists, the provision of fire safety officers, security personnel and fire fighting equipment at the site is assumed to be sufficient to manage this risk. Therefore the principal predictable effect on vegetation is the trampling of exotic pasture in the car park, camping and event areas.

6.3.1 Event impacts on threatened flora species

Within the event footprint and application area two threatened plants are present. A sapling Stinking Cryptocarya *Cryptocarya foetida* is located in Forest block "A" and will be protected by fencing which prevents patrons or vehicles from entering this area. Outside the event area, a Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata* is present in a small stand of forest, which is not close to any event activity, and thus which should be secure. All other threatened flora are located outside the application area and should not be adversely affected by the conduct of events, or any other aspect of the proposal.

6.3.2 Event impacts on endangered ecological communities

Endangered ecological communities of the site are listed in Section 2.2.3 and depicted in Figure 2, page 12.
Lowland rainforest and Coastal Cypress Pine forest EECs do not occur within the Application area, and are located well outside any predictable adverse impacts from events and event-related activities. Central forest blocks within the event area include swamp sclerophyll forest and sub-tropical coastal floodplain forest.

Direct impacts on EECs are largely avoided by separation of the event areas from the forest by fencing, but small blocks of swamp forest are embedded within the camping and event areas. Provided that these are barrier fenced and human incursion is minimised then no adverse effects are predicted to arise for this vegetation. The temporary removal of cattle from all event areas will provide a respite to unfenced EEC vegetation, since trampling and grazing effects will be suspended for the duration of the event including bump-in and bump-out. In the longer term staged reduction in cattle numbers will occur as forest blocks are fenced and rehabilitated

A fire management plan including provision of a water tanker and personnel allocated to fire management during any events at the site will be relied on to ensure any risk of arson is appropriately managed.

6.3.3 Relevant recovery plans
6.3.4 Threatened Fauna recovery plans

Relevant recovery plans for threatened fauna of the Parklands site include the following: Koala; Grey-headed Flying-fox; Large Forest Owls.

Large Forest Owls.
The proposal is not inconsistent with specific recovery objectives and actions of the large Forest Owl Recovery Plan. Surveys will contribute information on the patterns of occurrence of Masked Owl and any other large forest owls which occur on the Parklands site.

Grey-headed Flying-fox
A draft national recovery plan for the Grey-headed Flying-fox is under review. The proposal is not inconsistent with objectives, specific objectives or recovery actions of the draft national recovery plan. Plantings at Parklands already established include important fruiting and blossom producing species for the Grey-headed Flying-fox. Extensive future plantings and restoration of tree cover at the Parklands site will contribute increased habitat for the Grey-headed Flying-fox.

Grey-headed Flying-foxes will be monitored during events and event-related activities.

Koala
The proposal is not inconsistent with plan objectives, specific objectives or recovery actions of the draft Koala Recovery Plan. However, the development of a KPoM for the Parklands site and proposal, and careful implementation of preventative and

mitigatory management measures will be essential to conserve the local apparently declining Koala population.

6.3.5 Flora

Relevant recovery plans for the threatened flora of the Parklands site include the following:

Davidson's Plum
The proposal is not inconsistent with recovery objectives for the Davidson's Plum. Plants at Parklands are located outside the application area, and outside any predictable impacts from the proposal. Davidson's Plums are currently monitored and will be actively managed in the event of any threats from invasive plants.

Green-leaved Rose Walnut
The proposal is not inconsistent with recovery objectives for the Green-leaved Rose Walnut. Plants at Parklands are located within (1) and outside (1) outside the application area. Both are located outside any predictable impacts from the proposal. Green-leaved Rose Walnuts are currently monitored and will be actively managed in the event of any threats from invasive plants. See seven part tests in Appendix I for more detailed discussion of all threatened species, potential impacts and significance of impacts.

Threatened flora located outside the application area will be monitored and seed will be collected to establish an insurance population elsewhere on the property. A Section 132C licence under the National Parks and Wildlife Act 1974 will be required for this work.

9.2 Assess any potential direct or indirect impacts of the development on any wetland areas within or surrounding the site. Particular consideration should be given to SEPP 14 wetland no. 57.

7.0 Impacts on wetlands, SEPP 14 Wetland #57

While portions of grazed pasture are occasionally flooded, the only wetland of relevance to the proposal is the SEPP 14 wetland. SEPP 14 wetland No. 57 is entirely enclosed within Billinudgel Nature Reserve (BNR), and adjoins the southern portion of the Parklands property, designated as the southern car parking area.

Within the Nature Reserve in this area, the vegetation is swamp sclerophyll forest with extensive Camphor Laurel stands adjacent to the boundary fence, infested in areas with Lantana *Lantana camara*. Further within the reserve Broad-leaved Paperbark *Melaleuca quinquenervia* dominates, and the swamp forest is less weedy (pers. obs, 2009).

This area of Parklands is currently grazed pasture by cattle, however exclusion of cattle from the 30m buffer will result in the growth of pasture species (mainly South African Pigeon Grass *Setaria sphacelata* and Giant Paspalum *Paspalum urvillei*) and

other groundlayer vegetation. To achieve this vegetated buffer, an existing internal fence will be used to exclude cattle from the eastern ~25% of the southern car parking area. The internal edge of the 30m buffer from the BNR boundary fence will be delineated with flagging and the internal non-buffer grasslands will be slashed. This will provide an interception structure for run-off or minor flooding and will also deter human movement into the Nature Reserve.

Potential impacts in BNR from use of the southern car park area include pollution from runoff, littering and the risk of fire from arson. However, direct impacts on the SEPP 14 Wetland are considered unlikely. Indirect effects will include disturbance to fauna from human activity on the site during event parking. This will likely include disturbance of grassland fauna such as Masked Plovers, Magpies, Australasian Pipits, and Maned Ducks, as well as potential disturbance to foraging Swamp Wallabies. However, most parking activity is remote from the interface between the Parklands boundary and the Nature Reserve.

Impacts on fauna are mainly limited to temporary disturbance by parking activities in closely grazed pasture. While this includes the risk of roadkill of common terrestrial species, none of these impacts described are considered likely to affect the SEPP 14 wetland, either physically or by affecting biodiversity or ecosystem processes.

A fire management plan including provision of a water tanker and personnel allocated to fire management during any events at the site will be relied on to ensure any risk of arson is appropriately managed.

Multi-purpose spill kits will be available for any oil leakages from cars.

9.3 Assess any potential direct or indirect impacts of the development on any endangered ecological communities within or surrounding the site.

8.0 Impacts on endangered ecological communities

Endangered ecological communities of the site are listed in Section 2.2.3 and depicted in Figure 2, page 12.

Coastal Cypress Pine forest is located well outside any predictable impacts from events and event-related activities, is fenced and is being rehabilitated. Lowland Rainforest EEC is mainly located outside the application area in the west of the site. A small and weed-infested area of regenerating lowland rainforest is present on slopes south of Jones Rd. where minor tree removal is required for the underpass (32 native trees; 27 camphor Laurel) or at grade crossing (44 native trees, 21 Camphor Laurel). Twenty trees (10 native, 10 Camphor Laurel) are to be removed for road widening and construction of gate 'S'. See Table 18 for details.

Swamp sclerophyll forest and sub-tropical coastal floodplain forest EECs dominate central forest blocks within the application area.

Direct impacts on EECs within the application area are largely avoided by separation of the event areas from the forest by barrier fencing during events. Small blocks of swamp forest EEC (#4, 5 & 52) are embedded within the camping and event areas. Provided that these are barrier fenced and human incursion is minimised then no adverse effects are predicted to arise for this vegetation. The temporary removal of cattle from all event areas will provide a respite to normally unfenced EEC vegetation, since trampling and grazing effects will be suspended for the duration of the event, including bump-in and bump-out. In the longer term staged reduction in cattle numbers will occur as forest blocks are fenced and rehabilitated.

No EECs outside the site are considered likely to be affected by the proposal. Swamp sclerophyll forest in Billinudgel Nature Reserve (BNR) will be protected by a vegetated 30m buffer from parking activities in the southern part of the Parklands site. A co-operative management arrangement between Parklands management and DECCW will address issues of potential human incursion into the BNR during event times.

See Appendix I for seven part tests for all endangered ecological communities of the site.

9.4 Describe any actions that will be taken on order to avoid or mitigate impacts the proposal may have on any threatened species.

9.0 Mitigation of impacts on threatened species

Predicted impacts of the proposal on threatened fauna species are described in Section 6.2.4. These include disturbance of fauna from event activities: noise, human presence, lighting, vehicular and pedestrian traffic. Threatened fauna species present on the site during events will vary seasonally and according to the presence of key food resources.

Actions taken to avoid and mitigate impacts for these species include: limited activity on the site (8 large event days in year 1 and no more than 12 large event days annually in subsequent years of operation); plantings to screen southern margins of the large northern dam, tree plantings to restore habitat connectivity and increase overall tree cover at the site; traffic management to reduce the risk of roadkill; management of lighting to avoid illumination of any forest habitats, and monitoring to identify levels of fauna presence, alterations in abundance during events, and to develop adaptive strategies to minimise impacts.

Consideration of impacts for threatened species precautionarily includes species whose presence on the site during any event is considered of low likelihood. Monitoring is nominated as part of mitigation because improved recognition of the nature of impacts should lead to better management of disturbance regimes. Processes of habituation and sensitisation of fauna to particular elements of the disturbance regime are unpredictable, and will be informed by monitoring.

Detailed analysis of impacts on particular threatened species is found in 7 part tests provided in Appendix I.

Impact mitigation measures for particular threatened species are listed in the following tables. Table 15 refers to threatened fauna species recorded from the site from 2006-2010. Table 16 refers to threatened fauna species, either recorded prior to 2006 or considered possible occurrences at the site.

Table 16: Impacts & mitigation for threatened fauna species recorded on Parklands 2006-2010

Common Name	Likely Impact	Mitigation
BIRDS		
Comb-crested Jacana	If present may be disturbed by noise & human presence at the dam	Limited major event days ; screen planting at the dam
Masked Owl	Prevent foraging in or near event areas	Limited major event days & nights
Grass Owl	Prevent foraging in grassland in the event and car park areas during events	Limited major event days & nights; ~50Ha of grassland remains outside event areas.

Rose-crowned Fruit-dove	Prevent foraging in central swamp forest	Limited major event days & nights; plantings include known food plants for the species; increase in area of forest at the site
White-eared Monarch	Disturb foraging in forest adjacent to the event	Limited major event days & nights; plantings will increase area of forest at the site
MAMMALS		
Koala	Noise and human presence may affect movement patterns in forest adjacent to the event; elevate stress levels; risk of roadkill	Avoid any activities near core koala habitat if this is present in the application area; Traffic plan to control vehicle movements; limited major event days; increase in tree cover at the site will improve connectivity for the Koala
Eastern Bent-wing Bat	Disturb foraging in forest adjacent to the event	Limited major event days & nights; avoid illumination of forest habitat; targetted monitoring
Little Bent-wing Bat	Disturb foraging in forest adjacent to the event	Limited major event days & nights; avoid illumination of forest habitat; targetted monitoring
Northern Long-eared Bat	Disturb foraging in forest adjacent to the event	Limited major event days & nights; avoid illumination of forest habitat; targetted monitoring
Blossom Bat	Disturb foraging in forest adjacent to the event if blossom crop is present	Limited major event days & nights; avoid illumination of forest habitat; targetted monitoring
Grey headed Flying-fox	Disturb foraging in forest adjacent to the event; if blossom or fruit crops are present	Limited major event days & nights; avoid illumination of forest habitat; targetted monitoring

Predicted impacts of the proposal on threatened flora species are described in Section 6.3.1. A sapling Stinking Cryptocarya *Cryptocarya foetida* located in Forest block "A" will be protected by fencing, a Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata* present in a small stand of forest, far from any event activity, will be protected by barrier fencing before any construction takes place on the site. Threatened flora located outside the application area will be monitored and seed will be collected to establish an insurance population elsewhere on the property. A

Section 132C licence will be required for this work, under the national parks and Wildlife Act 1974.

Table 17: Threatened fauna species and mitigation likely or possible occurrences

Common Name	Likely Impacts	Mitigation
BIRDS		
Australasian Bittern	Potential occurrence at the northern dam; if present may be disturbed by noise & human presence at the dam & may leave; so disruption of foraging and roost behaviour	Limited major event days & nights; screen planting at the dam
Barred Cuckoo-shrike	Potential occurrence in any fruiting fig; some of which are within the event footprint; foraging may be disrupted	Limited major event days; Forested habitats are largely excluded from human activity
Black-necked Stork	Occasional potential for occurrence in large northern dam or pasture areas; therefore disruption of roost and forage behaviour	Limited major event days; screen plantings at the large northern dam
Black Bittern	Potential occurrence at the northern dam; if present may be disturbed by noise & human presence at the dam & may leave; so disruption of foraging and roost behaviour	Limited major event days; screen plantings at the large northern dam
Brolga	Potential occurrence in grassland or at the northern dam	Limited major event days; screen plantings at the large northern dam
Bush Stone-curlew	Potential occurrence in open habitats of the site; disruption of roost and forage behaviour	Limited major event days; forested habitats largely excluded from human activity
Glossy Black-cockatoo	Disruption of foraging behaviour due to human presence	Limited major event days; No other mitigation required as only likely occurrences well outside application area and event footprint
Little Lorikeet	Disruption of foraging behaviour due to human presence	Limited major event days; forested habitats largely excluded from human activity; food plants included in plantings

Magpie Goose	Disruption of foraging behaviour due to human presence	Limited major event days; screen plantings at the large northern dam
Osprey	Disruption of foraging behaviour due to human presence	Limited major event days; screen plantings at the large northern dam
Pale-vented Bush-hen	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Limited major event days; screen plantings at the large northern dam; establishment of a 30m vegetated buffer to Billinudgel Nature Reserve in the south of the site.
Red-backed Button-quail	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Limited major event days; establishment of a 30m vegetated buffer to Billinudgel Nature Reserve in the south of the site.
Square-tailed Kite	Areas of forest habitat potentially suitable for foraging will be alienated during the festival	Limited major event days; forested habitats largely excluded from human activity; plantings will increase tree cover and prey abundance
Superb Fruit-dove	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Limited major event days; forested habitats largely excluded from human activity; plantings will increase tree cover
Sooty Owl	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Limited major event days; forested habitats largely excluded from human activity; plantings will increase tree cover
Wompoo Fruit-dove	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Limited major event days; forested habitats largely excluded from human activity; plantings will increase tree cover
MAMMALS		
Common Planigale	Barrier effects from use of roads and presence of people; risk of roadkill; temporary for duration of the event	Limited major event days; traffic plan; establishment of a 30m vegetated buffer to Billinudgel Nature Reserve in the south of the site.
Greater Broad-nosed bat	Disturbance of foraging	Limited major event days

	behaviour due to human presence, noise and lighting	& nights; avoid illumination of forest habitat; targetted monitoring
Large-footed Myotis	Possible presence foraging at the large northern dam; potential for disturbance of foraging	Limited major event days & nights; screen plantings at the large northern dam
Long-nosed Potoroo	Disturbance to foraging and movement behaviour from noise, human presence and traffic	Limited major event days; traffic plan; establishment of a 30m vegetated buffer to Billinudgel Nature Reserve in the south of the site.
Yellow-bellied Sheathtail Bat	Disturbance to foraging and movement behaviour from noise, human presence and traffic	Limited major event days & nights; avoid illumination of forest habitat; targetted monitoring

A sixth threatened flora species, not addressed or mapped above was located on the Parklands property on June 5th 2010. Three Rough-shelled Bush-nut trees *Macadamia tetraphylla* and a seedling were found in the extreme northwestern corner of the property, well outside any impact from the operation of Parklands as a cultural events site. An assessment of potential impacts for this species from a water management system proposed for the site is provided in Appendix K.

9.5 Given the presence of core koala habitat across the site a comprehensive Koala Plan of Management is to be prepared.

10.0 Preparation of a Koala Plan of Management

State Environmental Planning Policy No. 44 Koala Habitat Protection

Commenced on February 13th 1995

This policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and to reverse the current trend of koala population decline:
(a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat; and
(b) by encouraging the identification of areas of core Koala habitat; and
(c) by encouraging the inclusion of areas of core koala habitat in environmental protection zones.

In this policy
"core koala habitat " means an area of land with a resident koala population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population;
" guidelines" means the guidelines as in force from time to time, made for the purposes of the policy by the Director;
" potential koala habitat" means areas of native vegetation where the trees of the types listed in Schedule 2 of the policy constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

Land to which this policy applies
This policy applies to each local government area listed in Schedule 1 of the policy.

10.1 Parklands Koala Assessment results

A Koala habitat assessment in 2007 recorded a small area of core Koala habitat in the central east of the Parklands site outside the current Application Area (Biolink 2007 see Appendix H). A Koala Plan of Management was accordingly prepared, based on staging SITG in 2008. A subsequent koala habitat assessment in 2008 (See Appendix H) recorded significantly lower levels of koala activity and the disappearance of core Koala habitat from the Parklands site (Biolink 2008).

Given the demonstrated dynamic nature of core Koala habitat at the Parklands site, it is proposed to defer the completion of a further KPoM until a contemporary assessment of Koala habitat is undertaken in late 2010 or early 2011. Given observed fluctuations in Koala presence over this time period, it is considered that it is important to use the most up-to-date information to develop optimal strategies for managing koalas at the site.

The updated KPoM will also address the operation of Parklands as an ongoing events site.

9.6 Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land.

11.0 Wildlife corridors and connective habitat values

The Cleland Commission of Inquiry (1997, page 35) states:

"The evidence before the Inquiry does not establish scientifically that the Jones Road land is part of a wildlife corridor. Neither can the evidence be construed as indicating that the Jones Road land does not have wildlife values. It clearly does have wildlife corridor values".

In the contemporary local landscape it is likely that all forested vegetation contributes to movement opportunities for non-flying fauna, because of the effects of historical clearing, of fragmentation of native vegetation, of the numbers of dogs present and the presence of a four lane divided freeway immediately to the west of the site with ~19kms of fauna exclusion fencing. Movement across this freeway by terrestrial fauna can only be safely accomplished through a series of dedicated fauna crossing structures, which are key features in establishing east to west connectivity in the locality. Tree plantings have already been established by Parklands to improve connectivity between the swamp forest habitats of Billinudgel Nature Reserve and habitats of the Parklands property with these culverts.

Within the Parklands site extensive grazed pasture also likely constrains movement of some terrestrial forest fauna. However the presence of native terrestrial fauna (*e.g.* Brown Antechinus *Antechinus stuartii*) in isolated central swamp forest blocks suggests that fauna are still able to move between forest patches, most likely at times when pasture grasses provide some cover, or along vegetated drains.

Under closely grazed conditions high risks of predation are likely when terrestrial fauna attempt to move between forest patches. For example analysis of dog scats from Parklands reveals likely predation on Northern Brown Bandicoot *Isoodon macrourus* and Swamp Wallaby *Wallabia bicolor*. Therefore opportunities for movement between forested habitats are important for habitat connectivity, as is restoration of groundlayer vegetation within forest patches.

Parklands management has adopted the mapped wildlife corridors from the Byron Biodiversity Conservation Strategy (2004) as areas to be dedicated to restoration of tree cover. Future plantings and assisted regeneration in these areas will significantly increase opportunities for movement of terrestrial fauna. The Ecological Structure Plan illustrates planned plantings of 11ha of new full habitat, and 48ha of managed parkland plantings. Staged exclusion of cattle by fencing of central swamp sclerophyll forest blocks will also assist with connectivity for terrestrial fauna by allowing the development of groundlayer and mid-layer vegetation and by providing additional shelter and food resources. Deployment of nestboxes will assist habitat connectivity for gliders by providing shelter sites in areas with low natural hollow abundance.

The draft Vegetation Management and Biodiversity Plan (Appendix M) will direct restoration of habitats and of tree cover in the site.

9.7 Address measures to protect and manage the riparian corridor both within and adjacent to the site. Any proposed works within the riparian areas should be outlined in the EA.

12.0 Riparian corridor management

Floodplain areas on Parklands support networks of man-made drains, and several dams, but the principal riparian habitat on the site is Yelgun Creek in the southern cattle grazing and occasional car parking area. This watercourse has been adversely modified by previous owners and a restoration order to rectify damage was imposed on a previous owner.

A rehabilitation plan for the modified section of Yelgun Creek has been prepared and is attached as Appendix J. Actions include fencing the riparian zone, establishing a secure crossing point, removal of weeds and establishment of native riparian vegetation and habitats. Note that in the proposed landscaping species list, *Casuarina cunninghamiana* will be replaced by local *C. glauca*.

Small sections of unnamed natural watercourses are present outside the event footprint in the west of the site. These areas are mainly embedded within forest which will ultimately be rehabilitated and fenced to exclude cattle. A new dam to provide potable water is proposed in an area of degraded riparian pasture habitat: see Appendix K.

Drains of the site support fauna and contribute to dispersal of aquatic biota. This includes pest species (carp, mosquito fish), but also freshwater turtles (Eastern Long-necked Turtle *Chelodina longicollis*). Drains will at present be maintained to serve their intended purpose. Drain crossings will be protected from sediment intrusion during event activities by implementation of standard sediment interception strategies, which will be monitored and audited.

9.8 The proposed car parking area to the south of the site is in close proximity to the Billinudgel Nature Reserve. Indicate what measures will be undertaken to prevent weed infestation and toxic runoff into the reserve. An appropriate buffering distance should be identified between the Reserve and proposed southern car park.

13.0 Buffering to Billinudgel nature Reserve

Billinudgel Nature Reserve (BNR) adjoins the southern portion of the Parklands property, designated as the southern car parking area. Within the Nature Reserve in this area, the vegetation is swamp sclerophyll forest with extensive Camphor Laurel stands adjacent to the boundary fence, infested in areas with Lantana *Lantana camara*. Further within the reserve Broad-leaved Paperbark *Melaleuca quinquenervia* dominates, and the swamp forest is less weedy (pers. obs, 2009). Thus an edge effect already operates for BNR in this area.

This part of Parklands is currently grazed pasture by cattle, however exclusion of cattle from the 30m buffer will result in the growth of pasture species (mainly South African Pigeon Grass *Setaria sphacelata* and Giant Paspalum *Paspalum urvillei*) and other groundlayer vegetation. While this is exotic vegetation it has also desirable structural characteristics, with dense stands of grass considered effective at intercepting sediment and other runoff in the case of flooding. A 30m wide stand of tall grassland will also provide forage resources for the threatened Grass Owl, and sheltering habitat for small terrestrial fauna.

To achieve this vegetated buffer, an existing internal fence will be used to exclude cattle from the eastern ~25% of the southern car parking area. The internal edge of the 30m buffer from the BNR boundary fence will be delineated with flagging and the internal non-buffer grasslands will be periodically slashed. This buffer will provide an interception structure for run-off or minor flooding and will also deter human movement into the Nature Reserve.

Potential impacts in BNR from use of the southern car park area include pollution from runoff, littering and the risk of fire from arson. However, direct impacts on the BNR are considered unlikely. Indirect effects will include disturbance to fauna from human activity on the site during event parking.

A fire management plan including provision of a water tanker and personnel allocated to fire management during any events at the site will be relied on to ensure any risk of arson is appropriately managed.

9.9 Outline measures to protect and manage proposed habitat areas and managed parklands.

14.0 Management of habitat areas and managed parklands

A draft Vegetation Management and Biodiversity Plan (Appendix M) directs the fencing, weed removal, planting and protection of designated pasture areas to restore forest vegetation and connectivity of habitats on the site. These 'full habitat' plantings to the north and south of Jones Road are designed to improve east-west connectivity. 'Full habitat' is a management zone which includes existing forest vegetation on the site and areas where native vegetation will be restored, as indicated in the ecological structure plan, and *e.g.* in Yelgun Creek restoration.

Plantings in 'full habitat' restoration areas will comprise locally sourced native species to develop plant communities similar to those existing on the site. A flora species list for the site (Appendix A), site topography, extant native community assemblages and structure, and predictions of species succession dynamics are used as a basis for selection of species for planting.

Plantings initially comprise a mixture dominated by suitable primary and pioneer species with fewer secondary and mature phase species. Plantings are fenced and treated with herbicides and slashed where practicable to assist establishment. Naturally occurring native seedlings are cultivated wherever practicable in a process of assisted regeneration.

'Managed parklands' describes areas where plantings to restore tree cover will take place, but where some event-related activities (*e.g.* camping, parking) can also take place. These will also mainly comprise native local plant species of local provenance. In the longer term a nursery and local seed collection will be developed on the site.

'Managed parklands' will vary in tree density, species selection, internal spacing and maintenance regimes to ensure that multiple uses can take place. Typically plantings within event and camping areas will include widely spaced clusters to provide shade and aesthetic value. In the southern car parking area rows and clusters of trees will be planted to permit sufficient car parking and safe vehicle movements.

The draft Vegetation Management and Biodiversity Plan incorporates relevant elements of a preliminary vegetation management plan and an earlier Biodiversity Conservation Management Plan (Fitzgerald 2009) to direct development of full habitat and managed parklands plantings at the site. The VMBP addresses management of weeds and fencing associated with staged removal of cattle from forest blocks within the central event areas of the site. The draft VMBP will be updated to also include provisions of a third round of Koala surveys and an updated Koala Plan of Management in 2010-2011, as well as feedback from fauna monitoring in 2010-2011.

9.10 Provide details on any proposed offset measures for the loss of biodiversity. Biodiversity offsets should be consistent with DECCW's *Principles for the use of Biodiversity Offsets in NSW*.

15.0 Proposed offset measures for the loss of biodiversity

Biodiversity offsets are required where a loss of biodiversity is expected. As far as can be predicted the first year of activity of the proposal is not likely to entail a net loss of biodiversity. There may be changes to patterns of biodiversity at the site arising from the operation of the cultural events. Changes also occur because ecological factors are in a state of change; including for example managed removal of weed and pest species, managed and natural increases in the amount of native vegetation present, broader scale landscape modification, seasonal and climatic variation.

Impacts on biodiversity of operating the event site include some unpredictability, because the disturbance regime is unprecedented for the site, and because fauna responses may include unpredicted behaviours. A program of monitoring is designed to increase baseline data on patterns of abundance of target groups so that impact assessment can include comparisons of pre- during- and post-event patterns of faunal occurrence.

The proposal entails a minor loss of weed-affected native vegetation to construct either an underpass, or at grade crossing of Jones Road and to widen Jones Road, but includes diverse and significant compensatory measures including: including dedication of lands to DECCW, a substantial on-site increase in native vegetation and tree cover, on-going weed removal, provision, maintenance and monitoring of nest boxes, on-going fauna monitoring and management and liaison with DECCW to manage potential impacts to BNR during events and event related activities.

Plantings of 7400 trees at the site since 2007 have already contributed resources (blossom, shelter, forage substrate) for fauna, and contributed to local ecosystem function.

Limits to the number of large event days (maximum 8 days in year 1 and 12 days subsequently) means that non-event days substantially dominate the annual cycle, providing time for 'normal' ecosystem processes, for post-disturbance recovery and for local rehabilitation of habitats to occur.

11. Off site impacts

11.1 The concept plan is located adjacent to the Billinudgel Nature Reserve. Address any direct and/or indirect impacts of the project where it adjoins this land.

16.0 Impacts on Billinudgel Nature Reserve

Billinudgel Nature Reserve (BNR) adjoins the southern portion of the Parklands property, designated as the southern car parking area. This area is proposed to be used periodically (3-4 times annually) for car parking for large scale events. Impacts associated with the use of the car park include grazing of cattle; marking out of car park spaces and internal access; parking and therefore trampling of pasture, potentially also including littering and minor oil leaks from parked cars.
All of the physical impacts of operating the car park will be confined within the Parklands site and at least 30m distant from the BNR lands.

Within the Nature Reserve in this area, the vegetation is swamp sclerophyll forest with extensive Camphor Laurel stands adjacent to the boundary fence, infested in areas with Lantana *Lantana camara*. Further within the reserve Broad-leaved Paperbark *Melaleuca quinquenervia* dominates, and the swamp forest is less weedy (pers. obs, 2009). Thus an edge effect already operates for BNR vegetation in this area.

This part of Parklands is currently grazed pasture by cattle, however exclusion of cattle from the 30m buffer will result in the growth of pasture species (mainly South African Pigeon Grass *Setaria sphacelata* and Giant Paspalum *Paspalum urvillei*) and other groundlayer vegetation. While this is exotic vegetation it has also desirable structural characteristics, with dense stands of grass considered effective at intercepting sediment and other runoff in the case of low-level flooding. A 30m wide stand of tall grassland will also provide forage resources for the threatened Grass Owl, and sheltering habitat for small terrestrial fauna.

To achieve this vegetated buffer, an existing internal fence will be used to exclude cattle from the eastern ~25% of the southern car parking area. The internal edge of the 30m buffer from the BNR boundary fence will be delineated with flagging and the internal non-buffer grasslands will be periodically slashed. This buffer will provide an interception structure for run-off or minor flooding and will also deter human movement into the Nature Reserve.

Potential impacts in BNR from use of the southern car park area include pollution from runoff, littering and the risk of fire from arson. However, direct impacts on the BNR are considered unlikely. Indirect effects will include disturbance to fauna from human activity on the site during event parking.

A fire management plan including provision of a water tanker and personnel allocated to fire management during any events at the site will be relied on to ensure any risk of arson is appropriately managed.

Table 18: Tree removal register

No.	Common Name	DBH	Stems	Count	design element
1	Sweet Pittosporum	25	1	1	At grade
2	Brown Kurrajong	25	1	1	At grade
3	Camphor Laurel*	14	1	1	At grade
4	Camphor Laurel*	21	1	1	At grade
5	Sweet Pittosporum	18	1	1	At grade
6	Creek Lilly-pilly	22	2	1	At grade
7	Guioa	12	1	1	At grade
8	Brush Ironbark Wattle	60	2	1	At grade
9	Willow Bottlebrush	5	1	1	At grade
10	Willow Bottlebrush	30	1	1	At grade
11	Brush Ironbark Wattle	9	1	1	At grade
12	Brush Ironbark Wattle	45	1	1	At grade
13	Willow Bottlebrush	24	1	1	At grade
14	Sweet Pittosporum	25	4	1	At grade
15	Brush Ironbark Wattle	35	1	1	At grade
16	Camphor Laurel*	50	1	1	At grade
17	Camphor Laurel*	65	1	1	At grade
18	Camphor Laurel*	30	1	1	At grade
19	Camphor Laurel*	30	2	1	At grade
20	Camphor Laurel*	38	1	1	At grade
21	Willow Bottlebrush	50	1	1	At grade
22	Brush Ironbark Wattle	35	1	1	At grade
23	Cheese Tree	19	1	1	At Grade and underpass
24	Creek Lilly-pilly	7	1	1	At Grade and underpass
25	Creek Lilly-pilly	10	1	1	At Grade and underpass
26	Camphor Laurel*	33	1	1	At Grade and underpass
27	Camphor Laurel*	9	1	1	At Grade and underpass
28	Camphor Laurel*	16	1	1	At Grade and underpass
29	Camphor Laurel*	12	1	1	At Grade and underpass
30	Camphor Laurel*	9	1	1	At Grade and underpass
31	Camphor Laurel*	24	2	1	At Grade and underpass
32	Creek Lilly-pilly	125	9	1	At Grade and underpass
33	Sweet Pittosporum	16	1	1	At Grade and underpass
34	Guioa	20	1	1	At Grade and underpass
35	Creek Lilly-pilly	95	8	1	At Grade and underpass
36	Guioa	12	2	1	At Grade and underpass
37	Camphor Laurel*	16	2	1	At Grade and underpass
38	Scrub Turpentine	22	1	1	At Grade and underpass
39	Umbrella Cheese Tree	45	1	1	At Grade and underpass

40	Guioa	20	1	1	At Grade and underpass
41	Camphor Laurel*	28	4	1	At Grade and underpass
42	Camphor Laurel*	80	2	1	At Grade and underpass
43	Brush Ironbark Wattle	22	1	1	At Grade and underpass
44	Scrub Turpentine	18	1	1	At Grade and underpass
45	Guioa	16	1	1	At Grade and underpass
46	Celerywood	13	1	1	At Grade and underpass
47	Camphor Laurel*	15	1	1	At Grade and underpass
48	Guioa	10	1	1	Underpass
49	Scentless Rosewood	18	1	1	At Grade and underpass
50	Pink Euodia	18	1	1	At Grade and underpass
51	Pink Euodia	28	1	1	At Grade and underpass
52	Pink Euodia	20	1	1	At Grade and underpass
53	Umbrella Cheese Tree	17	1	1	At Grade and underpass
54	Camphor Laurel*	20	2	1	At Grade and underpass
55	Sweet Pittosporum	14	1	1	At Grade and underpass
56	Guioa	14	1	1	At Grade and underpass
57	Pink Euodia	32	1	1	At Grade and underpass
58	Umbrella Cheese Tree	32	1	1	At Grade and underpass
59	Camphor Laurel*	16	1	1	At Grade and underpass
60	Pink Euodia	22	1	1	At Grade and underpass
61	Camphor Laurel*	16	1	1	At Grade and underpass
62	Sally Wattle	43	1	1	At Grade and underpass
63	Camphor Laurel*	19	3	1	At Grade and underpass
64	Pink Euodia	9	1	1	At Grade and underpass
65	Rough Tree Fern	13	1	1	At Grade and underpass
66	Cheese Tree	32	1	1	Underpass
67	Guioa	22	1	1	Underpass
68	Umbrella Cheese Tree	17	1	1	Underpass
69	Camphor Laurel*	16	2	1	Underpass
70	Camphor Laurel*	320	7	1	Underpass
71	Camphor Laurel*	32	2	1	Underpass
72	Willow Bottlebrush	22	1	1	Gate S and road widening
73	Umbrella Cheese Tree	18	1	1	Gate S and road widening
74	Camphor Laurel*	30	2	1	Gate S and road widening
75	Sweet Pittosporum	16	1	1	Gate S and road widening
76	Camphor Laurel*	30	2	1	Gate S and road widening
77	Red Ash	25	1	1	Gate S and road widening
78	Camphor Laurel*	60	2	1	Gate S and road widening
79	Camphor Laurel*	62	4	1	Gate S and road widening
80	Camphor Laurel*	60	2	1	Gate S and road widening
81	Camphor Laurel*	35	1	1	Gate S and road widening

82	Camphor Laurel*	35	1	1	Gate S and road widening
83	Umbrella Cheese Tree	65	2	1	Gate S and road widening
84	Camphor Laurel*	90	1	1	Gate S and road widening
85	Camphor Laurel*	85	2	1	Gate S and road widening
86	Camphor Laurel*	45	1	1	Gate S and road widening
87	Camphor Laurel*	240	5	1	Gate S and road widening
88	Camphor Laurel*	90	2	1	Gate S and road widening
89	Camphor Laurel*	140	4	1	Gate S and road widening
90	Camphor Laurel*	200	4	1	Gate S and road widening
91	Camphor Laurel*	28	1	1	Gate S and road widening
92	Camphor Laurel*	30	2	1	Gate S and road widening
93	Camphor Laurel*	15	1	1	Gate S and road widening
94	Tallowwood	45	2	1	Gate S and road widening
95	Forest Oak	35	1	1	Gate S and road widening
96	Forest Oak	30	2	1	Gate S and road widening
97	Stag/stump	30	1	1	Gate S and road widening
98	Northern Grey Ironbark	12	1	1	Gate S and road widening

Species summary

Common Name	**Scientific Name**	
Brown Kurrajong	*Commersonia bartramia*	1
Brush Ironbark Wattle	*Acacia disparrima*	6
Camphor Laurel*	*Cinnamomum camphora*	41
Celerywood	*Polyscias elegans*	1
Cheese Tree	*Glochidion ferdinandi*	2
Creek Lilly-pilly	*Acmena smithii*	5
Forest Oak	*Allocasuarina torulosa*	2
Guioa	*Guioa semiglauca*	8
Northern Grey Ironbark	*Eucalyptus siderophloia*	1
Pink Euodia	*Melicope elleryana*	6
Red Ash	*Alphitonia excelsa*	1
Rough Tree Fern	*Cyathea australis*	1
Sally Wattle	*Acacia melanoxylon*	1
Scentless Rosewood	*Synoum glandulosum*	1
Scrub Turpentine	*Rhodamnia rubescens*	2
Species unknown	stag /stump	1
Sweet Pittosporum	*Pittosporum undulatum*	6
Tallowwood	*Eucalyptus microcorys*	1
Umbrella Cheese Tree	*Glochidion sumatranum*	6
Willow Bottlebrush	*Callistemon salignus*	5
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See also references to all Appendices provided in Appendix N.

Appendix A

Vegetation mapping,

ecological characteristics

of central forest blocks

and flora species list.

Parklands-Application No. 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

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See Appendix G for Kooyman vegetation report (2009)

CONTENTS

FIGURES

TABLES

Figure 1: Central forest blocks (“A - P”) of the site. GA, GB and GC are pasture areas

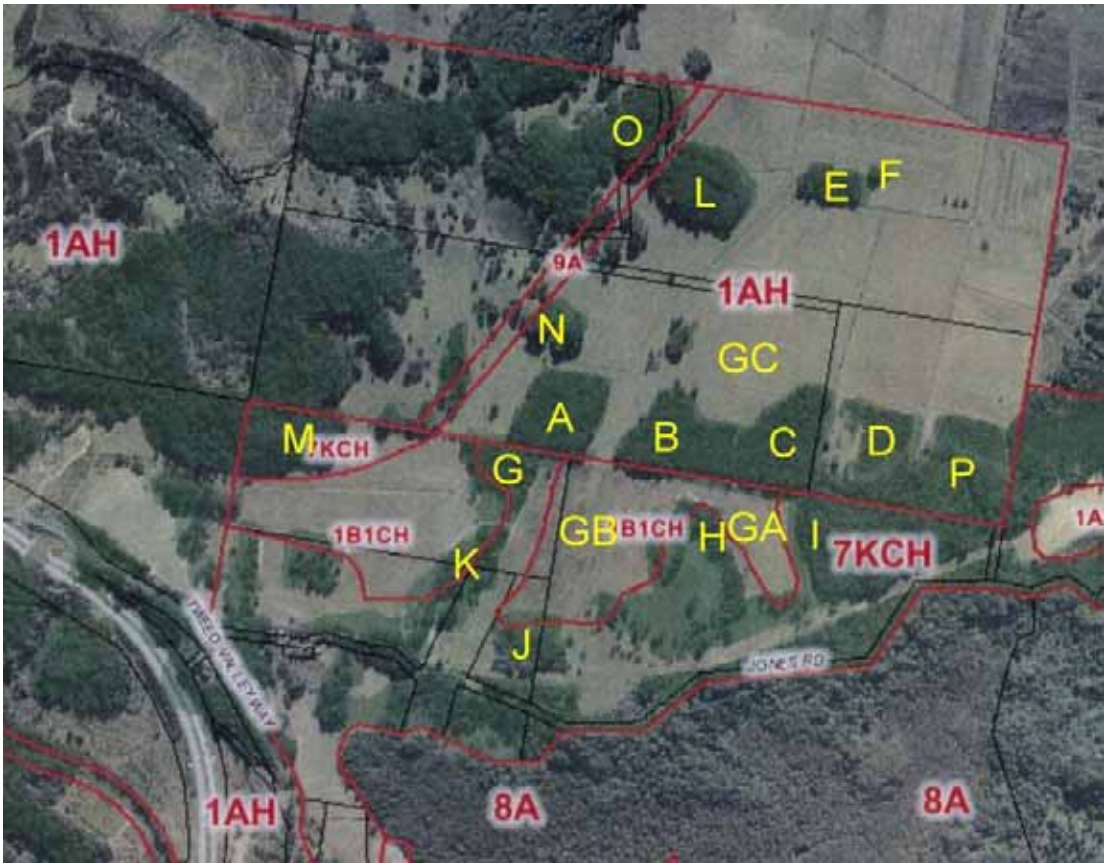


Table 1: Summary of vegetation and ecological characteristics of central forest blocks

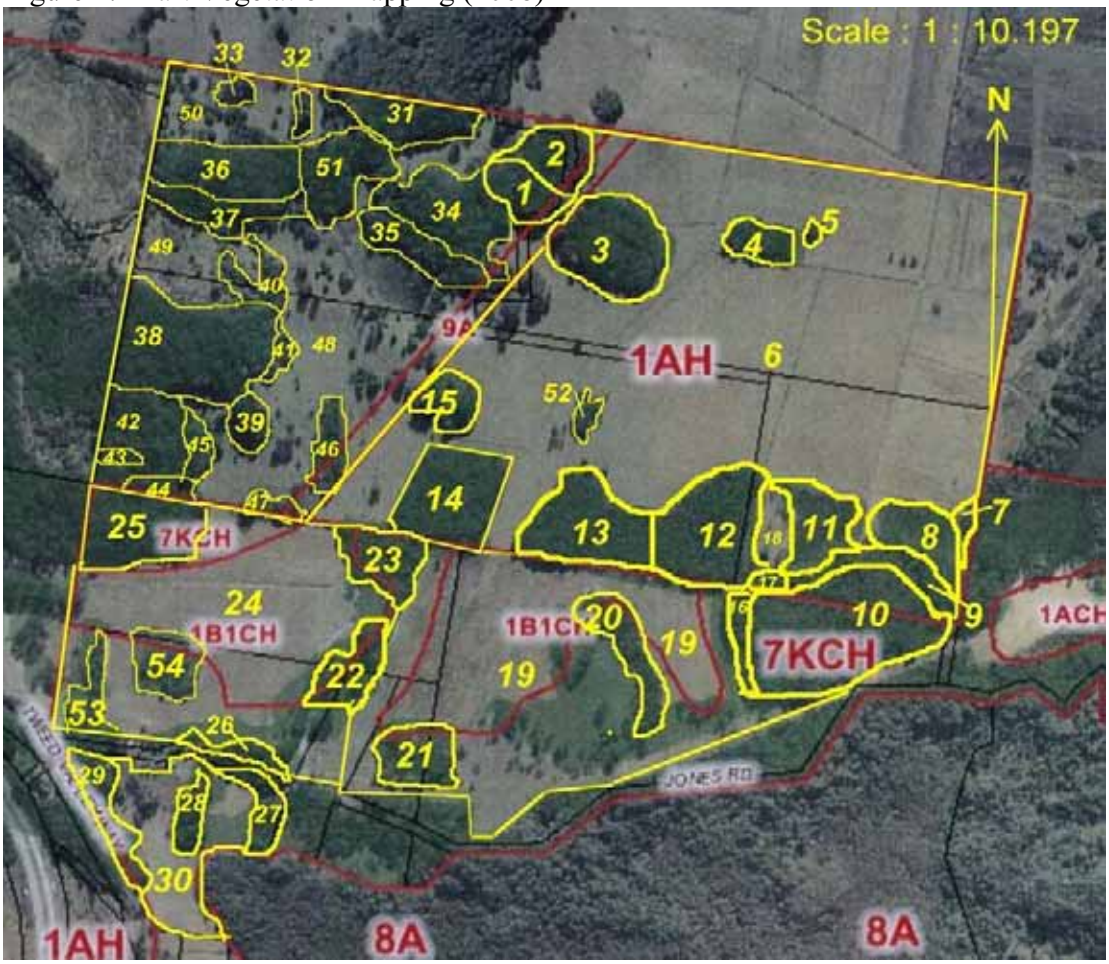
Block/ Polygon #	Vegetation and Ecological characteristics Summary
A/14	Swamp sclerophyll forest on coastal floodplain EEC, with developing lowland rainforest elements. Closed forest of Broad-leaved Paperbark, Swamp Turpentine, Camphor Laurel, Willow Bottlebrush, Hard Quandong and Pink Doughwood over a tall rainforest second stratum with Bangalow Palms, Lilly-pillies, and Figs. Complex and speciose midlayer, with open sparse groundlayer. Threatened Stinking Cryptocarya located in this block. Some small hollows, lower weed intensity; cattle present
Block/ Polygon #	**Vegetation and Ecological characteristics Summary**
B/13	Swamp sclerophyll forest on coastal floodplain EEC Closed Broad-leaved Paperbark/Camphor Laurel forest, with occasional Small-leaved Fig, Swamp Mahogany, Blackwood, Pink Doughwood over sparse to open groundlayer affected by cattle grazing and trampling. Few small hollows present
C/12	Swamp sclerophyll forest on coastal floodplain EEC Closed Broad-leaved Paperbark/Camphor Laurel forest, with Swamp Oak, Swamp Turpentine, Blackwood and Brush Ironbark Wattle over sparse to open groundlayer affected by cattle grazing and trampling. Numerous mature epiphytes in patches, few small hollows in dead Swamp Oak spouts. Many collapsed Broad-leaved Paperbarks.
D/11	Swamp sclerophyll forest on coastal floodplain EEC Peat fire area with dense low regenerating Broad-leaved Paperbark and Swamp Turpentine with occasional Swamp Oak beneath a layer of dead standing stags. Tangled piles of fallen logs, open water where tree bases have been undermined by fire. Ferny understorey, low weed occurrence, cattle largely excluded by log tangles.
G/23	Swamp sclerophyll forest on coastal floodplain EEC Swamp Turpentine with occasional Small-leaved and Moreton Bay

	Figs, Swamp Mahogany and Umbrella Cheese trees over Lantana dominated shrublayer. Cattle grazing and trampling. Large hardwood logs.
H/20	Subtropical coastal floodplain forest EEC Swamp Turpentine, Blackbutt, Broad-leaved Paperbark, Northern Grey Ironbark, and Pink Bloodwood over complex shrubby midlayer. Canopy species composition varies with elevation. Lantana, Bitou Bush, cattle. Active Brush Turkey mound.
I/10/18	Subtropical coastal floodplain forest EEC on lower margins; Blackbutt and Ironbark dry sclerophyll forest above. Swamp Turpentine, Umbrella Cheese Tree, Swamp Oak, Swamp Mahogany, Pink Bloodwood and Brown Kurrajong over weedy pasture and shrubs. Effects of recent fire apparent in lower southern portion. Cattle access previously through collapsed fence; now repaired.
J/21	Subtropical coastal floodplain forest EEC Fenced isolate with Forest Red Gum, Camphor Laurel, Swamp Turpentine, Broad-leaved Paperbark and Willow Bottlebrush over variable shrubby understorey. Extensive Lantana, dense tall clump of Ginger Lily; burnt, rubbish dumping. Active Brush Turkey mound.
K/22	Part Subtropical coastal floodplain forest EEC Brush Box, Camphor Laurel, Figs, Forest Red Gum, Blackbutt over complex rainforest shrub midlayer. Slightly elevated and drier ridge, open understorey with *Xanthorrhea* and *Lepidozamia* at northern end.

Vegetation mapping

Figure 2 shows draft vegetation mapping for the site. Table 2 below lists vegetation classifications (Walker and Hopkins 1990) for each of the numbered polygons.

Figure 2: Draft Vegetation Mapping (2008)



Clear boundaries between communities are rarely apparent, with interdigitation or gradation of adjoining communities commonly occurring. Therefore boundaries depicted between associations should be regarded as approximate.

Classification of vegetation in mapped polygons is provided in Table 2 below.
The vegetation classification used is that of Walker and Hopkins (1990), except in relation to exotic pasture.

Table 2: Key to mapped polygons in Figure 2

Mapped polygon	**Vegetation Classification (Walker and Hopkins 1990)**
1	*Lophostemon confertus- Eucalyptus pilularis-Eucalyptus carnea* very tall mid-dense to closed forest
2	*Eucalyptus siderophloia-E. pilularis-E. carnea-Corymbia intermedia* very tall mid-dense forest.
3	*Eucalyptus siderophloia-E. pilularis* very tall mid-dense to closed forest
4	*Melaleuca quinquenervia* tall closed forest
5	*Melaleuca quinquenervia-Cinnamomum camphora* tall closed forest
6	Mixed exotic species closed grassland with scattered trees and clumps of trees.
7	*Melaleuca quinquenervia* low closed shrubland.
8	*Melaleuca quinquenervia* low closed forest: post peat fire
9	*Eucalyptus tereticornis* very tall mid-dense to closed forest
10	*Eucalyptus siderophloia-E. pilularis-E. tereticornis-Corymbia intermedia* very tall closed forest
11	*Melaleuca quinquenervia* low closed forest: post peat fire
12	*Melaleuca quinquenervia* tall closed forest
13	*Melaleuca quinquenervia* tall closed forest
14	*Melaleuca quinquenervia* tall closed forest
15	*Eucalyptus pilularis-E. acmenoides-Corymbia intermedia* tall open-closed forest
16	*Lophostemon suaveolens* tall closed forest
17	*Casuarina glauca* tall closed forest
18	Mixed exotic species closed grassland with scattered trees and clumps of trees.
19	Mixed exotic species closed grassland with scattered trees and clumps of trees.
20	*Eucalyptus pilularis- Lophostemon suaveolens -Corymbia intermedia* tall to very tall closed forest
21	*Eucalyptus tereticornis* very tall mid-dense to closed forest
22	*Eucalyptus pilularis-Lophostemon confertus-Lophostemon suaveolens* tall mid-dense to closed forest
23	*Eucalyptus robusta-Melaleuca quinquenervia-Cinnamomum camphora*
24	Mixed exotic species closed grassland with scattered trees and clumps of trees.
25	*Lophostemon confertus- Cinnamomum camphora* very tall closed forest
26	*Eucalyptus pilularis* very tall mid-dense to closed forest
27	*Glochidion sumatranum-Cinnamomum camphora* mid-dense to closed tall forest.
28	*Lophostemon confertus- Cinnamomum camphora* tall mid-dense to closed

	forest (fragmented)
Mapped polygon	**Vegetation Classification(Walker and Hopkins 1990)**
29	*Lophostemon confertus- Cinnamomum camphora* tall mid-dense to closed forest (fragmented)
30	Mixed exotic species closed grassland with scattered trees and clumps of trees.
31	*Lophostemon confertus-Eucalyptus propinqua-E. microcorys* very tall closed forest
32	*Eucalyptus carnea-Lophostemon confertus* very tall closed forest
33	*Eucalyptus grandis-Cinnamomum camphora* very tall closed forest
34	*Eucalyptus pilularis-Corymbia intermedia-E. siderophloia-E. carnea* tall to very tall mid-dense to sparse open forest
35	*Lophostemon confertus-Eucalyptus propinqua-Syncarpia glomulifera* tall closed forest
36	*Lophostemon confertus-Eucalyptus carnea E. siderophloia-E. propinqua* tall closed forest
37	*Lophostemon confertus-Eucalyptus pilularis-Araucaria cunninghamii* very tall closed forest
38	*Eucalyptus tereticornis-E. propinqua-E. siderophloia-Lophostemon confertus* mid-high open forest and woodland
39	*Lophostemon confertus-Eucalyptus grandis* tall closed forest
40	*Acacia disparrima-Cinnamomum camphora* mid-high woodland and open forest
41	*Lophostemon suaveolens-Corymbia intermedia-Eucalyptus siderophloia-Guioa semiglauca Mischocarpus pyriformis-Acacia disparrima* mid-high closed forest
42	*Eucalyptus propinqua-Araucaria cunninghamii* very tall closed forest
43	*Acacia disparrima* low-mid-high closed forest
44	*Eucalyptus grandis-Araucaria cunninghamii-E. propinqua* very tall closed forest
45	*Araucaria cunninghamii-Lophostemon confertus-Cinnamomum camphora* tall closed forest
46	*Eucalyptus grandis-Lophostemon confertus-Cinnamomum camphora* tall closed forest
47	*Cinnamomum camphora-Corymbia intermedia* mid-high closed forest
48, 49, 50	Exotic pasture with scattered trees
51	*Eucalyptus pilularis-E.carnea-C intermedia* mid-high –tall open-closed forest and woodland
52	*Melaleuca quinquenervia-Cinnamomum camphora-Casuarina glauca* low closed forest
53	*Acacia disparrima-Lophostemon confertus-Callitris columellaris* low open-closed forest
54	*Corymbia intermedia- Acacia disparrima-Glochidion sumatranum-*

	Callistemon salignus low open-closed forest

Table 3: Parklands Flora Species list

Common Name	Scientific name	Family	TSC/ ROTAP	exotic
Brush Ironbark Wattle	*Acacia disparrima*	Mimosoideae cf Fabaceae		
Narrow-leaf Wattle	*Acacia longissima*	Fabaceae		
Blackwood	*Acacia melanoxylon*	Mimosoideae cf Fabaceae		
a Wattle	*Acacia obtusifolia*	Fabaceae		
Broad-leaved Lilly-pilly	*Acmena hemilampra*	Myrtaceae		
Lilly-pilly	*Acmena smithii*	Myrtaceae		
Beach Acronychia	*Acronychia imperforata*	Rutaceae		
Hairy Acronychia	*Acronychia pubens*	Rutaceae		
Silver Aspen	*Acronychia wilcoxiana*	Rutaceae		
Maidenhair Fern	*Adiantum aethiopicum*	Adiantaceae		
Maidenhair Fern	*Adiantum hispidulum*	Adiantaceae		
Crofton Weed	*Ageratina adenophora**	Asteraceae		1
Mistflower	*Ageratina riparia**	Asteraceae		1
Billygoat weed	*Ageratum houstonianum**	Asteraceae		1
Beach Alectryon	*Alectryon coriaceus*	Sapindaceae		
Forest Oak	*Allocasuarina torulosa*	Casuarinaceae		
Cunjevoi	*Alocasia brisbanensis*	Araceae		
Red Ash	*Alphitonia excelsa*	Rhamnaceae		
Native Ginger	*Alpinia caerulea*	Zingiberaceae		
Prickly Alyxia	*Alyxia ruscifolia*	Apocynaceae		
Whiskey Grass	*Andropogon virginicus**	Poaceae		1
Rough-leaved Elm	*Aphananthe phillippinensis*	Cannabaceae		
Hoop Pine	*Araucaria cunninghamii*	Araucariaceae		
Pink Laceflower	*Archidendron grandiflorum*	Mimosoideae cf Fabaceae		
Laceflower	*Archidendron hendersonii*	Fabaceae	Sch 1	
Veiny Laceflower	*Archidendron muellerianum*	Fabaceae	3RCa	
Rose Myrtle	*Archirhodomyrtus beckleri*	Myrtaceae		
Bangalow Palm	*Archontophoenix cunninghamiana*	Arecaceae		
Coral Berry	*Ardisia crenata**	Myrsinaceae		1
Blood Flower	*Asclepias curassavica**	Apocynaceae		1
Bird's Nest Fern	*Asplenium australasicum*	Aspleniaceae		
Sickle Spleenwort	*Asplenium polyodon*	Aspleniaceae		
Native Gardenia	*Atractocarpus benthamianus*	Rubiaceae		
Midgenberry	*Austromyrtus dulcis*	Myrtaceae		
Blood Vine	*Austrosteenisia blackii*	Fabaceae		
Broad-leaved Carpet Grass	*Axonopus compressus**	Poaceae		1
An aquatic fern	*Azolla sp.pinnata*	Azollaceae		
Groundsel	*Baccharis halimifolia**	Asteraceae		1
Farmer's Friends	*Bidens pilosa**	Asteraceae		1
Fishbone Fern	*Blechnum cartilagineum*	Blechnaceae		
Swamp Fishbone Fern	*Blechnum indicum*	Blechnaceae		
Coffee Bush	*Breynia oblongifolia*	Euphorbiaceae		

Bursaria	*Bursaria spinosa*	Pittosporaceae		
Caelospermum	*Caelospermum paniculatum*	Rubiaceae		
Large Prickle Vine	*Caesalpinia scortechinii*	Fabaceae		
Wait-a-While	*Calamus muelleri*	Arecaceae		
Callicarpa	*Callicarpa pedunculata*	Lamiaceae		
Willow Bottlebrush	*Callistemon salignus*	Myrtaceae		
False Bracken	*Calochlaena dubia*	Dicksoniaceae		
A Carex	*Carex sp*	Cyperaceae		
Swamp Oak	*Casuarina glauca*	Casuarinaceae		
Native Grape	*Cayratia clematidea*	Vitaceae		
Binung	*Christella dentata*	Thelypteridaceae		
Bitou bush	*Chrysanthemoides monilifera**	Asteraceae		1
Camphor Laurel	*Cinnamomum camphora**	Lauraceae		1
Red-barked Sassafras	*Cinnamomum virens*	Lauraceae		
Scotch Thistle	*Cirsium vulgare**	Asteraceae		1
Water Vine	*Cissus antarctica*	Vitaceae		
Five-leaf Water Vine	*Cissus hypoglauca*	Vitaceae		
Long-leaf Water Vine	*Cissus sterculifolia*	Vitaceae		
Bush Lemon	*Citrus limon**	Rutaceae		1
Smooth Clerodendrum	*Clerodendrum floribundum*	Verbenaceae		
Brown Kurrajong	*Commersonia bartramia*	Malvaceae		
Broad-leaved Palm Lily	*Cordyline petiolaris*	Laxmanniaceae		
Red-fruited Palm Lily	*Cordyline rubra*	Laxmanniaceae		
Pink Bloodwood	*Corymbia intermedia*	Myrtaceae		
Fleabane	*Coryza bonariensis**	Asteraceae		1
Native Cascarilla	*Croton verreauxii*	Euphorbiaceae		
Stinking Laurel	*Cryptocarya foetida*	Lauraceae	Sch 2	
Jackwood	*Cryptocarya glaucescens*	Lauraceae		
Murrogun	*Cryptocarya microneura*	Lauraceae		
Forest Maple	*Cryptocarya rigida*	Lauraceae		
Three-veined Cryptocarya	*Cryptocarya triplinervis var pubens*	Lauraceae		
Tuckeroo	*Cupaniopsis anacardioides*	Sapindaceae		
Small-leaved Tuckeroo	*Cupaniopsis parvifolia*	Sapindaceae		
Cuphea	*Cuphea carthagenensis**	Lythraceae		1
Rough Tree Fern	*Cyathea australis*	Cyatheaceae		
Smooth Tree Fern	*Cyathea cooperi*	Cyatheaceae		
Brush Canthium	*Cyclophyllum longipetalum*	Rubiaceae		
Cyclosorus	*Cyclosorus interruptus*	Thelypteridaceae		
Snake Orchid	*Cymbidium madidum*	Orchidaceae		
Blue Couch	*Cynodon dactylon**	Poaceae		1
Dirty Dora	*Cyperus difformis**	Cyperaceae		1
Umbrella Sedge	*Cyperus eragrostis**	Cyperaceae		1
A Sedge	*Cyperus polystachyos*	Cyperaceae		
A Sedge	*Cyperus sp*	Cyperaceae		
Native Carrot	*Daucus glochidiatus*	Apiaceae		
Hare's Foot Fern	*Davallia pyxidata*	Davalliaceae		
Davidson's Plum	*Davidsonia jerseyana*	Cunoniaceae	Sch 1	
Tree Bitter Pea	*Daviesia arborea*	Fabaceae		

Decaspermum	*Decaspermum humile*	Myrtaceae		
Denhamia	*Denhamia celastroides*	Celastraceae		
Desmodium	*Desmodium rhytidifolium*	Fabaceae		
Blue Flax-lily	*Dianella caerulea*	Phormiaceae / Hemerocallidaceae		
Kidney Weed	*Dichondra repens*	Convolvulaceae		
Native Yam	*Dioscorea transversa*	Dioscoreaceae		
Native Tamarind	*Diploglottis australis*	Sapindaceae		
Rasp Fern	*Doodia aspera*	Blechnaceae		
Soft Corkwood	*Duboisia myoporoides*	Solanaceae		
Rosewood	*Dysoxylum fraserianum*	Meliaceae		
Prickly Snake-Vine	*Echinostephia aculeata*	Menispermaceae		
Hard Quandong	*Elaeocarpus obovatus*	Elaeocarpaceae		
Blueberry Ash	*Elaeocarpus reticulatus*	Elaeocarpaceae		
a Spike-rush	*Eleocharis sp.aff. equisetina*	Cyperaceae		
Rose Walnut	*Endiandra discolor*	Lauraceae		
Black Walnut	*Endiandra globosa*	Lauraceae	2RC-	
Green-leaved Rose Walnut	*Endiandra muelleri ssp bracteata*	Lauraceae	Sch 1	
Wire Grass	*Entolasia stricta*	Poaceae		
White Mahogany	*Eucalyptus acmenoides*	Myrtaceae		
Flooded Gum	*Eucalyptus grandis*	Myrtaceae		
Tallowwood	*Eucalyptus microcorys*	Myrtaceae		
Blackbutt	*Eucalyptus pilularis*	Myrtaceae		
Grey Gum	*Eucalyptus propinqua*	Myrtaceae		
Swamp Mahogany	*Eucalyptus robusta*	Myrtaceae		
Red Mahogany	*Eucalyptus resinifera*	Myrtaceae		
Northern Grey Ironbark	*Eucalyptus siderophloia*	Myrtaceae		
Forest Red Gum	*Eucalyptus tereticornis*	Myrtaceae		
Broad-leaved White Mahogany	*Eucalyptus umbra*	Myrtaceae		
Small Bolwarra	*Eupomatia bennettii*	Eupomatiaceae		
Bolwarra	*Eupomatia laurina*	Eupomatiaceae		
Ribbonwood	*Euroschinus falcata*	Anacardiaceae		
Wombat Berry	*Eustrephus latifolius*	Philesiaceae		
Broad-leaf Ballart	*Exocarpos latifolius*	Santalaceae		
Sandpaper Fig	*Ficus coronata*	Moraceae		
Creek Sandpaper Fig	*Ficus fraseri*	Moraceae		
Moreton Bay Fig	*Ficus macrophylla*	Moraceae		
Small-leaved Fig	*Ficus obliqua*	Moraceae		
Deciduous Fig	*Ficus superba*	Moraceae		
Strangler Fig	*Ficus watkinsiana*	Moraceae		
Bull Cane	*Flagellaria indica*	Flagelleriaceae		
Teak	*Flindersia australis*	Rutaceae		
Bennett's Ash	*Flindersia bennettiana*	Rutaceae		
Cudgerie	*Flindersia schottiana*	Rutaceae		
A Saw Sedge	*Gahnia aspera*	Cyperaceae		
Tall Saw-sedge	*Gahnia clarkei*	Cyperaceae		
Red-fruited Saw-sedge	*Gahnia sieberiana*	Cyperaceae		
A Sedge	*Gahnia sp.*	Cyperaceae		

Scrambling Lily	*Geitonoplesium cymosum*	Hemerocallidaceae		
Cheese Tree	*Glochidion ferdinandi*	Phyllanthaceae / Euphorbiaceae		
Umbrella Cheese Tree	*Glochidion sumatranum*	Phyllanthaceae / Euphorbiaceae		
Small Glycine	*Glycine clandestina*	Fabaceae		
Cudweed	*Gnaphalium sphaericum**	Asteraceae		1
Narrow-leaved Cottonbush	*Gomphocarpus fruticosus**	Asclepiadaceae		1
Round-leaf Goodenia	*Goodenia rotundifolia*	Goodeniaceae		
Python Tree	*Gossia acmenioides*	Myrtaceae		
Scaly Myrtle	*Gossia hillii*	Myrtaceae		
Guilfoylia	*Guilfoylia monostylis*	Simaroubaceae		
Guioa	*Guioa semiglauca*	Sapindaceae		
Native Flax	*Gymnostachys anceps*	Araceae		
Saffron Heart	*Halfordia kendack*	Rutaceae		
Ginger Lily	*Hedychium gardnerianum**	Zingiberaceae		1
Twining Guinea Flower	*Hibbertia dentata*	Dilleniaceae		
Guinea Flower	*Hibbertia obtusifolia*	Dilleniaceae		
Scrambling Guinea Flower	*Hibbertia scandens*	Dilleniaceae		
Swamp Hibiscus	*Hibiscus diversifolius*	Malvaceae		
Hodgkinsonia	*Hodgkinsonia ovatifolia*	Rubiaceae		
Bleeding Heart	*Homolanthus populifolius*	Euphorbiaceae		
Hovea	*Hovea acutifolia*	Fabaceae		
Hybanthus	*Hybanthus monopetalus*	Violaceae		
Dandelion	*Hypochaeris radicata**	Asteraceae		1
Blady-grass	*Imperata cylindrica*	Poaceae		
Five-leaved Morning Glory	*Ipomoea cairica**	Convolvulaceae		1
Foambark	*Jagera pseudorhus*	Sapindaceae		
A rush	*Juncus mollis*	Juncaceae		
A rush	*Juncus sp aff usitatus*	Juncaceae		
Lantana	*Lantana camara**	Verbenaceae		1
A Sedge	*Lepidosperma cf. laterale*	Cyperaceae		
Shining Burrawang	*Lepidozamia peroffskyana*	Zamiaceae		
Giant Sedge	*Lepironia articulata*	Cyperaceae		
Small-leaved Privet	*Ligustrum sinense**	Rubiaceae		1
Brown Bolly Gum	*Litsea australis*	Lauraceae		
Bolly Gum	*Litsea reticulata*	Lauraceae		
Tall Lobelia	*Lobelia gibbosa*	Campanulaceae		
Mat-Rush	*Lomandra confertifolia ssp pallida*	Xanthorrhoeaceae / Lomandraceae		
Spiny Mat-rush	*Lomandra longifolia*	Lomandraceae		
Brush Box	*Lophostemon confertus*	Myrtaceae		
Swamp Turpentine	*Lophostemon suaveolens*	Myrtaceae		
Climbing Maidenhair Fern	*Lygodium microphyllum*	Schizaeaceae		
Macaranga	*Macaranga tanarius*	Euphorbiaceae		
Cockspur	*Maclura cochinchinensis*	Moraceae		
Siratro	*Macroptilium atropurpureum**	Fabaceae		1
White Kamala	*Mallotus discolor*	Euphorbiaceae		
Red Kamala	*Mallotus phillippensis*	Euphorbiaceae		
Mallow	*Malva sp.**	Malvaceae		1

Common Milk vine	*Marsdenia rostrata*	Asclepiadaceae		
Narrow-leaved Orange-bark	*Maytenus silvestris*	Celastraceae		
Medicosma	*Medicosma cunninghamii*	Rutaceae	SIG Plant	
Broad-leaved Paperbark	*Melaleuca quinquenervia*	Myrtaceae		
Pink Doughwood	*Melicope elleryana*	Rutaceae		
Melodinus	*Melodinus australis*	Apocynaceae		
Yellow Pearfruit	*Mischocarpus pyriformis*	Sapindaceae		
Morinda	*Morinda jasminoides*	Rubiaceae		
Murraya	*Murraya paniculata**	Rutaceae		1
Satinwood	*Nematolepis squameum*	Rutaceae		
Sword Fern	*Nephrolepis cordifolia*	Davalliaceae		
Mock Olive	*Notelaea longifolia*	Oleaceae		
Mickey Mouse Plant	*Ochna serrulata**	Ochnaceae		1
Bearded Grass	*Oplismenus aemulus*	Poaceae		
Basket Grass	*Oplismenus hirtellus ssp imbecilis*	Poaceae		
Oxalis	*Oxalis chnoodes*	Oxalidaceae		
White Dogwood	*Ozothamnus diosmifolius*	Asteraceae		
Wonga Vine	*Pandorea pandorana*	Bignoniaceae		
Native Panic	*Panicum spp (lamprophyllum)*	Poaceae		
Pygmy Panic	*Panicum pygmaeum*	Poaceae		
Snow Wood	*Pararchidendron pruinosum*	Fabaceae		
Common Silkpod vine	*Parsonsia straminea*	Apocynaceae		
Edible Passionfruit	*Passiflora edulis**	Passifloraceae		1
Corky Passionfruit	*Passiflora suberosa**	Passifloraceae		1
White Passionfruit	*Passiflora subpeltata**	Passifloraceae		1
Paspalum	*Paspalum dilatatum*	Poaceae		
Giant Paspalum	*Paspalum urvillei**	Poaceae		1
Broad-leaved Paspalum	*Paspalum wettsteinii**	Poaceae		1
Kikuyu	*Pennisetum clandestinum**	Poaceae		1
Crow's Ash	*Pentaceras australis*	Rutaceae		
Slender Knotweed	*Persicaria decipiens*	Polygonaceae		
A Knotweed	*Persicaria strigosa*	Polygonaceae		
Frogmouth	*Philydrum lanuginosum*	Phylidraceae		
Phyllanthus	*Phyllanthus gunnii*	Phyllanthaceae / Euphorbiaceae		
Plum Myrtle	*Pillidiostigma glabrum*	Myrtaceae		
Pisonia	*Pisonia aculeata*	Nyctaginaceae		
Hairy Pittosporum	*Pittosporum revolutum*	Pittosporaceae		
Sweet Pittosporum	*Pittosporum undulatum*	Pittosporaceae		
Elkhorn	*Platycerium bifurcatum*	Polypodiaceae		
Staghorn	*Platycerium superbum*	Polypodiaceae		
A Plectranthus	*Plectranthus sp.*	Lamiaceae		
Celerywood	*Polyscias elegans*	Araliaceae		
Elderberry Panax	*Polyscias sambucifolia*	Araliaceae		
Pomax	*Pomax umbellifera*	Rubiaceae		
Black Apple	*Pouteria australe*	Sapotaceae		
Thin-leaved Coondoo	*Pouteria chartacea*	Sapotaceae		
Whiteroot	*Pratia purpurascens*	Campanulaceae		

Ground Asparagus	*Protasparagus aethiopicus**	Asparagaceae		1
Pastel Flower	*Pseuderanthemum variabile*	Acanthaceae		
Rose Marara	*Pseudoweinmannia lachnocarpa*	Cunoniaceae		
Cherry Guava	*Psidium cattleianum**	Myrtaceae		1
Hairy Psychotria	*Psychotria loniceroides*	Rubiaceae		
Bracken	*Pteridium esculentum*	Dennstaedtiaceae		
Horseshoe Felt Fern	*Pyrrosia confluens*	Polypodiaceae		
Felt Fern	*Pyrrosia rupestris*	Polypodiaceae		
Swamp Ranunculus	*Ranunculus inundatus*	Ranunculaceae		
A Muttonwood	*Rapanea howittiana*	Myrsinaceae		
Muttonwood	*Rapanea variabile*	Myrsinaceae		
Smooth Scrub Turpentine	*Rhodamnia maideniana*	Myrtaceae	2RC-	
Scrub Turpentine	*Rhodamnia rubescens*	Myrtaceae		
Native Guava	*Rhodomyrtus psidioides*	Myrtaceae		
Supplejack	*Ripogonum album*	Ripogonaceae		
Small-leaved Supplejack	*Ripogonum brevifolium*	Ripogonaceae		
Hairy Supple-jack	*Ripogonum elseyanum*	Ripogonaceae		
Molucca Bramble	*Rubus hillii*	Rosaceae		
Rose-leaf Bramble	*Rubus rosifolius*	Rosaceae		
Steelwood	*Sarcopteryx stipata*	Sapindaceae		
Umbrella Tree	*Schefflera actinophylla**	Araliaceae		1
Corky Milk vine	*Secamone elliptica*	Apocynaceae		
Fireweed	*Senecio madagascariensis**	Asteraceae		1
A Senna	*Senna floribunda**	Fabaceae		1
Winter Senna	*Senna pendula**	Fabaceae		1
South African Pigeon Grass	*Setaria sphacelata**	Poaceae		1
Paddy's Lucerne	*Sida rhombifolia**	Malvaceae		1
Maiden's Blush	*Sloanea australis*	Elaeocarpaceae		
Yellow Carabeen	*Sloanea woolsii*	Elaeocarpaceae		
Austral Sarsaparilla	*Smilax australis*	Smilacaceae		
Sweet Sarsaparilla	*Smilax glyciphylla*	Smilacaceae		
Kangaroo Apple	*Solanum aviculare*	Solanaceae		
Devil's Apple	*Solanum capsicoides**	Solanaceae		1
A Solanum	*Solanum densevestitum*	Solanaceae		
Apple of Sodom	*Solanum linneaeanum*	Solanaceae		
Wild Tobacco	*Solanum mauritianum**	Solanaceae		1
Black Nightshade	*Solanum nigrum**	Solanaceae		1
Prickly Nightshade	*Solanum semiarmatum*	Solanaceae		
Climbing Nightshade	*Solanum seaforthianum**	Solanaceae		1
Prickly Solanum	*Solanum stelligerum*	Solanaceae		
Snake Vine	*Stephania japonica var. discolor*	Menispermaceae		
Pouched Fern	*Sticherus flabellatus*	Gleicheniaceae		
Coast Redberry Vine	*Streptothamnus moorei*	Berberidopsidaceae		
Cocos Palm	*Syagrus romanzoffianum**	Arecaceae		1
White Hazelwood	*Symplocos stawelli*	Symplocaceae		
Turpentine	*Syncarpia glomulifera*	Myrtaceae		
Scentless Rosewood	*Synoum glandulosum*	Meliaceae		
Brush Cherry	*Syzygium (Acmena) australe*	Myrtaceae		

Riberry	*Syzygium luehmannii*	Myrtaceae		
Blue Lilly-pilly	*Syzygium (Acmena) oleosum*	Myrtaceae		
Banana Bush	*Tabernaemontana pandacaqui*	Apocynaceae		
Blunt-leaved Steelwood	*Toechima dasyrrache*	Sapindaceae		
Kangaroo Grass	*Themeda australis*	Poaceae		
Tradescantia	*Tradescantia spp**	Commeleniaceae		1
Climbing Nettle	*Tragia novae-hollandiae*	Euphorbiaceae		
Poison Peach	*Trema tomentosum*	Ulmaceae		
White Clover	*Trifolium repens**	Fabaceae		1
Kreysigia	*Tripladenia cunninghamiana*	Uvulariaceae		
Tree-heath	*Trochocarpa laurina*	Ericaceae		
Burny Vine	*Trophis scandens*	Moraceae		
Tall Verbena	*Verbena bonariensis**	Verbenaceae		1
Native Violet	*Viola hederacea*	Violaceae		
Red-fruited Rice Flower	*Wikstroemia indica*	Thymeleaceae		
Veiny Wilkea	*Wilkea huegeliana*	Monimiaceae		
A Grass Tree	*Xanthorrhoea glauca*	Xanthorrhoeaceae		
A Grass Tree	*Xanthorrhoea latifolia*	Xanthorrhoeaceae		
A Cucumber Vine	*Zehneria cunninghamii*	Cucurbitaceae		
Sandfly Zieria	*Zieria smithii*	Rutaceae		
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Appendix B

Parklands-Application Number 09_0028

Parklands fauna species list

2006-2010

Prepared for

Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by Mark Fitzgerald

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Table 1 combines records from systematic fauna surveys in August 2007 & February 2009 with observations from additional visits to the site. The figure 1 in column cells indicates at least one record of that species from each broad habitat category.

Nomenclature for birds follows Christidis and Boles 2008; for reptiles: Swan, *et al* 2004; frogs: Barker *et al* 1995; mammals: Van Dyck and Strahan 2008, and Churchill 2008.

Habitat category
1 = central swamp sclerophyll and sub-tropical floodplain forests,
2 = northwestern hillslope forests
3 = exotic pasture
4 = drains and/or dams
5 = overhead
6 = other (*e.g.* house)

Species	**Scientific name**	**1**	**2**	**3**	**4**	**5**	**6**
AMPHIBIANS							
HYLIDAE							
Green Tree Frog	*Litoria caerulea*	1					
Broad-palmed frog	*Litoria latopalmata*			1	1		
Rocket Frog	*Litoria nasuta*			1			
Eastern Dwarf Tree Frog	*Litoria fallax*				1		
Laughing Tree Frog	*Litoria tyleri*				1		
Peron's Tree Frog	*Litoria peroni*				1		
Dainty Tree Frog	*Litoria gracilenta*	1	1				
Verreaux's Tree Frog	*Litoria verreauxii*	1					
MYOBATRACHIDAE							
Common Eastern Froglet	*Crinia signifera*			1			
Dusky Toadlet	*Uperoleia fusca*		1				
Tusked Frog	*Adelotus brevis*	1	1	1	1		
Brown-striped Marsh-frog	*Limnodynastes peroni*	1	1	1	1		
Red-backed Toadlet	*Pseudophryne coriacea*		1	1			
BUFONIDAE							
Cane Toad*	*Bufo marinus*	1	1	1	1		
BIRDS							
MEGAPODIDAE							
Brush-turkey	*Alectura lathami*	1	1				
TURNICIDAE							
Brown Quail	*Coturnix ypsilophora*	1					
ANATIDAE							
Maned Duck	*Chenonetta jubata*			1	1		
Pacific Black Duck	*Anas superciliosa*				1		
Hardhead	*Aythya australis*				1		
Wandering Whistleduck	*Dendrocygne arcuata*				1		
PODICIPEDIDAE							

Australasian Grebe	*Tachybaptus novaehollandiae*				1		
PHALACROCORIDAE							
Little Black Cormorant	*Phalacrocorax sulcirostris*				1		
Little Pied Cormorant	*Phalacrocorax melanoleucos*				1		
ANHINGIDAE							
Darter	*Anhinga melanogaster*				1		
ARDEIDAE							
White-faced Heron	*Egretta novaehollandiae*			1			
Pacific Heron	*Ardea pacifica*			1	1		
Rufous Night-heron	*Nycticorax caledonicus*	1					
Great Egret	*Egretta alba*				1		
Cattle Egret	*Ardea ibis*			1			
Straw-necked Ibis	*Threskiornis spinicollis*			1			
ACCIPITRIDAE							
Brahminy Kite	*Milvus indus*					1	
Pacific Baza	*Aviceda subcristata*	1	1				
White-bellied Sea-Eagle	*Haliaeetus leucogaster*					1	
Brown Goshawk	*Accipiter fasciatus*		1				
Grey Goshawk	*Accipiter novaehollandiae*		1			1	
Whistling Kite	*Haliastur sphenurus*					1	
Wedge-tailed Eagle	*Aquila audax*					1	
RALLIDAE							
Dusky Moorhen	*Gallinula tenebrosa*				1		
Purple Swamphen	*Porphyrio porphyrio*				1		
JACANIDAE							
Comb-crested Jacana	*Irediparra gallinacea*				1		
CHARADRIIDAE							
Masked Lapwing	*Vanellus miles*			1			
COLUMBIDAE							
White-headed Pigeon	*Columba leucomela*	1	1				
Emerald Dove	*Chalcophaps indica*	1	1				
Bar-shouldered Dove	*Geopelia humeralis*	1	1				
Wonga Pigeon	*Leucosarcia picata*	1	1				
Brown Cuckoo-dove	*Macropygia amboinensis*	1	1				
Crested Pigeon	*Ocyphaps lophotes*	1					
Rose-crowned Fruit-dove	*Ptilinopus regina*	1					
Topknot Pigeon	*Lopholaimus antarcticus*	1					
CACATUIDAE							
Galah	*Cacatua roseicapilla*			1			
Sulphur-crested Cockatoo	*Cacatua galerita*					1	
PSITTACIDAE							
King Parrot	*Alisterus scapularis*	1	1				

LORIDAE							
Rainbow Lorikeet	*Trichoglossus haematodus*	1					
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	1					
Musk Lorikeet	*Glossopsitta concinna*		1				
Eastern Rosella	*Platycercus eximius*	1		1			
Crimson Rosella	*Platycercus elegans*	1	1			1	
CUCULIDAE							
Brush Cuckoo	*Cacomantis variolosus*	1	1				
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	1	1				
Pheasant Coucal	*Centropus phasianinus*	1	1				
Shining Bronze-cuckoo	*Chalcites lucidus*	1					
Eastern Koel	*Eudynamys orientalis*	1					
Channel-billed Cuckoo	*Scythrops novaehollandiae*					1	
ALCEDINAE							
Azure Kingfisher	*Alcedo azurea*				1		
HALCYONIDAE							
Laughing Kookaburra	*Dacelo novaeguineae*	1	1	1	1		
Sacred Kingfisher	*Todirhamphus sanctus*	1	1				
Forest Kingfisher	*Todirhamphus macleayii*				1		
CORACIIDAE							
Dollarbird	*Eurystomus orientalis*	1	1	1			
MEROPIDAE							
Rainbow Bee-eater	*Merops ornatus*	1	1	1			
STRIGIDAE							
Southern Boobook	*Ninox novaseelandiae*		1				
TYTONIDAE							
Barn Owl	*Tyto alba*		1				
Grass Owl	*Tyto capensis*				1		
Masked Owl	*Tyto novaehollandiae*		1				
CAPRIMULGIDAE							
White-throated Nightjar	*Eurostopodus mystacalis*		1				
AEGOTHELIDAE							
Australian Owlet-nightjar	*Aegotheles cristatus*	1	1				
PODARGIDAE							
Tawny Frogmouth	*Podargus strigoides*	1	1				
PITTIDAE							
Noisy Pitta	*Pitta versicolor*	1					
APODIDAE							
White-throated Needletail	*Hirundapus caudacutus*					1	
HIRUNDINIDAE							
Welcome Swallow	*Hirundo neoxena*					1	
MOTACILLIDAE							

Australasian Pipit	*Anthus novaeseelandiae*			1			
CAMPEPHAGIDAE							
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	1	1	1	1	1	
Cicadabird	*Coracina tenuirostris*	1	1				
Varied Triller	*Lalage leucomela*	1	1				
PETROICIDAE							
Rose Robin	*Petroica rosea*	1	1				
Eastern Yellow Robin	*Eopsaltria australis*	1	1				
Pale Yellow Robin	*Tregellasia capito*		1				
PACHYCEPHALIDAE							
Grey Shrike-thrush	*Colluricincla harmonica*	1	1				
Little Shrike-thrush	*Colluricincla megarhyncha*	1	1				
Golden Whistler	*Pachycephala pectoralis*	1	1				
Rufous Whistler	*Pachycephala rufiventris*	1					
MONARCHIDAE							
Grey Fantail	*Rhipidura fuliginosa*	1	1				
Willie Wagtail	*Rhipidura leucophrys*	1	1	1			
White-eared Monarch	*Carterornis leucotis*		1				
Black-faced Monarch	*Monarcha melanopsis*	1	1				
Restless Flycatcher	*Myiagra inquieta*			1			
Magpie-lark	*Grallina cyanoleuca*			1			
Leaden Flycatcher	*Myiagra rubecula*	1	1				
ORTHONYCHIDAE							
Eastern Whipbird	*Psophodes olivaceus*	1	1				
SYLVIIDAE							
Tawny Grassbird	*Megalurus timoriensis*			1			
Golden-headed Cisticola	*Cisticola exilis*			1			
PTILINORHYNCHIDAE							
Regent Bowerbird	*Sericulus chrysocephalus*	1					
MALURIDAE							
Superb Fairy-wren	*Malurus cyaneus*			1	1		
Red-backed Fairy-wren	*Malurus melanocephalus*			1	1		
Variegated Fairy-wren	*Malurus lamberti*			1			
ACANTHIZIDAE							
White-browed Scrubwren	*Sericornis frontalis*	1	1				
White-throated Gerygone	*Gerygone albigularis*	1	1				
Striated Thornbill	*Acanthiza lineata*	1	1				
Large-billed Scrubwren	*Sericornis magnirostra*	1	1				
Yellow Thornbill	*Acanthiza nana*		1				
MELIPHAGIDAE							
Striped Honeyeater	*Plectorhyncha*	1					

	lanceolata						
Noisy Friarbird	*Philemon corniculatus*	1	1				
Noisy Miner	*Manorina melanocephala*	1	1				
Lewin's Honeyeater	*Meliphaga lewinii*	1	1				
Yellow-faced Honeyeater	*Lichenostomus chrysops*	1					
Eastern Spinebill	*Acanthorhynchus tenuirostris*	1					
Scarlet Honeyeater	*Myzomela sanguinolenta*	1	1				
Blue-faced Honeyeater	*Entomyzon cyanotis*	1	1				
Brown Honeyeater	*Lichmera indistincta*	1					
Brush Wattlebird	*Anthochaera chrysoptera*	1					
ZOSTEROPIDAE							
Silvereye	*Zosterops lateralis*	1	1				
DICAEIIDAE							
Mistletoebird	*Dicaeum hirundinaceum*	1	1				
PARDALOTIDAE							
Spotted Pardalote	*Pardalotus punctatus*	1					
Striated Pardalote	*Pardalotus striatus*	1	1				
PLOCEIDAE							
Red-browed Finch	*Neochmia temporalis*	1	1	1	1		
ORIOLIDAE							
Figbird	*Sphecotheres vieilloti*	1	1				
Oriole	*Oriolus sagittatus*	1					
STURNIDAE							
Common Starling	*Sturnus vulgaris*			1			
Common Myna*	*Acridotheres tristis*			1			
DICRURIDAE							
Spangled Drongo	*Dicrurus bracteatus*	1	1				
ARTAMIDAE							
White-breasted Woodswallow	*Artamus leucorhynchus*			1			
CRACTICIDAE							
Grey Butcherbird	*Cracticus torquatus*	1	1	1			
Pied Butcherbird	*Cracticus nigrogularis*	1	1	1			
Australian Magpie	*Cracticus tibicen*			1			
Pied Currawong	*Strepera graculina*	1	1	1			
CORVIDAE							
Torresian Crow	*Corvus orru*	1					
MAMMALS							
DASYURIDAE							
Brown Antechinus	*Antechinus stuartii*	1	1				
Yellow-footed Antechinus	*Antechinus flavipes*						

TACHYGLOSSIDAE							
Echidna	*Tachyglossus aculeatus*	1					
PHASCOLARCTIDAE							
Koala	*Phascolarctos cinereus*	1					
PERAMELIDAE							
Long-nosed Bandicoot	*Perameles nasuta*	1					
Northern Brown Bandicoot	*Isoodon macrourus*	1					
PHALANGERIDAE							
Brush-tailed Possum	*Trichosurus vulpecula*	1					
Bobuck	*Trichosurus caninus*	1					
PETAURIDAE							
Sugar Glider	*Petaurus breviceps*	1	1				
MACROPODIDAE							
Swamp Wallaby	*Wallabia bicolor*	1		1			
PTEROPODIDAE							
Blossom Bat	*Syconycteris australis*	1					
Grey-headed Flying-fox	*Pteropus poliocephalus*	1	1				
Black Flying-fox	*Pteropus alecto*	1	1				
MOLOSSIDAE							
Freetail Bat	*Mormopterus sp.*						
White-striped Freetail Bat	*Austronomus australis*		1				
RHINOLOPHIDAE							
Eastern Horseshoe bat	*Rhinolophus megaphyllus*						
VESPERTILIONIDAE							
Little Bent-wing Bat	*Miniopterus australis*	1	1				
Large bent-wing Bat	*Miniopterus orianae oceanensis*	1					
Eastern Long-eared Bat	*Nyctophilus bifax*	1					
Gould's Long-eared Bat	*Nyctophilus gouldii*	1					
Eastern Broad-nosed Bat	*Scotorepens orion*	1	1				
Eastern Forest Bat	*Vespadelus pumilus*	1	1				
MURIDAE							
Bush Rat	*Rattus fuscipes*	1	1				
Black Rat*	*Rattus rattus*	1	1				
House Mouse*	*Mus domesticus*	1					
CANIDAE							
Dog	*Canis familiaris*	1		1			
REPTILES							
CHELONIDAE							
Eastern Long-necked Turtle	*Chelodina longicollis*				1		
Saw-shelled Turtle	*Elseya latisternum*				1		
AGAMIDAE							
Eastern Water Dragon	*Physignathus leseuerii*				1		
Bearded Dragon	*Pogona barbata*			1			

SCINCIDAE							
Garden Sun-skink	*Lampropholis delicata*	1	1	1			
Friendly Skink	*Lampropholis amicula*	1					
Three-toed skink	*Saiphos equalis*	1					
Pink-tongued Skink	*Cyclodomorphus gerrardii*	1					
Major Skink	*Egernia frerei*						1
Fence Skink	*Cryptoblepharus virgatus*						1
VARANIDAE							
Lace Monitor	*Varanus varius*	1	1				
BOIDAE							
Carpet Python	*Morelia spilota mcdowelli*	1					
ELAPIDAE							
Small-eyed Snake	*Cryptophis nigrescens*	1					
Eastern Brown Snake	*Pseudonaja textilis*						1
	SPECIES COUNT	**105**	**77**	**40**	**31**	**11**	**3**
	Habitat category	**1**	**2**	**3**	**4**	**5**	**6**

Habitat category
1 = central swamp sclerophyll and sub-tropical floodplain forests,
2 = northwestern hillslope forests
3 = exotic pasture
4 = drains and/or dams
5 = overhead
6 = other (*e.g.* house)

REFERENCES

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Appendix C

Department of Environment, Water, Heritage and the Arts

search

matters of national environmental significance

Environment Protection and Biodiversity Conservation Act

Parklands-Application Number 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by

Mark Fitzgerald

Ecological Consultant,

P.O. Box 237 Mullumbimby NSW 2482

Protected Matters Search Tool

You are here: Environment Home > EPBC Act > Search
EPBC Act Protected Matters Report
13 October 2009 15:16
This report provides general guidance on matters of national environmental significance and
other matters protected by the EPBC Act in the area you have selected. Information on the
coverage of this report and qualifications on data supporting this report are contained in
the caveat at the end of the report.

You may wish to print this report for reference before moving to other pages or websites.

The Australian Natural Resources Atlas at http://www.environment.gov.au/atlas may provide
further environmental information relevant to your selected area. Information about the EPBC
Act including significance guidelines, forms and application process details can be found at
http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

Search Type: Point
Buffer: 5 km
Coordinates: -28.46666,153.5166

Report Contents: Summary
Details
Matters of NES
Other matters protected by the EPBC Act
Extra Information
Caveat
Acknowledgments

Summary

Matters of National Environmental Significance
This part of the report summarises the matters of national environmental significance that

may occur in, or may relate to, the area you nominated. Further information is available in
the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on
one or more matters of national environmental significance then you should consider the
Administrative Guidelines on Significance - see
http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties: None
National Heritage Places: None
Wetlands of International Significance:
(Ramsar Sites) None
Commonwealth Marine Areas: None
Threatened Ecological Communities: 1
Threatened Species: 50
Migratory Species: 30
Other Matters Protected by the EPBC Act
This part of the report summarises other matters protected under the Act that may relate to
the area you nominated. Approval may be required for a proposed activity that significantly
affects the environment on Commonwealth land, when the action is outside the Commonwealth
land, or the environment anywhere when the action is taken on Commonwealth land. Approval
may also be required for the Commonwealth or Commonwealth agencies proposing to take an
action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions
taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies.
As heritage values of a place are part of the 'environment', these aspects of the EPBC Act
protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage
values of a place on the Register of the National Estate. Information on the new heritage
laws can be found at http://www.environment.gov.au/heritage/index.html.

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including
Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a

member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands: 2
Commonwealth Heritage Places: None
Places on the RNE: None
Listed Marine Species: 52
Whales and Other Cetaceans: 12
Critical Habitats: None
Commonwealth Reserves: None
Extra Information

This part of the report provides information that may also be relevant to the area you have
nominated.

State and Territory Reserves: 3
Other Commonwealth Reserves: None
Regional Forest Agreements: 1

Details

Matters of National Environmental Significance

Threatened Ecological Communities [Dataset Information] Status Type of Presence
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia Critically Endangered Community likely to occur within area
Threatened Species [Dataset Information] Status Type of Presence
Birds
Anthochaera phrygia
Regent Honeyeater Endangered Species or species habitat may occur within area
Cyclopsitta diophthalma coxeni
Coxen's Fig-Parrot Endangered Species or species habitat likely to occur within area
Lathamus discolor
Swift Parrot Endangered Species or species habitat likely to occur within area
Macronectes giganteus
Southern Giant-Petrel Endangered Species or species habitat may occur within area
Macronectes halli
Northern Giant-Petrel Vulnerable Species or species habitat may occur within area
Poephila cincta cincta
Black-throated Finch (southern) Endangered Species or species habitat likely to occur
within area
Pterodroma neglecta neglecta
Kermadec Petrel (western) Vulnerable Species or species habitat may occur within area

Rostratula australis
Australian Painted Snipe Vulnerable Species or species habitat may occur within area
Thalassarche melanophris impavida
Campbell Albatross Vulnerable Species or species habitat may occur within area
Turnix melanogaster
Black-breasted Button-quail Vulnerable Species or species habitat likely to occur within area
Frogs
Litoria olongburensis
Wallum Sedge Frog Vulnerable Species or species habitat likely to occur within area
Mixophyes iteratus
Southern Barred Frog, Giant Barred Frog Endangered Species or species habitat likely to
occur within area
Insects
Phyllodes imperialis (southern subsp. - ANIC 3333)
a moth Endangered Species or species habitat likely to occur within area
Mammals
Chalinolobus dwyeri
Large-eared Pied Bat, Large Pied BatVulnerable Species or species habitat may occur
within area
Dasyurus maculatus maculatus (SE mainland population)
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)

Endangered Species or species habitat may occur within area
Eubalaena australis
Southern Right WhaleEndangered Species or species habitat likely to occur within area
Megaptera novaeangliae
Humpback Whale Vulnerable Species or species habitat known to occur within area
Potorous tridactylus tridactylus
Long-nosed Potoroo (SE mainland) Vulnerable Species or species habitat may occur
within area
Pteropus poliocephalus
Grey-headed Flying-fox Vulnerable Foraging, feeding or related behaviour known to
occur within area
Xeromys myoides
Water Mouse, False Water Rat Vulnerable Species or species habitat likely to occur
within area
Reptiles
Caretta caretta
Loggerhead Turtle Endangered Species or species habitat may occur within area
Chelonia mydas

Green Turtle Vulnerable Species or species habitat may occur within area
Coeranoscincus reticulatus
Three-toed Snake-tooth Skink Vulnerable Species or species habitat may occur within
area
Dermochelys coriacea
Leatherback Turtle, Leathery Turtle, Luth Endangered Species or species habitat may occur within area
Sharks
Carcharias taurus (east coast population)
Grey Nurse Shark (east coast population) Critically Endangered Species or species habitat may occur within area
Carcharodon carcharias
Great White Shark Vulnerable Species or species habitat may occur within area
Galeorhinus galeus
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark Conservation
Dependent Species or species habitat may occur within area
Pristis zijsron
Green Sawfish, Dindagubba, Narrowsnout Sawfish Vulnerable Species or species habitat
may occur within area
Rhincodon typus
Whale Shark Vulnerable Species or species habitat may occur within area
Plants
Acronychia littoralis
Scented Acronychia Endangered Species or species habitat likely to occur within area
Baloghia marmorata
Marbled Balogia, Jointed Baloghia Vulnerable Species or species habitat likely to
occur within area
Corokia whiteana Vulnerable Species or species habitat likely to occur within area
Cryptocarya foetida
Stinking Cryptocarya, Stinking Laurel Vulnerable Species or species habitat known to
occur within area
Davidsonia jerseyana
Davidson's Plum, Ooray Endangered Species or species habitat likely to occur within
area
Davidsonia johnsonii
Smooth Davidsonia, Smooth Davidson's Plum, Small-leaved Davidson's Plum Endangered
Species or species habitat likely to occur within area
Diploglottis campbellii
Small-leaved Tamarind Endangered Species or species habitat likely to occur within
area

Elaeocarpus williamsianus
Hairy Quandong Endangered Species or species habitat likely to occur within area
Endiandra floydii
Floyd's Walnut Endangered Species or species habitat likely to occur within area
Endiandra hayesii
Rusty Rose Walnut, Velvet Laurel Vulnerable Species or species habitat likely to
occur within area
Floydia praealta
Ball Nut, Possum Nut, Big Nut, Beefwood Vulnerable Species or species habitat likely to
occur within area
Gossia fragrantissima
Sweet Myrtle, Small-leaved Myrtle Endangered Species or species habitat likely to
occur within area
Hicksbeachia pinnatifolia
Monkey Nut, Bopple Nut, Red Bopple, Red Bopple Nut, Red Nut, Beef Nut, Red Apple Nut, Red
Boppel Nut, Ivory Silky Oak Vulnerable Species or species habitat likely to occur within area
Macadamia tetraphylla
Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut
Vulnerable Species or species habitat likely to occur within area
Marsdenia longiloba
Clear Milkvine Vulnerable Species or species habitat likely to occur within area
Ochrosia moorei
Southern Ochrosia Endangered Species or species habitat likely to occur within area
Randia moorei
Spiny Gardenia Endangered Species or species habitat likely to occur within area
Syzygium hodgkinsoniae
Smooth-bark Rose Apple, Red Lilly Pilly Vulnerable Species or species habitat likely to
occur within area
Syzygium moorei
Rose Apple, Coolamon, Robby, Durobby, Watermelon Tree, Coolamon Rose Apple
Vulnerable
Species or species habitat likely to occur within area
Taeniophyllum muelleri
Minute Orchid, Ribbon-root Orchid Vulnerable Species or species habitat likely to
occur within area
Tinospora tinosporoides

Arrow-head Vine Vulnerable Species or species habitat likely to occur within area

Migratory Species [Dataset Information] Status Type of Presence

Migratory Terrestrial Species

Birds

Cyclopsitta diophthalma coxeni

Coxen's Fig-Parrot Migratory Species or species habitat likely to occur within area

Haliaeetus leucogaster

White-bellied Sea-Eagle Migratory Species or species habitat likely to occur within area

Hirundapus caudacutus

White-throated Needletail Migratory Species or species habitat may occur within area

Merops ornatus

Rainbow Bee-eater Migratory Species or species habitat may occur within area

Monarcha melanopsis

Black-faced Monarch Migratory Breeding may occur within area

Monarcha trivirgatus

Spectacled Monarch Migratory Breeding likely to occur within area

Myiagra cyanoleuca

Satin Flycatcher Migratory Breeding likely to occur within area

Rhipidura rufifrons

Rufous Fantail Migratory Breeding may occur within area

Xanthomyza phrygia

Regent Honeyeater Migratory Species or species habitat may occur within area

Migratory Wetland Species

Birds

Ardea alba

Great Egret, White Egret Migratory Species or species habitat may occur within area

Ardea ibis

Cattle Egret Migratory Species or species habitat may occur within area

Rostratula benghalensis s. lat.

Painted Snipe Migratory Species or species habitat may occur within area

Migratory Marine Birds

Apus pacificus

Fork-tailed Swift Migratory Species or species habitat may occur within area

Ardea alba

Great Egret, White Egret Migratory Species or species habitat may occur within area

Ardea ibis

Cattle Egret Migratory Species or species habitat may occur within area

Macronectes giganteus

Southern Giant-Petrel Migratory Species or species habitat may occur within area

Macronectes halli

Northern Giant-Petrel Migratory Species or species habitat may occur within area
Sterna albifrons
Little Tern Migratory Species or species habitat may occur within area
Thalassarche impavida
Campbell Albatross Migratory Species or species habitat may occur within area
Migratory Marine Species
Mammals
Balaenoptera edeni
Bryde's Whale Migratory Species or species habitat may occur within area
Eubalaena australis
Southern Right Whale Migratory Species or species habitat likely to occur within area
Lagenorhynchus obscurus
Dusky Dolphin Migratory Species or species habitat may occur within area
Megaptera novaeangliae
Humpback Whale Migratory Species or species habitat known to occur within area
Orcinus orca
Killer Whale, Orca Migratory Species or species habitat may occur within area
Sousa chinensis
Indo-Pacific Humpback Dolphin Migratory Species or species habitat may occur within
area
Reptiles
Caretta caretta
Loggerhead Turtle Migratory Species or species habitat may occur within area
Chelonia mydas
Green Turtle Migratory Species or species habitat may occur within area
Dermochelys coriacea
Leatherback Turtle, Leathery Turtle, Luth Migratory Species or species habitat may occur within area
Sharks
Carcharodon carcharias
Great White Shark Migratory Species or species habitat may occur within area
Rhincodon typus
Whale Shark Migratory Species or species habitat may occur within area
Other Matters Protected by the EPBC Act
Listed Marine Species [Dataset Information] Status Type of Presence
Birds
Anseranas semipalmata
Magpie Goose Listed - overfly marine area Species or species habitat may occur within
area
Apus pacificus
Fork-tailed Swift Listed - overfly marine area Species or species habitat may occur
within area
Ardea alba
Great Egret, White Egret Listed - overfly marine area Species or species habitat may occur within area

Ardea ibis
Cattle Egret Listed - overfly marine area Species or species habitat may occur within
area
Haliaeetus leucogaster
White-bellied Sea-Eagle Listed Species or species habitat likely to occur within area
Hirundapus caudacutus
White-throated Needletail Listed - overfly marine area Species or species habitat may occur within area
Lathamus discolor
Swift Parrot Listed - overfly marine area Species or species habitat likely to occur within area
Macronectes giganteus
Southern Giant-Petrel Listed Species or species habitat may occur within area
Macronectes halli
Northern Giant-Petrel Listed Species or species habitat may occur within area
Merops ornatus
Rainbow Bee-eater Listed - overfly marine area Species or species habitat may occur
within area
Monarcha melanopsis
Black-faced Monarch Listed - overfly marine area Breeding may occur within area
Monarcha trivirgatus
Spectacled Monarch Listed - overfly marine area Breeding likely to occur within area
Myiagra cyanoleuca
Satin Flycatcher Listed - overfly marine area Breeding likely to occur within area
Rhipidura rufifrons
Rufous Fantail Listed - overfly marine area Breeding may occur within area
Rostratula benghalensis s. lat.
Painted Snipe Listed - overfly marine area Species or species habitat may occur within
area
Sterna albifrons
Little Tern Listed Species or species habitat may occur within area
Thalassarche impavida
Campbell Albatross Listed Species or species habitat may occur within area
Ray-finned fishes
Acentronura tentaculata
Hairy Pygmy Pipehorse Listed Species or species habitat may occur within area
Campichthys tryoni
Tryon's Pipefish Listed Species or species habitat may occur within area
Corythoichthys amplexus
Fijian Banded Pipefish, Brown-banded Pipefish Listed Species or species habitat may occur
within area
Corythoichthys ocellatus

Orange-spotted Pipefish, Ocellated Pipefish Listed Species or species habitat may occur
within area
Festucalex cinctus
Girdled Pipefish Listed Species or species habitat may occur within area
Filicampus tigris
Tiger Pipefish Listed Species or species habitat may occur within area
Halicampus grayi
Mud Pipefish, Gray's Pipefish Listed Species or species habitat may occur within area
Hippichthys cyanospilos
Blue-speckled Pipefish, Blue-spotted Pipefish Listed Species or species habitat may occur
within area
Hippichthys heptagonus
Madura Pipefish, Reticulated Freshwater Pipefish Listed Species or species habitat may occur within area
Hippichthys penicillus
Beady Pipefish, Steep-nosed PipefishListed Species or species habitat may occur within
area
Hippocampus kelloggi
Kellogg's Seahorse Listed Species or species habitat may occur within area
Hippocampus kuda
Spotted Seahorse, Yellow Seahorse Listed Species or species habitat may occur within
area
Hippocampus planifrons
Flat-face Seahorse Listed Species or species habitat may occur within area
Hippocampus whitei
White's Seahorse, Crowned Seahorse, Sydney Seahorse Listed Species or species habitat
may occur within area
Lissocampus runa
Javelin Pipefish Listed Species or species habitat may occur within area
Maroubra perserrata
Sawtooth Pipefish Listed Species or species habitat may occur within area
Micrognathus andersonii
Anderson's Pipefish, Shortnose Pipefish Listed Species or species habitat may occur within
area
Micrognathus brevirostris
Thorn-tailed Pipefish Listed Species or species habitat may occur within area
Microphis manadensis
Manado River Pipefish, Manado Pipefish Listed Species or species habitat may occur within
area
Solegnathus dunckeri
Duncker's Pipehorse Listed Species or species habitat may occur within area
Solegnathus hardwickii

Pipehorse Listed Species or species habitat may occur within area
Solegnathus spinosissimus
Spiny Pipehorse, Australian Spiny Pipehorse Listed Species or species habitat may occur
within area
Solenostomus cyanopterus
Blue-finned Ghost Pipefish, Robust Ghost Pipefish Listed Species or species habitat may occur within area
Solenostomus paradoxus
Harlequin Ghost Pipefish, Ornate Ghost Pipefish Listed Species or species habitat may occur
within area
Stigmatopora nigra
Wide-bodied Pipefish, Black Pipefish Listed Species or species habitat may occur within
area
Syngnathoides biaculeatus
Double-ended Pipehorse, Alligator Pipefish Listed Species or species habitat may occur
within area
Trachyrhamphus bicoarctatus
Bend Stick Pipefish, Short-tailed Pipefish Listed Species or species habitat may occur
within area
Urocampus carinirostris
Hairy Pipefish Listed Species or species habitat may occur within area
Vanacampus margaritifer
Mother-of-pearl Pipefish Listed Species or species habitat may occur within area
Reptiles
Astrotia stokesii
Stokes' Seasnake Listed Species or species habitat may occur within area
Caretta caretta
Loggerhead Turtle Listed Species or species habitat may occur within area
Chelonia mydas
Green Turtle Listed Species or species habitat may occur within area
Dermochelys coriacea
Leatherback Turtle, Leathery Turtle, Luth Listed Species or species habitat may occur
within area
Hydrophis elegans
Elegant Seasnake Listed Species or species habitat may occur within area
Pelamis platurus
Yellow-bellied Seasnake Listed Species or species habitat may occur within area
Whales and Other Cetaceans [Dataset Information] Status Type of Presence
Balaenoptera acutorostrata
Minke Whale Cetacean Species or species habitat may occur within area
Balaenoptera edeni
Bryde's Whale Cetacean Species or species habitat may occur within area
Delphinus delphis

Common Dophin, Short-beaked Common Dolphin Cetacean Species or species habitat
may occur within area
Eubalaena australis
Southern Right Whale Cetacean Species or species habitat likely to occur within area
Grampus griseus
Risso's Dolphin, Grampus Cetacean Species or species habitat may occur within
area
Lagenorhynchus obscurus
Dusky Dolphin Cetacean Species or species habitat may occur within area
Megaptera novaeangliae
Humpback Whale Cetacean Species or species habitat known to occur within area
Orcinus orca
Killer Whale, Orca Cetacean Species or species habitat may occur within area
Sousa chinensis
Indo-Pacific Humpback Dolphin Cetacean Species or species habitat may occur within
area
Stenella attenuata
Spotted Dolphin, Pantropical Spotted Dolphin Cetacean Species or species habitat
may occur within area
Tursiops aduncus
Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin Cetacean Species or
species habitat likely to occur within area
Tursiops truncatus s. str.
Bottlenose Dolphin Cetacean Species or species habitat may occur within area
Commonwealth Lands [Dataset Information]
Communications, Information Technology and the Arts - Telstra Corporation Limited

Unknown
Extra Information
State and Territory Reserves [Dataset Information]
Billinudgel Nature Reserve, NSW
Marshalls Creek Nature Reserve, NSW
Wooyung Nature Reserve, NSW
Regional Forest Agreements [Dataset Information]
Note that all RFA areas including those still under consideration have been included.
Upper North East NSW RFA, New South Wales

Caveat
The information presented in this report has been provided by a range of data sources as
acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under "type of presence". For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the migratory and marine provisions of the Act have been mapped.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

threatened species listed as extinct or considered as vagrants
some species and ecological communities that have only recently been listed
some terrestrial species that overfly the Commonwealth marine area
migratory species that are very widespread, vagrant, or only occur in small numbers.
The following groups have been mapped, but may not cover the complete distribution of the
species:

non-threatened seabirds which have only been mapped for recorded breeding sites;
seals which have only been mapped for breeding sites near the Australian continent.
Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgments
This database has been compiled from a range of data sources. The Department acknowledges
the following custodians who have contributed valuable data and advice:

New South Wales National Parks and Wildlife Service
Department of Sustainability and Environment, Victoria
Department of Primary Industries, Water and Environment, Tasmania
Department of Environment and Heritage, South Australia Planning SA
Parks and Wildlife Commission of the Northern Territory
Environmental Protection Agency, Queensland
Birds Australia
Australian Bird and Bat Banding Scheme
Australian National Wildlife Collection
Natural history museums of Australia
Queensland Herbarium
National Herbarium of NSW
Royal Botanic Gardens and National Herbarium of Victoria
Tasmanian Herbarium
State Herbarium of South Australia
Northern Territory Herbarium
Western Australian Herbarium
Australian National Herbarium, Atherton and Canberra
University of New England
Other groups and individuals
ANUCliM Version 1.8, Centre for Resource and Environmental Studies, Australian National
University was used extensively for the production of draft maps of species distribution.
Environment Australia is extremely grateful to the many organisations and individuals who
provided expert advice and information on numerous draft distributions.

Last updated: Thursday, 20-Nov-2008 14:17:56 EST

Department of the Environment, Water, Heritage and the Arts
GPO Box 787 Canberra ACT 2601 Australia
Telephone: +61 (0)2 6274 1111

Appendix D

Curriculum Vitae,
Dr. Mark Fitzgerald
Animal Research Authority,
ACEC Certificate of approval
for fauna surveys

Parklands-Application Number 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by

Mark Fitzgerald

Ecological Consultant,

P.O. Box 237 Mullumbimby NSW 2482

CV, Animal Research Authority, and ACEC Certificate of approval for fauna surveys

CURRICULUM VITAE Mark Alan Fitzgerald

PERSONAL DETAILS

Address:	P.O. Box 237, Mullumbimby, NSW 2482.
Email Address:	markfitz@mullum.com.au & hoplocephalus@hotmail.com
Date of Birth:	28/4/54

EDUCATION

1990-2	Bachelor of Applied Science (Conservation Technology), Southern Cross University, Lismore, NSW. Degree awarded April 16th 1993.
1997-2004	Doctor of Philosophy by research, School of Biological Sciences, University of Sydney Degree awarded October 29th 2004.

SYNOPSIS

Mark Fitzgerald is an independent ecological consultant based in Mullumbimby Creek in Northern NSW. Engaged in professional fauna survey activities since 1982, more recent work includes supervision of clearing works for Abigroup (Yelgun to Chinderah and Brunswick to Yelgun Pacific Highway Upgrades), sand trap monitoring of the YTOC and BTOY projects, fauna surveys and ecological assessments for town planners, corporate clients, Tweed, Ballina and Byron Shire Councils.

Recent projects include assessment of a major cultural events site, assessments of residential subdivisions, road, bridge and causeway works, assessment of impacts of a wind turbine, assessment of sportsfield lighting, and investigative fauna surveys for the new Mullumbimby Sewage Treatment Works. Specific fauna research projects include glossy black-cockatoo monitoring, surveys of the Stephens' banded snake, broad-headed snake and pale-headed snake, targetted grass owl and acid frog surveys in NSW and radiotelemetry of an endangered pitviper in Shedao, China.

I have a current NSW NPWS scientific licence (S10817), current ACEC approval, and current professional indemnity, public liability and personal accident insurance policies. Details of my employment history, fauna survey experience, consultancy activities and scientific publications follow.

EMPLOYMENT HISTORY—1992-2000

1992-4: Technical Officer, University of Sydney, Biological Sciences Department (Carpet python telemetry project and field survey of the Broad-headed Snake).

1995-6: Supervisor; The Forest Survey Project: a 6 month survey, training 8 participants in fauna and flora survey techniques in the State Forests of the Coffs Harbour/Urunga management areas for the Nambucca Valley Conservation Association, Bowraville 2449 NSW.

1996: Zoologist; Department of Natural Resources, Resource Sciences Centre, Department of Natural Resources(formerly DPI Forestry Fauna and Ecology Section). 81 Meiers Road, Indooroopilly, Queensland. Preparation of Management Profiles for Endangered and Vulnerable Reptile Species.

1999-2000: Project Officer; Brigalow Belt South Fauna Survey for Western Zone New South Wales National Parks and Wildlife Service, Dubbo. A comprehensive fauna survey targetting Threatened species at 54 sites in ironbark forest of the Pilliga region.

CONSULTANCIES—1995-2000

Australian Koala Foundation
Survey of Herpetofauna and Avifauna and compilation of reports for these groups, for a Fauna Impact Statement for the Searanch/Koala Beach Development, Hastings Point, NSW.

Survey of Herpetofauna and Avifauna and compilation of reports for these groups for a Local Planning Study of the Wedderburn Plateau for Campbelltown City Council.

Preparation and implementation of a management and monitoring plan for the Glossy Black-cockatoo, for the Searanch/Koala Beach Development, Hastings Point, NSW.

Liaison with NPWS Northern Zone and Ray Group Pty Ltd. to vary development design in order to ameliorate impacts of pipeline construction on the Wallum Froglet (*Crinia tinnula*) and its habitat on the Searanch/Koala Beach Development, Hastings Point, NSW.

CSIRO Division of Wildlife and Ecology, Lyneham, ACT
Survey of Herpetofauna of State Forests of NSW Murwillumbah Management Area.

Kendall and Kendall Ecological Consultants, West Kempsey
Survey of the Herpetofauna of Yengo National Park.

NSW National Parks and Wildlife Service, Northern Zone, Coffs Harbour
Upper north-eastern New South Wales Regional Audit (NRAC); survey of Herpetofauna and preparation of Reptiles chapter in final Audit report.

Preparation of species profiles and management prescriptions for threatened forest reptiles.

Field surveys of frogs and reptiles for CRA surveys in north-eastern New South Wales

Kyogle Shire Council
Flora and Fauna Assessments & eight part tests for proposed re-alignment and reconstruction of the Summerland Way and Mt. Lindesay Highway.

Landmark Ecological Services
Preparation of Rare and Threatened fauna species expert statement Appendix to the Tweed Coast Littoral rainforests (SEPP No. 26) management plan

NSW National Parks and Wildlife Service, Western Region, Dubbo.
Preparation of text for Farm Management Brochure program for the Pale-headed Snake *Hoplocephalus bitorquatus*.

CONSULTANCIES 2000-2010

Abigroup Contractors Pty. Ltd.
Preparation of Environmental Plan and implementation of pre-clearing and post-clearing surveys for the Yelgun to Chinderah Pacific Highway bypass Upgrade.

Monitoring of fauna sand traps and preparation of a series of reports on fauna movement for the Yelgun to Chinderah Pacific Highway bypass Upgrade.

Monitoring of Ospreys *Pandion haliaetus* and nest at Brunswick Heads (for RTA).

Pre-clearing surveys for the Brunswick to Yelgun Pacific Highway Upgrade.

Provision of ecological services- fauna and habitats- for the Brunswick Heads to Yelgun Pacific Highway Upgrade.

Ecological assessment including 7 part tests for a proposed concrete batch plant at Yelgun.

Angelini Planning Services, Sydney
Prepare and report on the potential ecological impacts of the installation, operation and maintenance of a proposed telecommunications tower at Haystack Mountain, in Yabbra National Park, including 8 part tests.

Australian Koala Foundation, Brisbane
Preparation of threatened species impact assessments and eight part tests for Stages 3 & 4 of the Koala Beach Estate residential development, Hastings Point, NSW.

Fauna surveys and preparation of threatened species impact assessment documents and eight part tests for stage 5 & 6 of proposed residential development at Koala Beach.

Revision of the Plan of Management for the Glossy Black-cockatoo *Calyptorhynchus lathami*at Koala Beach Estate.

Systematic survey for vertebrate fauna, Redland Bay and report preparation.

Conduct monitoring and report on Glossy Black-cockatoo reserved habitat at Koala Beach, NSW.

Balanced Planning Systems Bangalow
Ecological assessment including 7 part tests for the Splendour in the Grass festival, 2006.

Ballina Shire Council
Survey for Wallum Froglet *Crinia tinnula* at the Ballina Industrial Estate re-zoning area.

Bray's Forest Eco-community
Targetted Surveys for Grass Owl, Masked Owl and Bush-hen, at Broken Head.

Byron Shire Council
Review of Species Impact Statement for proposed West Byron Sewage Treatment Plant Upgrade.

Review of threatened species assessment and eight part tests for townhouse development at Cavvanbah Street, Byron Bay.

Review of environmental issues for proposed townhouse development at Constellation Close, Byron Bay.

Review of environmental issues for proposed development at Chumbee Ave, Ocean Shores.

Review of environmental issues for proposed tourist cabins development at Talofa.

Review of environmental issues for proposed tourist cabins development at Main Arm.

Review of environmental issues for proposed rural residential subdivision at Ewingsdale.

Review of environmental issues for proposed tourist cabins development at Tyagarah.

Review of environmental issues for proposed tourist cabins development at Bangalow.

Review of environmental issues for proposed residential subdivision at Suffolk Park.

Review of environmental issues for proposed tourist cabins development at Billinudgel.

Review of environmental issues for proposed variation to development consent – multiple occupancy development at Upper Main Arm.

Review of environmental issues for proposed telecommunications cable replacement and installation at Broken Head.

Part V Planning Assessment report for translocation of a sand stockpile into the West Byron Sewage Treatment Works.

Review of Statement of Environmental Effects and '8 part test' for sand stockpile at West Byron Bay.

Review of compliance with consent conditions and ecological issues at the Byron at Byron Resort development, Suffolk Park.

Review of REF for application of herbicides at the West Byron Sewage Treatment Plant.

Targetted Surveys and Habitat Assessments for Grass Owl *Tyto capensis*, Wallum Froglet *Crinia tinnula* and Wallum Sedge Frog *Litoria olongburensis* at the West Byron Sewage Treatment Works.

Threatened species surveys, vegetation mapping assessment and habitat assessments at 249 Ewingsdale Road.

Survey for acid frogs in the 24 ha planted Melaleuca irrigation project at West Byron Sewage Treatment Plant.

Fauna study of the ReGenesis Myocum Wind Turbine Site and adjoining properties.

Ecological assessment including 7 part tests for roadside trimming at Suffolk Park.

Mullumbimby Drought Management Pipeline: Review of the REF and supplementary environmental assessment; field inspection and recommendation/confirmation of 7 part tests required; Preparation of 7 part tests for relevant species and endangered ecological communities; Provision of a summary report outlining above findings, including recommended mitigation measures.

Ecological assessment including 7 part tests for cycleway repair at North Ocean Shores.

Ecological assessment including 7 part tests for widening of Repentance Creek Rd.

Ecological assessment including 7 part tests for widening of Mafeking Rd.

West Byron Acid Frog surveys and reporting 2008-2010.

Fauna surveys at the proposed Mullumbimby Sewage Treatment Works site, Vallance's Road Mullumbimby.

Preparation of a Koala Plan of Management for the proposed Mullumbimby Sewage Treatment Works site, Vallance's Road Mullumbimby.

Ecological Assessment for the proposed replacement of Donaghy's Bridge at Goonengerry.

Ecological Assessment for the repair of road slips at Possum Shoot and Coorabell.

Ecological Assessment of the impact of new lights at the New Brighton Sportsfields.

Preparation of an REF and Ecological Assessment of the impact of a beach scraping trial at New Brighton.

Chris Power Environmental Planning Services, Byron Bay
Review and report on the ecological components of a Development Application for industrial land development at Wardrop Valley, Murwillumbah.

Tree surveys for Asset Protection zone implementation at Sangsuriya, Old Bangalow Rd. Byron Bay.

Ecological Assessment and reporting, including 7 part tests for a Section 96 proposal at Gray's Lane Tyagarah.

Department of the Environment and Conservation Coffs Harbour
Prepare Recovery Action documents for 6 Threatened reptile species.

Ecotone Ecological Services, Waratah
Targetted Survey for the Giant Barred Frog *Mixophyes iterates* at Maria River, Kempsey.

Ecos Environmental Consultants
Surveys for Great Barred Frog *Mixophyes iteratus* at Pine Creek.

Humphreys Reynolds Perkins Planning Consultants, Southport.
Review of public submissions received re: a DA for proposed townhouse development at Byron Bay.

Review ecological components of DA for a proposed rural tourist facility at Bangalow.

Review ecological components of DA for a proposed community title subdivision at Broken Head.

Land and Environment Court
Expert witness: Scotts Head Protection Group ats Nambucca Shire Council and anor.

Expert witness: Chris Lonergan and Assocs ats Byron Shire Council.

Expert witness: J. Vaughan ats Byron Shire Council.

Expert witness: Broadwater Action Group ats NSW Sugar Milling Cooperative and Richmond River Council.

Landmark Ecological Services, Byron Bay
Survey and report on the fauna and ecological values of the Warrell and Gumma Peninsulas, Nambucca Heads.

Malcolm Scott Town Planning Consultants
Ecological assessment, including 7 part tests, of a proposed residential development at Blackbutt Lane, Broken Head.

Non-corporate clients
Ecological assessment of land at Cooper's Shoot.

Ecological assessment including 8 part tests for a proposed residential development at Byron Bay.

Ecological assessment including 7 part tests for a proposed residential development at Laverty's Gap, Mullumbimby.

Tree surveys and preparation of a Vegetation Management Plan for a proposed residential development at Ocean Shores.

Ecological Assessment and preparation of a Biodiversity Conservation Management Plan for the coastal cypress pine endangered ecological community (EEC) at Suffolk Park.

North Byron Parklands
Targetted Surveys for Koalas, *Phascolarctos cinereus* Masked Owl *Tyto novaehollandiae* and Grass Owl *Tyto capensis* 2007-2009.

Systematic vertebrate fauna survey, August 2007.

Systematic vertebrate fauna survey February 2009.

Forest bird transect surveys 2007-2009.

Petrac Pty Ltd
Systematic fauna surveys and ecological advice for a residential development at Suffolk Park.

Planning Resolutions
Ecological Assessment, including 7 part tests, of a proposed residential development in Paterson St. Byron Bay.

Rous Water
Ecological assessment, including 7 part tests, of the proposed construction of a water pipeline at Brunswick Heads.

Resource Strategies Pty Ltd - Barrick Gold.
Review of *Environment Protection and Biodiversity Act* 1996 referral for the Lake Cowal Gold Mine.

Snowy Mountains Engineering Corporation
Reptile and frog surveys, Dunoon Dam site.

State Forests of New South Wales
Tuition of Frog and Reptile Survey methods for State Forests of New South Wales General Wildlife School Nymboida.

Radiotracking study of the Threatened Pale-headed Snake *Hoplocephalus bitorquatus* in the Darling riverine plains.

Tuition of fauna survey skills at the SFNSW Wildlife School, September 2005 Cascade NSW.

Tuition of fauna survey skills at the SFNSW Wildlife School, September 2007 Cascade NSW.

Tuition of fauna survey skills at the SFNSW Wildlife School, March 2009, Cascade NSW.

Stevens Group & Birrigan Gargle Local Aboriginal Land Council
Preliminary assessment of ecological constraints of a parcel of land at West Yamba.

Systematic fauna surveys and ecological assessment including 7 part tests for a parcel of land at West Yamba
Preliminary assessment of ecological constraints of a parcel of land at Iluka

Tein McDonald
Report on native vertebrate fauna of the Dirawong Reserve.

Tweed Shire Council
Surveys of the Glossy Black-Cockatoo *Calyptorhynchus lathami* and reserved habitat at Koala Beach.

Preparation of ‘reptiles and amphibians’ chapter for Life of the Tweed Coast.

Supervision of artificial hollow project for Glossy Black-cockatoos *Calyptorhynchus* at Koala Beach.

University of Sydney, Department of the Environment and Conservation and Climate Change
Surveys of the endangered Broad-headed Snake *Hoplocephalus bungaroides* and its habitats 2007-2009.

INVITED SPEAKER

Ecological Consultants Association
Invited Speaker Wildlife Corridors Conference, Australian Museum, Sydney September 2006.

Envite
Invited speaker, Envite Conference on rehabilitation and restoration, Ballina.

Gold Coast City Council, Nerang
Invited speaker, conference on fauna and habitat connectivity at Burleigh Heads.

U3A Brunswick Heads, 2009, 2010.

Brunswick Valley Landcare World Environment Day 2010

PUBLICATIONS

Fitzgerald M. and Pollitt, C.C. (1981) Oviparity and Captive Breeding in the Mulga or King Brown Snake *Pseudechis australis* (Serpentes: Elapidae) **Australian Journal of Herpetology. 1**(2) 57-60.

Fitzgerald M. (1983) A note on water collection by the Bearded Dragon *Pogona vitticeps* and Some Observations on the reproductive biology of the Common Scaly-foot *Pygopus lepidopodus* **Herpetofauna 14**(1 & 2) August 1982 and April, 1983.

Fitzgerald M. (1984) A New South Wales record for the Freckled Monitor *Varanus tristis orientalis*. **Herpetofauna 15**(1 & 2) August 1983 and February, 1984.

Mengden, G.A. and Fitzgerald M. (1987) The Paradoxical Brown Snakes pp.459-469. Chapter in **Toxic Plants and Animals: a guide for Australia**. Queensland Museum, Brisbane.
Fitzgerald M. and Mengden G.A. (1987) Captive Breeding in *Pseudechis butleri* (Serpentes:Elapidae) **Amphibia:Reptilia 8**:165-170. E.J. Brill, Leiden.

Fitzgerald M. (1989) Captive Reproduction in the Rough-scaled Snake *Tropidechis carinatus.* **Herpetofauna 19**(1) May, 1989.

Shine R. and Fitzgerald M. (1989) Conservation and reproduction of an endangered species: the Broad-headed snake *Hoplocephalus bungaroides* (Elapidae) **Australian Zoologist 25**: 65-67.

Fitzgerald M. (1990) *Rattus rattus* the introduced Black Rat, a successful predator on the introduced Cane Toad *Bufo marinus* in northern New South Wales". **Herpetofauna 24**(1) May, 1990.

Fitzgerald M. and Thorstensen C. (1994) A note on Eastern Grass Owl *Tyto longimembris* diet from the north coast of New South Wales **Corella 18**(3) 87-88.

Fitzgerald M. (1994) Notes on the ecology of the Dwarf Crowned Snake (*Cacophis krefftì*) in northeastern NSW **Herpetofauna 24**(2) December, 1994.

Shine R., Webb J. K., Fitzgerald M. and Sumner J. (1995) An ecological survey of the broad-headed snake *Hoplocephalus bungaroides* (*Serpentes :Elapidae*). Unpublished report to Endangered Species Unit, Australian Nature Conservation Agency and Threatened Species Unit, NSW National Parks and Wildlife Service.

Shine R. and Fitzgerald M. (1995) Variation in mating systems and sexual size dimorphism between populations of the Australian python *Morelia spilota* (Serpentes: Pythonidae). **Oecologia 103**: 490-498.

Shine R. and Fitzgerald M. (1996) Large snakes in a mosaic rural landscape: the ecology of carpet pythons, *Morelia spilota* (Serpentes: Pythonidae) in coastal eastern Australia. **Biological Conservation 76**: 113-122.

Fitzgerald M. (2000) Notes on a winter aggregation site, diurnal activity and diet for the Brown Tree Snake *Boiga irregularis* in northern New South Wales. **Herpetofauna 30**:1.

Shine R., L. Sun, M. Fitzgerald and M. Kearney. (2002) Antipredator Responses of Free-ranging Pit-vipers (*Gloydius shedaoensis*, Viperidae) **Copeia 2002**(3) 843-850.

Fitzgerald M., Shine R. and Lemckert F. (2002) A Radiotelemetric study of habitat use by the arboreal snake *Hoplocephalus stephensii* (Elapidae) in eastern Australia. **Copeia 2002** (2), 321-332.

Fitzgerald M., Shine R. and Lemckert F. (2002) Spatial ecology of arboreal snakes (*Hoplocephalus stephensii,* Elapidae) in an eastern Australian forest. **Austral Ecology 2002** (27), 537-545.

Shine R., Sun Li-Xin, Kearney M. and Fitzgerald M. (2002) Thermal correlates of foraging-site selection by Chinese pit-vipers (Gloydius shedaoensis, Viperidae). **Journal of Thermal Biology 2002** (27) 405-412.

Richard Shine, Li-xin Sun, Michael Kearney and Mark Fitzgerald (2002) Why do juvenile Chinese pit-vipers (*Gloydius shedaoensis*) select arboreal ambush sites? **Ethology 108** 987-910.

Scott J. Keogh, Ian A. W. Scott, Mark Fitzgerald and Richard Shine (2003) Molecular phylogeny of the Australian Venomous snake genus *Hoplocephalus* (Serpentes, Elapidae) and conservation genetics of the Threatened *H. stephensii*. **Conservation Genetics 4** 57-65.

Shine R., L. Sun, M. Fitzgerald, and M. Kearney. (2002) Accidental altruism in insular pit-vipers (*Gloydius shedaoensis,* Viperidae). **Evolutionary Ecology.16** 541-548.

Fitzgerald M. Shine R. and Lemckert, F. (2003) A reluctant heliotherm: thermal ecology of an arboreal snake. (*Hoplocephalus stephensii,* Elapidae). **Journal of Thermal Biology** 28 (2003) 515-524.

Fitzgerald M. Shine R. and Lemckert F. (2004) Life History attributes of the threatened Australian snake (Stephen's Banded Snake *Hoplocephalus stephensii,* Elapidae). **Biological Conservation**, September 2004, Vol 119, Issue 1, pp121-128**.**

Fitzgerald M., Shine R. and Lemckert F. (2005) Habitat Requirements of the threatened Stephens' Banded Snake *Hoplocephalus stephensii* in eastern Australia. **Austral Ecology 2005 30,** 465-474.

Fitzgerald M., Lazell B. and Shine R. (2009) Ecology and conservation of the Pale-headed Snake *Hoplocephalus bitorquatus*. Australian ZoologistVol 35(2), pp 283-290, 2009.

Book Review
"Pythons of Australia a natural history" by Geordie Torr. UNSW Press. For **Australian Zoologist**. February 2001.

FAUNA SURVEY EXPERIENCE

1981-1990

Survey of the reptiles and frogs of Moreton Island for the Moreton Island Protection Society.

Survey of reptiles and frogs of Yengo National park and Parr State Recreation Area for New South Wales National Parks and Wildlife Service.

Survey of reptiles and frogs of the Big Scrub rainforest remnants for New South Wales National Parks and Wildlife Service.

Radio-tracking of koalas *Phascolarctos cinereus* relocated from the Tweed Bypass for the Australian Koala Foundation.

1991-2000

Survey of the reptiles and frogs of the Gloucester and Chichester State Forest Management Areas for Ecotone Ecological Consultants.

Telemetry study of Carpet Pythons *Morelia spilota mcdowelli* in north-eastern New South Wales for University of Sydney, School of Biological Sciences.

Survey of reptiles and frogs of Chaelundi State Forest for State Forests of New South Wales Dorrigo District Office.

Survey of Threatened frogs of Cpt. 579 Wild cattle Creek State Forest for State Forests of New South Wales Dorrigo District Office.

Survey of reptiles, frogs and birds of "Searanch"(now Koala Beach), at Hastings Point for the Australian Koala Foundation.

Survey of reptiles and frogs of coastal crown Lands of north-eastern New South Wales for Natural Resources Assessment Commission (NRAC), for New South Wales National Parks and Wildlife Service.

Survey of Broad-headed Snake *Hoplocephalus bungaroides* habitats for Prof. R. Shine, University of Sydney, School of Biological Sciences.

Survey of reptiles and frogs of Yengo National Park for Kendall and Kendall Ecological Consultants, Kempsey.

Survey of the reptiles and frogs of State Forests of New South Wales Murwillumbah Management Area for CSIRO Division of Wildlife and Ecology.

Survey of reptiles, frogs and birds of the Wedderburn Plateau for the Australian Koala Foundation.
Supervisor, 'Forest Survey Project" a 6 months training survey of flora and fauna of State Forests of Coffs Harbour and Urunga, for Nambucca Valley Conservation Association, funded by DEETYA .

Flora and Fauna Assessments for proposed road realignment and reconstruction at Unumgar and at Mt.Lindesay for Kyogle Shire council.

Survey of reptiles and frogs for the north-eastern CRA process, for New South Wales National Parks and Wildlife Service, Northern Zone.

Survey of fauna at Scott's Head for the Scott's Head Protection Group.

Surveys for Threatened frog species in State Forests of the Grafton and Coffs Harbour Districts, for State Forests of New South Wales, Coffs Harbour.

Radiotelemetry of Stephen's Banded Snakes *Hoplocephalus stephensii* for Ph.D research.

Surveys targetting Threatened fauna species, at 54 sites in ironbark forests of the Pilliga regions for the southern Brigalow belt survey for Western Zone, New South Wales National Parks and Wildlife Service.

Fieldwork surgery, transmitter implantation, and telemetry of the pit-viper *Gloydius shedaoensis,* Shedao, China, for University of Sydney, School of Biological Sciences.

2001-2010

Surveys and radiotracking of Pale-headed Snakes *Hoplocephalus bitorquatus* in Darling riverine plains.

Survey of Frogs of Emigrant Creek Dam.

Survey of fauna and habitats of the Warrell Creek and Gumma Peninsula.

Survey of fauna and habitats of White's property, Blackbutt Road Broken Head.

Survey of fauna and habitats of the proposed biogeneration site, Broadwater Sugar Mill.

Targetted Common Planigale *Planigale maculata* surveys at the Koala Beach Estate.

Survey of fauna and habitats at Wardrop Valley, Murwillumbah.

Survey for threatened flora at Middle Pocket cabin development site.

Survey of bird fauna of the ReGenesis farm wind turbine proposed site.

Systematic survey of all vertebrate fauna of a proposed coastal development site at Redland Bay.

Targetted surveys for Grass Owl *Tyto capensis*, Wallum Froglet *Crinia tinnula* and Wallum Sedge Frog *Litoria olongburensis* at the West Byron Treatment Works.

Monitoring of Osprey *Pandion haliaetus* nest at Brunswick Heads.
Survey for frogs in the 24 ha planted Melaleuca irrigation project at West Byron Sewage Treatment Plant.

Survey for Wallum Froglet *Crinia tinnula* at the Ballina Industrial Estate re-zoning area.

Targetted surveys for Giant Barred Frog *Mixophyes iteratus M*aria River, Kempsey.

Surveys of fauna and flora at Gray's Lane Tyagarah

Targetted and systematic vertebrate fauna surveys at Yelgun NSW, for North Byron Shire Parklands project.

Targetted and systematic vertebrate fauna surveys at Suffolk Park, for Petrac Pty Ltd.

West Byron Acid frog project surveys, Byron Sewage Treatment plant and surrounds.

Surveys and habitat analysis for the Broad-headed Snake *Hoplocephalus bungaroides*.

Reptile and frog surveys of the proposed Dunoon Dam site.

Animal Research Authority Current until 28 June 2010

Trim File No. 04/3135
Meeting 127, 29 June 2009

ANIMAL RESEARCH AUTHORITY

Issued by the
DIRECTOR-GENERAL OF
NSW DEPARTMENT OF PRIMARY INDUSTRIES

Principal Investigator: **Dr Mark Fitzgerald**
PO Box 237
MULLUMBIMBY NSW 2482

is authorised
to conduct the following research

FAUNA SURVEYS

Location: **Byron, Tweed and Ballina Shires, and various north coast locations in New South Wales**

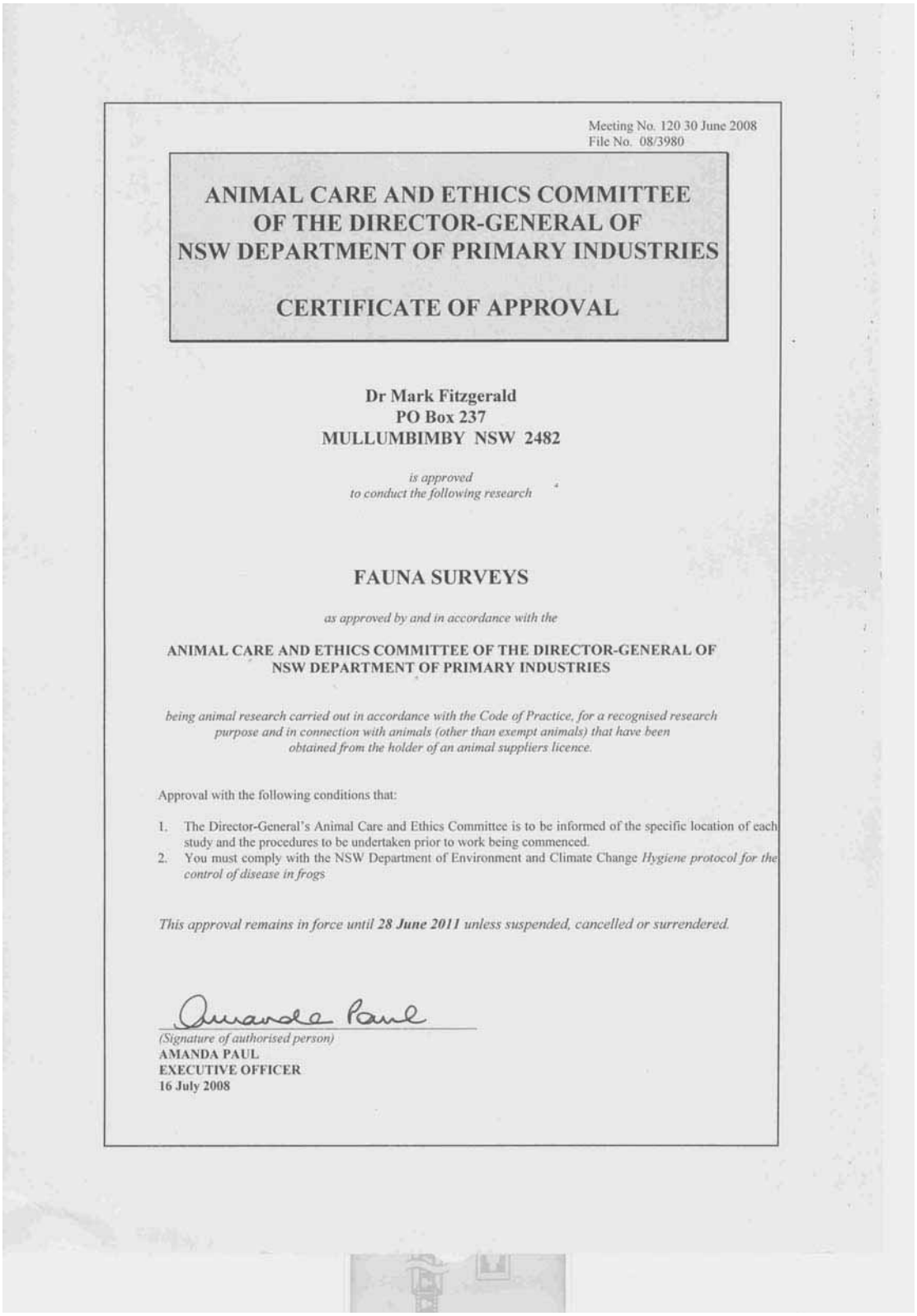
as approved by and in accordance with the
ANIMAL CARE AND ETHICS COMMITTEE OF THE DIRECTOR-GENERAL OF NSW DEPARTMENT OF PRIMARY INDUSTRIES

being animal research carried out in accordance with the Code of Practice, for a recognised research purpose and in connection with animals (other than exempt animals) that have been obtained from the holder of an animal suppliers licence.

*This authority remains in force until **28 June 2010** unless suspended, cancelled or surrendered.*

(Signature of authorised person)
ROSS BURTON
A/DIRECTOR, EMERGENCIES & ANIMAL WELFARE
7 July 2009

ACEC Certificate of Approval Fauna Surveys current to 28 June 2011



Meeting No. 120 30 June 2008
File No. 08/3980

ANIMAL CARE AND ETHICS COMMITTEE OF THE DIRECTOR-GENERAL OF NSW DEPARTMENT OF PRIMARY INDUSTRIES

CERTIFICATE OF APPROVAL

Dr Mark Fitzgerald
PO Box 237
MULLUMBIMBY NSW 2482

is approved
to conduct the following research

FAUNA SURVEYS

as approved by and in accordance with the

ANIMAL CARE AND ETHICS COMMITTEE OF THE DIRECTOR-GENERAL OF NSW DEPARTMENT OF PRIMARY INDUSTRIES

being animal research carried out in accordance with the Code of Practice, for a recognised research purpose and in connection with animals (other than exempt animals) that have been obtained from the holder of an animal suppliers licence.

Approval with the following conditions that:

1. The Director-General's Animal Care and Ethics Committee is to be informed of the specific location of each study and the procedures to be undertaken prior to work being commenced.
2. You must comply with the NSW Department of Environment and Climate Change *Hygiene protocol for the control of disease in frogs*

*This approval remains in force until **28 June 2011** unless suspended, cancelled or surrendered.*

Amanda Paul
(Signature of authorised person)
AMANDA PAUL
EXECUTIVE OFFICER
16 July 2008

Appendix E(i)

August 2007 fauna survey

of North Byron Parklands

Parklands-Application Number 09_0028

Prepared for

Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by

Mark Fitzgerald

Ecological Consultant

P. O. Box 237 Mullumbimby

NSW 2482

Executive summary

Systematic and targetted surveys in August 2007 identified the presence of 95 vertebrate species on the North Byron Parklands property, bringing the total known vertebrate fauna species on the property to 130 species. Eight fauna species listed as vulnerable under the NSW Threatened Species Conservation Act 1995 were recorded during the survey, and only four exotic species were detected.

The survey identified patterns of occurrence of fauna and of key resources for fauna on the site and identified suitable fauna species for monitoring to assess responses to disturbance during a proposed trial event planned for August 2008. A further summer (Feb-March) sample is proposed to ensure that summer migrants and summer active fauna of the site are adequately researched. Recommendations for both short term and long term monitoring of fauna and habitats are provided.

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APPENDICES

1.0 Introduction

Investigation of the ecological attributes of the North Byron Parklands site (NBSP) is an ongoing and iterative process. Site-specific data on the occurrence, distribution and abundance of fauna within the site will be used to inform patterns of use of the site and to direct strategies to minimise potentially adverse effects on fauna and their habitats. Earlier surveys (from November 2006 to June 2007) have provided details on the occurrence of flora and fauna in the NBSP site, including threatened species and endangered ecological communities. These include the following:

- Targetted survey for threatened flora within the proposed event footprint;
- Koala scat searches within the proposed event footprint;
- Property-wide surveys for Koalas (Biolink Consultants, Murwillumbah);
- Targetted rapid assessment surveys for threatened fauna;
- Targetted call playback surveys for forest owls.

The identification of fauna and habitats of the site is influenced by seasonal and climatic variation. Consequently a program of surveys and monitoring is being conducted to provide evidence of the fauna and ecology of the site. This includes the August 2007 survey reported here and involves a further survey in Feb-March 2008 and monitoring of selected fauna groups before, during and after the Splendour in the Grass 2008 event, if approved.

The first event proposed for the NBSP site is scheduled for August 2008, when Splendour in the Grass 2008 (SITG08) is proposed to be held. This proposal is the subject of a development application currently before Byron Shire Council. Among various mitigation measures included in the DA were recommendations for fauna surveys and monitoring. The current report describes the methods and results of a systematic fauna survey in August 2007. Survey results identify fauna groups present on the site which may be suitable targets for monitoring of reactions to event processes.

1.1 Rationale for the August 2007 fauna survey.

The purpose of the August 2007 fauna survey was described as to:
Identify patterns of use; location of significant resources; and influence event layout to minimise impacts (p147 Fitzgerald 2007). Because the first event proposed is scheduled to take place in August 2008, a similarly timed survey was intended to identify: fauna present on the site during August (late winter), and patterns of faunal occurrence, abundance and resource use at this time.

1.2 Limitations and factors affecting survey results

Climate at the time of survey was extremely dry and followed a period of colder than usual weather, including unexpected frost in lower parts of the NBSP site. Despite contact with agisters, cattle were not removed from the survey area as requested. This restricted the use of Anabat and Harp traps in some areas to avoid damage to expensive equipment. Where cattle had unlimited access, some nightly damage to drift fences in pitfall traps and interference with Elliot traps occurred. The timing of the survey and seasonal paucity of certain resources (especially fruits) mean that frugivores and summer migrants are under-represented in survey results. All survey activity took place north of Jones Rd.

1.3 Acknowledgements

David Newell assisted with fauna survey activities. Luke and Tom Fitzgerald assisted with the installation of pitfall traps. Anabat call analysis was performed by David Page. David Milledge assisted with *Antechinus* taxonomy.

2.0 Site Description—Location, topography, elevation, soils, waterbodies

The overall North Byron Parklands (NBSP) site holding comprises some 250ha located to the north and south of Jones Rd., Yelgun. The property is bounded to the west by the Tweed Valley Way and Billinudgel Nature Reserve (BNR) adjoins to the south.
The property is depicted in Figure 1.

Figure 1: The North Byron Parklands property

The southern portion of the site (south of Jones Rd.) is located in the Marshall's Creek floodplain, and the northern portion is in the Crabbe's Creek floodplain. The central portion of the overall site incorporates a low east-west oriented ridge upon which Jones Rd. is located. This ridge rises to ~30 m asl (AHD). However, the majority of the property, including the proposed parking, event and camping areas, lies below the 10 m contour.

Surface soils vary from dark organic loams to grey metasediment derived clays. Dense yellow clay substrates are exposed on lower slopes where surface soil has been removed. A man-made 1.8 ha dam is located in the northwest of the property, but is outside the direct footprint of the proposal, as are five other smaller dams. An established network of constructed drains is present in all lowland or floodplain areas. These vary from <1m to ~2m width and are up to 3m depth. Numerous drains are present in the proposed festival event area, camping and parking areas.

During the current survey the locality was experiencing prolonged drier-than-usual conditions, and most drains and smaller waterbodies were dry.

2.1 Site description—Vegetation summary

Vegetation of the site varies from: aquatic and fringing vegetation of drains, closely grazed pasture and various coastal floodplain forest communities. More elevated parts of the NBSP property support eucalypt and rainforest communities. The composition and condition of grassland communities reflect pastoral activities and management. In the north of the site management has resulted in a dense low and even sward of exotic pasture grasses. In the central property pasture is less intensively managed and comprises variable stands of exotic pasture species, the composition of which has been influenced by grazing pressure, groundwater levels and drainage. During the current survey grassland habitats were affected by drought, frost and grazing pressure, across the property.

A mosaic of remnant forest patches is present within the pasture matrix and includes the following associations listed as endangered ecological communities under the NSW *Threatened Species Conservation Act* 1995:

- Swamp sclerophyll forest on coastal floodplains of the NSW north coast bioregion;
- Sub-tropical floodplain forest of the NSW north coast bioregion;

Swamp Oak elements are present within some patches of the Swamp Sclerophyll Forest, but are localised minor or sub-dominant components of the upper stratum. Forest communities within the event footprint vary considerably in their canopy species dominance, species composition and groundlayer characteristics according to diverse environmental influences. However, they share several characteristics: all are regenerating communities, few or no old growth trees are present, large hollows are rare and very large trees are also rare or absent from all patches within the event site footprint. Cattle are currently using all unfenced forest patches within the event footprint and this has clearly affected the stature and species composition of groundlayer plant communities, the substrate, and terrestrial habitat values.

2.2 Site description—Landscape context

The event site is located in a largely fragmented landscape with small to moderate sized regenerating forest blocks in the immediate vicinity. However, much larger forest areas exist to the east and southeast in Billinudgel Nature Reserve; and to the northwest, including Mt Jerusalem National Park and forested lands extending to Mt Warning and ultimately to the Border Ranges.

Because of the fragmented nature of the local landscape, areas of habitat connectivity in the vicinity are likely to be important for terrestrial fauna. The wildlife corridor values of the area were recognised in the Cleland report (Office of the Commissioners of Inquiry for Environment and Planning 1997).

Distinct local barrier effects for terrestrial fauna are associated with the parallel Tweed Valley Way and Yelgun to Chinderah Pacific Highway upgrade and their associated fauna exclusion fencing. Fauna exclusion fencing associated with the recently completed Brunswick to Yelgun upgrade further restricts the movement of fauna in the locality. However dedicated crossing structures beneath the Yelgun to Chinderah freeway already facilitate movement of some fauna across this barrier (Fitzgerald 2007 in prep). Fauna use of these structures can generally be expected to increase over time, but is also limited by prevalent environmental conditions and the demographic nature of local fauna populations. Use of the fauna crossings by rare or declining fauna or by species with low density populations is predicted to be infrequent.

Open pasture areas also represent barriers for the movement of some smaller terrestrial vertebrate species *e.g.* small mammals, due to: specific habitat preferences and movement behaviour (*e.g.* Burnett 1992); and to the higher exposure to predator pressures in these areas.

The remnant forest patches of the site support many bird, flying-fox and microbat species, but the terrestrial fauna appears on initial investigation to be less speciose (fewer species present) due to habitat fragmentation, patch size limitations, widespread

degradation of terrestrial habitats by cattle, the influence of Cane Toads and feral predators. The proximity of Billinudgel Nature Reserve (BNR) and other vegetated lands in the vicinity potentially increases the capacity of the overall location to support local biodiversity of both flora and fauna, but existing forest fragmentation is a constraint. Importance of specific habitats of the NBSP site for particular species will be identified in fauna surveys and monitoring planned for the site.

3.0 Methods—Fauna

Survey effort in August 2007 was principally directed towards sampling small mammals, birds and bats. It was also directed towards identifying fauna groups occurring in sufficient numbers which could be monitored before, during and following the proposed SITG08 event, so that any impacts from the event on these fauna could be identified, quantified and mitigated.

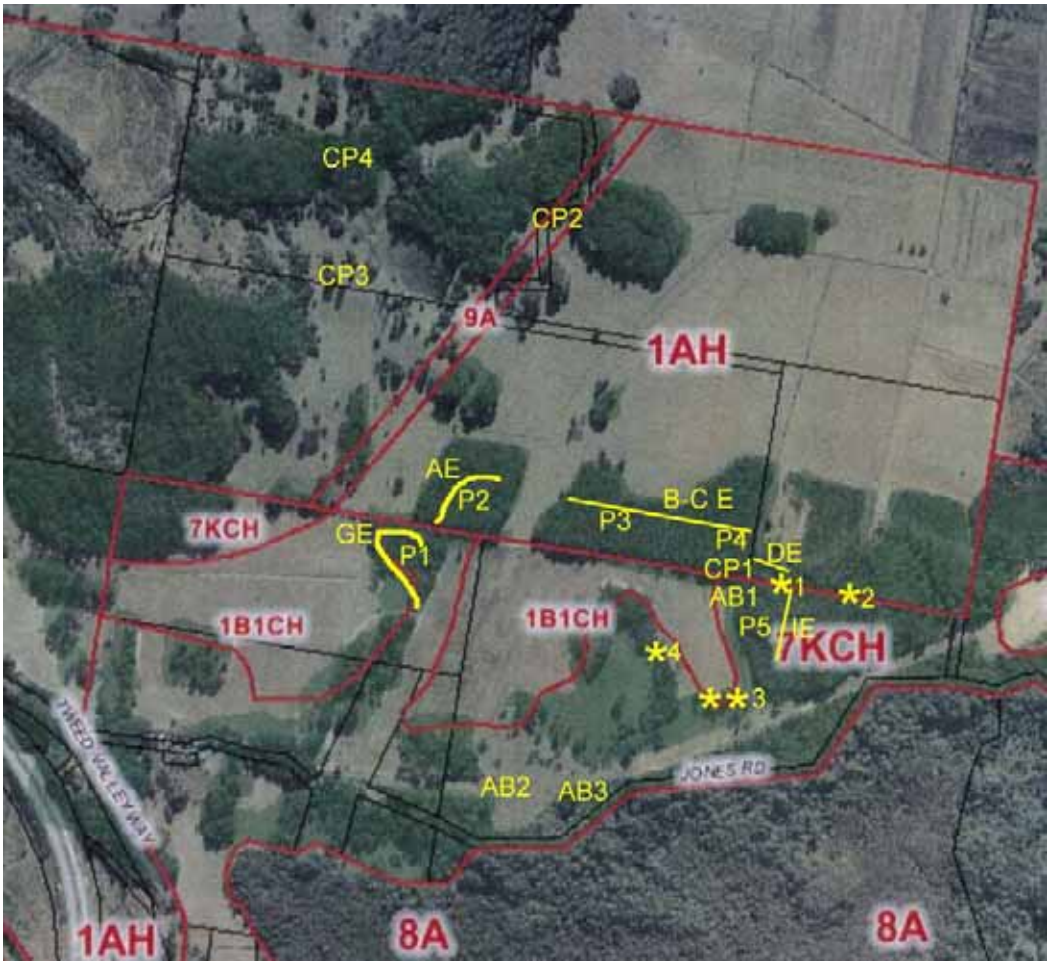
Survey effort allocated to the following techniques is detailed in Appendix A. Chronology of survey activities is detailed in Appendix A (i): Survey Diary. Details of the climate at time of survey (from the nearest recording station of Byron Bay) are included as Appendix B. Surveys were carried out under NPWS general scientific licence number S10817 and Animal Care and Ethics SRN 2675/250 and Protocol AW2004/029.

The location of most survey activities is depicted in Figure 2.

3.0.1 Methods—Drift fences and pitfall traps

Drift fences and pitfall traps were deployed in an attempt to detect the Threatened Common Planigale *Planigale maculata*, but pitfalls usually also capture other small vertebrates and many terrestrial invertebrate groups. Invertebrate captures in pitfalls can provide useful indices of biodiversity and groundlayer habitat quality.

Figure 2: Survey locations August 2007



Key: AB = Anabat sites; AE= Elliot trap line in block A; P1 = pitfall trap array; * = harp trap location; CP = call playback sites; spotlight transects involved repeated traverses of all central forest block margins and are not shown.

Five pitfall trap arrays each comprised five plastic buckets placed ~ 5 m apart and buried so the lip of the bucket was level with the ground surface. In total, buckets comprised twenty X 20 litre and five X 10 litre paint buckets. A single 30m roll of 30cm plastic dampcourse was then placed vertically to form a drift fence connecting the buckets and positioned so that fauna encountering the fence and moving along it were likely to then fall into the bucket. Drift fences were pegged in place with bamboo stakes and/or sticks. Buckets were equipped with dampened sponges to prevent desiccation, and with leaves and soil for smaller fauna to shelter beneath. Sponges were rehydrated where necessary.

Each morning pitfall traps were cleared at first light. Pitfall traps were also checked whenever encountered during the day or evening on other survey activities. Pitfall traps were installed with lids on August 11th, lids were removed on August 13th and three pitfall arrays were retrieved on July 15th. Two pitfall arrays in fenced forest blocks "G " and "I" were sealed and left *in situ* for further opportunistic monitoring.

3.0.2 Methods—Elliot traps

One hundred type A Elliot traps were deployed to sample the small mammal fauna of the site. Elliot traps are collapsible aluminium box traps which were baited with a mixture of peanut butter, oats and honey and placed in terrestrial vegetation, beside logs or in similar potential shelter sites. Elliot traps were each provided with a large handful of non-toxic fibre (Polyester Toy Fill) and were placed inside a plastic bag so trapped animals could stay warm and dry.

Elliot traps were deployed on the morning of August 13th. Elliot traps were removed from forest blocks "G and "I" on August 16th with 25 traps being placed in block "H". Details on Elliot trap effort in forest blocks is provided in Appendix A. All small mammal captures in Elliot traps are detailed in Appendix C.

Elliot traps were checked starting at first light each morning: all traps were cleared by ~ 9.00 each morning. Trapped rats were gently persuaded into a thick-walled clear plastic bag; Antechinus and House Mice were manually retrieved from the traps and identified as to species, sex and life stage (adult/immature), and released at the capture site.

3.0.3 Methods—Anabat detection

Anabat detection was used on 3 nights to record calls made by microchiropteran bats. Equipment used was an 'Anabat II Bat detector' (Titley Electronics, Ballina) connected to a compact flash storage zero crossing analysis interface module (ZCAIM). Anabat detection effort was focussed on small dams. Recorded calls were sent to a specialist analyst for species call diagnosis.

3.0.4 Methods—Frogs

Frogs were recorded opportunistically. An attempt was made to census Cane Toads *Bufo marinus* around waterbodies, but these animals were present at very low densities or absent due to the dry conditions. Frog surveys comprised spotlighting and listening at all waterbodies.

3.0.5 Methods—Harp Traps

Two Harp traps were used to sample microchiropteran bats. These were placed in various locations depicted in Figure 2. Harp traps were deployed on August 13th-14th; and 16th-18th. See Appendix D for details on harp trap results.

3.0.6 Methods—Birds and call playback

Birds were generally sampled opportunistically; records are based primarily upon identifying calls, but also include sightings. Call playback using a portable CD player and megaphone was used to target cryptic and nocturnal threatened birds: Black Bittern Bush-hen, Masked Owl, Grass Owl and Powerful Owl. Key flowering plant species *e.g.* Forest Red Gum *Eucalyptus tereticornis*, Swamp Mahogany *Eucalyptus robusta* and Broad-leaved Paperbark *Melaleuca quinquenervia* were examined to detect feeding birds by day. Birds were also recorded as they were encountered during other survey activities. Call playback took place on August 13th 14th & 16th: see Appendix E for details of locations and effort.

3.0.7 Methods—Flying-fox census

Because blossom crops were utilised nightly by Flying-foxes (mainly Grey-headed Flying-foxes *Pteropus poliocephalus*), effort was concentrated on identifying areas used and resources relied upon by these fauna. Spotlight searches of flowering trees took place on each night from August 13th to August 16th.

3.0.8 Methods—Spotlighting

Walking spotlight transects took place on three survey nights; and involved repeated traverses of central forest block margins, focussing on areas used by feeding Flying-

foxes. Spotlighting was used to illuminate the canopies of trees, particularly those in flower, in order to detect nocturnal fauna including Flying-foxes *Pteropus spp*. Spotlighting was used as well as to attempt to survey bandicoots and frogs at drains and swampy areas.

3.0.9 Methods—Reptiles

No threatened reptiles are considered likely to occur at the site. Given the dry and cold climate preceding and during the survey, no specific effort was directed towards the reptile fauna of the site. A warm seasonal survey proposed for February-March 3008 should allow optimal sampling of the reptile fauna of the NBSP site.

3.1.0 Methods—Tracks, scats, diggings and remains

Evidence of fauna in the presence of scats, tracks, remains and diggings was recorded whenever encountered.

3.1 Methods—Trapping and sampling locations

Survey activities focussed upon areas likely to be affected by conduct of the proposed SITG08 event and were carried out north of Jones Rd. Some areas remote from the event footprint were also sampled. Locations for traps were selected according to the known habitat preferences for target species and fauna groups. Locations of survey activities are depicted in Figure 2.

4.0 Results—Fauna recorded

Ninety-five (95) vertebrate fauna species were recorded from the site during the August 2007 survey. These included 4 exotic species. All fauna recorded during the survey are listed in Appendix F.

4.0.1 Results—Pitfall Trapping

Despite 125 pitfall trap/nights effort, pitfall trapping resulted in the capture of only one vertebrate: the Three-toed Skink *Saiphos equalis* in forest block "I". Invertebrate captures in pitfalls were also low in number and species diversity. In two areas where

they had access, cattle damaged drift fences almost nightly, and repeated repairs to drift fences were needed.

4.0.2 Results—Elliot trapping

Elliot trapping results over the survey period for each trapline are detailed in Appendix C. Fifty-nine (59) Elliot traps captures involved four (4) small mammal species. In order of abundance these were the Brown Antechinus *Antechinus stuartii* (43 captures), the native Bush Rat *Rattus fuscipes* (6), exotic House Mouse *Mus musculus* (6) and Black Rat *Rattus rattus* (4).

Table 1 lists the summary of small mammal captures by forest block.

Table 1: Summary of captures by Elliot traps in forest blocks

Forest block	**G**	**A**	**B-C**	**D**	**H**	**I**	**total**	**% of total**
Species								
Brown Antechinus	3	12	9	-	14	5	43	72.9
Bush Rat	-	2	-	-	-	4	6	10.1
Black Rat	-	-	-	-	4	-	4	6.7
House Mouse	-	-	6	-	-	-	6	10.1
TOTAL	3	14	15	0	18	9	59	

Because trap effort (number of traps & number of nights trapped) varied between forest blocks, the rate of captures, or captured per trap/night for forest blocks is shown in Table 2.

Table 2: Trap capture rate by forest block (captures per trap/night).

Forest	**G**	**A**	**B-C**	**D**	**H**	**I**	**total**

block							
Species							
Brown Antechinus	0.05	0.2	0.06	0	0.19	0.08	0.101
Bush Rat	0	0.03	0	0	0	0.07	0.014
Black Rat	0	0	0	0	0.05	0	0.014
House Mouse	0	0	0.04	0	0	0	0.009
total	0.05	0.23	0.10	0	0.24	0.15	0.138

4.0.3 Results—Anabat detection

Anabat detection was focussed upon small dams, and produced additional records of the threatened Little Bent-wing Bat *Miniopterus australis* from 2 small dams.

The White-striped Mastiff Bat *Nyctinomus australis* was also heard each night and occasionally seen in spotlight activities at various locations across the site.

4.0.4 Results—Frogs

Seven (7) native and one exotic frog species were recorded, despite the dry conditions. Native frog species detected included: the Common Eastern Froglet *Crinia signifera*, Brown-striped Marsh Frog *Limnodynastes peroni*, Broad-palmed Frog *Litoria latopalmata,* Eastern Dwarf Tree Frog *Litoria fallax*, Peron's Tree Frog *Litoria peroni* Rocket Frog *Litoria nasuta* and Verraux's Tree Frog *Litoria verrauxii*. The exotic Cane Toad *Bufo marinus* was also recorded.

4.0.5 Results—Harp Traps

Harp Trapping resulted in the capture of 36 bats comprising six (6) species. Four threatened bat species were included in the Harp trap captures. These were the threatened Blossom Bat *Syconycteris australis* (1), Eastern Long-eared Bat *Nyctophilus*

bifax (1), Large Bent-wing Bat *Miniopterus schreibersii* (1) and Little Bent-wing Bat *Miniopterus australis* (28): all listed as vulnerable under the NSW *Threatened Species Conservation Act* 1995 (TSC Act). Other bat species captured in harp traps included: Eastern Forest Bat *Vespadelus pumilus* (4) and Eastern Broad-nosed Bat *Scotorepens orion* (1).

4.0.6 Results—Birds and call playback

Seventy (70) species of native birds were recorded from the site during the survey period. Threatened species recorded include the Comb-crested Jacana *Irediparra gallinacea* and the Grass Owl *Tyto capensis*. The Grass Owl was detected during spotlighting and later also responded to call playback. Call playback for Black Bittern, Bush-hen, Masked Owl and Powerful Owl was unsuccessful. No exotic species were recorded. The bird species recorded are detailed in Appendix F.

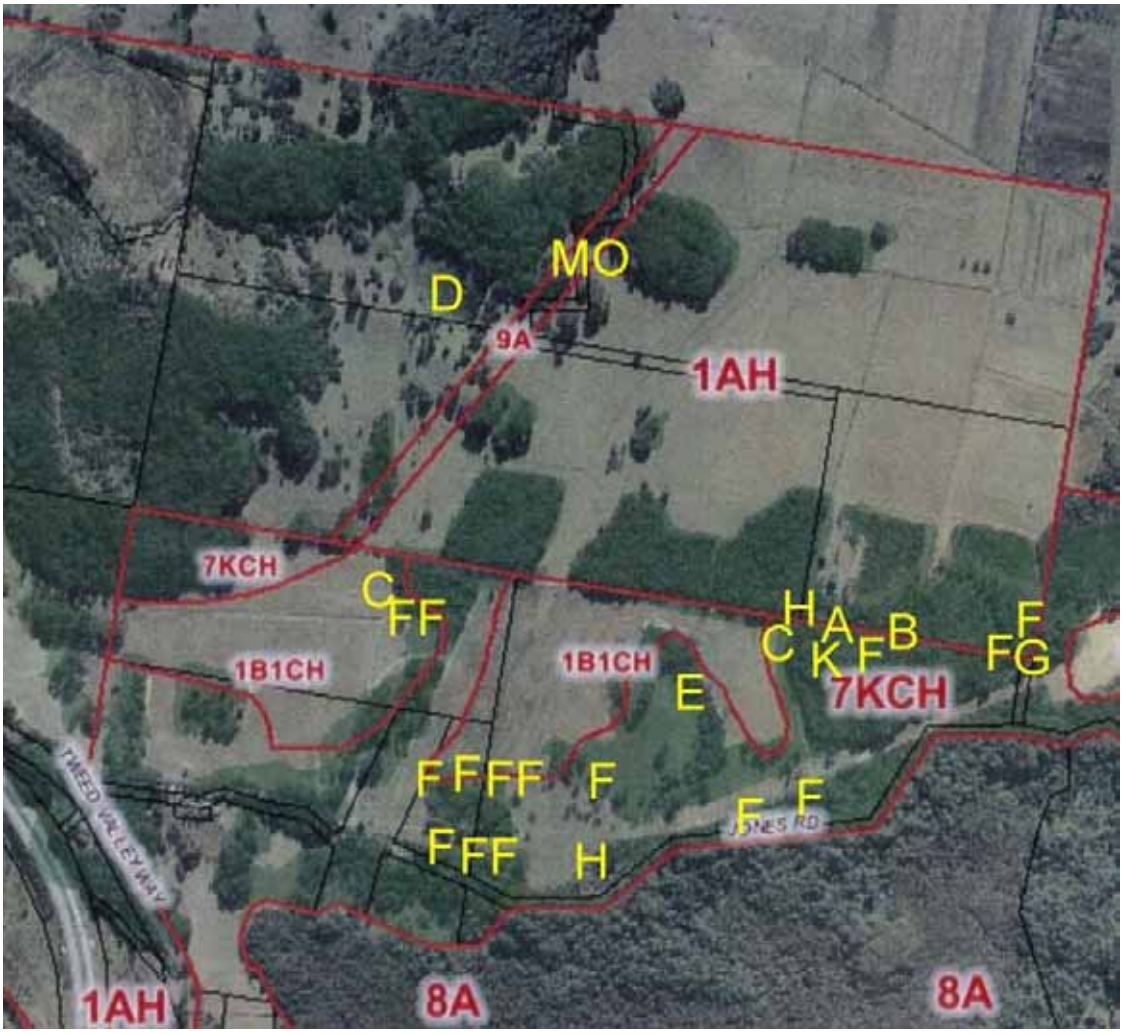
4.0.7 Results—Spotlighting

Spotlighting resulted in the detection of numerous Threatened Grey-headed Flying-foxes *Pteropus poliocephalus* and a single Black Flying-fox *Pteropus alecto* at various locations on the site where they were feeding in flowering Forest Red Gum *Eucalyptus tereticornis* and Swamp Mahogany *E. robusta*. Minor flowering was observed on Broad-leaved Paperbark *Melaleuca quinquenervia* but no Flying-foxes were detected utilising this resource during the survey period. Native figs on the site were targetted during spotlighting but no fruit was observed and no Flying-foxes (or frugivorous birds) were detected in figs during the August survey period.

The Long-nosed Bandicoot *Perameles nasuta* and Common Brush-tailed Possum *Pseudocheirus vulpecula* were detected by spotlighting as were active frogs, as described in section 4.0.4.

Threatened fauna species locations are depicted in Figure 3: all Threatened species records from the August survey are provided with map references in Appendix H.

Figure 3: Threatened fauna species locations



Key to Threatened species records: A = Little Bent-wing Bat *Miniopterus australis* and Blossom Bat *Syconycteris australis*; B = Little Bent-wing Bat and Large Bent-wing Bat *Miniopterus schreibersii*; C = Grass Owl *Tyto capensis*, D = Comb-crested Jacana *Irediparra gallinacea*, E = Eastern Long-eared Bat *Nyctophilus bifax*; F = Grey-headed Flying-fox *Pteropus poliocephalus*, and G = Black Flying-fox *Pteropus alecto*: H = Little bent-wing Bat

4.0.8 Results—Reptiles

The only reptile species detected during the survey was the Three-toed Skink *Saiphos equalis* recorded in a pitfall trap in forest block "I".

4.0.9 Results—Tracks, scats, remains, diggings

Swamp Wallaby scats were recorded at various locations of the site. Suitable track bearing surfaces, such as muddy waterhole edges were generally obliterated by cattle.

5.0 Discussion—Fauna communities of the site

Fauna recorded on site in this survey reflect the time of year and available resources. Fruits were in very limited supply during the survey period and as a consequence frugivorous birds were poorly represented or absent. The abundant blossoms of Forest Red Gum were exploited by lorikeets, honeyeaters, Noisy Friarbirds and Eastern Rosellas by day, and by Flying-foxes by night. Therefore, nectivorous fauna species dominate the sample.

The absence of reptiles is more difficult to explain: but groundlayer habitats within forest blocks were severely grazed and trampled wherever cattle had access to these areas. Climate was cool to mild and some rain fell during the survey period. Temperatures reached ~ 25^0C on August 11^{th} when pitfall traps were installed in 5 separate locations, yet even then the normally abundant and widespread Garden Sun-skink *Lampropholis delicata* was not recorded.

5.0.1 Discussion—Birds recorded during the survey

Birds were the most abundant fauna group at the site with seventy (70) species recorded in the August survey. As the site is dominated by extensive grassland areas, the most conspicuous bird fauna are those species occupying such open areas. These included the Masked Plover *Vanellus miles*, Richard's Pipit *Anthus novaseelandiae* Pied Butcherbird *Cracticus nigrogularis*, Australian Magpie *Gymnorhina tibicen*, Kookaburra *Dacelo* novaeguineae, Torresian Crow *Corvus orru*, Black-faced Cuckoo-shrike *Coracina novaehollandiae,* Cattle Egret *Ardeola ibis*, Wood Duck *Chenonetta jubata* and Straw-necked Ibis *T. spinicollis*.

Birds observed flying over the site included White-bellied Sea-eagle *Haliaeetus leucogaster*, Crested Hawk *Aviceda subcristata*, Grey Goshawk *Accipiter novaehollandiae*, Brown Goshawk *Accipiter fasciatus* and Torresian Crow *Corvus orru.*

The Pacific Black Duck *Anas superciliosa*, Hardhead *Aythya australis* , Australian Grebe, *Tachybaptus novaehollandiae,* Purple Swamphen *Porphyrio porphyrio*, Little Black Cormorant *Phalacrocorax sulcirostris* and Comb-crested Jacana *Irediparra gallinacea* were present on the large 1.8 ha dam (Jacana dam) in the north west of the property. Counts of these aquatic birds were made to provide a possible index of habitat use for comparison with counts during event processes.

Birds present in forest blocks foraging on blossoms of flowering Forest Red Gum and Swamp Mahogany; included Rainbow and Scaly-breasted Lorikeets *Trichoglossus haematodus* and *T. chlorolepidotus,* Noisy Friarbirds *Philemon corniculatus*, Yellow-faced Honeyeaters *Lichenostomus chrysops*, Striped Honeyeaters *Plectorhyncha lanceolata*, Noisy Miners *Manorina melanocephala*, Scarlet *Myzomela sanguinolenta* and Lewin's Honeyeaters *Meliphaga lewini*, and Eastern Spinebill *Acanthorhynchus tenuirostris*.

Other birds present in forest blocks included the Grey Shrike-thrush *Colluricincla harmonica,* Varied Triller *Lalage leucomela* , Rose Robin *Petroica rosea* Striated Thornbill *Acanthiza striata*, Golden and Rufous Whistlers *Pachycephala pectoralis* and *P. rufiventris* and Eastern Yellow Robin *Eopsaltria australis*.

Eastern Whipbirds *Psophodes* olivaceus, Superb Blue and Red-backed Fairy-wrens *Malurus cyaneus* and *M. melanocephalus* and White-browed Scrubwren *Sericornis frontalis*, Brown Quail *Coturnix ypsilophora* and Red-browed Finches *Stagonopleura oculata* were also recorded from forest habitats.

5.0.2 Discussion—Mammals recorded during the survey

Mammal fauna of the site included 17 species (14 native and 3 exotic). Native species included the Swamp Wallaby *Wallabia bicolor,* Echidna *Tachyglossus aculeatus*, Brush-tailed Possum *Trichosurus vulpecula*, Long-nosed Bandicoot *Perameles nasuta*, Brown

Antechinus *Antechinus stuartii*, Bush Rat *Rattus fuscipes*, 3 megachiropteran (Flying-foxes) and 6 microchiropteran (insectivorous bats) species. Exotic species recorded included the dog, Black Rat and House Mouse.

Bat fauna included 3 Megachiropteran species: Grey-headed Flying-fox, Black Flying-fox and Blossom Bat, all of which are listed as vulnerable in NSW under the TSC Act. The microbat fauna included 5 species, namely: the Threatened Little and Large Bent-wing Bats *Miniopterus australis* and *M. schreibersii*, and Eastern Long-eared Bat *Nyctophilus bifax*, and the Eastern Forest Bat *Vespadelus pumilus* and Eastern Broad-nosed Bat *Scotorepens orion.*

While the 2 Flying-fox species were recorded feeding in flowering forest red gums and swamp mahogany the remaining bat species were taken in harp traps in a track or gaps in forest habitats and recorded from Anabat detection at small dams (see Figure 2).

5.0.3 Discussion—Reptiles recorded during the survey

Climatic conditions and groundlayer habitat conditions combined with seasonal influences were clearly poor for detection of reptile species. Species detected earlier on the NBSP site, such as Carpet Pythons *Morelia spilota mcdowelli* and Eastern Water Dragons *Physignathus leseuerii* were unlikely to be encountered during the relatively cold conditions of late winter.

5.0.4 Discussion—Frogs recorded during the survey

Despite cold and dry conditions seven (7) native frog species and the Cane Toad *Bufo marinus* were detected during the August 2007 survey. The common Eastern Froglet was recorded from calls associated with drains and waterbodies across the areas surveyed. The Brown-striped Marsh Frog was only detected at the Jacana dam; and a chorus of Verraux's Tree Frogs *Litoria verrauxii* was heard nightly some distance from the site. The Broad-palmed Frog *Litoria latopalmata* was observed on bare soil around drains and the edge of dams, as was the Cane Toad. Peron's Tree Frog *Litoria peroni* and the

Eastern Dwarf Tree Frog *Litoria fallax* were recorded from calls at drains or watercourses and the Rocket Frog *Litoria nasuta* was recorded active in a drain.

5.05 Fish detected during the survey

The Plague Minnow *Gambusia holbrooki* which is a known predator of tadpoles, frog eggs and aquatic invertebrates (Anstis 2002) was observed in drains in the grassland block "GA", however, unexpectedly native fish were also observed in small numbers in these two drains (species unknown but possibly a gudgeon: family Eleotridae).

5.2 Discussion—Threatened fauna species of the site

For the purposes of this report 'Threatened species' are those listed under schedules of the New South Wales *Threatened Species Conservation Act* 1995. The Grey-headed Flying-fox is also listed as vulnerable federally under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Grey-headed Flying-foxes dominated the threatened fauna recorded at the site. Each night numbers of Grey-headed Flying-foxes (and an occasional Black Flying-fox) were seen and heard feeding in the blossoms of forest red gum and swamp mahogany on the site. The threatened Blossom Bat captured in a harp trap was probably also feeding on blossoms but were not detected in spotlighting. Different methods were used to quantify Flying-fox presence on the site. These included counts of feeding animals, counts of trees being used and a dusk fly-in census. The results are included as Appendix H. It was estimated that on the nights surveyed, this species was present in numbers from 100-200 animals across the event site.

The next most numerous threatened fauna were microbats, with three threatened species recorded: of these the Little Bent-wing Bat was most frequently recorded with 28 of the 36 (77%) Harp trap captures comprising this species.

A pair of Comb-crested Jacanas were observed active on the surface of the large dam in the north west of the site: this is called the 'Jacana dam' in this report. No evidence of nesting was seen, the breeding season is listed as November to May (Beruldsen 1980),

and September to January in the eastern portion of its range (Lindsey 1990). These birds are normally present when the dam is inspected and likely breed there.

The remaining threatened fauna species detected was the Grass Owl *Tyto capensis*. Suitable foraging habitat for this species is described as: dense vegetation < 2m high: (Woodward-Clyde 1998), and as: areas of tall grass, including grass tussocks in swampy areas, grassy plains, swampy heath, and cane grass, or sedges on floodplains (NPWS 2002). Recent records of the Grass Owl from the Byron coastal plain in 2007 were in areas with such tall groundlayer vegetation. Therefore it was unexpected to locate the Grass Owl on the evening of August 13th first by spotlighting a bird over a closely grazed paddock. On the same night the Grass Owl was also detected responding to call playback, by flying towards the call source, also in a closely grazed area. It can only be inferred that foraging behaviour for the species may change during drought periods. Small mammals are the major component of Eastern Grass Owl diet although the species will also take birds (Fitzgerald and Thorstensen 1994) and insects (*e.g.* Hollands 1991).

Two threatened species known from earlier surveys (Koala , Masked Owl) were not detected during the August survey.

6.0 Conclusion

Fauna recorded during the August 2007 survey reflect the time of year, prevailing dry period and patterns of resource availability. If more ripe fruit had been present it is possible that threatened Rose-crowned Fruit-doves *Ptilinopus regina* may have been detected in forests of the site, and certainly more frugivorous bird species would have been present.

Microchiropteran fauna recorded are similar to those recorded from the February rapid assessment surveys, with 4 species being present on both surveys (Little Bent-wing Bat, Eastern Long-eared bat, Eastern Broad-nosed and Eastern Forest Bat). This may indicate that these species may be present on the site throughout the year.

Survey results indicate that blossom crops on eucalypts may be the most important resource for fauna during the proposed Splendour 2008 event. Other important resources for fauna include the large dam, especially in dry years, and the forest interior. Grassland may be used by foraging Grass Owls.

6.1 Recommendations—long term fauna monitoring

Owners of the NBSP property are committed to an ongoing process of environmental repair and management to restore habitat connectivity and to optimise the biodiversity potential of the site. To demonstrate progress in this direction, it is proposed to monitor target fauna in key ecosystems of the property. In the long term, monitoring will document an increase in the area and quality of habitats available for native fauna. A collaborative process addressing target species and options of effective monitoring is in train and a discussion paper addressing the mechanisms of long term monitoring is provided as Appendix G to this report.

6.2 Recommendations—monitoring for the trial event: SITG08

In the short term, it is proposed to monitor the response of fauna to disturbance phenomena of the trial event: Splendour in the Grass 2008, in August 2008. Monitoring will be aimed at species considered likely to be disturbed by the conduct of the event, and will take place 3 days before the event, during the event and for 3 days following the event. A number of observers will be required to carry out the targetted monitoring described below.

Figure 3 depicts locations where threatened fauna were recorded during the August 2007 surveys. Within the proposed event footprint the northern margins of forest block "J" and forest red gums along the Jones Rd slopes were used by Grey-headed Flying-foxes on a nightly basis. Other areas used by Flying-foxes which coincide with event areas include the southern boundary of block "G. North and east of block "I", forage trees are more remote from the event processes but probably fall within an acoustic footprint. Thus opportunities exist to observe the reaction of these Flying-foxes in response to

diverse nocturnal event phenomena at a number of sites an, likely to vary along a disturbance threshold.

Stationing of observers at various locations to observe Flying-fox behaviour will provide clear evidence of responses to event phenomena such as noise and lighting. Such observation/monitoring continuing beyond the event will also determine if and when Flying-foxes return to use the resources following the cessation of event noise and lighting.

A similar opportunity exists at the Jacana Dam, where numbers of common waterbirds roost by night, and forage by day. However, the ducks observed at the Jacana dam also take flight and sometimes leave due to the presence of observers so care needs to be taken to ensure monitoring here detects responses to the event stimuli rather than approach of observers.

Monitoring of Koalas at the site will also take place with Biolink consultants conducting a search for Koalas and a review of activity areas identified in 2007 prior to the proposed trial event. If it is considered appropriate at the time, a radiotracking program may be employed to track koalas and koala movement during the event. .

6.3 Recommendations—Response to disturbance monitoring techniques for SITG08

Table 3 lists target species and monitoring techniques. Variation of seasonally available resources *e.g.* blossom, water may affect species targetted.

Table 3: Monitoring, target species, groups and techniques.

Target species/group	resource	Monitoring technique/timing
Nectivorous birds	blossom	Standard transect counts of birds; count of trees used/ morning
Jacana and Waterbirds	dams	Morning and afternoon counts by a well concealed observer
Flying-foxes	blossom	• Fly in census by stationary observers/dusk; • Count of trees used by feeding Flying-

		foxes; • Transect based count of feeding Flying-foxes
Blossom Bat	blossom	Harp Trap and/or Mist net sampling at standard sites
Microchiropteran Bats	forest	Harp traps at standard sites
Microchiropteran Bats	Forest, dams	Stationary Anabat at standard sites: dams and flyways
Koala	Forest, preferred food trees	Scat searches; spotlighting, radiotracking

REFERENCES

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APPENDICES

Appendix A: Survey Effort

Elliot traps

Number of traps	Nights in August 2007	Forest blocks sampled	Effort (Trap/nights)
100	13-15th	G, A, B, C-D, I	300
75	16th	A, B-C, D, H	75
25	17th	H	25
25	18th	H	25
Total			425

Harp Traps

Date	Period and location of operation	Trap/nights
13/8/07	All night/ separate locations on track btwn D & I	2
14/8/07	Traps closed late evening*; same locations as above	1
15/8/07	Inactive	-
16/8/07	Double trap set in forest stand to south of GA	2
17/8/07	One trap set in H	1
18/8/07	One trap set in H	1
	Total effort	7 trap/nights

* to prevent recaptures

Anabat Detection

Date	location	time	results
13/8/07	Corner dam; GA	1815-2000	Miniopterus australis
14/8/07	Jones Rd	1720-1815	
16/8/07	Dam near Jones Rd	1750-1830	Miniopterus australis

Appendix A (i):Survey Diary

Date	Activities	Person/hours
11/8/07	Dig pits and establish 5 pitfall trap arrays: 25 20L buckets and 150m of drift fence	15
13/8/07	AM: Set out 100 Elliot traps; erect 2 Harp Traps; open pitfall trap buckets; PM: Anabat corner dam; Spotlight transect; Grass Owl and Masked Owl call playback	12
14/8/07	AM: Clear Elliot traps, Harp traps; bird counts, Counts at Jacana dam PM: Clear harp traps and take bags off; Spotlight and call playback NW forest edge -Masked Owl & Powerful Owl; Call playback	16

	Black Bittern & Bush-hen at Jacana Dam; Grey-headed Flying-fox counts	
15/8/07	AM: Clear Pitfall ad Elliot traps; blossom search for nectivorous birds; incidental birds; Jacana dam bird count; PM: Flying-fox fly-in count; Anabat Jones Rd area	8
16/08/07	AM: Clear Pitfall traps and Elliot traps; Retrieve Elliot traps (50) from "G & I"; check block "K" unsuitable for Elliot traps; set up 25 Elliot traps in block "H"; set up 2 harp traps in "GA" PM: Reconnaissance, spotlight and call playback NW forest hilltop -Masked Owl & Powerful Owl; Anabat: dam on Jones Rd; Flying-fox count-fly-in; Spotlight search for Koalas, and Flying-fox count at feed trees; Masked Owl & Grass Owl call playback..	12
17/8/07	AM: bird census; check all pitfalls, check Harp traps; Pick up Elliots in "B & C-D"; dismantle grassland harp traps; install Harp trap in block "H"; wash and return Elliot traps to SCU	10
18/8/07	AM: Clear block "H" Elliot traps, check all pitfalls; clear Harp trap; Close pits in "I & G" retrieve pitfall traps and drift fences from "A, B- and C"	5
19/8/07	Clear and retrieve H" Elliot traps and clear & dismantle "G" Harp trap.	3
20/8/07	Wash Elliot traps and return to SCU	3

Appendix B Climate

Date	Min temp (°C)	Max temp (°C)	Rain (mm)	Dir max wind gust	Speed max wind gust (km/h)	Time max wind gust	9am Temp (°C)	9am rel hum (%)	9am cloud oktas	9am wind dir	9am wind speed (km/h)	9am Bar (hPa)
11/8/07	15.6	25.2	0	W	43	9:24	20	19	0	W	26	1018.8
12/8/07	15.5	24.1	0	SW	50	4:51	18.2	28	5	SW	19	1021.6
13/8/07	14.6	21.1	0	S	39	22:03	17.1	39	1	SW	15	1021
14/8/07	12.4		0.6				14.6	78	6	SW	22	1023.5
15/8/07									4			
16/8/07		19.9										
17/8/07	17.6	20.8		NNW	59	2:59	18.2	75		N	24	1020.2
18/8/07	15.6	19.3	0.2	WSW	41	3:39	18	52		SSW	17	1024.6
19/8/07	13.8	17	2	E	54	16:44	13.9	99		SSW	22	1027.7
Date												
11/8/07	3pm Temp (°C)	3pm rel hum (%)	3pm cloud amount oktas	3pm wind dir	3pm wind speed (km/h)	3pm pressure (hPa)						
12/8/07	22.6	44	0	NE	11	1016.4						
13/8/07	23.3	31	2	E	15	1019.1						
14/8/07	20.3	46	1	ESE	17	1019.1						
15/8/07	18.3	70	7	ESE	22	1021.4						
16/8/07			8									
17/8/07	19.9	69		N	31							
18/8/07	20.3	68		N	20	1017.3						
19/8/07	18.1	66		S	24	1023.7						
	16	93		SE	26	1024.9						

Appendix C: Elliot trap captures

Forest Block & trap numbers	**14/8/07**	**15/8/07**	**16/8/07**	**17/8/07**
G 1-25	--	A s	A s (2)	Traps out
A 26-40	A s (2)	A s (5)	A s (4)	A s R f (2)
B-C 41-75	A s M m	A s M m	A s (3) M m	A s (4) M m (3)
D 76-80	--	--	--	Traps out
I 81-100	A s (2) R f	A s R f (2)	A s (2) R f	Traps out
H 1-25	17/8/07	18/8/07	19/8/07	
	A s (5) R r	A s (5) R r	A s (4) R r (2)	

A s = *Antechinus stuartii* Brown Antechinus; M m = *Mus musculus* House Mouse*; R f = *Rattus fuscipes* Bush Rat; R r= *Rattus rattus* Black Rat*. Species marked with an asterisk are exotic.

Appendix D: Harp Trap results

Date	Location*	Species & TSC Act status	Sex	total
14/8/07	HT 1	Little Bent-wing Bat (V) *Miniopterus australis*	1M:7F	8
14/8/07	HT 1	Blossom Bat (V) *Syconycteris australis*	F	1
14/8/07	HT 2	Little Bent-wing Bat (V) *Miniopterus australis*	3M: 11F	14
14/8/07	HT 2	Eastern Forest Bat *Vespadelus pumilus*	1M: 1F	2
14/8/07	HT 1	Eastern Broad-nosed Bat	1F	1
14/8/07	HT 1	Eastern Forest Bat *Vespadelus pumilus*	Not sexed	1
14/8/07	HT 2	Large Bent-wing Bat (V) *Miniopterus schreibersii*	1 M	1
14/8/07	HT 2	Little Bent-wing Bat (V) *Miniopterus australis*	Not sexed	3
14/8/07	HT 2	Little Bent-wing Bat (V) *Miniopterus australis*	Not sexed	3
17/8/07	HT 3	nil		
18/8/07	HT 4	Eastern Long-eared bat (V) *Nyctophilus bifax*	1 M	1
19/8/07	HT 4	Eastern Forest Bat *Vespadelus pumilus*	1 M	1
		Total Harp trap captures		36

*Location of Harp traps are depicted in Figure 2.

Appendix E Call playback results

Date	Location	Species played	result
13/8/07	Corner dam; GA	Masked Owl, Grass Owl	Grass Owl observed
14/8/07	Northern forest edge	Masked Owl, Powerful Owl	Nil
14/8/07	Low ridge south of Jacana dam	Black Bittern , Bush-hen	Nil
16/8/07	Northwest forest hilltop	Masked Owl, Powerful Owl	Nil
16/8/07	Corner dam; GA	Masked Owl, Grass Owl	Nil

Appendix F: All fauna recorded in the survey and at the site

Species	Scientific name	August	Other	TSC Act	EPBC Act
AMPHIBIANS					
HYLIDAE					
Green Tree Frog	*Litoria caerulea*		X		
Broad-palmed frog	*Litoria latopalmata*	X	X		
Rocket Frog	*Litoria nasuta*	X	X		
Eastern Dwarf Tree Frog	*Litoria fallax*	X	X		
Laughing Tree Frog	*Litoria tyleri*		X		
Peron's Tree Frog	*Litoria peroni*	X	X		
Dainty Tree Frog	*Litoria gracilenta*		X		
Verraux's Tree-frog	*Litoria verrauxii*	X			
MYOBATRACHIDAE					
Common Eastern Froglet	*Crinia signifera*	X	X		
Tusked Frog	*Adelotus brevis*		X		
Brown-striped Marsh-frog	*Limnodynastes peroni*	X	X		
Red-backed Toadlet	*Pseudophryne coriacea*		X		
BUFONIDAE					
Cane Toad*	*Bufo marinus*	X	X		
BIRDS					
MEGAPODIDAE					
Brush-turkey	*Alectura lathami*	X	X		
TURNICIDAE					
Brown Quail	*Coturnix ypsilophora*	X			
ANATIDAE					
Maned Duck	*Chenonetta jubata*	X	X		
Pacific Black Duck	*Anas superciliosa*	X	X		
Hardhead	*Aythya australis*	X	X		
PODICIPEDIDAE					
Australasian Grebe	*Tachybaptus novaehollandiae*	X	X		
PHALACROCORIDAE					
Little Black Cormorant	*Phalacrocorax sulcirostris*	X	X		
ARDEIDAE					
White-faced Heron	*Egretta novaehollandiae*	X	X		
Pacific Heron	*Ardea pacifica*	X	X		
Rufous Night-heron	*Nycticorax caledonicus*		X		
Great Egret	*Egretta alba*		X		
Cattle Egret	*Ardea ibis*	X	X		
Straw-necked Ibis	*Threskiornis spinicollis*	X	X		
ACCIPITRIDAE					
Pacific Baza	*Aviceda subcristata*	X	X		
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	X	X		
Brown Goshawk	*Accipiter fasciatus*	X	X		
Grey Goshawk	*Accipiter novaehollandiae*	X	X		
Whistling Kite	*Haliastur sphenurus*		X		
Wedge-tailed Eagle	*Aquila audax*		X		

RALLIDAE					
Purple Swamphen	*Porphyrio porphyrio*	X	X		
JACANIDAE					
Comb-crested Jacana	*Irediparra gallinacea*	X	X	V	
CHARADRIIDAE					
Masked Lapwing	*Vanellus miles*	X	X		
COLUMBIDAE					
White-headed Pigeon	*Columba leucomela*	X	X		
Emerald Dove	*Chalcophaps indica*	X	X		
Bar-shouldered Dove	*Geopelia humeralis*	X	X		
Wonga Pigeon	*Leucosarcia melanoleuca*	X	X		
Brown Cuckoo-dove	*Macropygia amboinensis*		X		
Crested Pigeon	*Ocyphaps lophotes*		X		
PSITTACIDAE					
Galah	*Cacatua roseicapilla*	X			
LORIDAE					
Rainbow Lorikeet	*Trichoglossus haematodus*	X	X		
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	X	X		
Musk Lorikeet	*Glossopsitta concinna*	X			
PLATYCERCIDAE					
Eastern Rosella	*Platycercus eximius*	X	X		
CUCULIDAE					
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	X			
Pheasant Coucal	*Centropus phasianinus*	X			
Koel	*Eudynamys scolopacea*		X		
ALCEDINAE					
Azure Kingfisher	*Alcedo azurea*	X			
Laughing Kookaburra	*Dacelo novaeguineae*	X			
Sacred Kingfisher	*Halcyon sancta*		X		
CORACIIDAE					
Dollarbird	*Eurystomus orientalis*		X		
MEROPIDAE					
Rainbow Bee-eater	*Merops ornatus*		X		
TYTONIDAE					
Grass Owl	*Tyto capensis*	X		V	
Masked Owl	*Tyto novaehollandiae*		X	V	
CAPRIMULGIDAE					
White-throated Nightjar	*Eurostopodus mysticalis*	X	X		
AEGOTHELIDAE					
Australian Owlet-nightjar	*Aegotheles cristatus*	X	X		
PODARGIDAE					
Tawny Frogmouth	*Podargus strigoides*	X	X		
APODIDAE					
White-throated Needletail	*Hirundapus caudacutus*		X		
HIRUNDINIDAE					
Welcome Swallow	*Hirundo neoxena*	X	X		
MOTACILLIDAE					
Richard's Pipit	*Anthus novaeseelandiae*	X	X		

CAMPEPHAGIDAE					
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X	X		
Cicadabird	*Coracina tenuirostris*		X		
Varied Triller	*Lalage leucomela*	X	X		
PACHYCEPHALIDAE					
Rose Robin	*Petroica rosea*	X			
Eastern Yellow Robin	*Eopsaltria australis*	X	X		
Grey Shrike-thrush	*Colluricincla harmonica*	X	X		
Little Shrike-thrush	*Colluricincla megarhyncha*		X		
Golden Whistler	*Pachycephala pectoralis*	X	X		
Rufous Whistler	*Pachycephala rufiventris*	X			
MONARCHIDAE					
Grey Fantail	*Rhipidura fuliginosa*	X	X		
Willie Wagtail	*Rhipidura leucophrys*	X			
Black-faced Monarch	*Monarcha melanopsis*		X		
Restless Flycatcher	*Myiagra inquieta*		X		
ORTHONYCHIDAE					
Eastern Whipbird	*Psophodes olivaceus*	X	X		
SYLVIIDAE					
Tawny Grassbird	*Megalurus timoriensis*		X		
Golden-headed Cisticola	*Cisticola exilis*	X	X		
MALURIDAE					
Superb Fairy-wren	*Malurus cyaneus*	X	X		
Red-backed Fairy-wren	*Malurus melanocephalus*	X	X		
ACANTHIZIDAE					
White-browed Scrubwren	*Sericornis frontalis*	X	X		
White-throated Gerygone	*Gerygone olivacea*	X			
Striated Thornbill	*Acanthiza lineata*	X			
MELIPHAGIDAE					
Striped Honeyeater	*Plectorhyncha lanceolata*	X			
Noisy Friarbird	*Philemon corniculatus*	X	X		
Noisy Miner	*Manorina melanocephala*	X	X		
Lewin's Honeyeater	*Meliphaga lewinii*	X	X		
Yellow-faced Honeyeater	*Lichenostomus chrysops*	X			
Eastern Spinebill	*Acanthorhynchus tenuirostris*	X	X		
Scarlet Honeyeater	*Myzomela sanguinolenta*	X	X		
ZOSTEROPIDAE					
Silvereye	*Zosterops lateralis*		X		
DICAEIIDAE					
Mistletoebird	*Dicaeum hirundinaceum*		X		
PARDALOTIDAE					
Spotted Pardalote	*Pardalotus punctatus*	X	X		
Striated Pardalote	*Pardalotus striatus*	X	X		
PLOCEIDAE					
Red-browed Finch	*Neochmia temporalis*	X	X		
ORIOLIDAE					
Figbird	*Sphecotheres viridis*	X	X		
Oriole	*Oriolus sagittatus*		X		

STURNIDAE					
Common Myna*	*Acridotheres tristis*		X		
DICRURIDAE					
Spangled Drongo	*Dicrurus bracteatus*	X	X		
ARTAMIDAE					
White-breasted Woodswallow	*Artamus leucorhynchus*		X		
CRACTICIDAE					
Grey Butcherbird	*Cracticus torquatus*	X	X		
Pied Butcherbird	*Cracticus nigrogularis*	X	X		
Australian Magpie	*Gymnorhina tibicen*	X	X		
Pied Currawong	*Strepera graculina*	X	X		
CORVIDAE					
Torresian Crow	*Corvus orru*	X	X		
MAMMALS					
DASYURIDAE					
Brown Antechinus	*Antechinus stuartii*	X			
TACHYGLOSSIDAE					
Echidna	*Tachyglossus aculeatus*	X			
PHASCOLARCTIDAE					
Koala	*Phascolarctos cinereus*		X	V	
PERAMELIDAE					
Long-nosed Bandicoot	*Perameles nasuta*	X	X		
PHALANGERIDAE					
Brush-tailed Possum	*Trichosurus vulpecula*	X			
PETAURIDAE					
Sugar Glider	*Petaurus breviceps*		X		
MACROPODIDAE					
Swamp Wallaby	*Wallabia bicolor*	X	X		
PTEROPODIDAE					
Blossom Bat	*Syconycteris australis*	X	X	V	
Grey-headed Flying-fox	*Pteropus poliocephalus*	X	X	V	V
Black Flying-fox	*Pteropus alecto*	X		V	
MOLOSSIDAE					
Freetail Bat	*Mormopterus sp.*		X		
VESPERTILIONIDAE					
Little Bent-wing Bat	*Miniopterus australis*	X	X	V	
Large Bent-wing Bat	*Miniopterus schreibersii*	X		V	
Eastern Long-eared Bat	*Nyctophilus bifax*	X	X	V	
Eastern Broad-nosed Bat	*Scotorepens orion*	X	X		
Eastern Forest Bat	*Vespadelus pumilus*	X	X		
MURIDAE					
Bush Rat	*Rattus fuscipes*	X			
Black Rat*	*Rattus rattus*	X			
House Mouse*	*Mus musculus*	X			
CANIDAE					
Dog	*Canis familiaris*	X	X		

REPTILES					
CHELONIDAE					
Eastern Long-necked Turtle	*Chelodina longicollis*		X		
AGAMIDAE					
Eastern Water Dragon	*Physignathus leseuerii*		X		
SCINCIDAE					
Garden Sun-skink	*Lampropholis delicata*		X		
Friendly Skink	*Lampropholis amicula*		X		
Three-toed skink	*Saiphos equalis*	X			
Boidae					
Carpet Python	*Morelia spilota mcdowelli*		X		

Other: species recorded in earlier site work, including February 2007 survey; TSC Act = Threatened Species Conservation Act status: EPBC Act = Environment Protection and Biodiversity Conservation Act status: V = vulnerable.

Appendix G

Fauna Monitoring discussion paper: in consultation with David Milledge

Aim	Target Groups	Target Sub-groups/Species	Monitoring Methods
Biodiversity parameters			
Rare, specialised sensitive species	Conservation priority species including Threatened Species	Species not targeted by other methods: Red-bellied Black Snake, Glossy Black-cockatoo?, large owls, forest interior species	Call playback at standard sites, standard bird count and spotlight transects (should sample appropriate habitat and seasons)
Pest species	Introduced predators	Cane Toad, Red Fox	Standard spotlight transects, standard pitfall transects
	Native and introduced competitors	Noisy Miner, Indian Myna, Common Starling	Standard bird counts
Weeds	Major environmental weed species	Camphor Laurel?, Lantana, Crofton, Mist Weed etc	Standard weed transects (should sample appropriate habitat)
Ecosystem Functioning			
Increased nectar availability and pollination	Specialised nectarivores	Lorikeets, migratory/ nomadic honeyeaters, Blossom-bat, flying-foxes	Standard bird counts and spotlight transects; standard mist net/harp trap sites (should sample appropriate habitat and seasons)
Increased fruit/seed availability and dispersal	Specialised frugivores	White-headed Pigeon, *Ptilinopus* fruit-doves, Topknot Pigeon, Barred Cuckoo-shrike	Standard bird count transect (should sample appropriate habitat and seasons)
Improved vegetated ground cover, buffering and water quality	Specialised terrestrial frogs, specialised reptiles, small and medium-sized mammals	Tusked Frog, Red-backed Toadlet, *Mixophyes fasciolatus*?, Wallum Sedge Frog?, Land Mullet, *Saiphos equalis*, *Lampropholis amicula*?, Freshwater Snake?, Rough-scaled Snake, Lewin's Rail, Bush-hen, Grass Owl?, Tawny Grassbird, Common Planigale, Long-nosed Bandicoot, Long-nosed Potoroo, Grassland Melomys?	Standard pitfall and Elliott trapping transects; call playback (should sample appropriate habitat and seasons)
Improved vegetation connectivity	Forest interior species	*Egernia mcpheei*?, *Eulamprus murrayi*, *Saproscincus* spp, Dwarf Crowned Snake?, Noisy Pitta, Large-billed Scrubwren, Logrunner,	Standard pitfall, bird count, spotlight and Elliott trapping transects (should sample appropriate habitat and seasons); aerial

		Spectacled Monarch, White-eared Monarch, Little Shrike-thrush, Russet-tailed Thrush, Brown Antechinus, Koala, Fawn-footed Melomys, Eastern Long-eared Bat	photographic monitoring
Response to Disturbance			
	Light-sensitive species	Blossom-bat	Standard mist net/harp trap sites (should sample appropriate habitat, seasons and festival times)
	Noise sensitive species	Jacana?, Koala, microbats particularly sub-canopy species	Standard bird count and spotlight transects (should sample appropriate habitat, seasons and festival times), standard Anabat and harp trap sites
	Species sensitive to Camphor removal	White-headed Pigeon, *Ptilinopus* fruit-doves, Topknot Pigeon	Standard bird count transects (should sample appropriate habitat)

Appendix H: Threatened fauna species locations; all GDA 94; 13-19/8/07

Species and TSC Act status	Easting	Northing	number
Grey–headed Flying-fox *Pteropus poliocephalus* *V*	550950	6849870	20-30
Grey–headed Flying-fox *Pteropus poliocephalus* *V*	551550	6849848	Small groups 5-6
Grey–headed Flying-fox *Pteropus poliocephalus* *V*	551125	6850160	Small groups 5-6
Grey–headed Flying-fox *Pteropus poliocephalus* *V*	551700	6850130	Small groups 5-6
Grey–headed Flying-fox *Pteropus poliocephalus* *V*	551805	6850165	Small groups 5-6
Black Flying-fox *Pteropus alecto* *V*	551805	6850165	1
Blossom Bat *Syconycteris australis* *V*	551575	6850170	1
Eastern Long-eared Bat *Nyctophilus bifax* *V*	551325	6850070	1
Large bent-wing Bat *Miniopterus schreibersii* *V*	551700	6850130	1
Little Bent-wing Bat *Miniopterus australis*	551505	6850175	1
Little Bent-wing Bat *Miniopterus australis*	551175	6849775	1
Little Bent-wing Bat *Miniopterus australis*	551575	6850170	8
Little Bent-wing Bat	551700	6850130	20

Miniopterus australis			
Grass Owl *Tyto capensis* *V*	551505	6850175	1
Grass Owl *Tyto capensis* *V*	551125	6850160	1
Comb-crested Jacana *Irediparra gallinacea* *V*	550900	6850715	2

*Grey–headed Flying-fox is also listed as vulnerable under the federal EPBC Act.

Appendix E(ii)

February 2009 fauna survey

of North Byron Parklands

Parklands-Application Number 09_0028

prepared for

Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by

Mark Fitzgerald

Ecological Consultant

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Executive summary

Fauna survey effort in February 2009 resulted in the detection of 94 vertebrate species on the North Byron Parklands property, bringing the total known vertebrate fauna species on the property to 167 species. Three fauna species listed as vulnerable under the NSW *Threatened Species Conservation Act* 1995 were recorded, and four exotic species were detected during the February 2009 survey

The February 2009 fauna survey included samples of forested slopes in the northwest of the property which had not previously been intensively investigated. Survey effort in the central swamp and floodplain forests, which had been sampled in August 2007, provided information on seasonal variation in fauna occurrences in that area. Combined with winter 2008 bird and flying-fox surveys, the results of the February 2009 fauna surveys have added 33 vertebrate fauna species to the total known from the site since contemporary survey effort, resourced by Billinudgel Property Trust began in November 2006.

Availability of blossom and fruit resources clearly influenced the pattern of species abundance on the site, with one target group, the flying-foxes recorded in very low abundance due to the seasonal scarcity of blossom and fruit resources.

Analysis of accumulated fauna species records indicates the predominant importance of forest areas for vertebrate biodiversity of the Parklands site.

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APPENDICES

1.0 Introduction

Investigation of the ecological attributes of the North Byron Parklands site (NBSP) over the previous three years has provided information on contemporary patterns of biodiversity occurrence on the site, including threatened flora and fauna species and endangered ecological communities. Surveys from November 2006 to present include the following:

- Targetted survey for threatened flora November 2006;
- Koala scat searches May-June 2007;
- Property-wide surveys for Koalas June 2007 & September 2008 (Biolink Consultants, Murwillumbah);
- Targetted rapid assessment surveys for threatened fauna February 2007;
- Targetted call playback surveys for forest owls June 2007,
- Systematic fauna survey in August 2007;
- Bird and flying-fox surveys July-September 2008 and;
- Vegetation plot surveys in January 2009.

1.1 Rationale for the February 2009 fauna survey.

Following the August 2007 fauna survey of the Parklands site it was recommended that a further summer (Feb-March) sample be undertaken to ensure that summer migrants and summer active fauna of the site were investigated.

1.2 Limitations and factors affecting survey results

The February 2009 survey took place under wet conditions with minor local flooding which may have displaced terrestrial fauna from some central swamp forest trap lines. Wet conditions also constrained movement around the site, and limited the use of electronic equipment (Anabat, call playback) which can be easily damaged by moisture. Very little blossom was present on the Parklands property and fruit was also sparse so that nectivores and frugivores *e.g.* flying-foxes were poorly represented, or absent. The presence of cattle and their previous interference with pitfall arrays combined with forecasts of heavy rainfall determined the omission of pitfall traps for this survey.

Cicada noise started early (before 0900 DST) on most survey mornings and interfered with detection of calling birds. During night surveys noise from the Pacific Highway

was frequently loud and may have reduced the distance over which broadcast calls could be heard. Low flying small aircraft were a daily occurrence, the noise of which at times interfered with bird call detection. Elliot trap processing conflicted with optimal times for bird census. All survey activities took place north of Jones Road.

1.3 Acknowledgements

Tom Fitzgerald assisted with deployment, retrieval and scrubbing of Elliot traps. Ecotone Ecological Consultants provided Anabat bat call analysis, and Biolink Consultants undertook hair sample analyses.

2.0 Site Description—Location, topography, elevation, soils, waterbodies

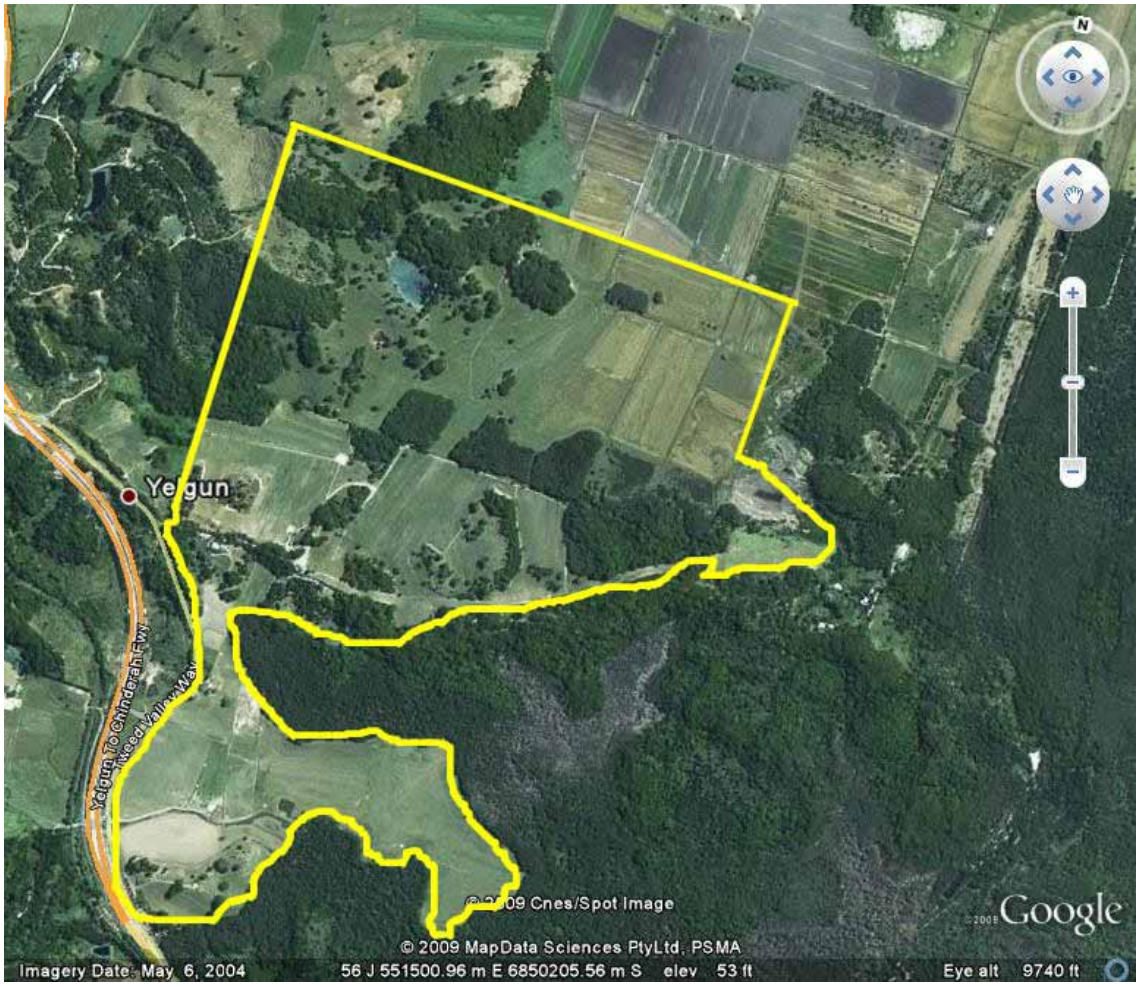
The Parklands site comprises ~ 250 ha lying on both sides of Jones Road at Yelgun, northeastern NSW. The northern property boundary is also Byron Shire's northern boundary. The property is bounded to the west by the Tweed Valley Way and Billinudgel Nature Reserve (BNR) adjoins to the south.

The southern portion of the site (south of Jones Rd.) is located in the Marshall's Creek floodplain, and the northern portion is in the Crabbe's Creek floodplain. The central portion of the overall site incorporates a low east-west oriented ridge upon which Jones Rd. is located. This ridge rises to ~30m asl (AHD). However, the majority of the property, including the proposed parking, event and camping areas, lies below the 10 m contour. The highest elevation on the Parklands site is ~ 100m AHD near the northwestern property boundary.

Surface soils vary from dark organic loams to grey metasediment derived clays. Dense yellow clay substrates are exposed on lower slopes where surface soil has been removed, and parts of the upper northwestern slopes are variably covered with small rock and low outcroppings.

A man-made 1.8 ha dam is located in the northwest of the property. Five other smaller dams are present on the site. An established network of constructed drains is present in all lowland or floodplain areas. These vary from <1m to ~2m width and from ~1.5m to 3m in depth. The property is depicted in Figure 1.

Figure 1: Parklands property outlined in yellow



Source: GoogleEarth; scale ~ 1: 29 100

2.1 Site description—Vegetation summary

More than half the area of the Parklands site is cattle pasture dominated by exotic grasses. Vegetation of the site includes aquatic and fringing vegetation of drains, closed sod grassland pasture and various forest communities. More elevated parts of the NBSP property support eucalypt and rainforest hill slope forests while swamp sclerophyll and floodplain forests are present in the lower central and eastern areas of the site. Trapping and survey activities in 2009 were focussed on forested habitats. Vegetation plot surveys undertaken in January 2009 and a vegetation report for Parklands (Kooyman 2009) provide more detailed information on vegetation of the site.

Endangered ecological communities listed under the NSW *Threatened Species Conservation Act* 1995which are present on the site include:

- Swamp sclerophyll forest on coastal floodplains of the NSW north coast bioregion;
- Sub-tropical floodplain forest of the NSW north coast bioregion;
- Lowland rainforest of the NSW north coast bioregion, and:
- Coastal Cypress Pine forest.

2.2 Site description—Landscape context

Parklands is located in a fragmented landscape with small to moderate sized forest blocks in the immediate vicinity. More extensive forest areas are present to the east and southeast in Billinudgel Nature Reserve; and to the northwest, including Mt Jerusalem National Park and forested lands extending to Mt Warning and ultimately to the Border Ranges. Extensive sugar cane cultivation occupies the landscape to the north.

Distinct local barrier effects for terrestrial fauna are associated with the parallel Tweed Valley Way and Yelgun to Chinderah Pacific Highway freeway and their associated fauna exclusion fencing. Fauna exclusion fencing associated with the recently completed Brunswick to Yelgun upgrade further restricts the movement of

fauna in the locality. A gap between fauna exclusion fences on the Yelgun flat may exacerbate the risk of roadkills for fauna in this area.

Dedicated crossing structures beneath the Yelgun to Chinderah freeway facilitate movement of some fauna across this barrier (Fitzgerald 2005). Fauna use of these structures can generally be expected to increase over time, but is also influenced by prevalent environmental conditions and the demographic nature of local fauna populations. Use of the fauna crossings by rare or declining fauna or by species with low density populations is predicted to be infrequent.

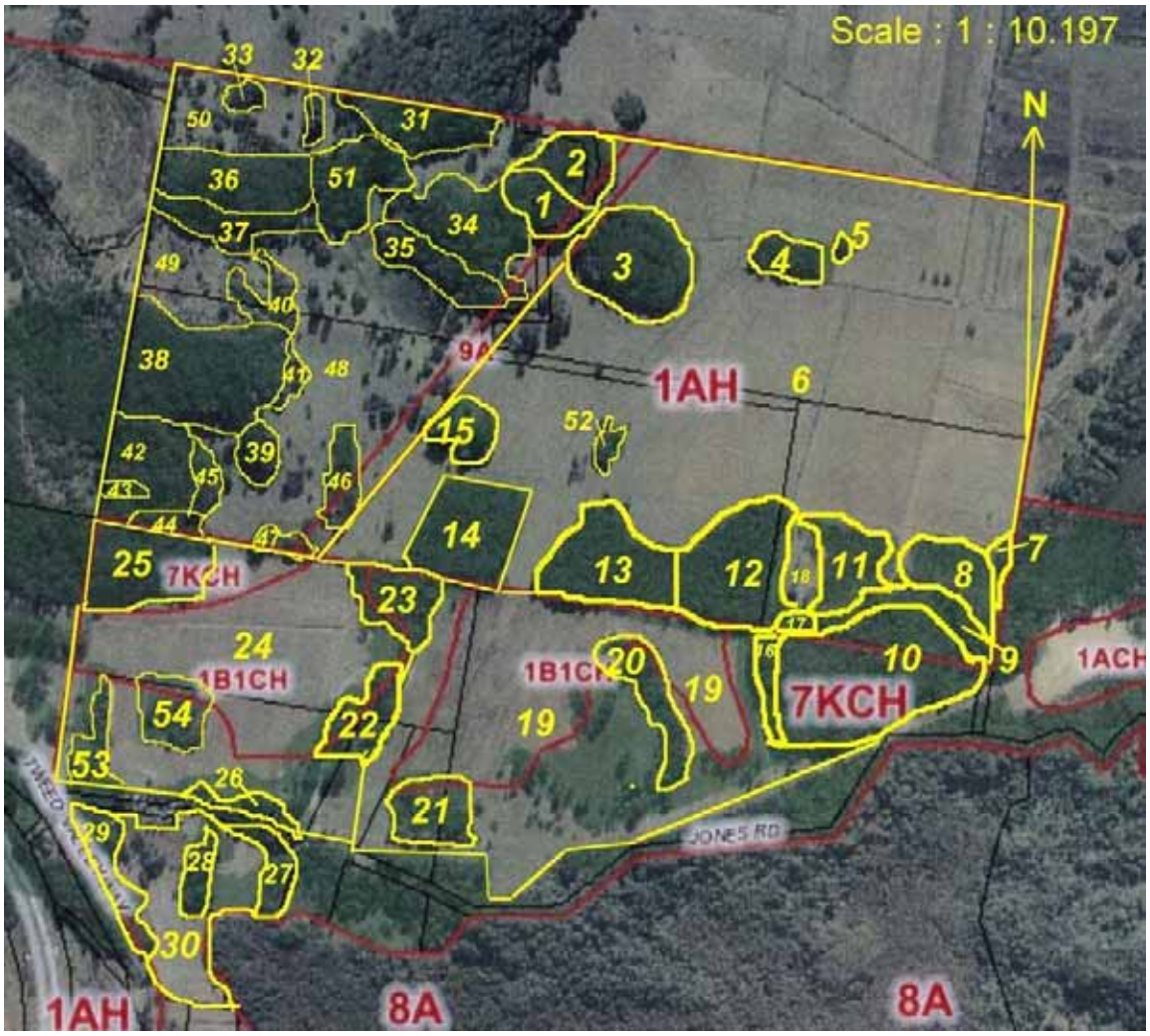
Open pasture areas also represent potential barriers for the movement of some smaller terrestrial vertebrate species *e.g.* small mammals, due to: specific habitat preferences and movement behaviour (*e.g.* Burnett 1992); and to the higher exposure to predator pressures in these areas. However, surveys at the Parklands site reveal the presence of small terrestrial mammals in pasture areas and in isolated forest blocks, indicating some movement across pasture between forest blocks.

The remnant forest patches of the site support many bird, flying-fox and microbat species, but fewer terrestrial fauna species are present, potentially due to: habitat fragmentation, patch size limitations, widespread degradation of terrestrial habitats by cattle, the influence of Cane Toads and feral predators and interactions between these factors. The proximity of Billinudgel Nature Reserve (BNR) and other forested lands in the vicinity potentially increases the capacity of the overall location to support local biodiversity of both flora and fauna, but existing forest fragmentation and small patch size remain important ecological constraints.

2.3 Identification of forest blocks

For the purpose of this survey report forest blocks are identified by numbers assigned to vegetation communities in Figure 2 (draft vegetation mapping: 2008).

Figure 2: Draft Vegetation Mapping 2008



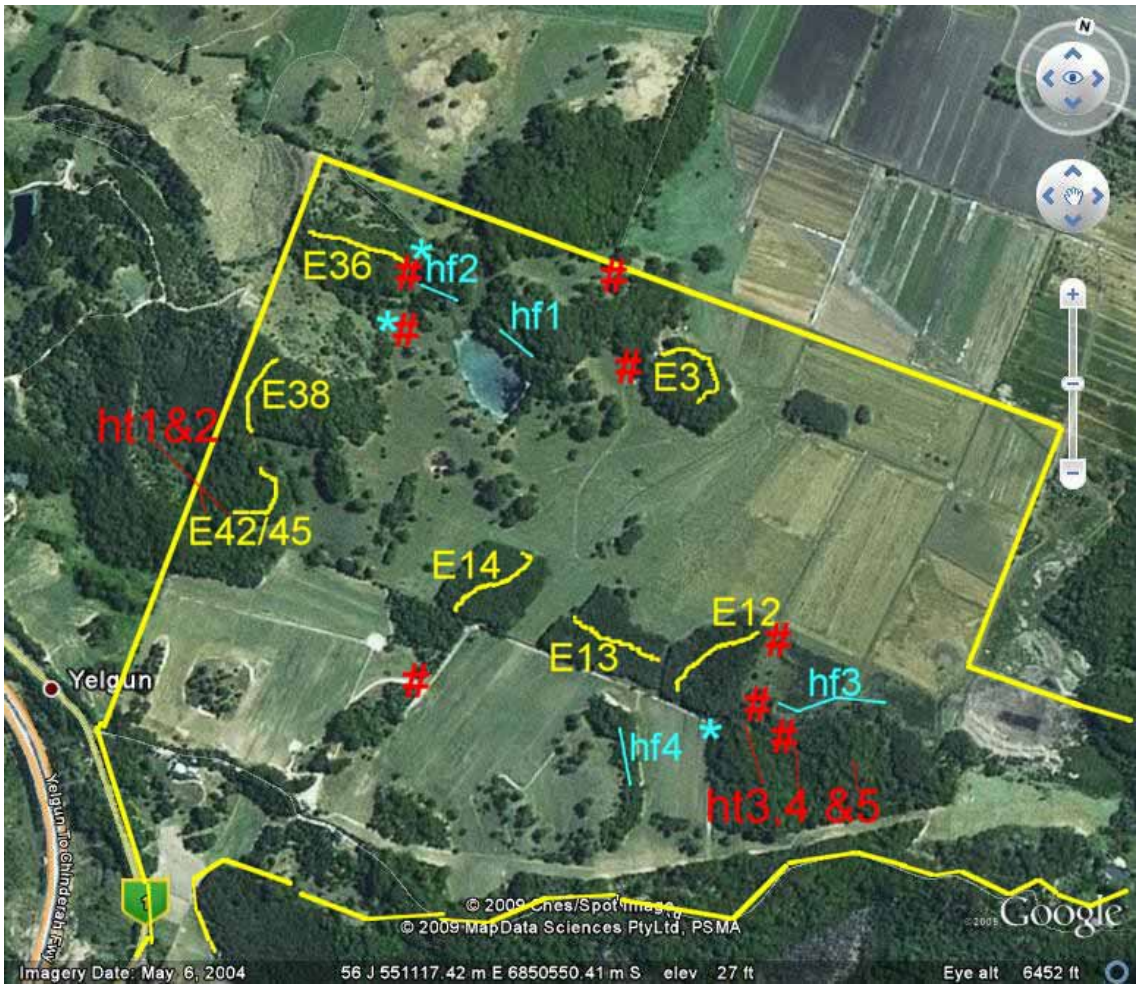
3.0 Methods—Fauna

Survey effort in February 2009 was generally directed towards investigating the fauna and habitat values of the northwestern hill slope forests which had not previously been intensively surveyed; and to obtaining additional summer data for the central swamp forest areas. Survey techniques included the use of type A Elliot traps to sample the small terrestrial mammal fauna; hair funnels to sample small to medium sized mammals, Anabat and Harp trapping for microchiropteran bats, call playback for nocturnal birds, walking spotlights for nocturnal fauna and diurnal searches for reptiles.

Survey effort allocated to the above techniques is detailed in Appendix A. Chronology of survey activities is detailed in Appendix A (i): Survey Diary. Details of the climate at time of survey are included as Appendix B. Surveys were carried out under NPWS general scientific licence number S10817 and Animal Care and Ethics

SRN 2675/250 and Protocol AW2004/029. The location of survey activities is depicted in Figure 3.

Figure 3: Location of survey activities



E38 = Elliot trap line in forest block #38; ht3 = Harp trap location#3; hf3 = hair funnel transect#3, red# = call playback locations.

3.0.1 Methods—Hair funnels

Fifty (50) hair funnels (Faunatech, Victoria) were deployed to detect the small to medium sized mammals of the site. Hair funnels were alternatively baited with a vegetable bait (rolled oats, peanut butter and honey) and a meat bait (dog chow). Four hair funnel lines were established in locations depicted in Figure 3.

3.0.2 Methods—Elliot traps

Elliot traps were deployed as follows: one hundred (100) Elliot traps were set out on February 16th in northwestern forest blocks. Twenty-five traps were set out 10m apart in ~250m transects in block 3 and in blocks (#s 36, 38 & 42: See Figure 2). Three nights of trapping ensued at these locations before traps were closed on February 19th. Traps were retrieved on February 22nd , re-baited, and three lines each of 25 traps were deployed in central swamp forest blocks #12, 13 & 14 for a further three nights. Elliot traps were retrieved on February 25th.

3.0.3 Methods—Anabat detection

Frequent rain limited use of Anabat which was operated at three locations over four nights. Mid-slope samples were obtained at two locations in hill slope forests on the nights of 17th & 19th of February. On the nights of 23rd & 24th February Anabat was operated at a small dam adjoining block I. Map references for all Anabat locations are provided in Appendix A.

3.0.4 Methods—Frogs

Frogs were recorded as detected, mainly by calls. Frog activity levels were high on all survey nights. Frogs were also detected during walking spotlight activities, during call playback and incidentally by calls and observations during other activities at the site.

3.0.5 Methods—Harp Traps

For the first night of survey only one Harp trap (Faunatech Victoria) was available, subsequently two Harp traps were deployed at 5 locations overall, designated HT#1-HT#5. Two locations on a track in rainforest in the west of the property were initially sampled (17-19/2/09), before Harp traps were moved to locations along a track in the central swamp forest blocks of the Parklands property(23/2/09-24/2/09). Harp traps were cleared each morning and bats were processed (weighed, measured & identified) each afternoon. However, when bats were located in traps late on the evenings of 17, 19, 23, & 24th February these were identified on site and immediately released. Map references for all Harp Trap locations are provided in Appendix A.

3.0.6 Methods—Birds and call playback

In the northwestern hill slope forests bird calls were recorded opportunistically along Elliot trap lines and in the vicinity in forest polygons #36, #38 and #s 42/45. In the central swamp forest area two standardised 20 minute/2 hectare bird counts took place along Elliot trap lines in vegetation polygons #12. #13 & #14. Birds were recorded during call playback, movement around the site and during other activities.

Call playback for forest owls (Powerful, Sooty & Masked) was undertaken at five sites in the northwestern hill slope forests. Call playback for the Grass Owl took place at five sites in the central swamp forests. Masked, Powerful and Sooty Owl calls were also broadcast at one site in the central swamp forests. Map references for all call playback locations are provided in Appendix A.

3.0.7 Methods—Flying-fox census

No flying-fox counts were undertaken due to the low numbers of this fauna at the site.

3.0.8 Methods—Spotlighting

Walking spotlight searches took place on four nights and focussed on forest edges and forest tracks in the northwestern hill slope forests (February 17th & 19th) and on forest edges and tracks in the central swamp forests (February 23rd & 24th).

3.0.9 Methods—Reptiles

Daytime searches on foot were made of the edge of forests in an attempt to detect basking reptiles, and reptiles were recorded during deployment of traps.

3.10 Methods—Tracks, scats, diggings and remains

Evidence of fauna in the presence of scats, tracks, remains and diggings was recorded whenever encountered.

3.1 Methods—Trapping and sampling locations

Survey activities focussed upon two areas: the northwestern hill slope forests, because these areas had not been intensively sampled previously; and the central swamp forests in order to provide data on summer faunal occurrences in this area. Locations for traps and for searches were selected according to habitat preferences of target

species and fauna groups. Locations of most survey activities are depicted in Figure 3.

4.0 Results—Fauna recorded

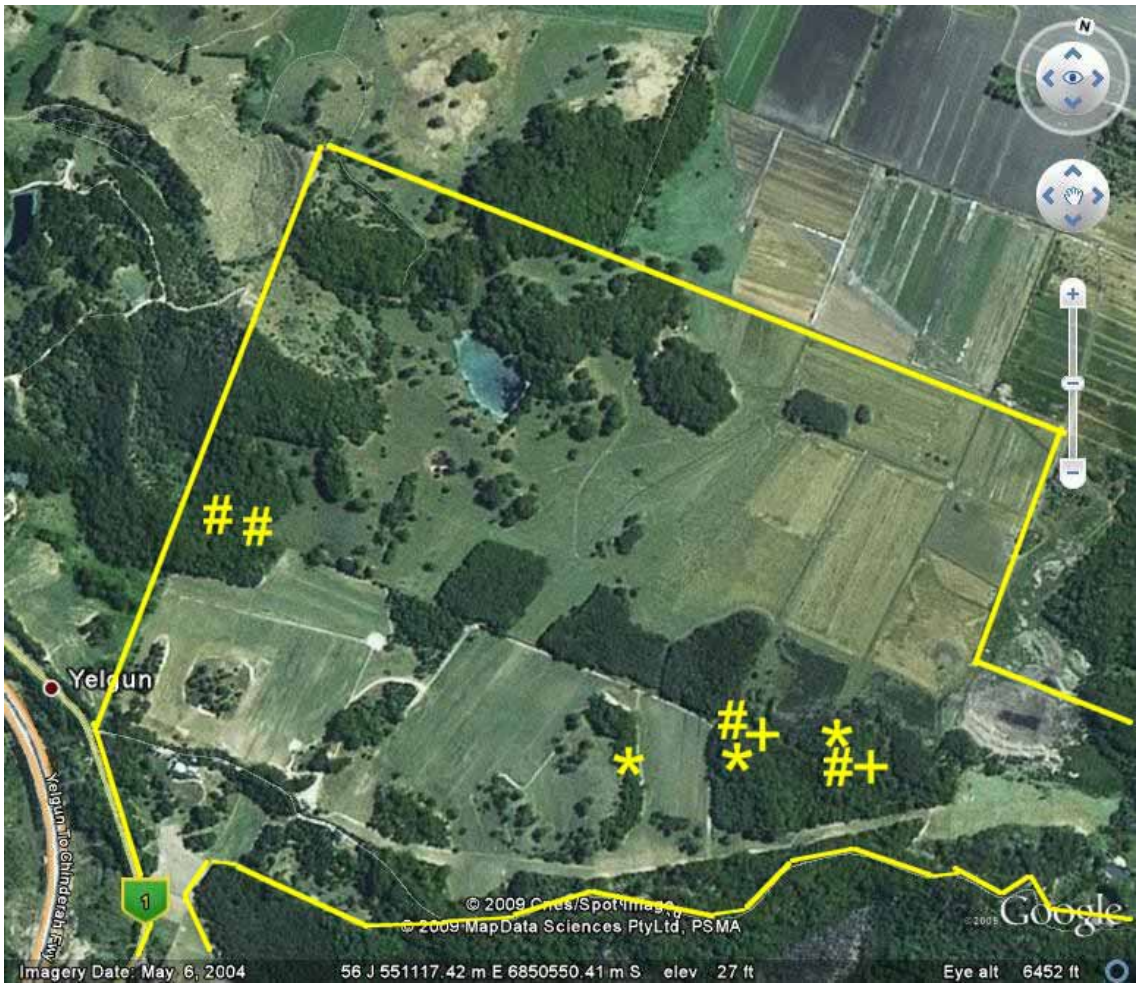
Ninety-four (94) vertebrate fauna species were recorded from the site during the February 2009 survey. The results of hair funnel analyses add probable species records to this total and three additional fauna species were located during an unrelated visit to the site in March 2009. The total species number will continue to change with the acquisition of additional records.

Three threatened fauna species were recorded during the February 2009 survey, namely: Rose-crowned Fruit-dove, *Ptilinopus regina*, Little Bent-wing Bat *Miniopterus australis* and Eastern Long-eared Bat *Nyctophilus bifax*. All three species are listed as vulnerable under the NSW *Threatened Species Conservation Act* 1995. Locations of Threatened species records obtained in this survey are depicted in Figure 4. Four (4) exotic species were recorded: Common Mynah *Acridotheres tristis*, Black Rat *Rattus rattus*, dingo/dog C*anis familiaris* and the Cane Toad *Bufo marinus*. All fauna recorded during the survey are listed in Appendix F.

4.0.1 Results—Hair Funnels

Hair analyses reveal the possible presence of a second Antechinus species on the site (Yellow-footed or Dusky Antechinus *A. flavipes* or *A. swainsonii*), and provide evidence of canid predation on two native mammals (Northern Brown Bandicoot *Isoodon macrourus* and Swamp Wallaby *Wallabia bicolor*). Other species recorded include the Bush Rat *Rattus fuscipes* and an unknown Rat species. Species identification from hair samples depends upon the quantity and condition of hair present, and may not provide certain identity to species level. See Appendix I.

Figure 4: Threatened fauna species detected in February 2009



= Little Bent-wing Bat *Miniopterus australis*; + = Eastern Long-eared Bat *Nyctophilus bifax*, and ⁎ = Rose-crowned Fruit dove *Ptilinopus regina.*

4.0.2 Results—Elliot trapping

Elliot trapping results over the survey period for each trapline are detailed in Appendix C. One hundred and eleven (111) Elliot trap captures over 525 trapnights involved three (3) small mammal species. In order of abundance these were the native Bush Rat *Rattus fuscipes* (88 captures), Brown Antechinus *Antechinus stuartii* (20 captures), the exotic Black Rat *Rattus rattus* (3). Details of captures on individual Eliot traplines are presented in Appendix C. Table 1 lists the summary of small mammal captures by forest block.

Table 1: Summary of captures by Elliot traps in forest blocks

Forest block	***3***	***36***	***38***	***42/45***	***12***	***13***	***14***	**total**	**% of total**
Bush Rat	12	15	13	26	3	2	17	88	79.3

Brown Antechinus	7	2	1	1	2	5	3	20	18.0
Black Rat	0	0	1	0	0	0	1	3	2.7
TOTAL	19	17	15	27	5	7	21	111	

Bush Rat = *Rattus fuscipes*; Brown Antechinus = *Antechinus stuartii*, and Black Rat = *Rattus rattus*.

4.0.3 Results—Anabat detection

Anabat call analyses produced the following records.

Table 2: Anabat call analysis by Ecotone Ecological Consultants, Waratah NSW.

Date	**Location**	**Species**	**Confidence**
17/2/09	550761/6850956	*Miniopterus australis* *Vespadelus pumilus*	Definite Possible
19/2/09	551134/6850761	*Scotorepens orion*	Highly probable
23/2/09	551495/6850157	*Miniopterus australis* *Vespadelus pumilus*	Definite Probable
24/2/09	551495/6850157	*Miniopterus australis* (6) *Miniopterus australis* (4) *Vespadelus pumilus* (2) *Scotorepens orion*	Definite Probable Highly probable Possible

4.0.4 Results—Frogs

Eleven (11) native and one exotic frog species were recorded, with frog activity levels generally high due to wet and warm conditions. Native frog species detected included: the following myobatrachid species: Red-backed Toadlet *Pseudophryne coriacea*, Tusked Frog *Adelotus brevis*, Common Eastern Froglet *Crinia signifera*, Brown-striped Marsh Frog *Limnodynastes peroni*, Dusky Toadlet *Uperoleia fusca* and hylid species: Broad-palmed Frog *Litoria latopalmata,* Eastern Dwarf Tree Frog *Litoria fallax*, Peron's Tree Frog *Litoria peroni , Tyler's Tree Frog Litoria tyleri,* Dainty Tree Frog *Litoria gracilenta,* Rocket Frog *Litoria nasuta* and Broad-palmed Frog *Litoria latopalmata*. The exotic Cane Toad *Bufo marinus* was widespread on the site.

4.0.5 Results—Harp Traps

Harp trapping effort of eleven (11) trap/nights resulted in the capture of 28 microchiropteran bats comprising six (6) species. Two threatened bat species included in the Harp trap captures were: the Little Bent-wing Bat *Miniopterus australis* (16 captures) and Eastern Long-eared Bat *Nyctophilus bifax* (5 captures). Both species are listed as vulnerable under the NSW *Threatened Species Conservation Act* 1995 (TSC Act). Other bat species captured in harp traps included: Eastern Forest Bat *Vespadelus pumilus* (4), Horseshoe Bat *Rhinolophus megaphyllus* (1), Gould's Wattled Bat *Chalinolobus gouldii* (1) and Gould's Long-eared Bat *Nyctophilus gouldii* (1).

Details of Harp trap captures are provided in Appendix D.

4.0.6 Results—Birds and call playback

Sixty-three species of birds were recorded during the survey. The threatened Rose-crowned Fruit-dove *Ptilinopus regina* was recorded from three locations in the central swamp forest blocks. Bird abundance was relatively low with most species recorded from < 3 observations over the survey period. Flocks of Pacific Black Duck A*nas superciliosa* (~50) on the large dam and groups of Masked Lapwings *Vanellus miles* (~25) in the northern grassland were recorded.

Data from standardised bird survey samples is presented in Appendix G.

Call playback did not elicit responses from the species targetted (Powerful, Masked Sooty and Grass Owls). Responses to call playback in the northwestern hill slope forests were recorded from the Australian Owlet-nightjar *Aegotheles cristatus* and Sugar Glider *Petaurus breviceps*. Call playback in the central swamp forests and grassland elicited alarm calls from disturbed Masked Lapwings (*Vanellus miles*).

4.0.7 Results—Spotlighting

A conspicuous scarcity of flying-foxes from the site was evident during spotlighting effort during the February 2009 survey. On two occasions individual flying-foxes were heard vocalising in central swamp forest but were not identified to species. A

single Black Flying-fox *Pteropus alecto* was spotlighted feeding in a mango tree near the northern gate.

The most commonly encountered fauna in all habitats during spotlighting was the Cane Toad. Native frogs encountered while spotlighting included the Rocket Frog *Litoria nasuta*, Brown-striped Grass Frog *Limnodynastes peroni*, and Broad-palmed Frog *Litoria latopalmata*. Two Mountain Brushtail Possums *Trichosurus caninus* were spotlighted in floodplain forest and foraging microchiropteran bats were regularly illuminated during walking spotlight activity. The Black Rat *Rattus rattus* was also detected during walking spotlights: both in forest (up to 10 m above the ground) and in overgrown pasture. It was the mammal species most frequently detected by this method.

4.0.8 Results—Reptiles

Four reptile species were recorded during the survey. Diurnal searches targetting reptiles produced records of the Carpet Python *Morelia spilota mcdowelli* and the Garden Sun-skink *Lampropholis delicata*. Eastern Water Dragons *Physignathus lesueurii* were encountered around waterbodies during walking spotlight activities; Lace Monitors *Varanus varius* were encountered during other survey activities.

4.0.9 Results—Tracks, scats, remains, diggings

Bandicoot diggings were noted at several sites, and a predator scat was collected for analysis. Analysis of this scat revealed hairs from a Swamp Wallaby *Wallabia bicolor* and a probable Northern Brown Bandicoot *Isoodon macrourus* (Biolink Ecological Consultants, Uki NSW).

5.0 Discussion—Fauna communities of the site

Conditions during the February 2009 survey were favourable for microchiropteran bats and frogs, and Bush Rat populations were relatively abundant, however, flying-foxes were rare and nectivorous and frugivorous birds were in relatively low abundance during the February 2009 survey. Recent flooding in the central swamp forest blocks (12 &13) may have negatively affected the abundance of terrestrial vertebrates in this area.

5.0.1 Discussion—Birds recorded during the survey

The sixty-three (63) species of birds recorded reflect patterns of resource abundance on the site during the February 2009 survey. Few blossoms were present on the Parklands site, with mainly light and short-lived blossom crops on some Pink Bloodwoods *Corymbia intermedia* (pers. obs.) and as a consequence nectivorous species (*e.g.* honeyeaters) were in low abundance.

Fruits of Rose Myrtle *Archirhodomyrtus beckleri* in block #20 were observed being exploited by small numbers of Figbirds *Sphecotheres viridis* and this resource may have contributed to the presence of six native pigeon species, of which the White-headed Pigeon *Columba leucomela* was most widespread and most frequently recorded. Open pasture habitats supported a number of common bird species (*e.g.* Masked Lapwing *Vanellus miles*, Australian Magpie *Gymnorhina tibicen*, Pied Butcherbird *Cracticus nigrogularis*, Torresian Crow *Corvus orru* and White-faced Heron *Ardea novaehollandiae*), and large numbers of grasshoppers were noted in this habitat during the survey period.

The Pacific Baza *Aviceda subcristata* was observed feeding two chicks in the north western hill slope forests and is likely to have been nesting in that area. A pair of White-throated Nightjars *Caprimulgus mysticalis* was disturbed at a daytime roost in block #3.

5.0.2 Discussion—Mammals recorded during the survey

5.0.2.1 Terrestrial and arboreal mammals

Small mammals were well represented in this survey sample largely due to the capture of large numbers (88) of native Bush Rats *Rattus fuscipes* recorded. In the northwestern hill slope forests the species was most frequently (26) captured in the trapline in block #42/45. In the central swamp forest blocks it was most frequently (17) captured in block# 14. Low small mammal captures in blocks #12 (5 captures) & #13 (7 captures) may have been due to recent flooding. While only the Brown Antechinus *Antechinus stuartii* was trapped (see Appendix C) hair analyses suggest the possible presence also of Yellow-footed or Dusky Antechinus on site. (*Antechinus flavipes*, *A. swainsonii*).

A bandicoot was heard vocalising and bandicoot diggings were observed. Characteristic vocalising is reported for the Long-nosed Bandicoot *Perameles nasuta* (Dickman and Stodart 2008) which is known from previous observations from the Parklands site. The Northern Brown Bandicoot *Isoodon macrourus* is also predicted to occur. Analysis of hair from a predator scat indicates the probable occurrence of this latter species on site (see Appendix I). A dingo *Canis familiaris* was observed in the central swamp forest area, providing the third record of this predator for the site.

The largest native mammal known from the site is the swamp wallaby *Wallabia bicolor*, which was recorded grazing in pasture in the vicinity of block#20 and from a predator scat. The Mountain Brushtail Possum *Trichosurus caninus* was an addition to the arboreal mammal fauna of the site observed during spotlighting in block#9. Sugar Gliders *Petaurus breviceps* were heard calling in northwestern hill slope forests.

5.0.2.2 Flying mammals

Because the blossom and fruit resource was scarce on the site few flying-fox records were obtained during the February 2009 survey. On two occasions individual flying–foxes were heard vocalising on the site, but these were not identified to species. Similarly, flying-foxes were observed overflying the Parklands site, but species identification was not attempted.

The sole firm species identification was of a Black Flying-fox *Pteropus alecto* feeding on a mango near the northern gate. At times during the August 2007 fauna survey and winter flying-fox counts, up to ~200 flying-foxes were estimated to be present on the Parklands site exploiting blossom and fruit crops. Clearly when food resources are scarce at the site these fauna forage elsewhere.

Microchiropteran bats are well represented in the survey results with twenty-eight (28) captures of six (6) species in Harp traps. The most abundant species trapped were the threatened Little Bent-wing Bat *Miniopterus australis* with fifteen (16) captures, threatened Eastern Long-eared Bat *Nyctophilus bifax* (5 captures) and Eastern Forest bat *Vespadelus pumilus* (4). Captures of the Eastern Horseshoe Bat

Rhinolophus megaphyllus, Gould's Long-eared Bat *Nyctophilus gouldii* and Gould's Wattled Bat *Chalinolobus gouldii* represent the first records of these species from the site. Anabat call analyses add the Eastern Broad-nosed Bat *Scotorepens orion* to the species list for the February 2009 survey, and provide additional records of other microbat species recorded from harp trap captures in this survey.

The relatively large numbers of Little Bent-wing Bats recorded in this survey and their early appearance on the site (Anabat records) indicate the presence of a roost site nearby (Ray Williams, Ecotone Ecological Consultants: pers. comm.). Results from the August 2007 survey also show this species as the most frequently recorded (28 harp trap captures) during that survey, providing further support for the likely presence of a roost nearby.

5.0.3 Discussion—Reptiles recorded during the survey

Reptile species diversity and abundance are low on the Parklands site, probably reflecting the predominance of pasture habitats, impacts of cattle on groundlayer habitats, habitat fragmentation and interactions between these effects. However, a maximal sized Carpet Python *Morelia spilota mcdowelli* (estimated >20kg) from the central swamp forests is an exceptional record: this is the largest individual of this species I have seen in 33 years of observation in northern New South Wales. The presence of large Lace Monitors *Varanus varius* in an area with high Cane Toad abundance is also noteworthy.

5.0.4 Discussion—Frogs recorded during the survey

The introduced Cane Toad *Bufo marinus* is the most abundant frog species recorded in the February 2009 Parklands survey. The species was recorded in all habitats, and calling from flooded pasture grassland and from drains. It was not recorded calling from dams on the site in this survey: this may be caused by the presence of fish in the dams and requires further investigation. Cane Toads in grazed pasture at night were frequently observed sitting on cow pats, presumably awaiting insects attracted to the manure.

Conditions were highly suitable for detection of many frog species and eleven native species were recorded. Frogs were present in all habitats, with Tyler's and Peron's Tree frogs *Litoria tyleri* and *L. peroni* were recorded calling from vegetation around dams, the Eastern Dwarf Tree Frog *Litoria fallax* was recorded calling from vegetation in dams and drains. The Rocket Frog *Litoria nasuta* was active in pasture and calling from flooded grassland. Red-backed Toadlets *Pseudophryne coriacea* called continually from soaks and the upper edge of water courses.

5.05 Discussion—Fish detected during the survey

A large (~65 cm) pale pigmented carp *Cyprinus carpio* was observed feeding in the shallow edge of the large dam in the north west of the property. This is a noxious pest species, listed under the NSW *Fisheries Management Act* 1994, but carp may be responsible for eating cane toad eggs (F. Lemckert DPI Forestry frog biologist, pers. comm.): this warrants further investigation.

5.2 Discussion—Threatened fauna species of the site

Three threatened fauna species were recorded during the February 2009 Parklands survey: Rose-crowned Fruit-dove *Ptilinopus regina*, Little Bent-wing Bat *Miniopterus australis* and Eastern Long-eared Bat *Nyctophilus bifax*. This result reflects the pattern of resource abundance during the survey period. When blossom and *e.g* fig resources are more abundant on the site, numbers of Grey-headed Flying-foxes *Pteropus poliocephalus* are predictably observed on site. Blossom Bats *Syconycteris australis* are also previously recorded from the Parklands site when blossoms are present.

Threatened bird species recorded from the site since 2006 include Jacana *Irediparra gallinacea*, White-eared Monarch *Carterornis leucotis*, Grass Owl *Tyto capensis* and Masked Owl *Tyto novaehollandiae*. These species are predicted to occur on the site as resources are available for them. The absence of Jacanas *Irediparra gallinacea* from the large dam where they were observed in August 2007 may reflect patterns of local resource availability.

Remaining threatened species previously recorded from the Parklands site include the Koala *Phascolarctos cinereus* and Large Bent-wing Bat *Miniopterus orianae*

oceanensis. Biolink Koala surveys over the past two years indicate a reduction in evidence of Koala presence in the far south east of the site, possibly related to local population declines (Biolink 2008). The Large Bent-wing Bat is infrequently and irregularly recorded at low abundance in Byron coastal floodplain surveys (pers. obs), but is predicted to occur at times on the site.

Based on habitats and resources of the Parklands site the following additional threatened species are predicted to occur at times on the site including: the Square-tailed Kite *Lophoictinia isura* (recorded in the south of the site in ~2003 pers. obs.); Bush-hen *Amaurornis olivaceus*, Barred Cuckoo-shrike *Coracina lineata* and Wompoo Fruit-dove *Ptilinopus magnificus*. Other threatened fauna species may also occur and changes to the habitats of the Parklands site and the surrounding landscape over time will also affect patterns of occurrence and abundance of both threatened and common fauna species.

5.3 Discussion—Comparison of summary results with the August 2007 survey

Repeated fauna sampling at the Parklands property from 2006 to the present has resulted in a total of 167 fauna species being recorded on site. Survey effort has been focussed on areas subject to the Splendour in the Grass DA proposal, north of Jones Road. Areas south of Jones Road, which are dominated by grazed pasture, have received little survey effort so far.

Systematic surveys in August 2007 and February 2009 have provided representative seasonal samples of faunal assemblages at the site. However additional surveys, particularly standardised 20min/2 hectare bird surveys and flying–fox counts in winter 2008 have provided much additional information and many species records for the site.

In the following table the category "other" includes results from the following survey effort:

- Koala scat searches May-June 2007;
- Targetted rapid assessment surveys for threatened fauna February 2007;
- Targetted call playback surveys for forest owls June 2007,and:

- Bird and Flying-fox surveys July-September 2008.

Exotic or introduced species are included in the following fauna species tallies. August 2007 and February 2009 surveys produced the same total number of fauna species tallied (94) but provided different information on the different fauna groups. Wet conditions in February 2009 were better for detection of frog species than the cool dry conditions prevalent during the August 2007 survey. A greater mammal species total in August 2007 reflects more abundant blossom resources and hence nectivorous mammals on the site. "Other" surveys sampled the Parklands site at various times when large fruit crops were present (especially Camphor Laurel *Cinnamomum camphora*) which attract many frugivorous species to concentrate at the site.

Further survey effort is planned for the site and more vertebrate species are predicted to be added to the current total. More importantly, information on the patterns of occurrence and abundance of species' will assist in the development of management strategies which will assist in the improvement of habitat quality and overall biodiversity values of the site. Table 3 illustrates the acquisition of fauna species records from the three survey categories, and Table 4 presents the proportional contribution of species from each faunal group for each survey category.

Table 3: Acquisition of fauna species records from the three sources.

Fauna group	**August 2007 Survey**	**Feb 2009 survey**	**Other surveys**	**Total species known for the Parklands site**
Frogs	8	12	13	14
Birds	68	63	100	118
Mammals	17	15	14	25
Reptiles	1	4	8	10
Totals	94	94	135	167

Table 4: Proportion of species from each faunal group for each survey category.

Fauna group	August 2007 survey	Feb 2009 survey	Other surveys	Total species known for the Parklands site
Frogs	0.57	0.86	0.93	14
Birds	0.58	0.53	0.85	118
Mammals	0.68	0.60	0.56	25
Reptiles	0.10	0.40	0.80	10
Totals	0.56	0.56	0.81	167

The larger contribution of fauna species records from 'other' surveys reflects multiple visits across time (Nov 2006-September 2008) and effort directed to single purpose 'targetted' surveys, which enabled more efficient species census techniques to be deployed. Each survey category in table 4 produced unique species records, but the systematic surveys are consistently constrained by a time conflict early each morning when time spent carefully retrieving bats and small mammals from traps coincides with the optimal time for bird call censuses.

5.4 Discussion—Species distribution across landscape categories

Consideration of accumulated fauna species records at the Parklands site provides some useful insights into the distribution of biodiversity across habitats. Effort has been so far concentrated on the central swamp forests (CSF) and intervening pasture, because these are closest to SITG event processes. Subsequent surveys are likely to increase the number of fauna species recorded from the north western hill slope forests (NWHSF). The following table demonstrates a concentration of species records from forested habitats of the site.

Table 5: Fauna species distributions according to landscape class

Species	CSF	NWHSF	Pasture	Drains/dams	overhead
Frogs (n = 14)	6	6	7	7	0
Birds (n= 118)	67	58	29	21	10
Reptiles (n = 10)	7	2	1	3	0
Mammals (n =25)	21	9	2	0	0
Total (n = 167)	102	75	39	31	10
Threatened Species (n = 11)	7	4	1	1	0

With the exception of frogs, where slightly more species have been recorded in pasture and drains/dams, forests contribute the majority of fauna species records on the Parklands site. Forests also are the source of most threatened fauna species records, with exceptions being the Grass Owl *Tyto capensis* recorded from pasture and the Comb-crested Jacana *Irediparra gallinacea* from the large dam.

6.0 Conclusion

Results from the February 2009 survey reflect the wet conditions and scarcity of fruit and blossom resources at that time. While the net species count from this survey (94) is the same as that from the August 2007 survey (94), more frog (12) and fewer (15) mammal species were recorded in the February 2009 survey, and fewer threatened fauna species were recorded (3) than in the August 2007 survey (9 species).

Survey results suggest that seasonal factors and related patterns of resource availability are strong influences on the patterns of fauna species presence and abundance observed at the Parklands site.

6.1 Recommendations

Future survey effort in winter is recommended for the northwestern hill slope forests. For the sake of completeness, further survey activities are also recommended for areas south of Jones Road. The above analysis (tables 3 & 4) demonstrates that multiple short surveys ('other') are at least as productive as systematic surveys in providing an inventory of fauna species at this site.

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Appendix A: Survey effort: Harp Traps, Call Playback and Anabat

Harp trap effort: Parklands February 2009 fauna survey

Date	17/2/09	18/2/09	19/2/09	22/2/09	23/2/09	24/2/09
Locations	HT#1	HT#1	HT#1	HT#3	HT#3	HT#3
		HT#2	HT#2	HT#4	HT#5	HT#5

Harp trap locations: Parklands February 2009 fauna survey
All locations WGD 94

Harp Trap Location	Easting	Northing
HT#1	550499	6850352
HT#2	550464	6850359
HT#3	551546	6850169
HT#4	551682	6850139
HT#5	551746	6850135

Anabat and call playback effort and locations: Parklands February 2009 fauna survey

Date	Activity	Easting	Northing
17/2/09	Anabat	550761	6850956
17/2/09	CP1	550761	6850956
17/2/09	CP2	550755	6850771
17/2/09	CP3	551123	6851017
19/2/09	Anabat	551134	6850761
19/2/09	CP1	551134	6850761
19/2/09	CP2	551134	6850761
23/2/09	Anabat	551495	6850157
23/2/09	CP1	551588	6850224
23/2/09	CP2	551577	6850379
24/2/09	Anabat	551495	6850157
24/2/09	CP1	551668	6850154
24/2/09	CP2	551577	6850379
24/2/09	CP3	550908	6850113

APPENDICES

Appendix A(i): Fauna survey diary

Date	Activities
16/2/09	Deploy 100 Elliot traps in northwestern hill slope forests: Lines L, X, Y & Z. Set up Harp trap#1.
17/2/09	Clear Elliot and harp traps, identify small mammals, set up Harp trap#2. Set out Hair funnel lines (10 each) on lines V and W. Process microbats. Anabat, call playback and walking spotlight hillslope forests.
18/2/09	Clear Elliot and harp traps, identify small mammals.
19/2/09	Clear Elliot and harp traps, close all Elliot traps, identify small mammals, Set out 20 Hair funnels on edge of peat fire ecotone (PF line), and 10 in forest block G (line G). Anabat, call playback and walking spotlight hillslope forests.
20/2/09	Clear Harp traps and conduct 20 min/ 2ha bird survey samples on lines L, X, Y & Z.
21/2/09	Rest day
22/2/09	Move harp traps into swamp forest locations Ht3 & Ht4 , pick up Elliot traps and relocate 75 of these in swamp forest blocks A, B & C.
23/2/09	Clear Elliot and harp traps, identify small mammals, undertake 20 min/ 2ha bird survey samples on lines A B & C. Herp search on block D. Relocate Ht #4 to Ht5. Anabat, call playback and walking spotlight, swamp forest
24/2/09	Clear Elliot and harp traps, identify small mammals, undertake 20 min/ 2ha bird survey samples on lines A B & C. Herp search on block D. Relocate Ht #4 to Ht5. Download Anabat files and consign for analysis. Anabat, call playback and walking spotlight, swamp forest
25/2/09	Clear Elliot and harp traps, identify small mammals, retrieve Elliot and Harp traps, clean and return Elliot traps to SCU.
26/2/09	Download Anabat files and consign for analysis.
5/3/09	Collect hair funnels and consign hair samples for analyses.

Appendix B: Climate during the February 2009 survey; highlighted in yellow

Date	Min Temp (°C)	Max Temp (°C)	Rain (mm)	Dir. Max wind gust	Speed max wind gust (km/h)	9am Temp (°C)	9am RH (%)	3pm Temp (°C)	3pm RH (%)
1/2/09	21.6	29	0	E	50	24.2	73	24.9	78
2/2/09	23.7	27.8	0.6	E	48	25.6	70	25.3	70
3/2/09	20.7	29.1	16.6	NE	41	22	92	27.1	72
4/2/09	21.9	29.6	2.2	E	37	25.4	73	28.2	60
5/2/09	23.5	28.6	0	E	41	25.9	67	27.4	64
6/2/09	22.7	28.1	0.2	E	33	24.1	72	27.2	63
7/2/09	22.5	28.4	0	E	35	26	68	27.3	62
8/2/09	19.9	27.5	0	SE	33	23.4	75	27.2	56
9/2/09	20.1	31.4	0	E	26	25.5	71	31.2	59
10/2/09	24.1	30.9	0	N	48	27.2	78	27.1	74
11/2/09	23.2	25	0	S	76	23.2	82	23.9	79
12/2/09	20.2	23.7	0	E	61	21.6	79	23.1	81
13/2/09	20.5	23.3	23	E	80	23.2	72	21.1	88
14/2/09	19	22.1	59.6	S	89	20.1	92	21.6	96
15/2/09	18.3	26.7	39	WSW	61	20.9	79	23.4	77
16/2/09	***19.6***	***24.6***	***0***	***SW***	***48***	***22.3***	***76***	***23.8***	***81***
17/2/09	***20.4***	***27***	***0***	***NE***	***54***	***22.6***	***82***	***26.3***	***74***
18/2/09	***22.2***	***24.6***	***5***	***ENE***	***50***	***22.2***	***88***	***22.9***	***92***
19/2/09	***20.5***	***29.1***	***7.6***	***WSW***	***30***	***23***	***84***	***27.9***	***66***
20/2/09	***22.1***	***29.6***	***0***	***SSW***	***44***	***23.8***	***83***	***26.9***	***76***
21/2/09	***20.8***	***26.9***	***0***	***E***	***41***	***21.9***	***82***	***24.6***	***80***
22/2/09	***21.8***	***27.3***	***0***	***E***	***48***	***23.1***	***85***	***26.3***	***65***
23/2/09	***20.6***	***29.2***	***0***	***E***	***33***	***22.8***	***83***	***28.8***	***62***
24/2/09	***21.3***	***29.9***	***0***	***NE***	***44***	***23.3***	***75***	***29.8***	***60***
25/2/09	***21.5***		***0***			***24.5***	***70***	***27.1***	***54***
26/2/09		29.9	0	S	69			23.6	82
27/2/09	18	24.2	0	SE	57	20.4	76	23.4	71
28/2/09	18.9	27.2	0	WSW	37	21.6	71	26.7	60

Appendix C: Elliot trap results

Rf = *Rattus fuscipes* Bush rat
As = *Antechinus stuartii* Brown Antechinus
Rr = *Rattus rattus* Black Rat (an exotic species)

North western hill slope forests: 16/2/09-19/2/09

block	***3***	***3***	***3***	***36***	***36***	***36***	***38***	***38***	***38***	***42/45***	***42/45***	***42/45***	***totals***
line	L	L	L	Z	Z	Z	Y	Y	Y	X	X	X	
Day	17	18	19	17	18	19	17	18	19	17	18	19	
Trap #1		Rf	As				Rf			Rf	Rf		
2		As	As	Rf		Rf						Rf	
3		As	As			Rf							
4				Rf				Rf				Rf	
5	Rf									Rf	Rf	Rf	
6						Rf					Rf		
7			Rf	Rf					Rf		Rf		
8			Rf	Rf			Rf	Rf		Rf			
9										Rf		Rf	
10				Rf									
11		Rf				Rf	Rf	Rf					
12						Rf			Rf		Rf		
13										Rf			
14		Rf						Rr		Rf			
15											Rf	Rf	
16	Rf			As				Rf			Rf		
17		Rf				Rf		Rf	Rf	Rf			
18			Rf			As				Rf			
19				Rf		Rf					Rf		
20	Rf				Rf						Rf		
21											Rf	Rf	
22			Rf								Rf	Rr	
23							Rf						
24	As	As	Rr						Rf				
25					Rf				As	Rf			
Total	4	7	8	7	2	8	4	6	5	9	11	7	78
Rf	3	4	5	6	2	7	4	5	4	9	11	6	66
As	1	3	3	1	0	1	0	0	1	0	0	0	10
Rr	0	0	0	0	0	0	0	1	0	0	0	1	2

Appendix C: Elliot trap results

Central Swamp Forest sample: 22/2/09-25/2/09

block	***14***	***14***	***14***	***13***	***13***	***13***	***13***	***13***	***13***	***totals***
line	A	A	A	B	B	B	C	C	C	
Day	23	24	25	23	24	25	23	24	25	
Trap#1										
2		As								
3	Rf	Rf	As							
4										
5	As									
6										
7									Rf	
8	RF									
9			Rf							
10	Rf					Rf				
11		Rf								
12	Rf	Rf			Rf					
13		Rf						As		
14					As	As				
15					As					
16						As				
17	Rf		Rf							
18									Rf	
19		Rr								
20			Rf							
21			Rf							
22	Rf								Rf	
23										
24			Rf			As			As	
25	Rf		Rf							
Total	8	6	7	0	3	4	0	1	4	33
Rf	7	4	6	0	1	1	0	0	3	22
As	1	1	1	0	2	3	0	1	1	10
Rr	0	1	0	0	0	0	0	0	0	1
	NWHSF	***CSF***	***TOTAL***							
Rf	66	22	88							
As	10	10	20							
Rr	2	1	3							
	78	33	111							
Effort	300	225	525							
T/success	0.26	0.15	0.21							

Appendix D: Harp trap results*

	17/2	19/2	19/2	20/2	20/2	23/2	23/2	24/2	24/2	Totals
	HT1	HT1	HT2	HT1	HT2	HT3	HT5	HT3	HT5	
RHINOLOPHIDAE										
Eastern Horseshoe bat								1		1
VESPERTILIONIDAE										
Little Bent-wing Bat	2	1		1	2	4	2	2	2	16
Eastern Long-eared Bat						1			4	5
Gould's Long-eared Bat						1				1
Eastern Forest Bat						1		1	2	4
Gould's Wattled Bat						1				1
TOTAL										28

*Nil results for 18/2 are omitted from this table.

Appendix E: Call Playback results

Date	Location	Calls played	Reponses
17/2/09	CP1	Marbled Frogmouth Sooty Owl Masked Owl Powerful Owl	Nil
17/2/09	CP2	Marbled Frogmouth Sooty Owl Masked Owl Powerful Owl	Sugar Glider calls
17/2/09	CP3	Sooty Owl Masked Owl Powerful Owl	nil
19/2/09	CP1	Sooty Owl Masked Owl Powerful Owl	nil
19/2/09	CP2	Marbled Frogmouth Sooty Owl Masked Owl Powerful Owl	Owlet Nightjar calls
23/2/09	CP1	Grass Owl Masked Owl	Masked Lapwing calls
23/2/09	CP2	Grass Owl	Masked Lapwing calls
24/2/09	CP1	Sooty Owl Masked Owl Powerful Owl	Tawny Frogmouth calls
24/2/09	CP2	Grass Owl	nil
24/2/09	CP3	Masked Owl	nil

Appendix F: Fauna List: accumulated data

Count refers to the number of times the species was recorded during the February 2009 Parklands survey, providing an index of relative abundance.

Species	Scientific name	Aug 07	Other	Feb 09	COUNT
AMPHIBIANS					
HYLIDAE					
Green Tree Frog	*Litoria caerulea*		X		
Broad-palmed frog	*Litoria latopalmata*	X	X	X	2
Rocket Frog	*Litoria nasuta*	X	X	X	6
Eastern Dwarf Tree Frog	*Litoria fallax*	X	X	X	8
Laughing Tree Frog	*Litoria tyleri*		X	X	5
Peron's Tree Frog	*Litoria peroni*	X	X	X	2
Dainty Tree Frog	*Litoria gracilenta*		X	X	1
Verreaux's Tree Frog	*Litoria verreauxi*	X			
MYOBATRACHIDAE					
Common Eastern Froglet	*Crinia signifera*	X	X	X	5
Dusky Toadlet	*Uperoleia fusca*		X	X	1
Tusked Frog	*Adelotus brevis*		X	X	6
Brown-striped Marsh-frog	*Limnodynastes peroni*	X	X	X	6
Red-backed Toadlet	*Pseudophryne coriacea*		X	X	8
BUFONIDAE					
Cane Toad*	*Bufo marinus*	X	X	X	12
BIRDS					
MEGAPODIDAE					
Brush-turkey	*Alectura lathami*	X	X	X	4
TURNICIDAE					
Brown Quail	*Coturnix ypsilophora*	X			
ANATIDAE					
Maned Duck	*Chenonetta jubata*	X	X	X	1
Pacific Black Duck	*Anas superciliosa*	X	X	X	1
Hardhead	*Aythya australis*	X	X		
Wandering Whistleduck	*Dendrocygne arcuata*		X		
PODICIPEDIDAE					
Australasian Grebe	*Tachybaptus novaehollandiae*	X	X	X	1
PHALACROCORIDAE					
Little Black Cormorant	*Phalacrocorax sulcirostris*	X	X		
Little Pied Cormorant	*Phalacrocorax melanoleucos*			X	1
ANHINGIDAE					
Darter	*Anhinga melanogaster*		X		
ARDEIDAE					
White-faced Heron	*Egretta novaehollandiae*	X	X	X	1
Pacific Heron	*Ardea pacifica*	X	X		
Rufous Night-heron	*Nycticorax caledonicus*		X		
Great Egret	*Egretta alba*		X		
Cattle Egret	*Ardea ibis*	X	X		
Straw-necked Ibis	*Threskiornis spinicollis*	X	X		
ACCIPITRIDAE					

Brahminy Kite	*Milvus indus*		X		
Pacific Baza	*Aviceda subcristata*	X	X	X	4
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	X	X		
Brown Goshawk	*Accipiter fasciatus*	X	X		
Grey Goshawk	*Accipiter novaehollandiae*	X	X		
Whistling Kite	*Haliastur sphenurus*		X		
Wedge-tailed Eagle	*Aquila audax*		X		
RALLIDAE					
Dusky Moorhen	*Gallinula tenebrosa*		X		
Purple Swamphen	*Porphyrio porphyrio*	X	X		
JACANIDAE					
Comb-crested Jacana	*Irediparra gallinacea*	X	X		
CHARADRIIDAE					
Masked Lapwing	*Vanellus miles*	X	X	X	9
COLUMBIDAE					
White-headed Pigeon	*Columba leucomela*	X	X	X	6
Emerald Dove	*Chalcophaps indica*	X	X	X	1
Bar-shouldered Dove	*Geopelia humeralis*	X	X	X	3
Wonga Pigeon	*Leucosarcia melanoleuca*	X	X	X	3
Brown Cuckoo-dove	*Macropygia amboinensis*		X	X	3
Crested Pigeon	*Ocyphaps lophotes*		X		
Rose-crowned Fruit-dove	*Ptilinopus regina*		X	X	3
Topknot Pigeon	*Lopholaimus antarcticus*		X		
CACATUIDAE					
Galah	*Cacatua roseicapilla*	X	X		
Sulphur-crested Cockatoo	*Cacatua galerita*		X		
PSITTACIDAE					
King Parrot	*Alisterus scapularis*		X	X	1
LORIDAE					
Rainbow Lorikeet	*Trichoglossus haematodus*	X	X		
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*	X	X	X	2
Musk Lorikeet	*Glossopsitta concinna*	X			
Eastern Rosella	*Platycercus eximius*	X		X	2
CUCULIDAE					
Brush Cuckoo	*Cacomantis variolosus*		X		
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	X		X	1
Pheasant Coucal	*Centropus phasianinus*		X	X	1
Shining Bronze-cuckoo	*Chalcites lucidus*		X		
Eastern Koel	*Eudynamys orientalis*		X		
Channel-billed Cuckoo	*Scythrops novaehollandiae*		X	X	1
ALCEDINAE					
Azure Kingfisher	*Alcedo azurea*	X			
HALCYONIDAE					
Laughing Kookaburra	*Dacelo novaeguineae*	X	X	X	2
Sacred Kingfisher	*Todirhamphus sanctus*		X	X	2
Forest Kingfisher	*Todirhamphus macleayii*		X		
CORACIIDAE			X		
Dollarbird	*Eurystomus orientalis*		X		
MEROPIDAE					
Rainbow Bee-eater	*Merops ornatus*		X		
STRIGIDAE					

Southern Boobook	*Ninox novaseelandiae*		X		
TYTONIDAE					
Barn Owl	*Tyto alba*		X		
Grass Owl	*Tyto capensis*	X	X		
Masked Owl	*Tyto novaehollandiae*				
CAPRIMULGIDAE					
White-throated Nightjar	*Eurostopodus mysticalis*	X	X	X	3
AEGOTHELIDAE					
Australian Owlet-nightjar	*Aegotheles cristatus*	X	X	X	3
PODARGIDAE					
Tawny Frogmouth	*Podargus strigoides*	X	X	X	2
APODIDAE					
White-throated Needletail	*Hirundapus caudacutus*		X	X	1
HIRUNDINIDAE					
Welcome Swallow	*Hirundo neoxena*	X	X	X	1
MOTACILLIDAE					
Richard's Pipit	*Anthus novaeseelandiae*	X	X		
CAMPEPHAGIDAE					
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	X	X	X	3
Cicadabird	*Coracina tenuirostris*		X	X	2
Varied Triller	*Lalage leucomela*		X	X	1
PETROICIDAE					
Rose Robin	*Petroica rosea*	X			
Eastern Yellow Robin	*Eopsaltria australis*	X	X	X	3
Pale Yellow Robin	*Tregellasia capito*			X	1
PACHYCEPHALIDAE					
Grey Shrike-thrush	*Colluricincla harmonica*	X	X	X	2
Little Shrike-thrush	*Colluricincla megarhyncha*		X	X	1
Golden Whistler	*Pachycephala pectoralis*	X	X		
Rufous Whistler	*Pachycephala rufiventris*	X		X	1
MONARCHIDAE					
Grey Fantail	*Rhipidura fuliginosa*	X	X	X	2
Willie Wagtail	*Rhipidura leucophrys*	X		X	1
White-eared Monarch	*Carterornis leucotis*		X		
Black-faced Monarch	*Monarcha melanopsis*		X	X	2
Restless Flycatcher	*Myiagra inquieta*		X		
Magpie-lark	*Grallina cyanoleuca*		X		
Leaden Flycatcher	*Myiagra rubecula*	X	X	X	2
ORTHONYCHIDAE					
Eastern Whipbird	*Psophodes olivaceus*	X	X	X	5
SYLVIIDAE					
Tawny Grassbird	*Megalurus timoriensis*		X		
Golden-headed Cisticola	*Cisticola exilis*	X	X	X	1
PTILINORHYNCHIDAE					
Regent Bowerbird	*Sericulus chrysocephalus*			X	
MALURIDAE					
Superb Fairy-wren	*Malurus cyaneus*	X	X		
Red-backed Fairy-wren	*Malurus melanocephalus*	X	X		
Variegated Fairy-wren	*Malurus lamberti*			X	1
ACANTHIZIDAE					
White-browed Scrubwren	*Sericornis frontalis*	X	X	X	1
White-throated Gerygone	*Gerygone albigularis*	X			

Striated Thornbill	*Acanthiza lineata*	X		X	3
Large-billed Scrubwren	*Sericornis magnirostra*		X	X	2
Yellow Thornbill	*Acanthiza nana*			X	1
MELIPHAGIDAE					
Striped Honeyeater	*Plectorhyncha lanceolata*	X			
Noisy Friarbird	*Philemon corniculatus*	X	X	X	1
Noisy Miner	*Manorina melanocephala*	X	X	X	9
Lewin's Honeyeater	*Meliphaga lewinii*	X	X	X	8
Yellow-faced Honeyeater	*Lichenostomus chrysops*	X			
Eastern Spinebill	*Acanthorhynchus tenuirostris*	X	X		
Scarlet Honeyeater	*Myzomela sanguinolenta*	X	X	X	1
Blue-faced Honeyeater	*Entomyzon cyanotis*		X	X	2
Brown Honeyeater	*Lichmera indistincta*		X		
ZOSTEROPIDAE					
Silvereye	*Zosterops lateralis*		X	X	1
DICAEIIDAE					
Mistletoebird	*Dicaeum hirundinaceum*		X		
PARDALOTIDAE					
Spotted Pardalote	*Pardalotus punctatus*	X	X		
Striated Pardalote	*Pardalotus striatus*	X	X	X	1
PLOCEIDAE					
Red-browed Finch	*Neochmia temporalis*	X	X	X	2
ORIOLIDAE					
Figbird	*Sphecotheres viridis*	X	X	X	5
Oriole	*Oriolus sagittatus*		X		
STURNIDAE					
Common Starling	*Sturnus vulgaris*				
Common Myna*	*Acridotheres tristis*		X	X	1
DICRURIDAE					
Spangled Drongo	*Dicrurus bracteatus*		X	X	4
ARTAMIDAE					
White-breasted Woodswallow	*Artamus leucorhynchus*		X		
CRACTICIDAE					
Grey Butcherbird	*Cracticus torquatus*	X	X	X	4
Pied Butcherbird	*Cracticus nigrogularis*	X	X	X	5
Australian Magpie	*Cracticus tibicen*	X	X	X	6
Pied Currawong	*Strepera graculina*	X	X	X	5
CORVIDAE					
Torresian Crow	*Corvus orru*	X	X	X	4
MAMMALS					
DASYURIDAE					
Brown Antechinus	*Antechinus stuartii*	X	X	X	20
TACHYGLOSSIDAE					
Echidna	*Tachyglossus aculeatus*	X			
PHASCOLARCTIDAE					
Koala	*Phascolarctos cinereus*		X		
PERAMELIDAE					
Long-nosed Bandicoot	*Perameles nasuta*	X	X		
PHALANGERIDAE					

Brush-tailed Possum	*Trichosurus vulpecula*	X			
Bobuck	*Trichosurus caninus*			X	1
PETAURIDAE					
Sugar Glider	*Petaurus breviceps*		X	X	2
MACROPODIDAE					
Swamp Wallaby	*Wallabia bicolor*	X	X	X	2
PTEROPODIDAE					
Blossom Bat	*Syconycteris australis*	X	X		
Grey-headed Flying-fox	*Pteropus poliocephalus*	X	X		
Black Flying-fox	*Pteropus alecto*	X		X	1
MOLOSSIDAE					
Freetail Bat	*Mormopterus sp.*		X		
White-striped Freetail Bat	*Nyctinomus australis*		X		
RHINOLOPHIDAE					
Eastern Horseshoe bat	*Rhinolophus megaphyllus*			X	1
VESPERTILIONIDAE					
Little Bent-wing Bat	*Miniopterus australis*	X	X	X	16
Large bent-wing Bat	*Miniopterus schreibersii*	X			
Eastern Long-eared Bat	*Nyctophilus bifax*	X	X	X	5
Gould's Long-eared Bat	*Nyctophilus gouldii*			X	1
Eastern Broad-nosed Bat	*Scotorepens orion*	X	X	X	1
Eastern Forest Bat	*Vespadelus pumilus*	X	X	X	4
Gould's Wattled Bat	*Chalinolobus gouldii*			X	1
MURIDAE					
Bush Rat	*Rattus fuscipes*	X		X	88
Black Rat*	*Rattus rattus*	X		X	3
House Mouse*	*Mus domesticus*	X			
CANIDAE					
Dog	*Canis familiaris*	X	X	X	1
REPTILES					
CHELONIDAE					
Eastern Long-necked Turtle	*Chelodina longicollis*		X		
Saw-shelled Turtle	*Elseya latisternum*		X		
AGAMIDAE					
Eastern Water Dragon	*Physignathus lesueurii*		X	X	5
SCINCIDAE					
Garden Sun-skink	*Lampropholis delicata*		X	X	5
Friendly Skink	*Lampropholis amicula*		X		
Three-toed skink	*Saiphos equalis*	X			
Pink-tongued Skink	*Cyclodomorphus gerrardii*		X		
VARANIDAE					
Lace Monitor	*Varanus varius*			X	2
BOIDAE					
Carpet Python	*Morelia spilota mcdowelli*		X	X	2
ELAPIDAE					
Small-eyed Snake	*Cryptophis nigrescens*		X		

Appendix G: Standardised bird counts of Central Swamp Forest Blocks

DATE	23/2/09	23/2/09	23/2/09	24/2/09	24/2/09	24/2/09	
Forest block	***B14***	***B13***	***B12***	***B12***	***B13***	***B14***	***totals***
Bar-shouldered Dove						2	2
Bee-eater							0
Black-faced Cuckoo-shrike		1					1
Black-faced Monarch	1						1
Brown Cuckoo-dove			1	1			2
Brush Cuckoo							0
Brush Turkey							0
Cicadabird					2	1	3
Crimson Rosella							0
Eastern Rosella			1		1		2
Eastern Whipbird		1			1	1	3
Eastern Yellow Robin	1	2	2	1	2	1	9
Fan-tailed cuckoo							0
Figbird		1	5	1	1	5	13
Golden Whistler							0
Grey Butcherbird		3	1	2		1	7
Grey Fantail	1		3			1	5
Grey Shrike-thrush	1		2				3
King Parrot					1		1
Kookaburra	1						1
Large-billed Scrubwren	2			1			3
Leaden Flycatcher							0
Lewin Honeyeater	8	8	8	8	8	8	48
Little Wattlebird							0
Little Shrike-thrush						2	2
Magpie	3	3	1	2	2	4	15
Masked Lapwing						2	2
Noisy Friarbird							0
Noisy Miner					1		1
Noisy Pitta							0
Oriole							0
Pied Butcherbird	1		1			2	4
Pied Currawong		1					1
Red-browed Finch							0
Regent Bowerbird							0
Rose-crowned Fruit-dove			1		1		2
Rufous Whistler							0
Scaly-breasted Lorikeet	1	2	3	2	1		9
Scarlet Honeyeater						1	1
Silvereye		1		1		1	3
Spangled Drongo	2					1	3
Striated Thornbill							0
Sulphur-crested cockatoo							0
Topknot Pigeon							0
Torresian Crow		1		1		4	6
Varied Triller							0

Variegated Fairy-wren							0
White-browed Scrubwren		4	2	3	1	2	12
White-headed Pigeon	1		4		2		7
White-throated Gerygone					1		1

Appendix H: Threatened fauna locations: Parklands February 2009 fauna survey

Species	Number & type of record	Easting	Northing
Rose-crowned Fruit-dove* *Ptilinopus regina*	1/call	551583	6850113
Rose-crowned Fruit-dove* *Ptilinopus regina*	1/call	551724	6850200
Rose-crowned Fruit-dove* *Ptilinopus regina*	1/call	551348	68500047
Little bent-wing Bat *Miniopterus australis*	4	550499	6850352
Little bent-wing Bat *Miniopterus australis*	2	550464	6850359
Little bent-wing Bat *Miniopterus australis*	6	551546	6850169
Little bent-wing Bat *Miniopterus australis*	3	551746	6850135
Eastern Long-eared Bat *Nyctophilus bifax*	1	551546	6850169
Eastern Long-eared Bat *Nyctophilus bifax*	4	551746	6850135

*Locations for call–based records for Rose-crowned Fruit-dove = +/- 100m accuracy

Appendix I: Hair sample analyses

Loc'n	type	Acc.	Family	Acc.	Species
22/23	Predator scat	Def.	Peramelidae	Prob.	*Isoodon macrourus* Northern Brown Bandicoot
22/23	Predator scat			Def.	*Wallabia bicolor* Swamp Wallaby
20/10	Hair funnel	Def.	Antechinus	Prob.	*A. flavipes*, or *A swainsonii* Yellow-footed or Dusky Antechinus
20/1	Hair funnel			Prob.	*A. flavipes* Yellow-footed Antechinus
V5	Hair funnel			Def.	*Rattus fuscipes* Bush rat
W5	Hair funnel			Def.	*Rattus sp.* Unknown Rat
W9	Hair funnel			Def.	*Rattus fuscipes* Bush Rat
W10	Hair funnel			Def.	*Tachyglossus aculeatus* Echidna

Appendix F

Fauna and Flora monitoring

at Parklands.

Parklands-Application Number 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by Mark Fitzgerald

Ecological Consultant,

P.O. Box 237 Mullumbimby NSW

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1.0 Introduction

The operation of North Byron Parklands as a cultural events site introduces unprecedented activities and a novel episodic disturbance regime to a pastoral and forested landscape adjoining Billinudgel Nature Reserve. Predictions of the ecological impacts of these activities are unavoidably speculative, and require testing, confirmation, modification or repudiation. Evidence from monitoring is considered essential to produce appropriate management of ecological impacts.

Monitoring described here is considered separately from the need to continue biannual systematic fauna surveys and to further research fauna and habitat values in the southern car park area of the site. A separate ecological audit process for events is described in Appendix "L".

Basis of monitoring—previous surveys

Contemporary information on fauna and habitats of the site derives from a series of studies carried out since 2006.

- Targetted survey for threatened flora November 2006;
- Koala scat searches May-June 2007;
- Property-wide surveys for Koalas June 2007 & September 2008 (Biolink Consultants, Murwillumbah);
- Targetted rapid assessment surveys for threatened fauna February 2007;
- Targetted call playback surveys for forest owls June 2007,
- Systematic fauna survey in August 2007 (see Appendix E(ii));
- Bird transect and flying-fox census surveys July-September 2008 and February 2009;
- Vegetation plot surveys in January 2009, and:
- Systematic fauna survey in February 2009 (see Appendix E(ii)),
- Point surveys of waterbirds at the large northern dam 2007-2010.

1.0.1 Aims of monitoring

Aims of fauna monitoring are:

- to increase the amount of baseline numerical data on fauna of the site, and:

- to detect any impacts on fauna or habitats arising from year 1 of operation of the Parklands site.

Subsequent ongoing monitoring is considered essential for the location, and methods employed will be determined by analysis of monitoring results.

1.0.2 Timing and sample sizes—baseline data

Because potentially high impact activities (noise, lights, large numbers of people) associated with major events typically occur over a ~3 day period, it is proposed to acquire a 3 day sample each month from June 2010 to June 2011, prior to the first event for the site in July 2011. Timing of the three day sample will be randomly selected for each month, acknowledging the need for a minimum of 1 week between samples, and comprise consecutive days where practicable.

This will enable multiple samples of target groups across an annual cycle in areas likely to experience impacts. Based on techniques proposed this would provide 36 nights of Anabat bat detection at two or three sites; 72 point surveys of the large northern dam, 180 timed transect samples in five forest blocks for forest birds to add to existing samples (20 at the dam and 46 of forest birds). It is considered that it is better to monitor a few entities well, rather than many things poorly (RIRDC 2009).

The resultant data set will provide statistics of 'normal' or pre-disturbance variation of species presence and abundance in key areas of the site.

1.0.3 Rationale for selection of monitoring locations

Central forest blocks are considered likely to experience some impacts from event activities (human presence, noise) due to proposed event layouts. Timed bird transect surveys (n = 46) in the central forest blocks (A, B, C & D) in 2008 & 2009 provided a measure of bird and species abundance in these patches; future monitoring will also sample block "I". If disturbance stimuli have adverse impacts on birds in these areas, transect counts before, during and after event activities will provide measurable data on changes to bird, species and abundance at these locations.

Similarly, Anabat detection of microchiropteran bat activity around two or three sites close to event activities will provide numerical data on the number of passes, and bat species present overnight before, during and after event activities.

Point surveys (n = 20) at the large northern dam have recorded a variable pattern of water bird occurrence with both resident species (Australasian Grebe, Purple Swamphen, Dusky Moorhen) and itinerant species (Cormorants, various ducks). Waterbirds respond variably to the presence of humans close to the dam, and to noise phenomena and daily monitoring can potentially provide another indicator of disturbance.

Flying-foxes are episodically present at the site in numbers, according to the availability of blossom and fruit resources, and management of impacts of event activities on threatened grey-headed flying-foxes is of importance in developing a sustainable event site. Timed point censusses of a regular evening flyover, and later counts of flying-foxes

at trees (including counts of trees used) demonstrate high variability in the number of flying-foxes present on any night. Before, during and after event monitoring will provide numerical data to assist in identifying any effects of disturbance phenomena for this group.

Other monitoring techniques considered include the use of harp traps at selected locations, and the possible radiotracking of koalas.

1.0.4 Monitoring techniques proposed

Fauna monitoring associated with the operation of the Parklands site in 2010-2011 will involve where practical:

- Standardised timed transect-based counts of birds in five forest blocks within and adjacent to event activities;
- Standardised timed point-based counts of birds at the large northwestern dam;
- Flying-fox counts at feed trees, and: a census of Flying-foxes as they overfly the site early each evening, and:
- Stationary overnight Anabat call detection for microchiropteran bats at two or three locations.

Forest birds: based on 46 trial samples between 2008 & 2009 a marked transect (see Figure 2) in each central forest block (14,13, 12 & 11, & 10/18) will be surveyed for a minimum of 20 minutes. Because monitoring of each event will rely upon a sample of 3 consecutive days, before and after event samples will similarly aim for 3 consecutive days each.

A single observer walks slowly along marked transects which traverse the longest axis of three forest blocks (A, B,C, I) and around the perimeter of block 'D', recording all birds seen or heard in that forest block. The intent is to record each individual bird just once. Care is to be taken not to count birds twice which, for example, once recorded then move relative to the observer (Bibby *et al* 2000). Birds outside the forest block, or flying overhead are not recorded for that transect. Samples in 2008-9 indicate that most records are call based, and that relatively consistent numbers are achievable for some resident species.

Bird samples represent an encounter rate with both resident birds (*e.g.* Lewin Honeyeaters, Figbirds, Orioles) of the central forest blocks and visitors (*e.g*. Noisy Pitta, Rose-crowned Fruit-dove). Samples will provide a the following data: number of birds recorded per transect, number of species recorded per transect and per forest block; total birds per day, total species per day; total birds and species per 3 day sample, and encounter rates according to effort (species or birds/minute of survey). The combined 4

transects also comprise a gradient from relatively high (polygon 14) to relatively low levels of disturbance (polygon 11) from noise, human presence and vehicle movements. Timing of the sampling regime is provided below.
Flying-foxes will be sampled by a combination of two methods. A nightly census of flying-foxes overflying the site will be taken from a fixed location on the property where flying-foxes can usually be seen crossing a powerline easement (see Figure 2). There is a peak of movement from ~1800 hours on most August nights sampled (~80%), that includes animals that land and feed in the NBSP site (if resources are present) or that continue northwards. These flying-foxes are assumed to emanate from the colonial camp located in Brunswick Heads Nature Reserve, ~ 6 km to the south.

Secondly, flying-foxes foraging within forest blocks or trees of the event site will be counted by observers using red-filtered spotlights and binoculars to count feeding flying-foxes. This will involve two teams each of 2 observers or more observers if food resources are abundant and flying fox numbers are greater. Methods involve an observer using a red filtered spotlight to illuminate the tree canopy while the second observer uses binoculars to identify and count flying-foxes.

Vocalising by flying-foxes unseen within tree canopies will also be used to estimate the number of flying-foxes present. The number of trees used and tree species used each night will be recorded as will the time dedicated to searches. The abundance of fruits and blossom resources will be scored according to percentage of foliage in flower for each tree (Law *et al* 2000).

The area of interest is the central forest blocks of the event area (blocks 14, 13, 12, 11, 23, 21, 22, and 20) because of their proximity to stages and event processes. However, if flying–foxes are also recorded foraging elsewhere in the vicinity, consideration will be given to extending the search area.

Data derived from the two Flying-fox sample methods will include: nightly flyover counts; number of flying-foxes per forest block, counts of the number of feed trees used; number of feed tree species used; total number of flying foxes recorded for each night and for each sample period; species of flying-fox recorded, and recording rate over time spent surveying. If flying-foxes react to disturbance phenomena, for example by flying off en masse during monitoring, this will also be recorded.

Birds of the large dam will be counted each morning by a concealed observer for a period of 20 minutes after a 5 minute settling down period. Counts will be completed before at consistent times to ensure comparable samples. Data from dam bird counts will include: number of birds/species present per day and per sample period. Additionally observations of the large dam will be undertaken each afternoon to coincide with the commencement of music broadcast during events to record any responses to noise.

Microchiropteran bats will be sampled by stationary all night Anabat call detection at two waterbodies, known (corner dam) and predicted to be used (large dam) by microbats over

the 9 nights of fauna monitoring; a third location may also be sampled. Flowering sites will also be considered for microchiropteran monitoring.

1.0.5 Limitations of Proposed Monitoring

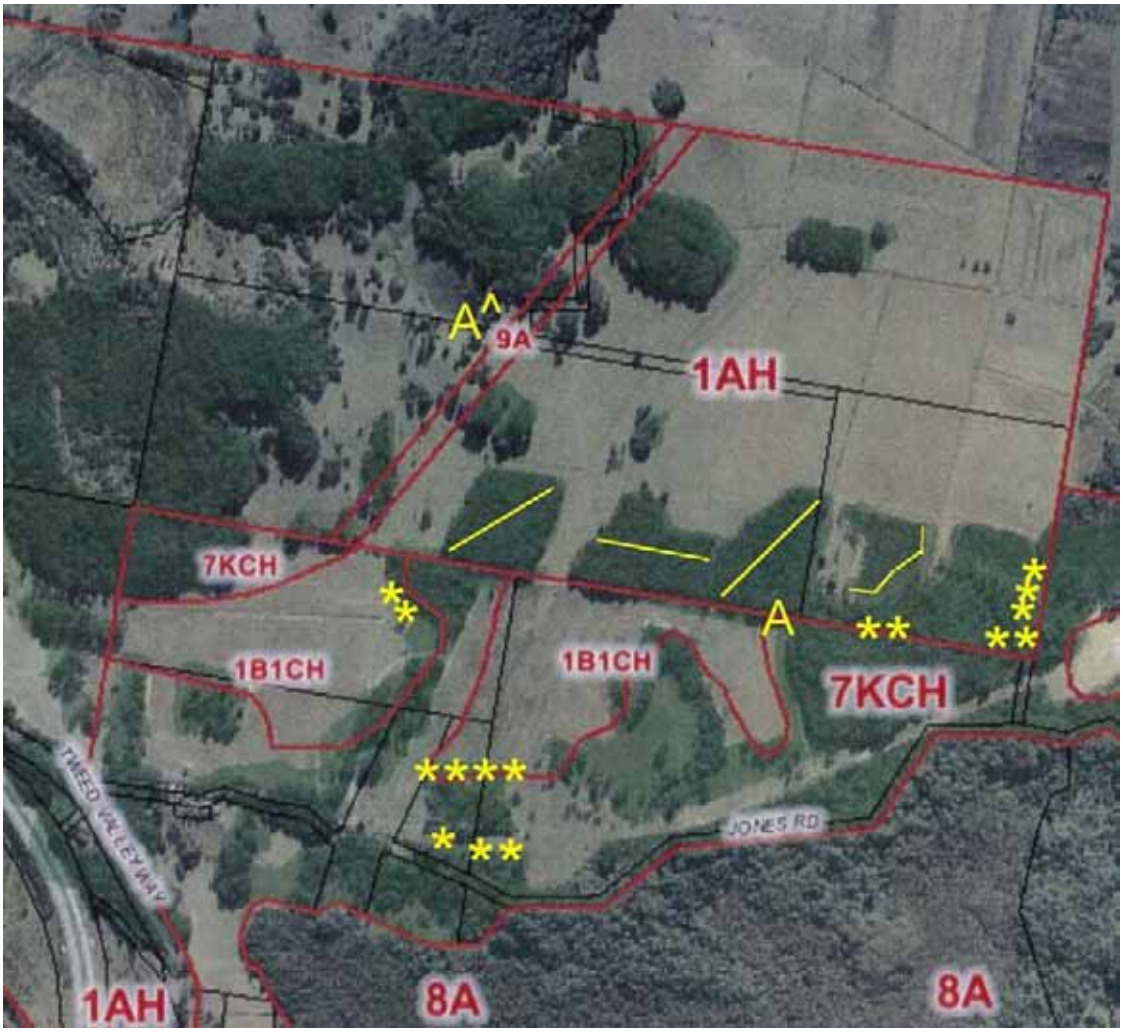
Identification of effects from events and related activities at the site is complicated by the natural variability in factors to be assessed. The fauna species and number of individuals recorded on site varies from day to day and between seasons and years. The pattern and abundance of resource availability (*e.g.* blossoms and fruit) has also varied widely between years.

However, the proposed annual monitoring regime described in section 1.0.2 will provide substantial baseline data against which to compare fluctuations in the abundance of targetted fauna groups. It may be difficult to determine which factor or combination of factors of the disturbance regime produces particular responses in fauna groups.

Following determination of an effect in counts of targetted fauna groups, measurement of disturbance factors (noise, light, patronage numbers) may assist in establishing cause and effect linkages. Sampling techniques may need to be refined to focus on particular disturbance types, times and locations to clarify which disturbance effect is influential.

Monitoring techniques and target groups may be subject to change.

Figure 1: Sampling locations: may vary according to resource distribution for Flying-foxes



A= Anabat locations; ^ = bird hide, lines are forest bird transects; *asterisks are previously used Flying-fox count locations.

1.2 Additional fauna monitoring methods considered

1.2.1 Radio-tracking of Koalas

While the radiotracking of resident koalas on site was initially considered a means of assessing impacts on this species, results of the 2008 Biolink koala survey indicated a low likelihood of tracking koalas on the event site, due to the absence of core koala habitat and the low numbers of animals present (see Appendix H; Biolink 2007 & 2008 reports).

The relevance and usefulness of this technique will be reconsidered following more up-to-date koala surveys and preparation of a KPoM in 2010-2011.

1.2.2 Monitoring of next box occupation

Installation of nest boxes to supplement the low hollow abundance in areas of the site will also over time provide a potential opportunity for monitoring. However occupation of nestboxes may take years (Irvine and Bender 1997: Organ Pipes NP experiment), and patterns of occupancy need to be clearly established before monitoring results can be usefully interpreted. Hollow sheltering species usually move between a number of den or shelter sites (Gibbons and Lindenmayer 2002; *e.g.* squirrel gliders (Rowston 1998); Stephens banded snakes (Fitzgerald *et al* 2002), so these are often not occupied permanently. Thus the presence or absence of animals in nest boxes may be due as much to normal behavioural repertoires as to displacement by disturbance phenomena. Six monthly nestbox monitoring will in the medium to longer term contribute to an understanding of such patterns of occupation.

1.2.3 Monitoring of roadkills

Roadkill of fauna will also be monitored on all roads used in the event, by late night and early morning traverses of roads in ecological audits of event activities.

2.0 Fauna monitoring for event assessment

Staging of events involves three phases of activity and potentially disturbance regimes, typically fourteen days of establishing infrastructure for the festival (bump-in); three days of event; and seven days of dismantling and removing portable infrastructure (bump-out).

Therefore the event monitoring regime proposed involves three by three day samples (3 X 3 days); one sample during bump-in and one sample during bump-out and, one sample during the event.

These samples can then be compared to monthly three day samples before and after each event. Thus any change in target fauna group numbers or species which occurs at any phase of event-related activities will be able to be identified.

Table 1: Event related monitoring schedule

Fauna group	Monitoring schedule
Forest birds	Three count days during bump-in; three count days during the event; three count days during bump-out* Total =9 mornings and 9 afternoons in each of 5 forest blocks.
Flying-foxes	Spotlight searches and counts in forest blocks within the event perimeter over 3 bump-in nights, 3 during event and 3 bump-out nights; Total = 9 nights, effort and locations will be determined by patterns of flowering, fruiting and

	flying-fox behaviour at the time
Dam birds	Morning and afternoon 20 minute counts of all birds on the dam over 3 days pre-event, 3 during event and 3 post event counts. Total = 9 mornings and 9 afternoon samples
Microchiropteran bats	Stationary Anabat detection overnight on each sample day at the large dam and corner dam, and possibly at a 3rd location; Total = 9 nights

Table 2 Monitoring methodologies summarised-see also methods

Fauna group	Methods
Forest birds	Birds encountered by observation and call along marked transects along the longest axes of blocks 14, 13, 12, 11, and 10/18.
Flying-foxes	Spotlight searches and counts in forest blocks wherever vocalising or other sounds of flying-fox feeding are detected, within the event area.
Dam birds	A bird hide will be erected on the dam wall where a wide view of the dam can be obtained. Each morning and afternoon of each sample day an observer will enter the hide and conduct a 20 minute count of all birds on and around the dam, focussing on the water birds
Microchiropteran bats	Stationary Anabat detection at the large dam and corner dam, and possibly at a 3rd location

An ecological audit immediately following the event will also investigate habitat condition, and any incidents such as roadkills associated with the event (see Appendix L).

2.1 Replication and controls

Since the focus and purpose of monitoring is to detect impacts from the staging of the events, the monthly before and after event samples are the 'controls' against which any changed parameters may be identified. Samples during bump-in and bump-out may also provide contrasting data to event samples.

2.2 Data analysis techniques

Selection of data analysis techniques will vary according to sample sizes, and the nature of data collected (sample sizes, independence of samples, 'normality, autocorrelation, pseudoreplication). When *e.g.* Flying-foxes are present in abundance, estimates of size classes rather than counts may be practically unavoidable; these data will require different analysis to actual counts (frequencies). Table 3 lists options for data analyses.

Table 3: Options for data analyses

Type of data	Suitable statistical tests / options
Frequency data: daily counts of birds at the large dam	Contingency table testing, Chi square, paired t tests (before and after compared to during event data); single factor ANOVA for aggregated means, sign test, Wilcoxon ranks tests; PERMANOVA
Frequency data: daily counts of forest birds in central forest blocks	Contingency table testing, Chi square, paired t tests (before and after compared to during event data); single factor ANOVA for aggregated means, sign test, Wilcoxon ranks tests; PERMANOVA
Frequency data: nightly counts of flying-foxes in central forest blocks of the event area	Contingency table testing, Chi square, paired student t tests (before and after compared to during event data); single factor ANOVA for aggregated means, sign test, Wilcoxon ranks tests; PERMANOVA
Frequency data: nightly counts of flying-foxes flying over the power easement north of Jones Road.	Contingency table testing, Chi square, paired t tests (before and after compared to during event data); single factor ANOVA for aggregated means, sign test, Wilcoxon ranks tests; PERMANOVA
Semiquantitative descriptors *e.g.* abundance scores or size classes	Mann-Whitney U test or Kruskal Wallis tests

3.0 Vegetation assessments

Vegetation data from 22 sample plots includes full floristics, abundance, environmental variables, and measured data for plant and tree sizes; cover abundance. A vegetation report including analysis of plot attributes is in Appendix G (Kooyman 2009). Plot data are available on request.

Establishment of permanent vegetation plots will enable future monitoring of changes to the composition, structure and condition of trees. Attributes measured are listed in the vegetation plot sample data sheet provided below.

In the event of any damage to vegetation taking place in any of the permanent plot locations, relevant plots can be re-measured to quantify the extent of changes to vegetation structure. Table 4 lists vegetation and habitat attributes recorded in each sample plot

Table 4: Vegetation and habitat attributes recorded in each sample plot

Plot data (400m2)		
Variable	**Description**	**Rationale**
Identity	Unique identifier	Identifies sample plot
canopy dominants	up to 4 species	Characterises vegetation structure and canopy dominants
Location	AMG, datum	Accurate location enables repeat sampling
Subplot		Finer resolution of spacing data
Date		Identify seasonal aspect of sampling
Aspect		Identifies abiotic influence
Elevation		Identifies abiotic influence
number of strata		Identifies a structural element
grazing	yes/no	Identifies influence on vegetation, especially groundlayer
cattle disturbance	cattle camp, tree destruction, bark eating etc	Identifies influence on vegetation, especially groundlayer
other disturbance	type	Identifies influence on vegetation,
fire	brief description of (lack of) evidence of fire	Identifies influence on vegetation,
Flora	Full Floristics and CA by plot	

Species	dbh (for stems >10cm dbh)	Logistics dictate need for a threshold for practical and timely acquisition of plot data.
	height (classes; 0-1m, 1-2m, 2-5m, 5-10m, >10)	All species including weeds are recorded
	Growth stage	Immature/mature/senescent/stag
	cover abundance	Braun-Blanquet CA measure (1-6)
	life form	Identifies structural diversity
	% canopy cover	Identifies significant feature of stand condition
	bark roughness	Identifies structural attribute for fauna
	hollows	Identifies structural attribute for fauna
	termitaria	Identifies structural attribute for fauna
	epiphytes	Identifies structural attribute for fauna
	litter	Identifies structural attribute for fauna
	logs	Identifies structural attribute for fauna
Stratum	Cover abundance	Identifies structural and condition attributes of vegetation

3.1 Vegetation Monitoring

Vegetation monitoring associated with assessment of impacts from the conduct of the events and event-related activities will be approached by an ecological audit which will examine any changes to vegetation. This will be accomplished by the use of photopoints from fixed locations along margins of forest blocks adjoining event activities (see Figure 3) prior to bump-in.

Where any damage to vegetation is observed during the ecological audit, photographs in conjunction with written reporting will be used to record the incidence, extent and severity of such impacts (see Appendix L).

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Appendix G (Kooyman 2009)

Parklands-Application Number 09_0028

Vegetation Report

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by R.M Kooyman

Earth Process

Ecological Services

Dingo Lane Myocum

* Spreadsheet containing all plot data available on request

Vegetation Assessment and Monitoring

Report detailing results of permanent plot establishment and associated vegetation surveys to determine the nature and condition of vegetation on the site; to allow monitoring through time; and to assist with the development of recommendations for any planned remediation, rehabilitation and / or revegetation to enhance environmental / ecological / habitat values of the land in Byron Shire, northern New South Wales.

Subject Land:

Splendour Site – Jones Road, Yelgun

Byron Shire

Report prepared by: Robert Kooyman (ecologist / botanist)
Earth Process Ecological Services
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ecodingo@bordernet.com.au
Date: 8/01/2009

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1.0 Introduction

My name is ROBERT MICHAEL KOOYMAN and I am a partner in the environmental consultancy business, Earth Process Ecological Services (EPES). I am a Research Associate of the National Herbarium of NSW and Royal Botanic Gardens and Domain Trust, Sydney; and a research scientist in plant ecology at Macquarie University, Sydney.

In response to consent conditions provided by Byron Shire Council to the proponents I was requested to undertake detailed work on the vegetation of the site.

Specifically the brief provided for this project included:

- Establishment of sufficient permanent vegetation plots (as 20 x 20m quadrats with 10 x10m subplots) to sample the range of native vegetation community types on the site, inclusive of floristic and structural components;
- compilation of a property species list based on the samples;
- collection of additional site data to allow improved interpretation of habitat values and to support recommendations for any proposed native vegetation rehabilitation or expansion;
- initial data analysis and synthesis and provision of data in electronic format suitable for storage and future analysis;
- provide a brief overview report.

2.0 Methods

Plot Establishment

A total of 22 permanent plots were established across the range of habitats and forest communities present on site. Plots were 20 x 20m (400 m^2) with four sub-plots (10 x10m) identified in each (NW-NE-SE-SW). Plots were aligned N-S in all cases unless specified (refer to supporting information). Plots were marked with a galvanized steel centre peg and wooden pegs along the plot centre line. Plots were numerically tagged (stainless steel tag) and secured with stainless steel wire to the centre peg.

Data Collection

Data collected included:

- Full floristics with cover abundance measures (1-6, modified Braun Blanquet) for all species by plot. Where 1 = <5% cover and rare; 2 = <5% cover and more abundant; 3 = 6-20%; 4 = 21-50%; 5 = 51-75%; 6 = 76-100%.
- Strata (height range) in which species occurred (1-5) in each plot; (consistent with Walker and Hopkins). Where (in this case) 5 = 0-1m; 4 = 1-5m; 3 = 5-15m; 2 = 15-20m; 1 = >20m.
- Diameter at breast height (over bark) (DBH in centimetres) for all stems greater than 10cm in diameter (by sub-plot and plot).
- Estimate of height for all measured stems (by sub-plot and plot).
- Environmental variables - topographic position, aspect, slope, soil depth – estimate, soil type, and disturbance (including cattle grazing, fire, and other factors).
- Habitat information – including bark texture, presence or absence of tree hollows, termitaria, and percentage cover of logs, rocks, and litter cover.
- Some additional recording of species outside plots to improve property level species lists for flora.
- Photographic record for each plot. Five sequential photographs per plot representing N-E-S-W views of vegetation along plot axes and one canopy cover image.

Data management

All data were entered into Excel spreadsheets and are provided as both 'original' matrices and synthesised extracts and compilations by plot (supplementary materials).

Data analysis

Initial data compilation, synthesis, and analyses were undertaken in Excel (Microsoft). Additional analyses included clustering (classification) and ordination (NMDS) routines for full floristic plot-based samples, tests of dissimilarity (simprof) for the classification dendrogram, and identification and ordination of plot samples along environmental gradients. These were undertaken in the Primer Package.

Clustering and ordination routines used the Bray-Curtis distance measure. Environmental variables were 'normalised' before analysis. Aspect was ArcSin transformed. Spearman Rank and Pearson correlation measures were used to investigate the influence of environmental variables.

3.0 Site Description and Overview of Vegetation

3.1 Topography

The site ranges in elevation from just a few metres above sea level (a.s.l.) on the floodplain to 90m on the highest peak in the northwest of the property. The property is dominated by extensive floodplains (mostly in the east), and hill slopes in the west and south.

3.2 Soils

General description

Soils are derived from meta-sediments on the hill slopes, varying in depth along the topographical gradient (mostly shallower on crests and upper slopes). Parent materials include metamorphosed mudstone and siltstones, but include some sandstone. Soils are mostly brown clay loams, and vary relative to clay content. Soils on the floodplain are much heavier, black-grey (cracking) clays. Some areas of Melaleuca Swamp Forest have a distinct 'peat' layer (though much of this has been burned). The floodplain soils are characterised as heavy clays with a drainage impeded clay sub-soil layer and high water-table.

3.3 Native Vegetation

General description

The native vegetation on the site falls into two main categories: 1) lowland (drainage impeded) sclerophyll swamp forests and transitions; and 2) better drained hill slope forests (Fig. 1). Within those broad categories community assemblages partition relative to a range of environmental factors, including edaphic influences (soils), drainage, aspect, slope, and topographic position (Figs. 2-8).

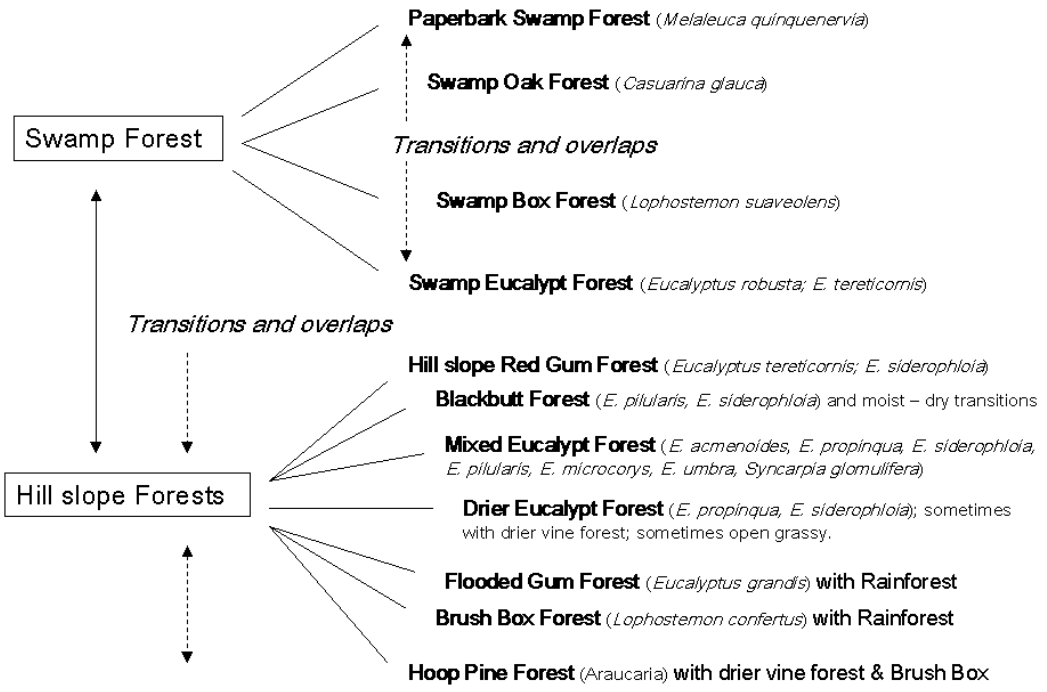

Figure 1 Schematic of forest community types for the Splendour – Yelgun site showing the main split between floodplain swamp forests and hill slope forests, the range of forest communities, and the potential for community and assemblage level variation relative to overlaps and transitions along environmental gradients.

4.0 Results

4.1 Plot samples

A total of 22 plot samples were established across the range of forest types identified on site (Table 1; Figs. 1-3). Clustering analysis (classification) showed some additional subdivision of several forest types along environmental gradients (Figs. 2-3). Alpha (within plot) diversity ranged from 28 – 56 species; with an overall beta diversity of 188 species (plot samples only) (Table 1; and supplementary materials). Plot-based beta diversity is high relative to the 298 species recorded for the whole property (to date) (see supplementary materials). Basal area of stems by plot varied from 2.8 m^2 to 11.4 m^2 (Table 1). This indicates a wide range of variation in tree size, development stage, and condition of the forest between sites, and variation both within and between forest types.

Table 1 List of plots (1-22) with brief identifying descriptor; Australian Map Grid references; Block number (refer to aerial photo overlay Map in supplementary materials); Sp. Div. – Species Richness by plot; BA – Basal Area of tree > 10cm in diameter by plot in m^2 (square metres).

Vegetation Type	AMG		Block	Sp.Div	BA
1. Eucalyptus tereticornis - edge swamp forest transition	551750	6850261	9	54	6.5
2. Eucalyptus tereticornis - Corymbia intermedia ridge top	551783	6850138	10	51	7.4
3. Casuarina glauca - Melaleuca quinquenervia	551529	6850279	12	28	6.1
4. Melaleuca quinquenervia	551266	6850368	13	28	6.5
5. Melaleuca quinquenervia - Lophostemon suaveolens	550948	6850400	14	35	8.0
6. Eucalyptus grandis with Rainforest (NVF)	550451	6850402	44	35	9.0
7. Eucalyptus propinqua with drier NVF	550549	6850367	42	30	5.1
8. Araucaria cunninghamii - Lophostemon confertus	550549	6850367	45	31	7.1
9. Lophostemon confertus	550575	6850522	42/45	47	6.0
10. Lophostemon confertus	550670	6850515	39	36	5.9
11. Eucalyptus tereticornis - E. siderophloia - E. acmenoides -ridge	550463	6850707	38	36	4.9
12. Eucalyptus pilularis	550533	6850916	36	34	10.0
13. Lophostemon confertus	550679	6850938	36	44	5.1
14. Eucalyptus pilularis	550785	6850971	51	41	11.4
15. Eucalyptus pilularis - E. siderophloia (ridge top forest)	551010	6850889	34	50	5.4
16. Eucalyptus spp (mixed) - Syncarpia glomulifera	551124	6850949	34	56	7.3
17. Melaleuca quinquenervia - Syncarpia glomulifera - Acacia	551218	6850761	3	47	6.2
18. Melaleuca quinquenervia	551538	6850788	4	39	9.8
19. Eucalyptus robusta	550898	6850296	23	37	7.8
20. Lophostemon suaveolens - NVF - hillslope	551333	6849971	20	43	4.4
21. Eucalyptus tereticornis - Lophostemon suaveolens	550937	6849894	21	35	3.8
22. Ficus obliqua - NVF transition to Lophostemon confertus	550786	6850009	22	43	2.8

Detailed information for each plot sample is provided in the supplementary materials and includes a synthesis of species by plot by cover abundance by strata; and plot-based information about environmental variables.

4.2 Species lists (floristics)

A property species list, inclusive of rare, significant, and threatened species is provided in the supplementary materials.

Species lists for each plot are provided in the supplementary materials both as individual lists and in matrix format for the full sample.

4.3 Results of multivariate analyses

The results of multivariate analysis of the plot-based samples are presented below. These provide an overview of the floristic associations, and provide baseline information to compare to through time. Figures 2 a-b represent the dendrogram

(classification) of forest types based on full floristics. Figure 2a shows that the main split is between the floodplain and hill slope forests. S7 (*Eucalyptus propinqua* with drier vine forest) and S20 (*Lophostemon suaveolens* on hill slope with some rainforest species) represent outliers. S20 (above), S17 (*Melaleuca* and hill slope *Eucalyptus*), and S1 (*Eucalyptus tereticornis* on foothills near S2) have elements of both (floodplain and hill slope forests). S6 (*Eucalyptus grandis* with rainforest) and S8 (*Araucaria cunninghamii* with rainforest) represent rainforest transitions.

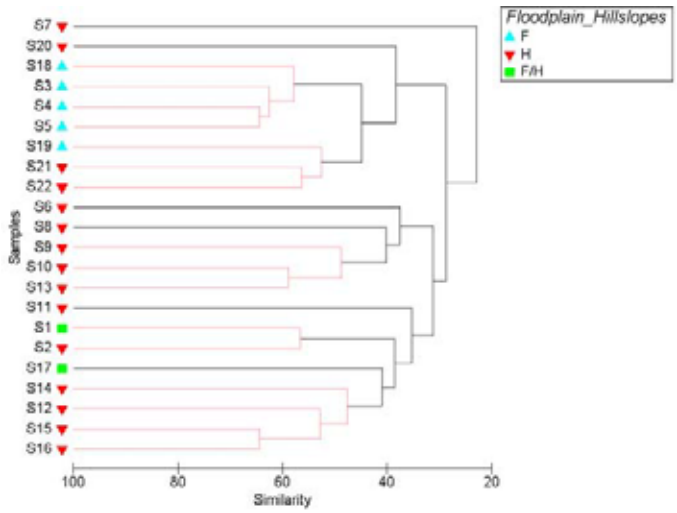

Figure 2a Classification dendrogram for 22 plot-samples (full floristics) by F – floodplain forest; H – hill slope forest; and F / H – overlap of both.

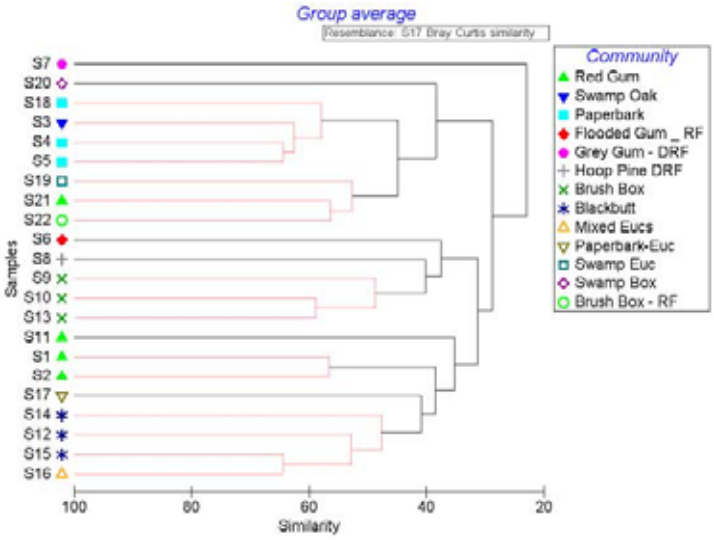

Figure 2b Classification dendrogram showing forest types, and the sub-grouping around key indicator species for each forest community.

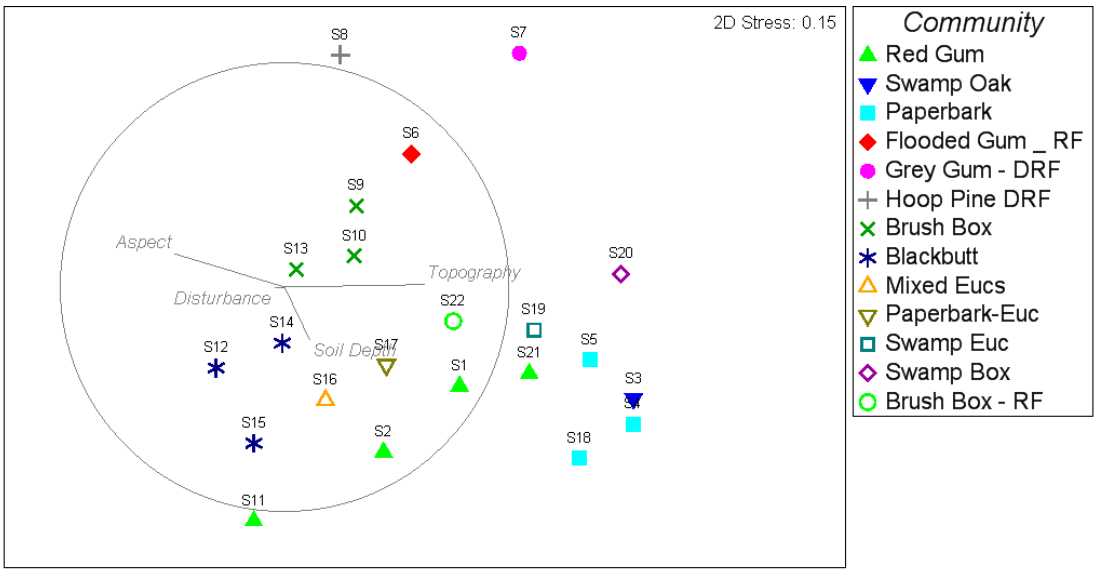

Figure 3 NMDS ordination showing grouping of plots by community based on full floristics. Relative influence and direction (of influence) of environmental variables (aspect, topography, soil depth, and disturbance) are shown. Slope removed as (in this case) it largely correlates with topography. The primary axis of variation represents physiography and edaphic (soil) factors; while disturbance is secondary and represents an independent axis of variation.

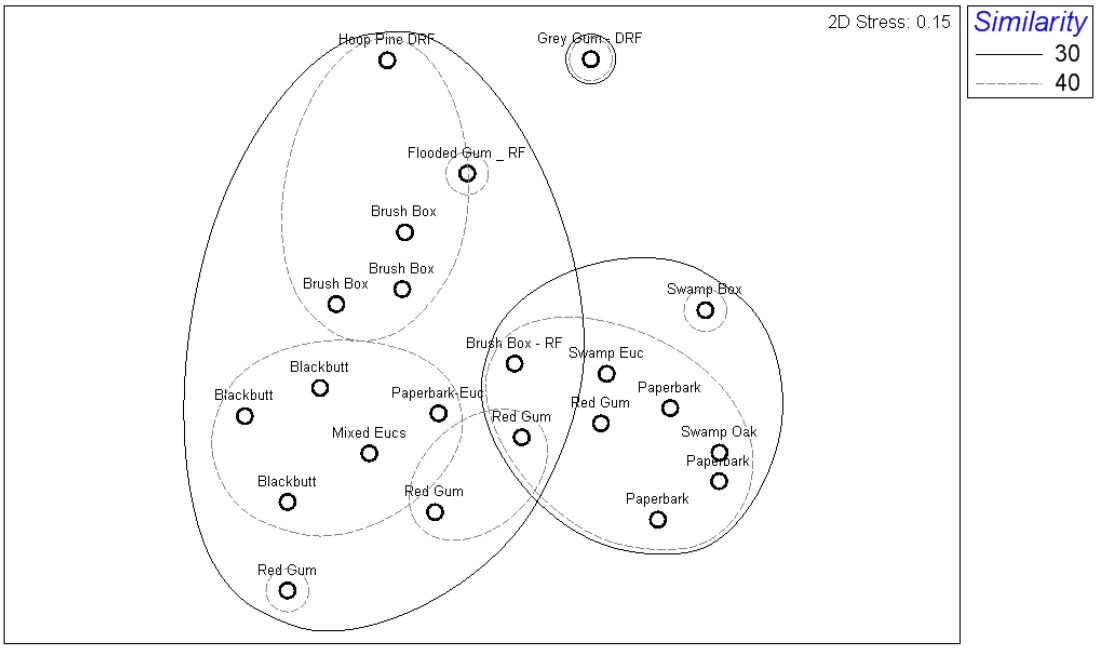

Figure 4 NMDS ordination including classification contours (similarity - dissimilarity) to show grouping relative to the classification dendrogram.

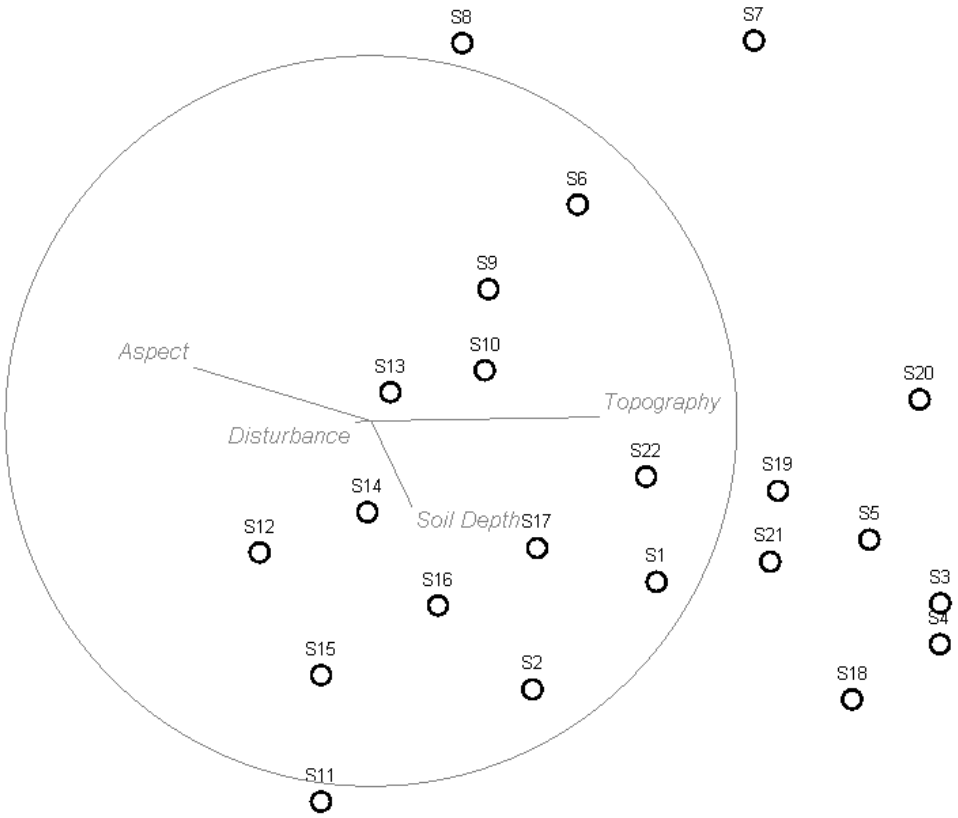

Figure 5 NMDS ordination showing sites relative to environmental gradients.

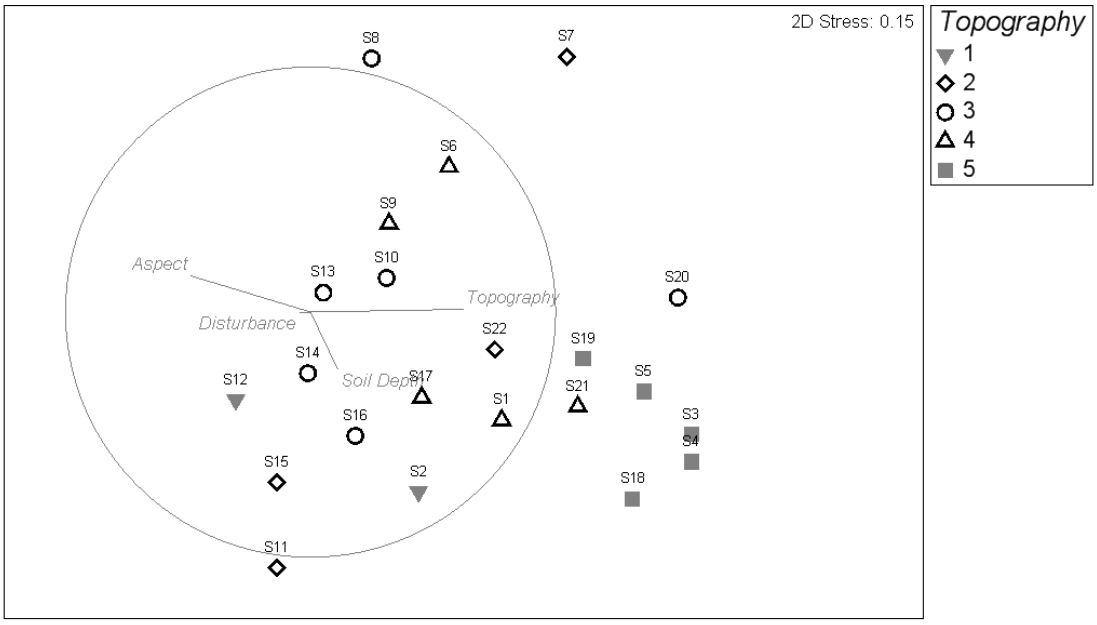

Figure 6 NMDS ordination showing sites relative to topography. 1 – crest; 2 – upslope; 3 – mid-slope; 4 – lower slope; 5 – flat (floodplain).

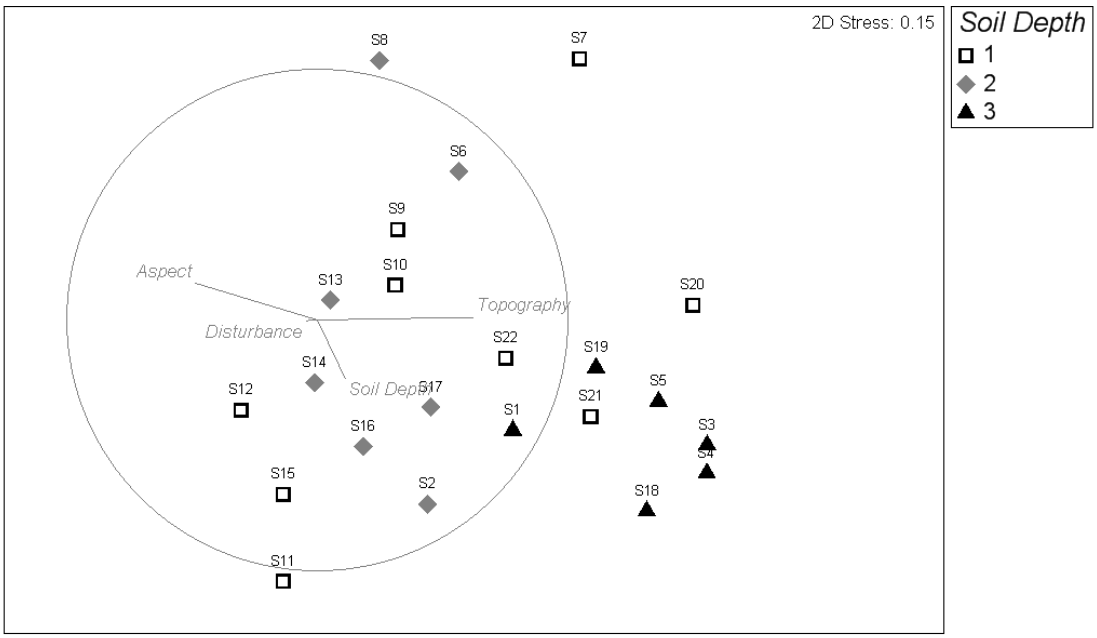

Figure 7 NMDS ordination showing sites relative to soil depth. 1 – shallow; 2 – medium; 3 – deeper.

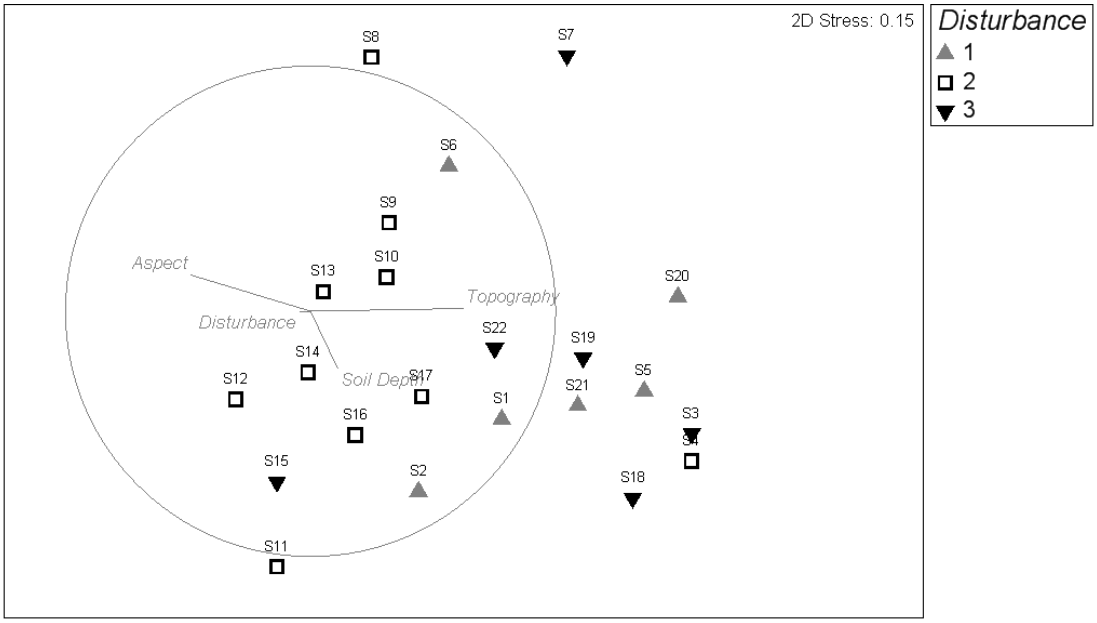

Figure 8 NMDS ordination showing sites relative to disturbance. 1 – low; 2 – medium; 3 – high. Disturbance is widespread across the site and differentiating the various factors that contribute, including historic from more recent influences on floristics, is problematic.

The spread of disturbance across the sites (Fig. 8) has allowed the woody weed *Cinnamomum camphora* (Camphor Laurel) to establish (or be present as seedlings) in many of the plots. The cover abundance measures show that it is the most significant weed species on site (Fig. 9). As such it will potentially provide a useful measure of performance for the implementation of rehabilitation measures through time.

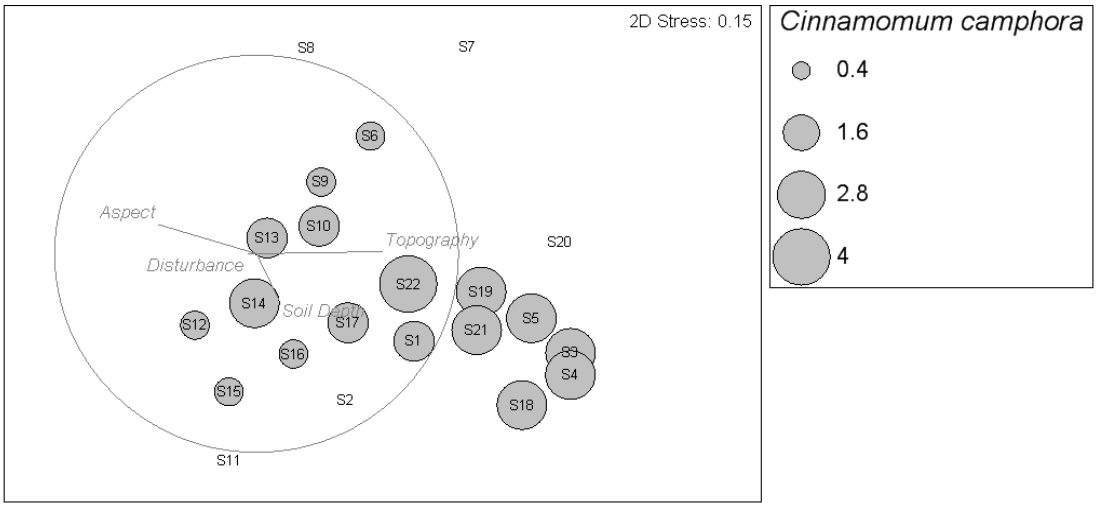

Figure 9 NMDS ordination as a 'bubble plot' showing the presence and abundance (as grey bubbles) of Camphor Laurel in the plot samples. Larger bubbles equate with higher abundance. Representation by strata is provided in the supplementary materials.

5.0 References and Background

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6.0 List of Supplementary Materials (available on request)

Map (aerial photo overlay) of site with 'Blocks' of vegetation defined and numbered.

Site by Species matrix – with species abundance measures.

Site by Species matrix – species by strata.

Site by Environmental variables and code to variables.

Site by species by strata.

Plot and sub-plot DBH and height for species >10cm DBH.

BA for all species by plot, by sub-plot, as individual conversion of DBH to BA.

Photographic record of all plots (5 images per plot); in sequence (1-22), with 5 shots (in sequence) representing N-E-S-W axes of plots (4) and 1 canopy cover.

Appendix H

Koala survey reports (2007 & 2008)

and

Koala Plan of Management (2007)

Parklands-Application Number 09_0028

Prepared for

Billinudgel Property Trust (Billinudgel Property Pty Ltd)

by

Biolink Ecological Consultants

Marshall Street Uki

NSW 2481

A further Koala survey is scheduled for late 2010-early 2011, and an updated Koala Plan of Management will be prepared to reflect ongoing use of the Parklands site.

Yelgun Koala Survey (SEPP 44 Assessment) & Koala Plan of Management



Report to Billinudgel Property Trust

July 2007

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Document Control

Draft #	1	**Date**	**Signature**
Prepared by	M. Hopkins	6th July 2007	
Reviewed by	S. Phillips	6th July 2007	

Introduction

State Environmental Planning Policy No. 44 (Koala Habitat Protection) commenced on the 13th February 1995, its aim to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline:

a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of *Core Koala Habitat*;
b) by encouraging the identification of areas of *Core Koala Habitat*; and
c) by encouraging the inclusion of areas of *Core Koala Habitat* in environment protection zones.

This report and associated Koala Plan of Management has been prepared for Billinudgel Property Trust Pty. Ltd. (BPT) and details the results of a koala habitat assessment for a land unit at Yelgun in the Byron Shire Local Government Area (LGA) on the north coast of New South Wales. The Byron LGA is listed in Schedule 1 of SEPP 44 as lands to which the policy applies. The site in question (see below) has an area of more than one hectare and is thus potentially subject to Part 2 of the Policy (Development Control of Koala Habitats).

BPT propose to seek development approval from Byron Shire Council to trial use of the site for a music festival. The proposal is for staging of a three-day music event (and associated period of ~ 3 weeks of set-up/pack down activity) on the site, during which a patronage of 22,500 is expected, along with high noise and nocturnal light levels. Infrastructure construction will consist of an underpass below and a widening of Jones Road as well as construction of internal vehicular and pedestrian roads and some realignment of drainage lines. Existing cleared grazing land on the site is to be utilised for event staging and camping within which temporary infrastructure will be constructed including stages, camping facilities and food stalls, as well as temporary fencing to surround patches of remnant vegetation.

The purpose of this report is to augment preliminary flora and fauna investigations currently being undertaken by other consultants, by specifically focusing on koalas, their habitat and other issues associated with SEPP 44.

Threatening processes

Free-ranging koala populations are threatened by a variety of processes including:

- Destruction of *Core Koala Habitat* by inappropriate clearing for urban development, roadworks, agricultural and mining activities.
- Fragmentation of both *Potential* and *Core Koala Habitat* such that barriers to movement are created that isolate individuals and populations, hence altering population dynamics, impeding gene flow and the ability to maintain effective recruitment levels.
- Unsustainable mortalities caused by dog attacks and road fatalities.
- Mortalities caused by stochastic events such as fire.
- Degradation of habitat by logging of preferred food trees.

PART A - ECOLOGICAL ASSESSMENT

Methods

Study Area

The site (Figure 1) is approximately 250ha in size and located in the north east of the Byron Shire LGA. The site is bordered partially in the west by the Pacific Motorway, to the north by the Byron Shire LGA boundary and in the south and east by other landholdings including parts of what is now the Billinudgel Nature Reserve (BNR).

Vegetation of the Study Area

Approximately 26% of the study area is vegetated, and although largely fragmented within the property itself, vegetation in the south-east of the property is largely contiguous with that of the adjoining BNR. The remainder of the site consists of cleared grassland with scattered trees. The site supports a wide range of vegetation communities including wet to dry sclerophyll forest variously dominated by Forest Red Gum *Eucalyptus tereticornis*, Brushbox *Lophostemon confertus*, Blackbutt *Eucalyptus pilularis* and Turpentine *Syncarpia glomulifera* in areas of higher elevation, with patches of subtropical rainforest ± Camphor Laurel *Cinnamomum camphora* and Broad-leaved Paperbark *Melaleuca quinquenervia* – Swamp Turpentine *Lophostemon suaveolens* ± Swamp Mahogany *Eucalyptus robusta* forests in lower lying areas.

Yelgun Koala Survey & Koala Plan of Management

Study area

Jones Road

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N
W
E
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Figure 1. Study area

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Survey Methodology

A. Historical Records

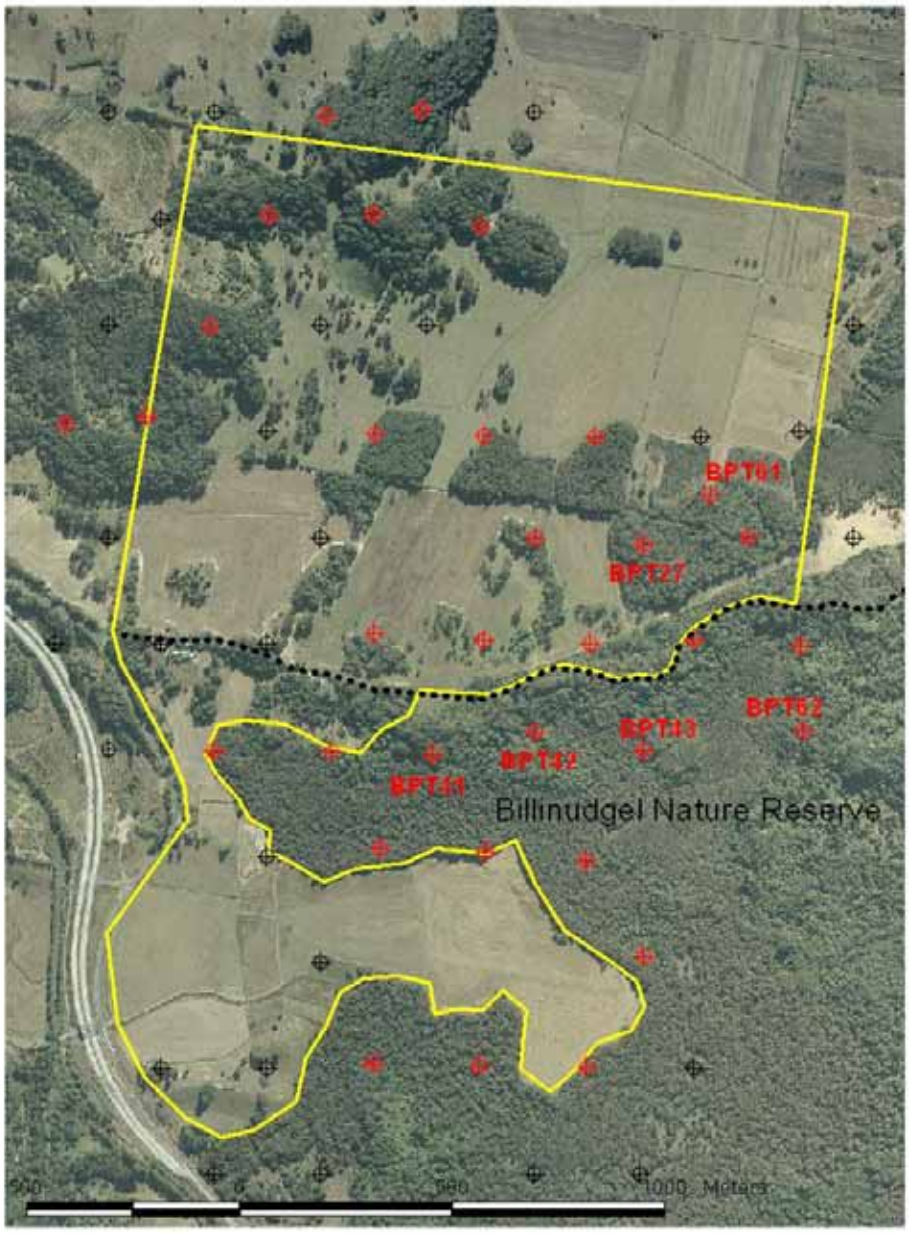
Records from the NSW National Parks and Wildlife Service's Wildlife Atlas database for an area of 100km^2 centrally located over the site (153°28'10.9"E, -28°31'31.8"S – 153°34'20.4"E, -28°25'31.8"S) were obtained for the purposes of identifying historical/contemporary records of relevance to the study area.

B. Field Survey

In order to gain a more complete understanding of koala activity in the area, we extended our sampling area beyond the site boundaries to adjoining landholdings including parts of the BNR in order to ensure that the entire property was effectively surveyed and that immediately adjoining habitat areas were taken into account. A systematic approach was used to survey for evidence of koala activity. In order to ensure a uniform and unbiased distribution of sampling effort throughout the study area, a 250m by 250m offset grid was overlain on a map of the study area and the resulting grid-cell intersections selected as initial sampling points where they intersected remnant patches of native vegetation (Figure 2). UTM coordinates for each grid-cell intersection were then determined and programmed into a 12 parallel-channel GPS receiver navigating on a GDA94 datum to assist their location in the field. Once located, each point was sampled using the Spot Assessment Technique (SAT) of Phillips and Callaghan (Appendix I). Amongst other things, this methodology categorises koala activity for the purposes of SEPP 44, with activity levels greater than 22.52 (23)% being indicative of the presence of *Core Koala Habitat* (refer Appendix 1, Table 2).

In addition to the formal survey component, our field work also included examination of known koala food trees (Tallowwood *E. microcorys*, Forest Red Gum *E. tereticornis*, Swamp Mahogany *E. robusta* and Grey Gum *E. propinqua*) for koalas or signs of koalas as such trees were encountered while traversing between sites. Cursory inspections were also undertaken within parts of the BNR.

Yelgun Koala Survey & Koala Plan of Management



Study area

Jones Road

Sampling points

Sampled

Not sampled

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Figure 2. Location of sampling points

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Results

A. Historical records

Our search of the NSW NPWS Wildlife Atlas returned one record of a koala from within the site and an additional seven records within a five kilometre radius from the centre of the site. These records date from 1986 to 1997, with a record from 1990 located within the site and another in the same year from within BNR to the south. The most recent Atlas record (1997) is located to the west of the site (<1km). Other records from the surrounding area are located to the north at Burringbar and Cudgera, to the east at Inner Pocket Nature Reserve, and south at Brunswick Heads.

During 1999, survey work undertaken by Australian Museum Business Services (AMBS) for purposes of the Yelgun-Chinderah Pacific Highway upgrade also resulted in a record from just within the western boundary of the site, in addition to several others along Jones Road; one of which being an animal that was subsequently radiotracked for a period of several months.

Documented historical records for the site are illustrated in Figure 3. The presence of koalas in the general vicinity of the site is also recognised by local residents.

B. Field Survey

Field survey was undertaken over the period 11th – 22nd June 2007 during which time 62 potential SAT sites were inspected, 33 of which were formally assessed. Collectively, a total of 844 trees were inspected, comprising at least 9 species from the Genus *Eucalyptus*. Table 1 details the tree species sampled during the course of the field survey.

Table 1. Number of each tree species sampled for koala faecal pellets during field sampling and number of sites in which the species was recorded.

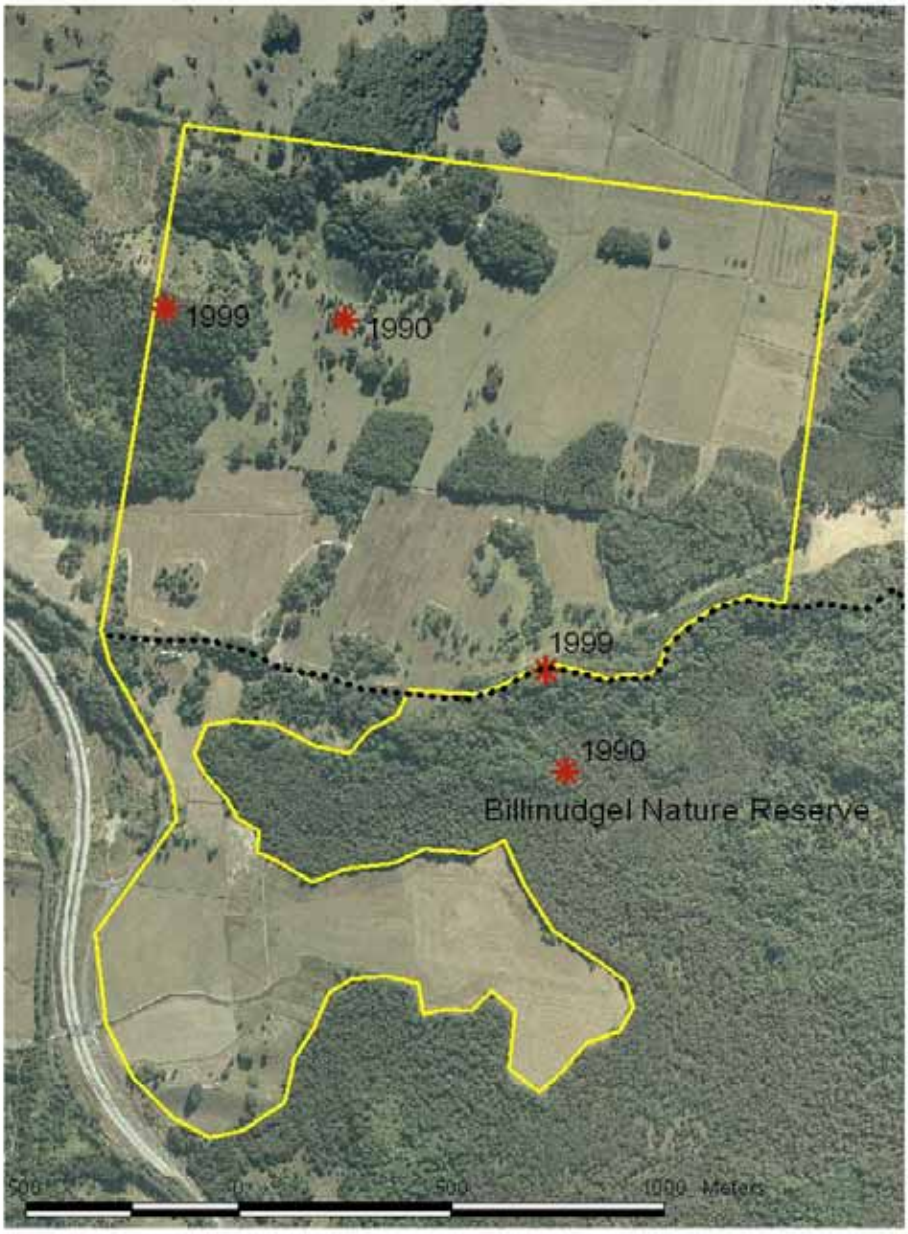
Species	Common name	Trees sampled	Sites
Eucalypts			
Eucalyptus pilularis	Blackbutt	29	7
E. tereticornis	Forest Red Gum	29	7
E. siderophloia	Grey Ironbark	18	6
E. microcorys	Tallowwood	13	6
E. carnea	Broad-leaved White Mahogany	13	2
E. robusta	Swamp Mahogany	11	3
E. resinifera	Red Mahogany	9	2
E. propinqua	Small-fruited Grey Gum	6	2
E. grandis	Flooded Gum	6	1
E. spp.		3	2
*E. patentinervis**		1	1

Non-eucalypts			
Melaleuca quinqenervia	Broad-leaved Paperbark	224	21
Lophostemon confertus	Brushbox	98	12
Rainforest spp		98	20
L. suaveolens	Swamp Turpentine	83	17
Cinnamomum camphora[i]	Camphor Laurel	79	17
Corymbia intermedia	Pink Bloodwood	28	9
Casuarina glauca	Swamp Oak	25	3
Glochidion ferdinandi	Cheese Tree	23	6
Callistemon salignus	Willow Bottlebrush	16	5
Syncarpia glomulifera	Turpentine	11	3
Melicope elleryana	Pink-flowered Doughwood	6	3
Acacia spp	Wattle	5	4
Acacia melanoxylon	Blackwood	4	3
Allocasuarina torulosa	Forest Oak	2	2
Daviesia arborea		2	1
Pittosporum sp.		1	1
Callicoma serratifolia	Callicoma	1	1
Total		**844**	

**E. robusta* x *E. tereticornis* hybrid
[i] introduced species

Evidence of koala activity was scarce with faecal pellets recorded in only two of the formally assessed SAT sites (BPT27 (Activity level: 13%) & BPT41 (Activity level: 4%)) as well as being observed opportunistically at two locations (between BPT 42 & BPT43, and between Jones Road and BPT43) during the course of the field survey (refer Figure 2). This data alluded to the possible presence of higher activity levels to the south west, a notion that we were able to confirm with a fill-in site (BPT 62 - Activity level: 43%) in the BNR. A fill-in site to the north of BPT 27 also yielded significant koala activity (BPT61 – Activity level: 30%). Surface modelling of this activity data using SAT threshold values supported by GIS-based regularized splining and contouring subsequently indicated the presence of a small isolated cell of *Core Koala Habitat* in the southeastern corner of the site to the north of Jones Road. *Core Koala Habitat* was also present within the BNR but does not appear to be widespread, a notion confirmed by our results for the BNR generally, but also supported by cursory field inspections of suitable but otherwise unoccupied koala habitat (Swamp Mahogany forest) at the end of Quarry Trail. Figure 4 illustrates the modeled distribution of *Core Koala Habitat* within our study area, including the indicative edge of what is likely to be a larger cell in the BNR. Commensurate with the sampling intensity (250m centres) applied for the purposes of this assessment, a 125m buffer has been applied to the identified *Core Koala Habitat* cell.

Yelgun Koala Survey & Koala Plan of Management



Study area
Jones Road
Koala record

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Figure 3. Date and location of historical koala records

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Yelgun Koala Survey & Koala Plan of Management

Study area
Jones Road

Core koala habitat
High activity area
125m buffer

Remnant vegetation
Melaleuca regrowth
Waterbody

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Figure 4. Core Koala Habitat and remnant vegetation

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PART B PLANNING AND MANAGEMENT

General discussion

Core Koala Habitat is a dynamic rather than static phenomenon, the boundaries of which can be expected to change over the course of successive koala "generations", the measure of which has been estimated to be 5.6 – 7.8 years (Phillips 2000). The direction of such change (i.e. expansion or contraction) is dependent upon several factors including:

- the level of historical disturbance prior to assessment,
- the size and proximity of any other resident population(s),
- the availability of suitable habitat in proximity to that currently being occupied by resident koala populations,
- habitat linkages to assist processes of emigration and recruitment, and
- extant threatening processes.

Given the above, we consider that the 1999 AMBS records and associated radiotracking data evidenced the presence of a resident koala population along the Jones Road ridgeline at that time. Hence our results at this point in time confirm that a measure of population attrition has occurred in the general area over the last 6 – 7 years.

A primary objective of SEPP 44 is to reverse koala population decline. Knowledge of the size and demographics of the koala population in the study area and beyond is limited (see below), however the purpose of this plan is to ensure negative impacts on koalas are minimised prior to and during the event and that development occurs such that the quality and quantity of the habitat resource does not change over time. The systematic SAT-based sampling methodology applied to this investigation has been widely applied to koala habitat and conservation assessments throughout eastern Australia. Locally, it has formed the basis for the Kings Forest Koala Plan of Management (Biolink 2005) and most recently for detailed population assessments in the Coomera-Pimpama and Coombabah areas of the Gold Coast Council LGA as part of a shire wide koala habitat and population assessment (Biolink 2007). In these studies, sampling was undertaken at a similar scale and detected significant areas of koala activity in addition to forming the basis for modeling population boundaries and providing robust estimates of koala population size. Such results are in contrast to those reported herein which otherwise serve to confirm that save for a very small area of *Core Koala Habitat*, the majority of site is currently the subject of low levels of use by koalas.

The Director-General of the now Department of Planning has prepared guidelines to assist implementation and assessment procedures for the purposes of SEPP 44, including those relating to the preparation of a KPoM which, *inter alia*, must address such matters as detailed below:

(i) an estimate of population size;

(ii) identification of preferred feed tree species for the locality and the extent of resource available;

(iii) an assessment of the regional distribution of koalas and the extent of alternative habitat available to compensate for that to be affected by the actions;

(iv) identification of linkages of *Core Koala Habitat* to other adjacent areas of habitat and provision of strategies to enhance and manage these corridors;

(v) identification of major threatening processes such as disease, clearance of habitat, road kill and dog attack which impact the population;

(vi) provision of detailed proposals for amelioration of impacts on koala populations from any anticipated development within zones of *Core Koala Habitat;* and

(vii) identification of any opportunities to increase size or improve condition of existing *Core Koala Habitat*.

The following discussion addresses these matters through interpretation of the results of our field survey work and results in terms of the site's significance as koala habitat for the purposes of SEPP 44.

(i) estimate of population size

A precise estimate of population size is not possible based on the results of this study. The small cell of *Core Koala Habitat* we have identified in the southeastern corner of the property likely represents the home range areas of no more than 2 koalas, our data suggesting that it is an isolated cell/population outlier associated with a larger population cell to the southeast. The size of this latter cell is unknown, though it is also likely to be small given suitable areas of habitat located within the immediate vicinity of Site BPT 62 that are clearly not being utilized.

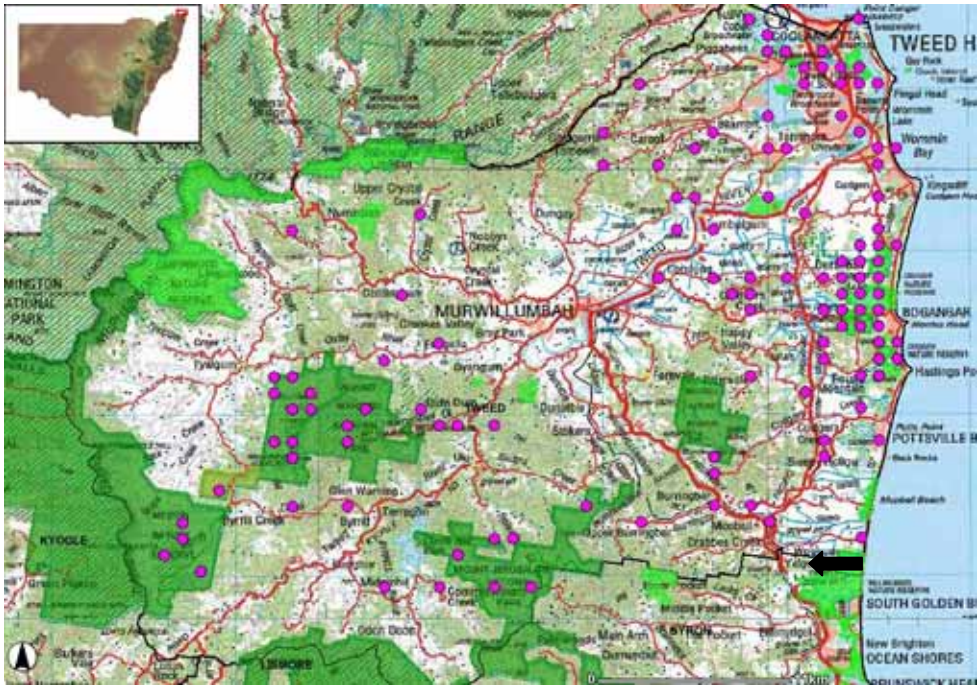
Given favourable recruitment conditions, we consider it likely that the small cell we have identified could increase in size over time, while the worst case scenario is that it could also disappear altogether for reasons which may be unrelated to any proposed development activity (e.g. predation and/or misadventure).

(ii) identification of preferred feed tree species for the locality and the extent of resource available

For the purposes of SEPP 44, potential koala habitat "*means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component*." Koalas are obligate folivores feeding on species in the genus *Eucalyptus*. The site has some substantial patches of native vegetation consisting of a number of distinct vegetation communities that support at least nine *Eucalyptus* species. Of the eucalypts we observed and/or recorded, four (Tallowwood *E. microcorys,* Forest Red Gum *E. tereticornis* Swamp Mahogany *E. robusta* and Grey gum *E. propinqua*) are important koala food trees and the former three are listed on Schedule 2 (koala food trees) of SEPP 44. These tree species were recorded in 14 of our formally assessed field sites with a range of percentage occurrences from 4% - 56% (Mean proportion of Schedule 2 tree species = 14.76% ± 4.32% (SE)), indicating that at least some of the vegetation in the study area theoretically qualifies as potential koala habitat due to the aforementioned tree species forming part of the overstorey in many of the vegetated areas. Having said this, we generally advocate disregard for the 15% rule because it has no scientific basis in terms of koala ecology. Indeed, koalas have the capacity to cross areas of open land to move between remnants (Prevett 1990, Phillips 1999), to utilise isolated paddock trees (Prevett 1990, Phillips 1999) and to access their preferred food trees even when they occur at very low density (Phillips and Callaghan 2000). In a management context, this knowledge is important as it highlights the necessity for maximising retention of preferred koala food trees wherever they occur, quite independently of their abundance in the landscape.

(iii) an assessment of the regional distribution of koalas and the extent of alternative habitat available to compensate for that to be affected by the actions

Records of koalas are widely distributed throughout the Byron and Tweed LGAs (Figure 5) but there is little meaningful data upon which to base an objective assessment. Prior to an extensive wildfire at Round Mountain in 2004, Phillips (2002) conservatively estimated a total population size of 302 - 517 individuals in the Tweed Coast, that area immediately



adjoining and extending north from our study area and bounded in the west by the Yelgun – Chinderah Pacific Highway upgrade. A smaller number of koalas are likely to be contained in the adjoining coastal strip within the Byron LGA that extends southwards from our study area through Ocean Shores to the Brunswick River.

Figure 5. Distribution of post 1980 koala records within the Tweed and Byron LGAs (Source: NSWNPWS Wildlife Atlas). Arrows indicate approximate location of study area.

To the best of our knowledge, no areas of potential or core koala habitat will be directly affected by actions arising from the proposed event and thus the need to consider alternative habitat as a compensatory measure is not warranted in this instance.

(iv) identification of linkages of Core Koala Habitat to other adjacent areas of habitat and provision of strategies to enhance and manage these corridors

The small cell of *Core Koala Habitat* we have identified is effectively linked to the nearest likely *Core Koala Habitat* cell in BNR via existing forest that is currently bisected by a power line easement and Jones Road. This linkage is unlikely to be compromised by the proposed event, while those to other adjacent areas of habitat are not expected to be diminished due to the temporary nature of the event.

(v) identification of major threatening processes such as disease, clearance of habitat, road kill and dog attack which impact the population

The most likely threatening processes impacting upon the population at present include the presence of unrestrained domestic dogs towards the western end of Jones Road, the barrier effect of the Yelgun – Chinderah Pacific Highway Upgrade and the recent fire history within the adjoining BNR.

A primary but speculative impact arising from the proposed development is likely to be auditory disturbance arising from the presence of a large number of people, ancillary development works (motor vehicle activity and noise) and music. Because the potential impacts from these activities upon koalas are unknown, we propose that effective monitoring prior, during and subsequent to the event (as detailed in attached Working Provisions) be used to quantify and document any changes in the behaviour and/or health status of any resident koalas.

(vi) provision of detailed proposals for amelioration of impacts on koala populations from any anticipated development within zones of Core Koala Habitat

Please refer to attached Management Provisions

(v) identification of any opportunities to increase size or improve condition of existing Core Koala Habitat.

The majority of vegetated areas on the site are capable of supporting koala populations due to the wide distribution of preferred koala food trees. However, any increase in size of the existing *Core Koala Habitat* on the property will be dependent on recruitment from any population in the adjoining BNR, rather than any specific action by the proponent. Opportunity for population expansion into areas of currently unoccupied habitat on the property will be continued through maintenance of the north-south linkage from the *Core Koala Habitat* cell on the property to the BNR.

In response to the preceding discussion, a number of specific management provisions are detailed on the following pages.

Management Provisions

PART 1 - Preliminaries

1.1 Definitions

"*Core Koala Habitat*" – means that area of the site currently supporting a resident population of koalas.

"DECC" – means the NSW Department of Environment and Climate Change.

"DoP" – means the NSW Department of Planning

"*Potential Koala Habitat*" – means any area of the site not currently mapped as *Core Koala Habitat* but that otherwise contains preferred koala food trees.

"Preferred Koala Food Trees" – means the following tree species:

Tallowwood (*E. microcorys*)

Grey Gum (*E. propinqua*)

Swamp Mahogany* (*E. robusta*)

Forest Red Gum* (*E. tereticornis*)

* includes the naturally occurring *E. tereticornis* x *E. robusta* hybrid.

"suitably qualified and/or accredited koala specialist" – means a individual with *post*-graduate qualifications in koala ecology, and/or demonstrable work experience that includes publication of works on koala ecology in peer-reviewed scientific literature, and/or accreditation as a koala specialist by DECC and/or the Ecological Consultants Association of NSW.

"The Determining Authority" – means Byron Shire Council

"The event" – means a "one-off" music festival proposed for August 2008 and being the subject of the initial Development Application.

"The plan" – means the *Yelgun Koala Survey (SEPP 44 Assessment) & Koala Plan of Management*.

"The proponent' – means Billinudgel Property Trust Pty Ltd.

1.2 Land to which the plan applies

The plan applies to that area of land edged in yellow identified in Figure 1 of the plan.

1.3 Duration of Plan

The plan will come into force once approved by Local and State Government authorities and shall remain in force until the 31st December 2008 unless otherwise amended.

PART 2 – Management Aim and Objectives

2.1 The primary aim of the plan is to accommodate development whilst ensuring, to the maximum extent possible, that physical disturbance to areas of *Core Koala Habitat* is minimised, that any impacts on resident koalas as a consequence of the event are documented and that conservation of *Potential Koala Habitat* elsewhere on the site is maximised. This task is reflected in the following objectives:

(i) Ensuring that the full extent of *Core Koala Habitat* within the land to which the plan applies is known immediately prior to staging of the event;

(ii) Quantifying the extent of any changes in ranging patterns and health status of koalas residing within areas of *Core Koala Habitat* that are on land to which the plan applies; and

(iii) Ensuring retention of preferred koala food trees within all areas of *Potential Koala Habitat.*

The preceding aims and objectives will be realised through the actions and measures detailed below.

PART 3 - General Provisions

3.1 Protection of koalas from undue disturbance

(i) The clearing of vegetation for development purposes must not proceed until the area has been inspected and approval given in writing by a suitably qualified and/or accredited koala specialist.

(ii) Approval to proceed with the clearing of vegetation is only valid for the day on which the inspection has been undertaken.

(iii) The clearing of vegetation and/or earthworks for the purposes of Sec 3.1(i) or any other purpose must be temporarily suspended within a range of 25m from any tree which is concurrently occupied by a koala and must not resume until the koala has moved from the tree of its own accord.

PART 4 – Planning for the event

4.1 Pre-planning

(i) A reassessment of the extent of *Core Koala Habitat* currently known to occur within the land to which the plan applies must be undertaken no less than two months prior to staging of the event in order to confirm the continued persistence of and/or identify any changes to the currently mapped boundary.

(ii) Reassessment of the currently mapped area of *Core Koala Habitat* must be carried out using SAT methodology at intervals of 125m as detailed in Figure 6 below.

(iii) Additional to those sites referred to in 4.1(ii) above, 50% of the original field sites

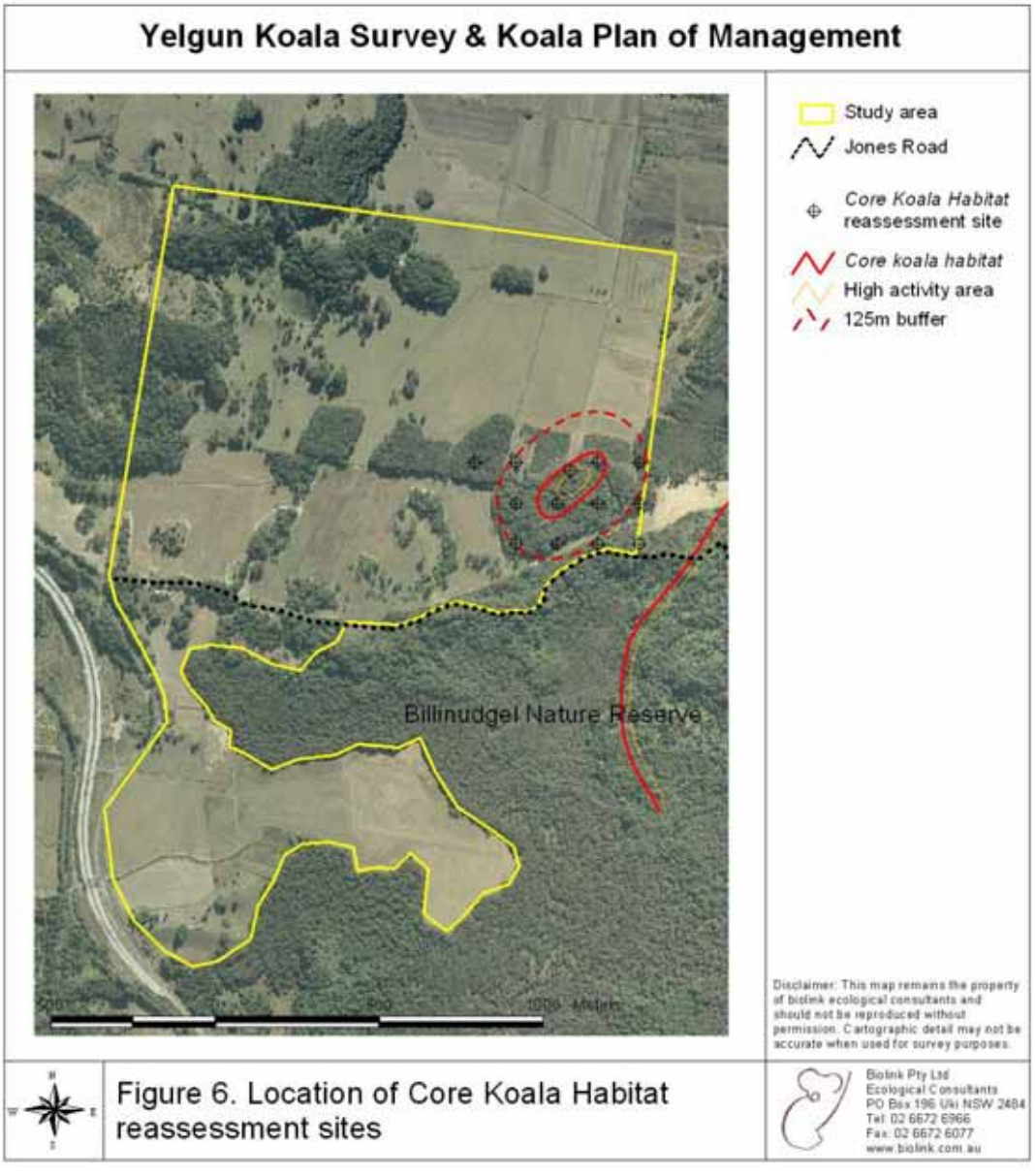


Figure 6. Location of Core Koala Habitat reassessment sites

described in the plan and located within the land to which the plan applies must be randomly selected and resampled for koala activity.

(iv) A report on results of 4.1(ii) and (iii) must be prepared within 7 days following the reassessment and forwarded to the Determining Authority, DoP and DECC.

(v) The report referred to in 4.1(iv) above must include an updated figure detailing the location and extent of *Core Koala Habitat*.

(vi) Parts 6 & 7 of the plan apply to any area identified as *Core Koala Habitat*.

PART 5 – Ancillary event works in areas of *Potential Koala Habitat*

5.1 Where works are to be carried out in areas that are *Potential Koala Habitat*, the following provisions will apply:

(i) Where development involves removal of native vegetation, preferred koala food trees must be retained.

(ii) As a general principle, the retention of native vegetation within land to which the plan applies must be maximized, with any loss in cover to be replaced at a minimum ratio of 4:1 that must include a minimum of 50% preferred koala food trees.

(iii) Motor vehicle speeds must be kept below 40 km/h, to be reinforced with appropriate signage.

PART 6 – Event staging in areas of *Core Koala Habitat*

5.1 Where staging of the event has the potential to affect areas that have been identified as *Core Koala Habitat*, the following provisions will apply:

(i) For the purposes of planning the event, any area of *Core Koala Habitat* identified as a consequence of Part 4.1(ii) of the plan must be afforded a minimum buffer of 65m.

(ii) The retention of all native vegetation is required within any area identified as *Core Koala Habitat*.

(iii) Lighting and sound produced during the course of the event must be directed away from any area that has been identified as *Core Koala Habitat*.

(iv) Any temporary fencing deployed during the course of the event that traverses an area of *Core Koala Habitat* must have a minimum ground clearance of 250mm or provide a square gap of this dimension at intervals of no less than one gap for every 10m of fencing.

(v) The taking of domestic dogs either into or within a distance of 250m from an area of *Core Koala Habitat* is prohibited.

(vi) A maximum vehicle speed of 15 km/h will apply in all areas of *Core Koala Habitat*, to be reinforced with appropriate signage.

PART 7 – Koala Monitoring*

7.1 Where an area of *Core Koala Habitat* is identified in the report referred to in Section 4.1(iv) above, the following provisions will apply:

(i) Resident koalas must be radio-tracked every second day for a minimum of 6-8 weeks prior to the staging of the event, daily during the course of the event, and every second day for a minimum period of 6-8 weeks following conclusion of the event.

(ii) Radio-tracking must be preceded by a full health assessment and concluded with a full health assessment undertaken by a suitably qualified koala biologist and/or a qualified Veterinarian with koala expertise.

(iii) For the purposes of this plan, a full health assessment must include the following:

(a) sex, weight, age and reproductive status,

(b) urogenital and ocular swabs for Chlamydial assay,

(c) koala retro-virus (KoRV) assay,

(d) assessment for external signs of chlamydiosis.

(iv) A report detailing the results of the koala monitoring program must be completed within 30 days of the cessation of the radiotracking program and be forwarded to the Determining Authority, DoP and DECC.

(v) All costs of the koala monitoring component must be met by the proponent.

* Protocols subject to licensing and ethics approval.

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Appendix I

The Spot Assessment Technique

Yelgun Koala Survey

Koala habitat reassessment



Report to Billinudgel Property Trust

October 2008

biolink pty ltd
ecological consultants

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Project Team

Principal Consultant	Dr. Stephen Phillips
Sen. Ecologist	Marama Hopkins
Field Staff	Dan Pollard, Sally Jacka

Introduction

Billinudgel Property Trust has gained development approval from Byron Shire Council to trial use of an approximately 250ha site at Yelgun for a music festival. The development is to involve staging of a three-day music event (and associated set-up/pack down activity) on the site, permanent and temporary infrastructure construction and some realignment of drainage lines as well as temporary fencing to surround patches of remnant vegetation.

Previous survey by Biolink (2007) recorded limited use of the site by koalas, with a small cell (approximately 3ha) of *Core Koala Habitat* identified within remnant vegetation in the east of the site. Subsequently, a Koala Plan of Management (KPoM) was prepared which required, amongst other things, reassessment of the site prior to commencement of any development activity in order to assess any changes to the area of *Core Koala Habitat* identified by the initial study.

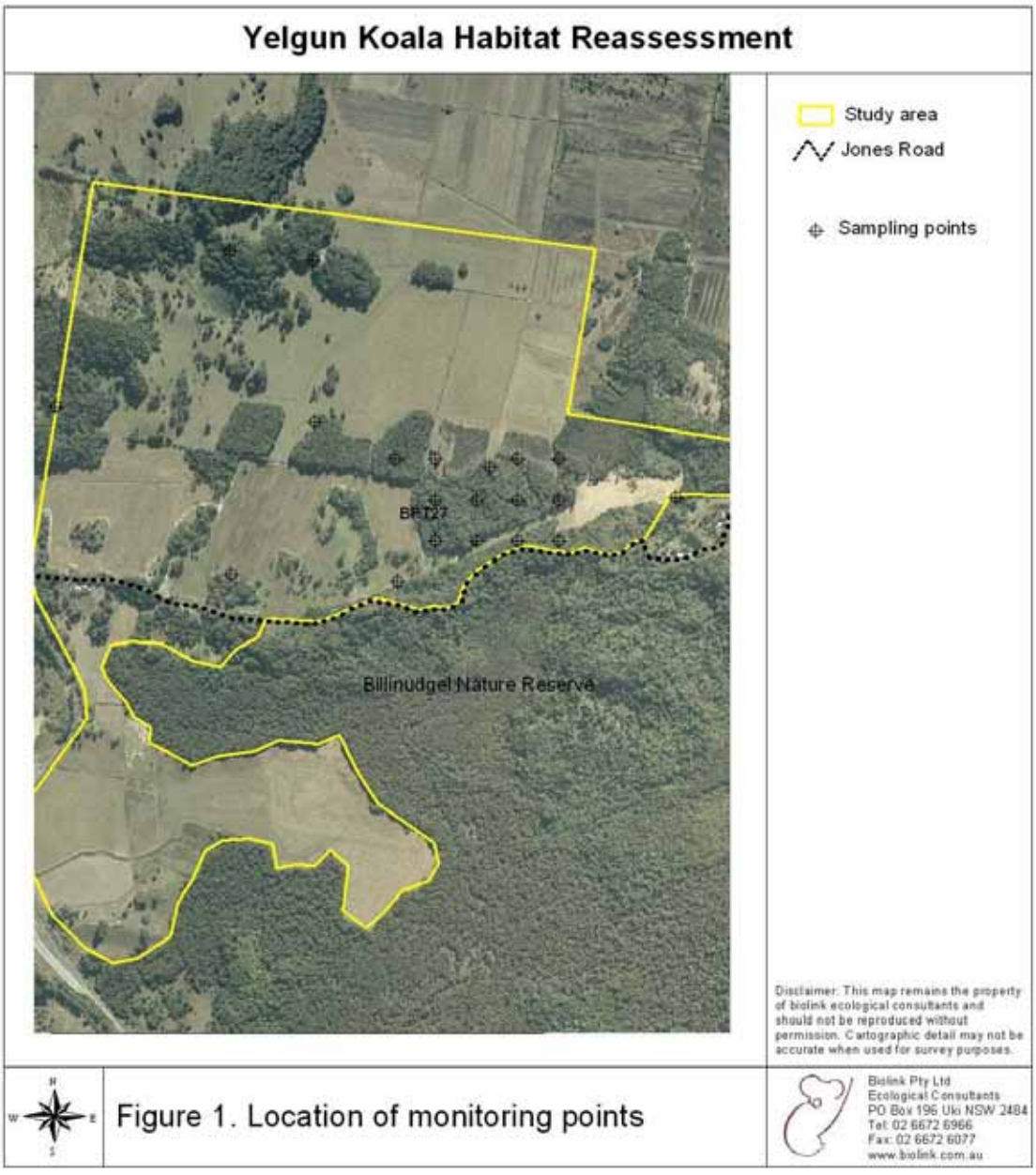
This monitoring report has consequently been prepared for Billinudgel Property Trust pursuant to working provisions of the approved KPoM, and for the explicit purpose of reassessing the extent of *Core Koala Habitat* occurring within the land to which the plan applies.

Methods

Sampling points were determined in accord with management provisions 4.1 and Fig. 6 of the approved KPoM (Biolink 2007). Thus, 13 sites were located at 125m intervals within the area identified as Core Koala Habitat and an additional 7 sites (50% of those originally sampled in 2007) were selected randomly. Figure 1 illustrates the location of sampling points. Our study area boundary was also extended to the east, and an additional field site generated to sample koala activity in that area.

Each point was sampled using the Spot Assessment Technique (SAT). This methodology categorises koala activity for the purposes of SEPP 44, with activity levels greater than 22.52 (23)% being indicative of the presence of c*ore koala habitat*.

Additionally, known koala food trees (Tallowwood *E. microcorys*, Forest Red Gum *E. tereticornis*, Swamp Mahogany *E. robusta* and Grey Gum *E. propinqua*) were examined for koalas or signs of koalas as such trees were encountered while traversing between sites.

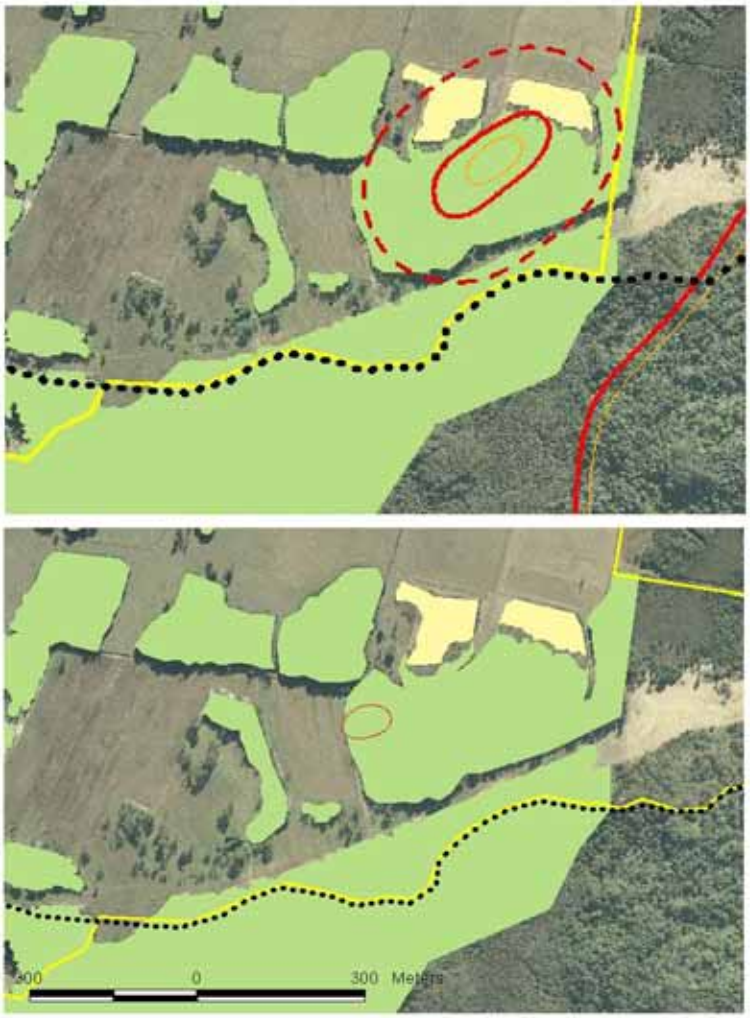


Results

Field survey was undertaken over the period 23rd – 26th September 2008 during which time 10 *Core Koala Habitat* reassessment sites were sampled, nine of the initial (primary) SAT sites were resampled, and the new (primary) site within the eastern extension to the study area was also sampled. A total of 509 trees were inspected at these 20 sites.

Evidence of koala activity was recorded at only one site (BPT27) with an activity level of 10% (pellets present under three of 30 trees inspected). This particular site returned an activity level of 13% in our 2007 assessment. No activity was recorded at site BPT61 which had returned an activity level of 30% in 2007. No other evidence of recent koala activity was recorded and no koalas were sighted during the survey. Figure 2 illustrates the modeled distribution of *Core Koala Habitat* within the study area in 2007 (from Biolink 2007) and koala activity recorded during this survey.

Yelgun Koala Habitat Reassessment



Study area
Jones Road
Remnant vegetation
Melaleuca regrowth

2007 activity
Core koala habitat
High activity area
125m buffer

2008 activity
10% activity contour

Figure 2. Modelled koala activity in 2007 (above) and 2008 (below)

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Discussion

We concluded from the results of our survey work in 2007 that the area of koala activity recorded on the site was attributable to one or two animals, the activity levels suggesting that the cell of *Core Koala Habitat* was possibly an isolated population outlier associated with a larger population cell to the southeast. While the presence of koala activity confirms continued use of the site by koalas, the results of this survey suggest that overall use of the area has diminished significantly, so much so that the activity level does not reach the threshold that indicates active, ongoing use by resident animals at this point in time.

These results reinforce the understanding that *Core Koala Habitat* is a dynamic rather than static phenomenon. While reasons for the contraction of the extent of koala activity and the disappearance of the area of *Core Koala Habitat* must remain speculative, our data would appear to evidence an ongoing decline in occupancy *post* 1999 - 2000, at which time a resident koala population was known be present in the general area.

Recommendations

The absence of *Core Koala Habitat* on the site at this point in time potentially precludes the need for monitoring as detailed at Part 7 of the working provisions in the approved KPoM. If required as a precautionary measure however, we would propose a cursory reinspection of the 10 primary sites as detailed in this report no less than 2 months prior to the event in 2009, the detection of any koala activity essentially reactivating the Part 4 provisions.

References

Biolink. 2007. *Yelgun koala survey (SEPP 44 Assessment) and Koala Plan of Management*. Report to Billinudgel Property Trust.

Appendix I

Seven Part tests

North Byron Parklands

Cultural Events site proposal

Parklands-Application Number 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by Mark Fitzgerald

Ecological Consultant,

P.O. Box 237 Mullumbimby NSW

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TABLES

1.0 Introduction

"Under the *Threatened Species Conservation Amendment Act 2002* , the factors to be considered when determining whether an action development or activity is likely to significantly affect threatened species, populations or communities or their habitats (previously known as the 8-part test) have been revised (Threatened Species Assessment Guidelines, August 2005)." The revised factors are listed below:

(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
(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
(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
(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed , modified or fragmented or isolated to the long-term survival of the species , population or ecological community in the locality
(e) whether the action proposed is likely to have an adverse effect on critical habitat (whether directly or indirectly)
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
(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

1.1 Threatened species and endangered ecological communities of Parklands

Identification of threatened species and endangered ecological communities of the Parklands site has been developed through surveys and fieldwork over more than four years, including:

- Targetted survey for threatened flora November 2006;
- Koala scat searches May-June 2007;
- Property-wide surveys for Koalas June 2007 & September 2008 (Biolink Consultants, Murwillumbah);
- Targetted rapid assessment surveys for threatened fauna February 2007;
- Targetted call playback surveys for forest owls June 2007,
- Systematic fauna survey in August 2007;
- Bird and flying-fox surveys July-September 2008;
- Vegetation plot surveys in January 2009, and:
- Systematic fauna survey in February 2009.

In addition, existing records of threatened species occurrence were consulted; these include:

- Byron Shire Council threatened flora and fauna species databases;
- NSW NPWS Atlas of NSW Wildlife database;
- EPBC Act matters of national environmental significance database;
- Billinudgel Nature Reserve Plan of Management.

Local ecologists (Andrew Benwell, Robert Kooyman, David Milledge and Steve Phillips) were consulted in relation to their personal records of threatened species and flying-fox camps of Billinudgel Nature Reserve and the vicinity. Pre-clearing surveys undertaken along the route of the Yelgun to Chinderah Pacific Highway upgrade, and subsequent (2003-2005) sandtrap surveys in designated fauna crossings beneath and across the highway provide useful information on the patterns of faunal occurrence in the locality. See Appendix D for examples of additional local ecological surveys.

1.2 Selection of fauna species for consideration

Initial investigations revealed 52 threatened fauna species from the locality (Fitzgerald 2007). Marine and littoral species and species whose habitat is not present on the Parklands site or within the likely footprint of the proposal are excluded from further consideration. Eleven threatened fauna species are known from recent records (since 2006) at Parklands and an additional 21 fauna species are considered possible occurrences, therefore 7 part tests have been prepared for 32 threatened fauna species.

These are listed in Table 1.

1.3 Threatened flora species and endangered ecological communities

Five threatened flora species and four endangered ecological communities are known from the Parklands site. No adverse effects are likely for vegetation outside Parklands therefore seven part tests have been prepared for the following communities listed as endangered under the NSW *Threatened Species Conservation Act* 1995.

Swamp Sclerophyll Forest,
Sub-tropical Coastal Floodplain Forest,
Coastal Cypress Pine Forest, and:
Lowland Rainforest of the NSW north coast bioregion.

2.0 Impacts from the proposal

Assessments of the significance of impacts for threatened species and endangered ecological communities which follow are based on impacts summarised in the 'Ecological Assessment and response to Director-General's requirements' section of this report. Briefly these fall into two broad categories, those associated with the construction of infrastructure and buildings at the site, and those associated with the conduct of three musical events in year 1 of the proposal.

Impacts on vegetation are limited to the removal of vegetation for the Jones Road underpass or 'at grade' crossing, and road widening. Impacts of cattle grazing on groundlayer habitats continue as part of the existing use of the site.

Impacts on fauna from the proposal are likely to vary according to species-specific characteristics, however activities considered likely to produce impacts on fauna include the presence of large numbers of people, vehicle traffic, noise and artificial lighting associated with the staging of events. Interactions between disturbance phenomena are also likely and to a large extent unpredictable. For example some fauna are less disturbed by vehicle movement than by pedestrians; noise impacts also vary according to the suddenness of onset, and whether the noise is associated with human presence, or of a particular frequency (Larkin undated). The location, duration and type of lighting used influence potential impacts on biota (Frank in Rich and Longcore 2006).

Given multiple potential influences and the species-specific variability of fauna, the nature and extent of impacts and interactions is at least in part, unpredictable. Discussion of impacts in seven part tests attempts to identify these uncertainties. Predicted potential impacts are listed in Tables 3 & 4 below, other potential impacts may be not be recognised.

2.1 Assumptions

Assessment of the significance of impacts is focussed on the event activities proposed for year 1 on the basis that unprecedented disturbance regimes at the site need to be carefully monitored to validate, modify or refute predictions of fauna behaviour and the scale and intensity of disturbance phenomena.

It is also assumed that substantial periods of down time (no large events) will take place between scheduled events, and that mitigation measures proposed will be effectively implemented, including monitoring (Appendix F). Results of targetted fauna monitoring and an ecological audit should influence the configurations and timing of future event activities.

3.0 Threatened species and endangered ecological communities

3.0.1 Threatened fauna of the Parklands site

Table 1 lists Threatened fauna species recorded from Parklands since 2006.

Table 1: Threatened fauna species recorded from the site 2006-2010

Common Name	**Scientific Name**	**Status TSC/EPBC**
BIRDS		
Comb-crested Jacana	*Irediparra gallinacea*	V/-
Masked Owl	*Tyto novaehollandiae*	V/-
Grass Owl	*Tyto capensis*	V/-
Rose-crowned Fruit-dove	*Ptilinopus regina*	V/-
White-eared Monarch	*Carterornis leucotis*	V/-
MAMMALS		
Koala	*Phascolarctos cinereus*	V/-
Eastern Bent-wing Bat	*Miniopterus orianae oceanensis*	V/-
Little Bent-wing Bat	*Miniopterus australis*	V/-
Northern Long-eared Bat	*Nyctophilus bifax*	V/-
Blossom Bat	*Syconycteris australis*	V/-
Grey headed Flying-fox	*Pteropus poliocephalus*	V/V

Additional threatened fauna species are known from the property earlier (*e.g.* Square-tailed Kite *Lophoictinia isura*: 2003) and are considered likely or possible occurrences at times within the application area or nearby. These are listed in Table 2.

Table 2: Additional Threatened fauna species—possible occurrences

Common Name	**Scientific Name**	**Status TSC/EPBC**
BIRDS		
Australasian Bittern	*Botaurus poiciloptilus*	V/-
Barred Cuckoo-shrike	*Coracina lineata*	V/-
Black-necked Stork	*Ephippiorhynchus asiaticus*	E/-
Black Bittern	*Ixobrychus flavicollis*	V/-
Brolga	*Grus rubicundus*	V/-
Bush Stone-curlew	*Burhinus grallarius*	
Glossy Black-cockatoo	*Calyptorhynchus lathami*	V/-

Little Lorikeet	*Glossopsitta pusilla*	V/-
Magpie Goose	*Anseranas semipalmata*	V/-
Osprey	*Pandion haliaetus*	V/-
Pale-vented Bush-hen	*Amaurornis olivaceus*	V/-
Red-backed Button-quail	*Turnix maculosa*	V/-
Square-tailed Kite	*Lophoictinia isura*	V/-
Superb Fruit-dove	*Ptilinopus superbus*	V/-
Sooty Owl	*Tyto tenebricosa*	V/-
Wompoo Fruit-dove	*Ptilinopus magnificus*	V/-
MAMMALS		
Common Planigale	*Planigale maculata*	V/-
Greater Broad-nosed bat	*Scoteanax rueppelli*	V/-
Large-footed Myotis	*Myotis macropus*	V/-
Long-nosed Potoroo	*Potorous tridactylus*	V/V
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	V/-

Table 3: Likely impacts on threatened fauna species recorded from 2006-2010.

Common Name	**Likely Impact**	**Severity**
BIRDS		
Comb-crested Jacana	If present may be disturbed by noise & human presence at the dam	Unpredictable and time dependent: If breeding, could interfere with breeding success; otherwise likely minor disturbance causing flight behaviour and/or concealment.
Masked Owl	Human presence may prevent foraging in or near event areas	Event nights only, minor because the species has a large range, and may forage elsewhere; no roost trees or nest trees known from the property.
Grass Owl	Camping and car parking in grassland may prevent foraging	Alienation of the event and car park pasture areas for event nights; moderate severity; 30% of grassland (~50ha) remains outside event areas.
Rose-crowned Fruit-dove	Human presence may prevent foraging in central swamp forest and floodplain forest	Minor; alienation of food resources in the central swamp forest and floodplain forest
White-eared Monarch	Human presence may prevent foraging in forest adjacent to the event	Minor disturbance to foraging area

MAMMALS		
Koala	Noise and human presence may affect movement patterns in forest adjacent to the event; elevate stress levels; risk of roadkill	Low-severe. Occupied Koala habitat is outside the event area, but koala movement will involve increased risks of roadkill.
Eastern Bent-wing Bat	Human presence, noise, lighting may disturb foraging in forest adjacent to the event	Low severity; Minor disturbance to foraging area; because forest is largely outside the event footprint
Little Bent-wing Bat	Human presence, noise, lighting may disturb foraging in forest adjacent to the event	Low-moderate-unpredictable; Minor disturbance to foraging area; because forest is largely outside the event footprint; but a frequently used watering point is located within ~200m of a stage.
Northern Long-eared Bat	Human presence, noise, lighting may disturb foraging in forest adjacent to the event	Low severity; Minor disturbance to foraging area; because forest is largely outside the event footprint
Blossom Bat	Human presence, noise, lighting may disturb foraging in forest adjacent to the event to the event, especially if blossom crop is present	Low-unpredictable response to noise; Minor disturbance to foraging area; because forest is largely outside the event footprint
Grey headed Flying-fox	Human presence, noise, lighting may disturb foraging in forest adjacent to the event to the event, especially if blossom crop or fruit crops are present	Low-moderate: May alienate resources in forest near event phenomena, but following cessation of activities nocturnal foraging may resume during the event, and immediately after.

Additional threatened fauna species are known from the property earlier (*e.g.* Square-tailed Kite *Lophoictinia isura* 2003) and species considered likely or possible occurrences at times within the application area or nearby. These are listed in Table 4.

Table 4: Impacts on threatened fauna species considered likely or possible.

Common Name	**Likely Impact**	**Severity**
BIRDS		
Australasian Bittern	Potential occurrence at the northern dam; if present may be disturbed by noise & human presence at the	Very low likelihood of presence, moderate severity operating for an individual or pair

	dam & may leave; so disruption of foraging and roost behaviour	
Barred Cuckoo-shrike	Potential occurrence in any fruiting fig; some of which are within the event footprint; foraging may be disrupted	Low-unpredictable response to noise; known from suburban roadside habitats
Black-necked Stork	Occasional potential for occurrence in large northern dam or pasture areas; therefore disruption of roost and forage behaviour	Low; resources are available elsewhere and nearby
Black Bittern	Potential occurrence at the northern dam; if present may be disturbed by noise & human presence at the dam & may leave; so disruption of foraging and roost behaviour	Low-moderate likelihood of presence, moderate severity operating for an individual or pair
Brolga	Potential occurrence in grassland or at the northern dam	Low; resources are available elsewhere and nearby
Bush Stone-curlew	Potential occurrence in open habitats of the site; disruption of roost and forage behaviour	Moderate severity; but not likely to be recorded on the site under the present cattle and feral dog regime.
Glossy Black-cockatoo	Disruption of foraging behaviour due to human presence	Low severity; potential food trees are present in a small area of the site , distant from the disturbance regime
Little Lorikeet	Disruption of foraging behaviour due to human presence	Low; resources are available elsewhere and nearby, and lorikeets feeding high in trees by day are unlikely to be adversely affected by disturbance regime
Magpie Goose	Disruption of foraging behaviour due to human presence	Low severity; very low likelihood of occurrence
Osprey	Disruption of foraging behaviour due to human presence	Low severity; resources of the site for osprey are minor and abundant resources available in the locality.
Pale-vented Bush-hen	Disturbance of birds from	Moderate: the 30m buffer

	human presence and noise; disruption of foraging and movement patterns	to BNR may protect the habitat potentially likely to be used by this species.
Red-backed Button-quail	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low severity;; largely unsuitable habitat and none within the event area
Square-tailed Kite	Areas of forest habitat potentially suitable for foraging may be alienated during events	Low severity; birds have a very large home range and can resume foraging after bump-out is complete. Species sometimes seen foraging in urban habitats.
Superb Fruit-dove	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low severity; suitable habitat is largely well outside the event footprint and the species occurrence is unlikely.
Sooty Owl	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low severity; a small area of marginally suitable habitat present is largely outside the event footprint and the species occurrence is unlikely.
Wompoo Fruit-dove	Disturbance of birds from human presence and noise; disruption of foraging and movement patterns	Low severity; suitable habitat is largely outside the event footprint
MAMMALS		
Common Planigale	Barrier effects from use of roads and presence of people; risk of roadkill; for duration of the event and bump-in, bump-out periods	Low-Moderate; if the species is present then large areas of grassland will be alienated by the event and risk of roadkill is present.
Greater Broad-nosed bat	Disturbance of foraging behaviour due to human presence, noise and lighting	Low: preferred habitat is largely outside the event footprint, and lighting should be managed to limit impacts on microchiropteran bats.
Large-footed Myotis	Possible presence foraging at the large northern dam; potential for disturbance of foraging	Low; not yet recorded and minor probability of occurrence; large dam may be sufficiently distant from the event disturbances to remain available for foraging

Long-nosed Potoroo	Disturbance to foraging and movement behaviour from noise, human presence and traffic	Low: buffer to BNR and fencing should protect potential habitat for this species in BNR east of the car parking area.
Yellow-bellied Sheathtail Bat	Disturbance to foraging and movement behaviour from noise, human presence and traffic	Low: species occurrence is moderately probable but suitable forage habitat is abundant outside the event area

4.0 Threatened flora species of the Parklands property

Threatened flora species of the Parklands site include the following (TSC /EPBC Act status):

Davidson's Plum	*Davidsonia jerseyana*	E/E
Durobby or Coolamon	*Syzygium moorei*	V/V
Green-leaved Rose Walnut	*Endiandra muelleri ssp. bracteata*	E/-
Stinking Cryptocarya	*Cryptocarya foetida*	V/V
White Laceflower	*Archidendron hendersoni*	V/-

A sixth species: Rough-shelled Bush-nut *Macadamia tetraphylla* was discovered remote from any event impacts on Parklands recently (June 5th 2010). A seven part test prepared for this species in relation to the proposed development of a water management system for the property is provided in Appendix K.

4.1 Endangered Ecological Communities of the Parklands site

The following communities listed as endangered under the NSW *Threatened Species Conservation Act* 1995 also occur on the Parklands property:

Swamp Sclerophyll Forest,
Sub-tropical Coastal Floodplain Forest,
Coastal Cypress Pine Forest, and:
Lowland Rainforest of the NSW north coast bioregion.

Swamp sclerophyll forest EEC in Billinudgel Nature Reserve dominated by Broad-leaved Paperbark *Melaleuca quinquenervia* surrounds the southern car parking area.

Impact processes for threatened flora species and endangered ecological communities are described in the respective seven part tests.

5.0 The seven part tests: threatened fauna species
5.1 Species known from the site since 2006

BIRDS

5.1.1 Seven part test for the Comb-crested Jacana *Irediparra gallinacea*
Life-cycle and background information

The Comb-crested Jacana or Lily-trotter is a bird of open waterbodies which occurs where surface vegetation is present. Jacanas forage, shelter and nest among floating aquatic vegetation. This species is listed as Vulnerable under the TSC Act and has been recorded from the large northern dam. Threats to the species are listed as drainage of waterbodies, removal of surface vegetation, altered water quality, pollution and weeds (NPWS 2002).

The Comb-crested Jacana has been recorded sporadically from the large northern dam in September 2006, August 2007 and again in February and May 2010, and it is possible that the species could nest at this site. Breeding in the eastern distribution of the species range, which includes the site of the proposal, occurs from September to January (Lindsey 1992; McKean 2007). While this large (1.8 ha) dam is outside the direct event footprint, a noise effect of unknown intensity may operate in relation to any fauna occupying the dam, depending on noise levels.

It is also proposed to extract ~ 105 000L from the dam to provide water for fire fighting in tanks on the site. The removal of 105 000L of water would lower surface water levels of this 1.8 ha dam by ~ 6-7 mm, and so is unlikely to severely affect any Jacanas or other resident fauna of the dam. It is planned to extract the needed water gradually over a 2 week period prior to the event so that water levels in the dam will not fall suddenly.

(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

The irregular presence of the species at the large dam (not present for ~90% of timed point surveys) raises questions as to the suitability of this habitat. The presence of large carp *Cyprinus carpio* in the dam, and frequent incursions by cattle to graze on aquatic vegetation may affect habitat quality for the Jacana.

The main adverse effects are considered to be the possible alienation of the large dam habitat by human presence and/or noise from any event. Forest vegetation between the stages and the dam may ameliorate the noise generated during performances, and the Jacanas may either tolerate this, or be sufficiently disturbed to move away within the dam vicinity, or to flee the site. If Jacanas were breeding at the time of the event, this could result in the abandonment of eggs, however even in this worst case scenario the effect is insufficient to place a viable local population at risk of extinction. Following the termination of the proposal and dismantling phase (bump-out), birds could be expected to return to the site.

(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

Not applicable-the Comb-crested Jacana is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Comb-crested Jacana is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Extraction of water may result in a lowering of the dam surface level of ~ 6 mm. The extent of noise impacts and human intrusion in the vicinity of the large dam is unpredictable, dependent upon distance from the nearest stage or other source of noise.

(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

No area of habitat for the Comb-crested Jacana is likely to become fragmented, but habitats of the large dam may be temporarily unavailable if disturbance is of sufficient intensity to cause Jacana to leave. If disturbed by a human observer, Jacanas tend to seek shelter in fringing vegetation.

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

The habitat which will be temporarily or episodically modified by the proposal is unlikely to be important to the long-term survival of the species in the locality, since it appears to be infrequently used. Proposed screen plantings and staged removal of cattle may ultimately improve the habitat quality of the dam for this species.

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

There is no critical habitat for the Comb-crested Jacana at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.2 Seven part test for the Masked Owl *Tyto novaehollandiae*
Life-cycle and background information

The Masked Owl is a nocturnal predator of a variety of vertebrate prey, including rats (NPWS 2002) and rabbits (Lyndsey 1992). It roosts in a large tree hollow and occurs in a variety of forest and woodland types, but also forages on the edge of these communities (Kavanagh and Murray 1996). Home range size for a pair is reported to be from 500-1000ha (NPWS 2002).

Forests of Parklands contain suitable habitat for this species. Rats are abundant in parts of the site, Northern and Long-nosed Bandicoots are present at lower abundances, so a prey resource for Masked Owls is present.

Targetted call playback for Masked Owls produced a clear response and later series of responses from a probable Masked Owl on June 12th 2007 and a single response on July 3rd, in the north of the site and outside the direct event footprint. Subsequent call playback and survey effort in February 2009 did not result in detection of the species. There is a 1993 record of the Masked Owl from Jones Rd (BSC database).

The Masked Owl is listed as Vulnerable in NSW under the TSC Act. Threats to the species are listed as: loss of hollow-bearing trees, clearing and degradation of habitat, roadkill and reduced prey populations due to pesticide (NPWS 2002).

(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

The proposal may result in the temporary disturbance of potential foraging habitat by increased human presence, illumination and noise. These factors may cause any foraging or roosting Masked Owl to leave the site for the duration of the disturbance or the event and forage elsewhere, or to retreat a shorter distance so that disturbance intensity is tolerable. This response is considered insufficient to cause a viable local population of the species to be placed at risk of extinction.

(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

Not applicable-the Masked Owl is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Masked Owl is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Disturbance from increased human presence, artificial lighting and acoustic effects will affect an unknown area of potential forage habitat (forest, forest ecotones and pasture) over a maximum of 8 large event days in year 1 of operation. The spatial extent of this impact for this species is unable to be precisely defined, however the pattern of disturbance is episodic with long recovery periods during down time.

(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

No area of habitat for the Masked Owl is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The few suitably large hollow-bearing trees on the Parklands property have been searched for the presence of nesting or roosting Masked Owls, without the species being detected. The area of habitat which will be episodically modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Masked Owl at the site of the proposal.

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

A recovery plan has been prepared for the 3 large forest owl species, including the Masked Owl (DEC 2006). The action proposed is not inconsistent with the objectives or actions of this recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.3 Seven part test for the Grass Owl *Tyto capensis*
Life-cycle and background information

The Grass Owl is a nocturnal predator of small mammals, insects and birds which inhabits tall rank vegetation in a variety of coastal and inland habitats. It roosts and nests on the ground by day and hunts from early evening by flying low over grassland and heathland sites and diving feet first to the ground in pursuit of prey. Grass Owls feed on a range of small mammals (Calaby 2007), birds and invertebrates (Fitzgerald and Thorstensen 1994). The species is listed as Vulnerable in NSW under the TSC Act and has been recorded at Parklands from call playback in August 2007 adjacent to central swamp sclerophyll forest blocks in the centre of the event area.

Threats listed for this species include: loss of habitat by grazing, agriculture and development, disturbance and habitats degradation by stock, use of rodenticides and inappropriate fire regimes (NPWS 20002).

(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

The Grass Owl was not detected in the February 2009 survey, but responds to call playback more readily in winter (pers. obs.) and can be expected to occur mainly in pasture areas of the site in any season. Disturbance arising from the conduct of events will alienate up to 60% of grassland habitats on Parklands (leaving ~50ha of grassland outside the direct footprint of events and roads).

Since bump-in bump-out activity is mainly diurnal, disturbance effects for the Grass Owl are likely to be restricted to the period of large events when nocturnal activities and camping may prevent the species from foraging in those areas. If as predicted Grass Owls avoid these areas then they are obliged to forage elsewhere. Since abundant sugar cane and pastoral habitats are present close to Parklands and since Grass Owls forage widely (McKean 2007) this temporary unavailability of ~100 ha of forage habitat is not considered sufficient 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.

(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

Not applicable-the Grass Owl is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Grass Owl is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Suitable tall rank vegetation which comprises potential roost habitat for the Grass Owl is rare on the site because of past and present cattle grazing activities. However Grass Owls may forage in any pasture habitats of the site. During event processes ~ 100ha

of grassland will be disturbed by event related activities, leaving ~50ha in the Parklands site outside the direct footprint of disturbance.

(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

Foraging habitat for the Grass Owl will become fragmented during large events.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Grass Owl at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.4 Seven part test for the Rose-crowned Fruit-dove *Ptilinopus regina*
Life-cycle and background information

The Rose-crowned Fruit-dove is a secretive frugivorous bird which occurs locally in a range of forest types, especially rainforest, but also Camphor Laurel dominated

forests. It feeds upon a variety of fruits, including those of the following plant species: Camphor Laurel *Cinnamomum* camphora, native Laurels *Cryptocarya spp.*, Bolly Gums *Litsea* and *Neolitsea spp.*, Lilly-pilly *e.g. Acmena smithii*, Figs *Ficus spp*., Lantana *Lantana camara*, Wild Tobacco *Solanum mauritianum* and Inkweed *Phytolacca octandra*. Rose-crowned Fruit-doves usually nest in dense forest (Frith 1982) and birds in the eastern distribution are reported to breed from August to February (Lindsey 1992). Rose-crowned Fruit-dove has been recorded from central swamp sclerophyll forest blocks and from blackbutt forest on the Jones Road ridge.

Threats to this species include clearing, roading, and burning of forest habitats and invasion of habitat by weeds (NPWS 2002).

(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

Food plants for this species including Camphor Laurels and Lilly-pillies, vines, Lantana, Wild Tobacco and Laurels are present in forest blocks within the event footprint, so suitable forage and roost habitat is widespread. Where food trees are located adjacent to areas of high numbers of humans or vehicular activity it is probable that feeding birds will be disturbed and leave.

As a worst case scenario, impacts from the proposal might disrupt the foraging and possibly the breeding of a small number of Rose-crowned Fruit-doves. This is not considered 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.

(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

Not applicable-the Rose-crowned Fruit-dove is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Rose-crowned Fruit-dove is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Construction of a crossing of Jones Road requires removal of either 31 or 37 Camphor Laurel trees which this species may feed on seasonally. Disturbance effects likely to operate on this species will largely be confined to the central swamp sclerophyll and sub-tropical coastal floodplain forest blocks within the event area.

(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

No area of habitat for the Rose-crowned Fruit-dove is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Rose-crowned Fruit-dove at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.5 Seven part test for the White-eared Monarch *Monarcha leucotis*
Life-cycle and background information

The White-eared Monarch occurs in rainforest, swamp sclerophyll forest and Camphor Laurel forests where it forages for insects in the structurally complex and often viney canopy edges. This species is listed as Vulnerable in NSW under the TSC Act and has been recorded from gully forest adjacent to the large northern dam. It has not yet been recorded in the more fragmented forests of the centre of the site, but may at times occur there. Threats to the species are listed as: clearing, isolation and fragmentation of lowland forest habitats, simplification of forest demography through logging and weed invasion degrading habitats (NPWS 2002).

(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

Impacts of the proposal may include disturbance of foraging behaviour and, less likely, disturbance of nesting behaviour. White-eared Monarchs may avoid forest habitats of the site where these adjoin areas of high levels of event activity.

Some uncertainty exists with regard to the sensitivity or tolerance of the bird to this type of disturbance, and any birds displaced by event-related disturbance can find suitable habitat within short distances of the event footprint. The proposal is considered unlikely 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.

(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

Not applicable-the White-eared Monarch is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.
Not applicable-the White-eared Monarch is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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,

The likely response of this species to the disturbance phenomena of the proposal is not clear. If it is assumed that such disturbance will disturb these birds, this impact

will likely apply to forested areas adjoining areas of high human activity, and high diurnal noise levels.

(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

No area of habitat for the White-eared Monarch is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the White-eared Monarch at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

MAMMALS

5.1.6 Seven part test for the Koala *Phascolarctos cinereus*
Life-cycle and background information

The Koala is an obligate folivore which mostly consumes eucalypt leaves. Other tree species are sometimes used: for refuge in hot weather *e.g.* Brush Box *Lophostemon confertus* and for concealment *e.g.* Willow Bottlebrush *Callistemon salignus* and Camphor Laurel *Cinnamomum camphora* (pers. obs.). Preferred food trees on the site include: Forest Red Gum *Eucalyptus tereticornis*, Swamp Mahogany *Eucalyptus robusta*, Tallowwood *Eucalyptus microcorys* and Grey Gum *Eucalyptus propinqua.* The mosaic of swamp sclerophyll and coastal floodplain forest in the event footprint and its vicinity generally comprise good potential and historical Koala habitat, but the nearby Pacific Highway may affect Koala movement.

The Koala is known from scats located in the south east of the property, just outside the direct event footprint, and in Billinudgel Nature Reserve to the south east (see Appendix H). These locations are outside the direct footprint of the event, but presumably within the acoustic footprint. More detailed information on the status and ecology of this population is presented in the Biolink report.

Koala populations in the locality appear to have declined over the past decade (Appendix H). Several koala roadkills have been reported from a ~400m gap in fauna exclusion fences between the two local freeway projects. Combined with a recent fire in Billinudgel Nature Reserve, high levels of dog activity on the site and in its near vicinity, these factors threaten local persistence of Koalas. Coastal development in Tweed Shire, and in Byron Shire, with concomitant increases in traffic and habitat removal, also exert additional pressure on the local Koala population.

The Koala is listed as Vulnerable in NSW under the TSC Act and threats include the clearance of habitat, roadkill, predation by dogs (NPWS 2002).

(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

Biolink data indicate a decline in the levels of Koala presence at the Parklands site, and a further survey is proposed for late 2010-early 2011 to investigate and provide up-to-date information on koala habitat, and develop a Koala Plan of Management in consideration of the Parklands current proposal. A 2007 Koala Plan of Management related to the conduct of a single event at the site.

Temporary security fencing proposed for event areas will affect the potential for Koalas and other large terrestrial fauna to move through parts of the Parklands site. In the 97ha event area a perimeter fence will contain the event area and an internal swamp forest block (#52). No fencing other than the existing cattle fences will apply in the remaining 150ha of the Parklands site outside the event area.

Impacts on Koalas from operation of year 1 will include disturbance from increased vehicular traffic within and near the Parklands site, noise from amplified music, high levels of human presence and potentially from the use of artificial lighting.

Given the origin of noise and levels of human presence within fenced areas, Koalas are more likely to move away from than towards the fences. It is recommended that fencing be in place for the shortest time period practicable and be dismantled as soon as possible following the event.

Prior to any event the risk of injury to Koalas by vehicle strike will be addressed by conducting an environmental induction for all workers on the NBSP site, and by enforcing low vehicle speeds (30km/h) on all vehicle access roads and tracks. Signage will be posted to alert patrons to the presence of Koalas and other native fauna, and their vulnerability to road strike. Existing plantings of ~7400 trees on the Parklands property to improve local habitat connectivity include 8 locally occurring eucalypt species and ~700 preferred koala food trees (Tallowwood, Swamp Mahogany, Grey Gum and Forest Red Gum). These plantings will increase food and potential habitat resources for this species.

Provided that ameliorative measures described above are effectively implemented, the net impact for Koalas should be no greater than a temporary disruption of movement by fences, noise and human intrusion, and potentially the alienation of feed trees. This assumes that there are koalas present within the Parklands site and nearby, which may be verified in future targetted survey.

Provided that management measures described are effectively implemented it is considered that unlikely that the proposal for year 1 will cause a viable local population to be placed at risk of extinction.

(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

Not applicable-the Koala is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Koala is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Based on recent surveys (2008) the Koala is not present within the direct event footprint (event area and car parking area), but it may occur nearby. Future surveys will provide up-to-date information on Koala distribution on Parklands before any event takes place.

Conduct of an event will result in noise effects within this area, and the bump-in and bump-out phases will produce diurnal vehicle movements and human presence nearby. Event related disturbance is limited to eight major event days in the first year of operation. Disturbance will cease following any event and bump-out phase, with prolonged periods of down time between the three proposed events in year 1.

(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

Based on existing survey data, no area of known habitat for the Koala is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Koala at the site of the proposal.

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

A recovery Plan has been prepared for the Koala in NSW (DECC 2008). The principal objective is to reverse Koala decline in NSW. An ancillary objective is to rehabilitate Koala habitat and populations. Plantings and Camphor Laurel control at Parklands will contribute to the extent and quality of potential Koala habitat. Contributions to control of local feral dog populations will also likely assist with these objectives.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure,*

composition and ecological function of a stand or stands". From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.7 Seven part test for the Eastern Bent-wing Bat *Miniopterus orianae oceanensis*
Life-cycle and background information

Eastern Bent-wing Bats are found in a broad range of habitats including rainforest, wet and dry sclerophyll, open woodland and *Melaleuca* forest (Churchill 2008). Eastern Bent-wing bats are the dominant cave-dwelling species in south-eastern Australia (Hall and Richards 1979), however; they also roost in man-made habitats such as mine adits and road culverts. The species roosts in large colonies and the territorial range of a population may extend over 300km. The Eastern Bent-wing Bat's diet consists mainly of moths, and foraging occurs at great speed either above the canopy or within about 6m of the ground in open areas (Churchill 2008).

The species is listed as vulnerable in NSW under the TSC Act and threats to the species include the disturbance or destruction of colonial cave roosts, degradation of forest habitat and use of insecticides (NPWS 2002).

(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

The Eastern Bent-wing Bat is recorded from central swamp forest at Parklands and may forage within any forest habitats of the site. It is unpredictable, but possible that high noise levels in the immediate vicinity of stages and performance areas, or artificial lighting might affect the foraging behaviour of this species, although flight is so rapid that bats may be able to continue foraging on the site, regardless of high noise levels, as their exposure is likely to be brief.

If it is assumed that some disruption of foraging behaviour is possible due to high noise levels or other disturbance factors then, it is likely to be short-term, and to result in individuals returning to the site after disturbance levels are reduced at the end of each evening and after each event is completed. It is not known whether Eastern Bent-wing Bats are attracted to insects that may concentrate around artificial lighting.

The proposal is not considered likely to cause a viable local population to be placed at risk of extinction.

(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

Not applicable-the Eastern Bent-wing Bat is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Eastern Bent-wing Bat is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Assuming that Eastern Bent-wing Bats are affected by noise or artificial lighting, those forested areas adjacent to stages and performance areas may be rendered temporarily unsuitable or unavailable for foraging for the duration of events.

(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

No area of habitat for the Eastern Bent-wing Bat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily and episodically modified by the proposal is unlikely to be important to the long-term survival of the species in the locality. Additional forested habitat created by plantings will augment habitat for this species at the site.

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

There is no critical habitat for the Eastern Bent-wing Bat at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.8 Seven part test for the Little Bent-wing Bat *Miniopterus australis*
Life-cycle and background information

The Little Bent-wing Bat inhabits a range of coastal and sub-coastal forest environments and roosts by day in caves and tree hollows. This species aggregates in maternity colonies in caves in summer, often with Eastern Bent-wing Bats *M. orianae oceanensis*, and disperses during winter (Churchill 2008). Little Bent-wing Bats forage beneath the forest canopy for insects and other arthropods.

The species is listed as vulnerable in NSW under the TSC Act and threats to the Little Bent-wing Bat include destruction or damage to roost caves, disturbance of colonies at caves, and to the environment surrounding caves, and the use of insecticides (NPWS 2002). The Little Bent-wing Bat has been recorded in and near central swamp forests at the Parklands site in surveys in 2007 & 2009. Early call behaviour at a watering site suggest that a roost site may be present nearby.

(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

The Little Bent-wing Bat has been recorded from the site and is likely to forage widely within forest blocks of the site. This species was recorded in surveys at Belongil Fields where a long history of event related disturbance is known (pers. obs.). It is unpredictable, but possible, that high noise levels in the immediate vicinity of stages and performance areas, or artificial lighting might affect the foraging behaviour of this species, although flight is so rapid that bats may be able to continue foraging on the site, regardless of high noise levels, as their exposure is likely to be brief. It is not known whether Little Bent-wing Bats are attracted to insects that may focus around artificial lighting.

If it is assumed that some disruption of foraging behaviour is possible due to high noise levels or other disturbance, then, it is likely to be short-term, and to result in individuals either returning to forage at the site after noise levels are reduced at the end of each evening and/or after the event is completed; or foraging elsewhere.

Therefore, the proposal is not considered likely to cause a viable local population to be placed at risk of extinction.

(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

Not applicable-the Little Bent-wing Bat is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Little Bent-wing Bat is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Assuming that Little Bent-wing Bats are affected by noise or lighting from the event, those forested areas adjacent to stages and performance areas may be rendered temporarily unsuitable or unavailable for foraging for the duration of the event.

(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

No area of habitat for the Little Bent-wing Bat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Little Bent-wing Bat at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.9 Seven part test for the Eastern Long-eared bat *Nyctophilus bifax*
Life-cycle and background information

Eastern Long-eared Bats are forest dwellers which have been recorded roosting under bark, in epiphytes, in tree hollows and in foliage (Lunney *et al* 1995). They are reported to forage along forest edges (Churchill 2008) and regularly forage and roost in and around the author's house adjacent to a rainforest gully (pers. obs.). This species has been recorded in harp traps in both 2007 and 2009 surveys at Parklands, and is recorded from the nearby Billinudgel Nature Reserve (NSW Wildlife Atlas data). The species is listed as vulnerable in NSW under the TSC Act and threats to the species include the loss and fragmentation of habitat, weed invasion of habitat and the use of pesticides (NPWS 2002).

(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

Forested habitats of the site including within the direct event footprint are likely to be used for foraging by this species and the Eastern Long-eared Bat may also roost in epiphytes and tree foliage in the better developed rainforest elements of some of the forest blocks. It is not known to what extent the Eastern Long-eared Bat is likely to be adversely affected by large scale human presence, noise and illumination in the

vicinity of foraging habitat. This species was recorded in surveys at Belongil Fields where a long history of event related disturbance is known (pers. obs.).

Assuming that some foraging habitat may be temporarily alienated for this species where performance areas and other event infrastructure are located close to forest, the impacts are likely to be restricted to few individuals and to be sub-lethal. Following any event these resources would return to being available for the Eastern Long-eared Bat, therefore the proposal is not considered likely to cause a viable local population to be placed at risk of extinction.

(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

Not applicable-the Eastern Long-eared Bat is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Eastern Long-eared Bat is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Habitat for this species which is potentially modified by the proposal includes forest blocks and forest edges located close to performance areas and other event infrastructure, *e.g*. light towers.

(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

No area of habitat for the Eastern Long-eared Bat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action
(iii) the importance of the habitat to be removed , modified or fragmented or isolated to the long-term survival of the species , population or ecological community in the locality

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Eastern Long-eared Bat at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.10 Seven part test for the Common Blossom Bat *Syconycteris australis*
Life-cycle and background information

The Common or Eastern Blossom Bat is a coastal species which roosts in littoral rainforest and forages on blossoms in nearby heathland and swamp sclerophyll habitats. It is reported to use the same areas for foraging each night and to defend food plants from conspecifics (Churchill 2008). Coast Banksia *Banksia integrifolia* is a favourite food tree (pers. obs.; & Koala Beach monitoring), but other abundant local blossoms may also be utilised *e.g.* Broad-leaved Paperbark *Melaleuca quinquenervia*, Forest Red Gum *Eucalyptus tereticornis*, Swamp Mahogany *Eucalyptus robusta* and Pink Bloodwood *Corymbia intermedia*. Swamp sclerophyll forest on the site represents suitable potential foraging habitat and some lowland rainforest elements comprise suitable potential roost habitat for this species. The Blossom Bat has been captured in a harp trap in central swamp forest of the site in August 2007 (Appendix E(i)).

The Common Blossom Bat is listed as vulnerable in NSW under the TSC Act and threats listed for this species include the clearing of coastal habitat and suppression of food tree regeneration by weeds (NPWS 2002).

(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

For the Common Blossom Bat impacts from the event potentially include the focal alienation of forage resources through illumination and noise. There is evidence that Blossom Bats delay emergence from roosts under conditions of bright moonlight (Law 1997) so adverse impacts from artificial lighting of the SITG08 event are possible for this species.

Small areas within forest blocks where rainforest vegetation is better developed comprise potential roost sites. It is unknown whether the species roosts on the site: it is not listed in NPWS atlas records for Billinudgel NR, but is known from the Marshall's Ridges area (BSC database). Potential roost habitat (*e.g.* large epiphyte clumps) is located in the interior of central swamp forest and floodplain forest blocks and may experience disturbance from the proposal through acoustic impacts.

Disturbance effects for this species are likely to occur at night where stages or other performance areas adjoin swamp sclerophyll or coastal floodplain forest when food trees are present and productive. If forage resources on site (blossom) are scarce or absent during staging of any event then adverse impacts for this species may be minor or non-existent.

If abundant blossom is present during the event, Common Blossom Bats may be discouraged from feeding in areas of high levels of noise and or illumination. This effect is likely to be spatially localised and temporary: *i.e*. when the disturbance ceases, either on the night, or following completion of the event, such resources are again potentially available for the species. Given the temporary and episodic nature of event processes in year 1, adverse potential effects *e.g.* delayed emergence, or alienation of forage resources are unlikely to be fatal to Blossom Bats.

Assuming a worst case scenario where Common Blossom Bats are prevented from foraging on the site due to disturbance from the event, this effect is likely to operate at the individual or sub-population level, to be sub-lethal and to be temporary. Therefore the proposal is considered unlikely to cause a viable local population of the species to be placed at risk of extinction.

(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

Not applicable-the Common Blossom Bat is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or

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

Not applicable-the Common Blossom Bat is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

The extent of habitat modification for this species is difficult to predict depending as it does upon the variation in levels of noise and illumination, the variation in response of individual Common Blossom Bats, and the spatial and temporal distribution of forage resources around the stages and performance areas. Without these data, and precautionarily, it is assumed that all forest in the vicinity of the performance areas and areas with high levels of nocturnal human activity may be alienated for the species for the duration of an event.

(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

Some areas of potential forage habitat may be temporarily unavailable during conduct of events. However movement in and between these areas may still be possible, and such effects are temporary. No area of habitat for the Common Blossom Bat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Common Blossom Bat at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.1.11 Seven part test for the Grey-headed Flying-fox *Pteropus poliocephalus*
Life-cycle and background information

The Grey-headed Flying-fox is reported from a wide range of forested habitats and cultivated areas, and is an important pollinator of native plant communities, as it feeds upon blossoms of a range of tree species and transfers pollen between plant populations. The fruits or blossoms of more than 80 species of plants are eaten; however the main food is eucalypt blossom (Churchill 2008). Grey-headed Flying-foxes aggregate in summer in large communal roosts or camps which often include other Flying-fox species. Small groups disperse long distances from camps during winter (Churchill 2008).

Grey-headed Flying-foxes currently roost with Black Flying-foxes *Pteropus alecto* at a camp in the Brunswick Heads Nature Reserve, and a temporary roost is reported for Marshall's Creek Nature Reserve (pers. comm., S. Hetherington, Ecologist Byron Shire Council). Grey-headed Flying-foxes have been recorded feeding in flowering Pink Bloodwood *Corymbia intermedia* at Parklands in February 2007 (Appendix E(i)). On other occasions the species has been observed on blossoms of Swamp Mahogany and Forest Red Gum (Appendix E(ii)) and Blackbutt *Eucalyptus pilularis* (pers. obs.).

Threats include the clearance, degradation and or fragmentation of forest habitats and disturbance at camps (NPWS 2002). Flying-foxes also get impaled on barbed wire and in thorny foliage (pers. obs.).

(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

For the Grey-headed Flying-fox impacts from events may include the focal alienation of forage resources through illumination and noise. These effects are likely to occur at night where stages or other performance areas adjoin swamp sclerophyll or coastal floodplain forest where food trees are present and productive. If forage resources on

site are scarce or absent during events, then adverse impacts for this species may be minimal or non-existent.

If abundant blossom and fruit resources are present during an event, Grey-headed Flying-foxes may be discouraged from feeding in areas of high levels of noise, illumination or human presence. This effect is likely to be spatially localised and temporary: *i.e*. when the disturbance ceases, either on the night, or following completion of the event, such resources are again potentially available for the species.

Assuming a worst case scenario where Grey-headed Flying-foxes are prevented from foraging in parts of the site due to disturbance from an event, this effect is likely to operate at the sub-population level, to be sub-lethal and to be temporary. Fencing of plantings and new fencing of forest blocks on the site will not include barbed wire. Therefore the proposal is considered unlikely to cause a viable local population of the species to be placed at risk of extinction.

(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

Not applicable-the Grey-headed Flying-fox is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Grey-headed Flying-fox is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

A Grey-headed Flying-fox disturbed by amplified music was observed to return to feed upon blossoms of Swamp Mahogany at Belongil Fields during SITG 08 once music stopped (pers. comm. Mark Robinson, Ecologist, Byron Shire Council). Urban Flying-foxes persist in areas of high traffic noise levels and lights, and Grey-headed Flying-foxes monitored at a sportsfield show individually varying reactions to new lighting (pers. obs.).

The extent of habitat modification for this species is difficult to predict depending as it does upon the variation in levels of noise and illumination, wide variation in the number of Grey-headed Flying-foxes present, variation in the response of individual

Grey-headed Flying-foxes, and the spatial distribution of forage resources around the stages and performance areas.

(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

No area of habitat for the Grey-headed Flying-fox is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Grey-headed Flying-fox at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of the Grey-headed Flying-fox Recovery Plan (DECCW 2009).

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2 Species considered possible occurrences

Threatened fauna species listed in Table 2 are either considered possible occurrences at the site, or have been recorded on the property prior to development of the current proposal *e.g.* Square-tailed Kite *Lophoictinia isura* in 2003.

BIRDS

5.2.1 Seven part test for the Australasian Bittern *Botaurus poiciloptilus*
Life-cycle and background information

The Australasian Bittern is a solitary predator which shelters in tall and dense fringing vegetation of permanent freshwater wetlands (NPWS 2002). Australasian Bitterns mainly forage at night and produce a loud call. The species is listed as Vulnerable in New South Wales under the TSC Act, and threats recorded for this species include drainage of wetlands, degradation of habitats grazing and inappropriate fire regimes and predation by feral cats and foxes (NWS 2002). Habitats of the site are marginal but small areas of dense vegetation fringing the large dam may at times be used by this species.

(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

The proposal may disturb any Australasian Bittern on the site. Since the potentially available habitat is only sufficient to support an individual or few birds at most, it is unlikely that the proposal will 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

(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

Not applicable-the Australasian Bittern is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Australasian Bittern is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Disturbance impacts from the proposal may extend to the large dam. Dense vegetation adjacent to the parking area may also be indirectly affected, depending upon the performance of a 30m buffer around the interface between the site and Billinudgel NR.

(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

No area of habitat for the Australasian Bittern is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Australasian Bittern at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.2 Seven part test for the Barred Cuckoo-shrike *Coracina lineata*
Life-cycle and background information

Barred Cuckoo-shrikes are birds of forest and woodland which move in response to the availability of food (insects and fruit, especially figs). This species is listed as Vulnerable in NSW under the TSC Act, and may be expected to occur in any of the forest blocks within the event footprint and elsewhere, due to the scattered presence of figs and widespread suitable foraging substrate for insects. The species has been recorded from Marshall's Creek (BSC database), but has not yet been recorded from Parklands. Threats listed include the clearing of habitat (NPWS 2002).

(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

Native fig trees are located throughout the forest blocks of the site, including large Strangler Figs, Moreton Bay and Small-leaved Figs as well as smaller Sandpaper Figs. Many figs are mature and producing fruit, therefore potential foraging habitat is present for the Barred Cuckoo-shrike.

Barred Cuckoo-shrikes forage in pairs or small groups (NPWS 2002) and occur on the site in small numbers during the event. These birds tolerate some levels of human presence, being occasionally recorded from street trees within the Grafton area (G. Clancy pers. comm.). It is not known how this diurnal species will respond to the level of disturbance during event activities. Assuming that effects of noise and human activity will be greatest in the open camping and event areas and at night, Barred Cuckoo-shrikes active diurnally within the interior of forest blocks may not be significantly disturbed by the proposal.

Assuming that some potential feed trees on the edge of forest blocks may be subject to higher levels of disturbance, it is possible that the proposal may disrupt foraging behaviour for an unknown but likely small number of Barred Cuckoo-shrikes. This is considered insufficient to cause a viable local population of the species to be placed at risk of extinction.

(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

Not applicable-the Barred Cuckoo-shrike is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Barred Cuckoo-shrike is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Large figs within the Parklands site will be protected by fencing to exclude cattle. The extent of adverse impacts on habitat for the Barred Cuckoo-shrike is largely unpredictable: forested areas within and adjacent to the direct event footprint may be temporarily alienated for this species during the event.

(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

No area of habitat for the Barred Cuckoo-shrike is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Barred Cuckoo-shrike at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.3 Seven part test for the Black-necked Stork *Ephippiorhynchus asiaticus*
Life-cycle and background information

The Black-necked Stork is a large bird of estuaries and wetlands which is widespread in northern Australia, but which occurs sparsely in the locality of the proposal (NPWS 2002). It is usually encountered alone or in pairs, but may form small groups: breeding occurs from March to June (Lindsey 1992). This species is listed as Endangered in NSW under the TSC Act and threats include loss and degradation of wetland habitats, use of chemicals near wetlands, collision with powerlines, loss of nest trees and disturbance by stock (NPWS 2002).

(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

The Black-necked Stork is considered a possible occurrence at times during flooding on the site, and on drains and at the large dam. It is recorded from Marshall's Creek and the Ocean Shores golf club to the near south (BSC database). Black-necked Storks are occasionally seen in the Brunswick River (pers. obs.) and may occur at flood times within the event footprint.

The proposal will produce disturbance for this species if it is present at an event time, by the large number of people on the site. This will alienate much of the drain habitat of the site. The large dam remains screened from vegetation outside the direct footprint of the proposal, but noise or human presence may disturb Black-necked Storks if they were using the dam habitat at the time of the event. This effect may result in temporary alienation of the dam habitats, but these factors are considered unlikely to place a viable local population of the species at risk of extinction.

(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

Not applicable-the Black-necked Stork is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Black-necked Stork is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal will result in the modification of habitat for the duration of any event by disturbance from noise and human presence. This effect will operate in relation to the large dam, and drains within the event footprint.

(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

No area of habitat for the Black-necked Stork is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The total area of habitat available for the species at the site depends to a large part on water levels. While it is possible that the site may provide suitable occasional habitat for a few individuals it is unlikely to be important habitat for the long term survival of the species in the locality.

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

There is no critical habitat for the Black-necked Stork at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific

committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.4 Seven part test for the Black Bittern *Ixobrychus flavicollis*
Life-cycle and background information

The Black Bittern is a solitary nocturnal predator that hides by day in dense streamside vegetation and hunts at dusk by stabbing prey with its bill. Preferred habitat exists as a narrow discontinuous strip along suitable waterbodies (AGC Woodward-Clyde 1998); while 'required streams' are described as being 'small to moderate with a mix of clear pools and running water and a dense overhanging canopy of vegetation' (CSIRO 1995). The species is also recorded from an open dredged section of Christie's Creek on the Tweed coast with dense tall *Phragmites* as the riparian vegetation (pers. obs.), and from the timbered edges of swamps and lakes (Beruldsen, 1980). Sightings from drains in sugar cane lands are reported (AGC Woodward-Clyde 1998) and mangrove vegetation is also utilised (Slater *et al.* 1997).

Black Bitterns are reported to prey on fish, crustaceans, molluscs and insects which are taken from the edge of streams (CSIRO 1995). The species is among a number of Australian vertebrates recorded to have died after ingesting Cane Toads *Bufo marinus* or their larvae (Fitzgerald 1990). Other threats include the loss and degradation of habitat, predation by foxes and feral cats and disturbance of nesting birds by water craft (NPWS 2002). Black Bitterns produce a booming call during the September to March breeding season. Nesting is reported as occurring on horizontal branches overhanging preferred streams (van Tets 1988, CSIRO 1995). However, mangrove belts along coastal waterways are also considered important breeding habitat for this species (Lindsey 1992). Clutch size varies from 3-5 (Beruldsen 1980) to 6 (van Tets 1998).

The species is listed as vulnerable in NSW under the TSC Act, and threats identified include: loss and degradation of habitat by clearing or grazing, predation by feral cats and foxes and disturbance of nest sites by humans (NPWS 2002). It is considered that the Black Bittern may occur: within swamp sclerophyll forest patches of Billinudgel NR , and may at times forage in the large dam and along the larger drains when water levels are high.

(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

If the Black Bittern uses habitats within the footprint of the proposal, it is likely that the presence of a large number of people and noise will cause the species to abandon the area for the duration of the event. This effect of alienation of habitats may extend to elements of the bump-in, bump-out phase if and where these activities are close to potential Black Bittern habitat.

Any large event at the site has the potential to disturb foraging and roosting Black Bitterns. Since there is abundant suitable habitat in the vicinity and since this effect is likely to be limited to an individual bird or few birds, as the species is solitary, the proposal is not likely to cause a viable local population of the species to be placed at risk of extinction.

Rehabilitation of Yelgun Creek will also restore an area of habitat for this species.

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

Not applicable-the Black Bittern is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Black Bittern is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Disturbance impacts from the proposal may operate for the large dam. Swamp sclerophyll vegetation in Billinudgel NR surrounding the parking area may also be affected. The 30m buffer to BNR will serve as a screen from visual disturbance.

(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

No area of habitat for the Black Bittern is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Black Bittern at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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 proposal does not contribute to any listed key threatening process. Ultimately, vegetation management strategies, including riparian plantings and weed removal will reduce the effect of some threatening processes on site, by removal of Lantana and Bitou Bush.

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.5 Seven part test for the Brolga *Grus rubicundus*
Life-cycle and background information

The Brolga is a large waterbird which inhabits swamps and wetlands as well as grasslands and floodplains, occurring in pairs or small groups. This species is common in northern Australia but uncommon in the locality of the proposal (NPWS 2002). Listed as vulnerable under the TSC Act, threats to the species include loss and degradation of wetland habitats, inappropriate fire regimes, disturbance of nests, predation at nests, and collisions with powerlines (NPWS 2002). Habitat on the site is marginal for this species, which can only be expected to occur occasionally on the site either in the large dam, or when grasslands are extensively flooded.

(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

In conditions dry enough to stage events, the occurrence of the Brolga is likely to be restricted to the large dam or larger drains if these are flowing well. Impacts from the proposal may include the disturbance of birds at the site and this would be expected to operate from the bump-in phase through the staging of any event until bump-out was completed.

However, habitats of the site are unlikely to support more than a pair or small group of the birds over a short period; temporary alienation of potential habitat for a small number of Brolga it is unlikely to cause a viable local population of the species to be placed at risk of extinction by the proposal

(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

Not applicable-the Brolga is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Brolga is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

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

No area of habitat for the Brolga is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Brolga at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.6 Seven part test for the Bush Stone-curlew *Burhinus grallarius*
Life-cycle and background information

The Bush Stone-curlew is a terrestrial bird of open forest, woodlands and rangelands with a sparse to moderate groundcover. Mangroves are occasionally used as a refuge (Lindsey 1992, CSIRO 1995). Birds avoid heavy forest (M^{c}Gill 1988), and appear to be able to occupy certain suburban environments, as at Koala Beach on the Tweed coast (pers. obs.) and, *e.g.* the EPA grounds at Long Pocket near Indooroopilly (pers. obs) and the University of Queensland grounds at St Lucia (J. Callaghan, pers. comm.).

Bush Stone-curlews are cryptic and are usually seldom seen, but call loudly and distinctively at night (NPWS 2000). Activity is principally nocturnal (AGC Woodward-Clyde 1998, CSIRO 1995). Birds roost by day on the ground and walk or fly to foraging areas where they feed on 'insects, molluscs, centipedes, crustaceans, spiders, frogs and reptiles' (CSIRO 1995).

Birds occur in small groups outside the breeding season (July to January, M^{c}Gill 1988). Pairing is permanent and breeding pairs defend a territory of 10-25 hectares. The nest is located on the ground or in a scrape 'in or near the edge of open woodland where there is good visibility for at least 100 metres in every direction'. Nests are sometimes used for as long as 30 years, but may be abandoned if grass around the nesting site becomes tall (NPWS 2000). The usual clutch is two eggs; the young are precocial and are dependent upon parents for two months (CSIRO 1995). Parents can

apparently carry young off beneath their wings in event of threats (M^{c}Gill 1988) but despite this, recruitment rates are low (CSIRO 1995).

Birds are long-lived (20-30 years, NPWS 2000), but the species is regarded as '...particularly vulnerable to predation by the dog/dingo, fox and feral cat.'(AGC Woodward-Clyde 1998). The Bush Stone-curlew is listed as endangered in NSW under the TSC Act; listed threats include clearing and modification of grassy woodland habitats, collection of firewood and predation by foxes and feral cats (NPWS 2002); chicks are also at risk of roadkill (pers. obs.).

This species is considered unlikely to occur within the direct footprint of the proposal, but is a possible occurrence in adjacent lands outside the Application area: the Bush Stone-curlew has been recorded from Brunswick Heads to the south of the proposal (BSC database) and from Billinudgel NR.

(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

The widespread influence of cattle militates against the likelihood of this ground-roosting species occurring in most parts of the event areas. Some fenced woodland areas in the centre of the site include areas of marginal roosting habitat. The species has not been recorded on the Parklands property and it is a low possibility that the species may occur at times within the event footprint. It may however occur in forested areas of the site and is more likely to occur once cattle are excluded from forest areas.

Potential impacts include disturbance of breeding birds by noise and human activity on the site, in which case Bush Stone-curlews may experience reduced breeding success if eggs were abandoned for a long period of time. This disturbance would not be fatal to adult birds, or hatched chicks, which the adults can transport away from threats.

While Bush Stone-curlews are known to be attracted to insects at streetlights, a lighting management strategy including the strategic use of low pressure sodium vapour lights which attract fewer insects, should limit this risk of birds being attracted to roads and exposed to the risk of roadkill. The proposal is not considered likely to place a viable local population of Bush Stone-curlews at risk of extinction.

(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

Not applicable-the Bush Stone-curlew is a threatened species, not an endangered population.

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

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

Not applicable-the Bush Stone-curlew is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Some fenced woodland areas in the centre of the site include potential roosting habitat.

(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

No area of habitat for the Bush Stone-curlew is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Bush Stone-curlew at the site of the proposal.

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

A recovery plan has been prepared for the Bush Stone-curlew: the action proposed is not inconsistent with the objectives or actions of this recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure,*

composition and ecological function of a stand or stands". From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.7 Seven part test for the Glossy Black-cockatoo *Calyptorhynchus lathami*
Life-cycle and background information

The Glossy Black-cockatoo is a species of sclerophyllous forests (Schodde *et al*. 1993) where it prefers the lower slopes of dry ridges (Pugh 1994). Birds are also found in sclerophyll and rainforest ecotones where Forest Oak is common and in coastal woodland and forest where Black Oak *Allocasuarina littoralis* is present.

Glossy Black-cockatoos are usually seen in pairs, family parties or small flocks (Forshaw and Cooper 1981) not far from Casuarina trees where they spend up to 88% of their time feeding (Clout 1989). Birds are often detected while feeding due to the soft clicking noise as they tear into the tough Casuarina cones (Forshaw and Cooper 1981). It is suggested that feeding locations are usually in shaded trees (Saunders, in Schodde and Tidemann 1988).

Glossy Black-cockatoos feed almost exclusively on the seeds of Casuarinas or Sheoaks. In northeastern New South Wales the seeds of *Allocasuarina littoralis* and *A torulosa* are usually eaten. Birds leave a distinctive and persistent litter of chewed cones beneath feed trees (Clout 1989). Seeds of *Acacia*, *Angophora* and *Eucalyptus* as well as wood-boring insect larvae are also eaten (Forshaw and Cooper 1981).

Glossy Black-cockatoos are highly selective of feed trees, utilising those trees with a high yield of seeds per cone. Birds also select cones at an advanced stage of maturity for optimal nutrient yield, but before cones become too woody and difficult to open (Clout 1989, Joseph 1982). Extraction of seeds from the cones is a learned behaviour (Crome and Shields 1992) and young birds take some time to develop adequate cone handling skills (Clout 1989, Joseph 1982).

Glossy Black-cockatoos pair for life and produce one egg each year, usually breeding between March and August (Forshaw and Cooper 1981). Glossy Black-cockatoos require large hollows in the trunk or branch (usually of a dead tree) from 13-22 metres above the ground for breeding (Beruldsen 1980, Forshaw and Cooper 1981, Slater 1997). No suitable large hollow-bearing trees have been identified within the direct footprint of the event.

Competition for nesting hollows may limit reproductive output in this species. Glossy Black-cockatoos may compete for nest hollows with Mountain Brushtail Possums, Owls, Yellow-tailed Black-cockatoos, Sulphur-crested Cockatoos (I. Mason pers. comm.) and Honeybees (Garnett 1993).

Generally, threats to Glossy Black-cockatoo populations include the destruction and fragmentation of habitat, loss of feed trees, loss of roosting and nest trees, disturbance of habitat by logging and predation (SFNSW 1995). Kangaroo Island populations experience predation of eggs and nestlings by Brush-tailed Possums (Olsen *et al* 2006). The Glossy Black-cockatoo is listed as Vulnerable in NSW under the TSC Act.

(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

Small areas of potential feed trees (Forest Oak *Allocasuarina torulosa*) are present in some of the more elevated forest blocks within the property, but outside the direct event footprint. It is possible that local Glossy Black-cockatoos may occasionally forage on the property, but the species is not yet recorded from Parklands.

Disturbance from increased human presence may produce disturbance sufficient to alienate some areas of potential forage habitat within the event footprint, but this is unlikely to cause a viable local population of Glossy Black-cockatoos to be placed at risk of extinction, because the disturbance effect is temporary and episodic and remote from minor forage resources.

(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

Not applicable-the Glossy Black-cockatoo is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Glossy Black-cockatoo is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Small areas with potential forage tree species may be temporarily disturbed by the increased human presence on the site.

(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

No area of habitat for the Glossy Black-cockatoo is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

Given the apparent absence of suitable nest trees and the low frequency of forage trees within the property it is unlikely that habitat affected by disturbance processes associated with year 1 of operation is important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Glossy Black-cockatoo at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.8 Seven Part test for the Little Lorikeet *Glossopsitta pusilla*
Life-cycle and background information

The Little Lorikeet is a small nectivorous parrot which also takes pollen, native and introduced fruits and seeds in tree canopy foliage. Little Lorikeets disperse widely in search of blossom, and often form mixed species groups with other lorikeets (Forshaw 2007). The species has only recently (July 2009) been listed as threatened in NSW

due to widespread population declines and loss of habitat, especially breeding sites (hollow-bearing trees: DECCW Final determination).

The species has not yet been detected at Parklands but can easily be overlooked feeding with other lorikeets in tall eucalypts. A small flock was observed at Brunswick Heads in March 2010 (pers. obs.) and this mobile species may occur on the Parklands site when eucalypt blossom resources are present.

(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

Lorikeets feeding habitat high in the canopy of eucalypts and their noisy behaviour tend to suggest that diurnal disturbances from musical events are unlikely to affect them. No food trees for this species will be removed, and the plantings at Parklands include eight locally occurring eucalypt species. No aspect of the proposal seems likely to affect Little Lorikeets, therefore it is considered unlikely 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.

(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

Not applicable-the Little Lorikeet is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Little Lorikeet is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

No known or potential habitat for the Little Lorikeet habitat is likely to be removed or modified as a result of the proposal.

(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

No area of habitat for the species is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the species at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any Recovery Plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.9 Seven part test for the Magpie Goose *Anseranas semipalmata*
Life-cycle and background information

The Magpie Goose is a coastal waterbird from northern Australia and southern Papua New Guinea. It occurs primarily in shallow freshwater wetland habitats, but also forages in grasslands. The species is described as a rare vagrant to NSW, but may occur in seasonally flooded areas. Only one record for this species was found in the database searches, however the property's floodplain location and presence of a large

dam mean that at flood times habitats within the footprint of the proposal would be potentially suitable for this species.

The species is listed as Vulnerable in NSW under the TSC Act. Threats to the species include drainage and degradation of habitats, altered hydrological and fire regimes and predation by foxes (NPWS 2002).

(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

In wet conditions with extensive flooding of pasture Magpie Geese may occur within the footprint of the proposal; however under such conditions event activities may be unable to take place. Under the relatively dry conditions necessary for staging events, habitat for the Magpie Goose is essentially restricted to dams, particularly the large (1.8ha) dam. This dam is located outside the direct footprint of the proposal, but a noise effect is possible for this or any other waterbirds using the dam habitats.

The dam is a small area of habitat for this species and is unlikely to support Magpie Geese in large numbers, or for any length of time. The most severe impact of the proposal on this species would be the disturbance of birds roosting at the dam which may take flight and have to find another suitable roosting/foraging site for the duration of the event. This effect is temporary and non-fatal so it is unlikely that a viable local population of the species is likely to be placed at risk of extinction by the proposal.

(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

Not applicable-the Magpie Goose is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Magpie Goose is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Habitat modification is essentially restricted to the large dam (1.8 ha), located outside the direct event footprint. Modification is limited to disturbance by noise during the staging of large events (8 days in year 1 of operation). Lower intensity noise during bump-in and bump-out phases is less likely to disturb the birds, if present.

(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

No area of habitat for the Magpie Goose is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The Magpie Goose is an abundant species from northern Australia which occurs in NSW as a rare vagrant (NPWS 2002). The importance of the habitat of the site for this species is essentially unknown, however it is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Magpie Goose at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.10 Seven part test for the Osprey *Pandion haliaetus*
Life-cycle and background information

The Osprey is a cosmopolitan species of rivers, lakes, estuaries and ocean shorelines. Ospreys feed on live fish and have specialised feet to maintain a grip on the struggling prey item. Ospreys build a large bulky stick nest which they utilise year after year, adding to and sometimes rebuilding the structure. In areas such as offshore islands where terrestrial predators are absent, nests may be built on the ground, or on a clifftop, but most nests are placed in a "*substantial fork of a large tree; ";"... nests in trees may be at any height up to twenty metres, but are usually much less*" (Beruldsen 1980).

Ospreys also nest on power poles and other man-made structures. "The tops of isolated trees, often dead ones, are preferred nest sites throughout the world" (Clancy 2006). Emergent trees (protruding above the surrounding forest canopy) are used because they offer visibility of nest predators, and easy flight access when birds bring live prey to the nest. Nest trees often include projecting branches above the nest for ease of landing.

Avian predators are described as the most likely threat to eggs and nestlings, with White-bellied Sea-eagles *Haliaeetus leucogaster* and Torresian Crows *Corvus orru* being most frequently expelled from nest sites in a north coast New South Wales study (Clancy 2006). Osprey *Pandion haliaetus* are listed as Vulnerable in New South Wales under the TSC Act.

Known threats include: the loss of nest trees; reduced breeding success because of disturbance at the nest; reduction in quality or quantity of fish stock, pesticide contamination of fish; entanglement in discarded fishing lines; collision with or electrocution by power lines (NPWS 2002)as well as egg collecting and shooting (Clancy 2006).

Ospreys are certain to overfly the site because of its near-coastal location. The large dam contains large carp and may at time be used for foraging.

(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

Occupation and use of the event site may potentially alienate potential foraging habitat at the large dam for the Osprey for the duration of any event. This is not considered likely to place a viable local population at risk of extinction.

(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

Not applicable-the Osprey is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Osprey is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

A large dam outside the direct event footprint may be used at time by foraging Osprey. The influx of people for events may alienate this habitat for local Ospreys.

(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

No area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The small area of potential foraging habitat which may be temporarily alienated is considered of minor importance for an individual or pair of Ospreys and unimportant to the long-term survival of the species in the locality.

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

There is no critical habitat for the Osprey at the site of the proposal.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
No recovery plan is available for the Osprey.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native*

vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands". From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.11 Seven part test for the Pale-vented Bush-hen *Amaurornis olivaceus*
Life-cycle and background information

The Pale-vented Bush-hen is a shy species of tall dense groundlayer vegetation in riparian or swampy habitats. Bush-hens nest in tall grasses, reeds or rushes (Beruldsen 1980): a nest at Mullumbimby Creek was located close to a permanent creek suspended in tall South African Pigeon Grass *Setaria sphacelata* (pers. obs.). Bush-hens are mainly active at night and are seldom seen, but readily detected by their distinctive calls. The species has not yet been recorded from Parklands.

Bush-hens are listed as Vulnerable under the TSC Act and may occur at times in swamp sclerophyll forest and around the large dam. Tall groundlayer vegetation and swamp sclerophyll forest of BNR fringing the carpark area may also be suitable for this species. Threats to the species include degradation, pollution and loss of habitat and predation by feral cats and foxes (NPWS 2002).

(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

The Pale-vented Bush-hen is considered a likely occurrence in swamp sclerophyll forests of the site, possibly foraging around the large dam and along the better vegetated drains at night. Within the event site groundlayer habitats are largely closely grazed and trampled, but some patches of dense Lantana and tall groundlayer vegetation fringing the carpark area may be suitable for this species.

The main impacts of the proposal would be human disturbance from the large number of people active in the area, and noise effects in the vicinity of the stages and other activities. It is expected that the combined effect of this disturbance would be to scare Pale-vented Bush-hens away from the vicinity during event days. This effect would likely operate in relation to a few individual birds at most given the areas of habitat within the potential footprint of the proposal.

It is considered unlikely that the proposal would 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.

(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

Not applicable-the Pale-vented Bush-hen is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Pale-vented Bush-hen is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Modification of habitat is limited to temporary disturbance from noise and human presence. Swamp sclerophyll forest and some patches of dense Lantana within the central event site; and tall groundlayer vegetation fringing the carpark area may be suitable for this species and may be adversely affected by the proposal for the duration of events.

(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

No area of habitat for the Pale-vented Bush-hen is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Pale-vented Bush-hen at the site of the proposal.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.12 Seven part test for the Red-backed Button-quail *Turnix maculosa*
Life-cycle and background information

The NSW Scientific Committee made a final determination to list the Red-backed Button-quail as a Vulnerable species in NSW under the TSC Act in October 2005. The species inhabits grasslands, woodlands and sedgelands near water and is crepuscular and nocturnal in its activity. Red-backed Button-quails fed on seed and insects, nest in dense grass or sedgeland habitats, and breed mainly between October and July (Lindsey 1992).

Threats recorded for the species include inappropriate fire and grazing regimes, drainage of coastal wetlands, trampling of groundlayer habitat by livestock, and feral pigs and predation by the red fox and feral cat (from the NPWS website: http://www.nationalparks.nsw.gov.au/npws.nsf/content/red-backed_button-quail_vulnerable).

(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

The majority of the footprint of the proposal is unsuitable habitat for this species at present because of the current cattle grazing regime, however, fringing vegetation in the southern car parking area may at times be suitable for this species. It is considered to be a low possibility of occurrence within the direct footprint of the proposal. Adverse impacts would be limited to the disturbance of birds in tall fringing vegetation around the southern car park by the parking of cars nearby.

A 30m buffer proposed in this area may provide habitat for this species and screen adjacent habitat ion Billinudgel NR from visual and auditory disturbance processes within the car park. It is considered that this would create minor adverse effects for a

few individuals at most and is unlikely 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.

(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

Not applicable-the Red-backed Button-quail is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Red-backed Button-quail is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Tall groundlayer vegetation fringing the southern carpark area is the only potential habitat likely to be affected by the proposal. Effects are limited to disturbance from nearby movements and noise from vehicles and pedestrians.

(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

No area of habitat for the Red-backed Button-quail is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

(iii) the importance of the habitat to be removed , modified or fragmented or isolated to the long-term survival of the species , population or ecological community in the locality
The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Red-backed Button-quail at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.13 Seven part test for the Square-tailed Kite *Lophoictinia isura*
Life-cycle and background information

Square-tailed Kites are birds of eucalypt-dominated forest and woodlands which hunt over tree canopies for nestling and fledgling birds, but also take lizards, rabbits and insects (AGC Woodward-Clyde 1998). Square-tailed Kites also exploit suburban and low density residential areas including nature strip plantings (pers. obs), orchards and plantations (AGC Woodward-Clyde 1998). The Square-tailed Kite was recorded in 2003 from near the proposed car parking area; and nearby on the western side of the Yelgun to Chinderah Pacific Highway upgrade in July 2004 (pers. obs.; BSC database). This species may occur anywhere in or near forested habitats of the site.

The species is listed as Vulnerable in NSW under the TSC Act. Threats to the species include loss of habitat, degradation of habitat by inappropriate fire regimes, egg collection and shooting (NPWS 2002).

(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

The proposal has the potential to alienate foraging habitat for this species, in the areas of greatest diurnal disturbance. It is not possible to ascertain precisely what the extent of this effect will be. Square-tailed Kites tolerate some level of human disturbance: *e.g.* a Square-tailed Kite was observed foraging over nature strip shrubs beside a busy road in the centre of Kempsey (pers. obs.). Therefore, the species may continue to forage over the interior of forested habitats of the site during some events. A Harrier

(*sp* not provided) is reported foraging over a bombing range during use (Manci *et al* 1988) so some raptors may tolerate particular disturbance phenomena.

Even postulating the maximum disturbance effect for this species, it is a wide ranging and mobile species with a large home range and is unlikely to be significantly adversely affected by the temporary unavailability of some foraging habitat. Therefore, the action proposed is not 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

(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

Not applicable-the Square-tailed Kite is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Square-tailed Kite is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Areas of forest adjoining the camping and event areas will experience a high level of human presence and disturbance in the form of noise and activity for large event days; bump-in and bump-out phases of the proposal will extend this effect at lower intensities over an additional period.

(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

No area of habitat for the Square-tailed Kite is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to an individual Square-tailed Kite; therefore it is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Square-tailed Kite at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.14 Seven part test for the Superb Fruit-dove *Ptilinopus superbus*
Life-cycle and background information

The Superb Fruit-dove is a secretive frugivorous bird which occurs locally in a range of forest types, especially rainforest, wet sclerophyll and swamp sclerophyll forests. It feeds upon a variety of fruits, including those of the following plant species: Quandongs *Elaeocarpus spp.*, Laurels *Cryptocarya spp.*, Bolly Gums *Litsea* and *Neolitsea spp.*, Figs *Ficus spp*., Palms *Archontophoenix cunninghamiana* and *Calamus muelleri*, and vines *e.g. Flagellaria indica, Cissus hypoglauca* and *C. sterculifolia* (Frith 1982). The species has not been recorded from the Parklands site and habitats are considered marginal for this species.

Superb Fruit-dove is listed as Vulnerable in NSW under the TSC Act and is considered a low possibility occurrence in any forest block where fruiting trees are present, especially Figs and Laurels. Threats to this species include clearing, roading,

and burning of forest habitats and invasion of habitat by weeds (NPWS 2002). It is also reported to occasionally collide with lighted windows during nocturnal migratory flight in north Queensland (Frith 1982).

(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

Quandongs, Bangalow Palms, figs and native grape vines *Cissus spp.* are present in several forest blocks within the event footprint. It is possible that the Superb Fruit-dove forages seasonally in the vicinity of the proposal. Where food trees are located adjacent to areas of high numbers of humans or vehicular activity it is probable that feeding birds would be disturbed and leave.

The species is reported not to breed in NSW (Frith 1982, NPWS 2002). Therefore, disturbance from the proposal might temporarily disrupt the foraging of a small number of Superb Fruit-doves. A risk presumably exists of Superb Fruit-doves being attracted to lighting at event sand a risk of colliding with illuminated structures during the event exists, but is considered of low probability. A lighting management strategy is in place to minimise potential adverse effects on fauna, and fauna behaviour during the event will be monitored.

These factors are not considered 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.

(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

Not applicable-the Superb Fruit-dove is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Superb Fruit-dove is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Disturbance effects potentially likely to operate on this species will largely be confined to the margins of forest blocks within the event footprint.

(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

No area of habitat for the Superb Fruit-dove is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Superb Fruit-dove at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.15 Seven part test for the Sooty Owl *Tyto tenebricosa*
Life-cycle and background information

The Sooty Owl is a nocturnal predator of a variety of small vertebrates which occurs in a range of forest types, but particularly in rainforest. It requires a large tree hollow for breeding and occupies a large home range. Tall Brush Box forest with better mid-layer rainforest and old-growth components outside the event areas may at times be used by this species for foraging. However the species has not yet been recorded at Parklands. The Sooty Owl is listed as Vulnerable under the TSC Act. Threats to the species include: loss of mature hollow-bearing trees, clearing and degradation of habitat (NPWS 2002).

(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

Most records in the Shire are from the densely forested hinterland (BSC database). This species is only expected to occur on the site in occasional foraging episodes, when it may forage in the sub-tropical floodplain forest, rainforest gully or taller sclerophyll forest of the slopes in the west of the property.

It is considered that the Sooty Owl would seldom occur on the property and the presence of a Sooty Owl within the event footprint during the event would be unlikely. The worst case scenario would be the noise and illumination associated with the proposal resulting in an individual Sooty Owl having to leave the site and forage elsewhere: this is considered insufficient to cause a viable local population of the species to be placed at risk of extinction.

(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

Not applicable-the Sooty Owl is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Sooty Owl is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Forested habitats fringing the event footprint may occasionally be visited by Sooty Owls. Habitat modification is limited to disturbance from increased human presence and an acoustic effect over 8 large event days proposed for year 1.

(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

No area of habitat for the Sooty Owl is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Sooty Owl at the site of the proposal.

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

A recovery plan has been prepared for the 3 large forest owl species, including the Sooty Owl. The action proposed is not inconsistent with the objectives or actions of this recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.16 Seven part test for the Wompoo Fruit-dove *Ptilinopus magnificus*
Life-cycle and background information

The Wompoo Fruit-dove is an obligate frugivore of rainforests "which feeds upon the fruits of trees palms vines and epiphytes" (Frith 1982), including Fan Palm *Livistona* australis, Native Tamarind *Diploglottis australis*, Blue Quandong *Elaeocarpus grandis,* Brush Cherry *Syzygium australe*, Austral Sarsaparilla *Smilax australis*, Bolly Gums *Litsea* and *Neolitsea spp.*(Frith 1982), and Figs *Ficus spp*. (pers. obs.).
This species is listed as Vulnerable in NSW under the TSC Act and is considered a likely occurrence in any rainforest where fruiting trees are present, especially Figs and Laurels. Its occurrence in the swamp sclerophyll and coastal floodplain forests in and adjoining the event area is likely to be associated with the distribution of large fig trees. Wompoo Fruit-doves have loud and distinctive call, but the species has not been recorded on the Parklands site and it is considered to represent marginal habitat for this species. Threats to this species include clearing, logging, roading, and burning of forest habitats (NPWS 2002).

(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

Figs are present in several forest blocks within the event footprint and Austral Sarsaparilla is present in virtually every forest block. Wompoo Fruit-dove may forage at times in the direct footprint of the proposal and nearby. Where food trees are located adjacent to areas of high numbers of humans or vehicular activity it is probable that feeding birds would be disturbed and leave the locality.

As a worst case scenario impacts from the proposal might temporarily disrupt the foraging and very unlikely the breeding of a small number of Wompoo Fruit-doves.

This is not considered 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. Most records of the species locally are from the foothills and forested hinterland of the Shire (BSC database).

(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

Not applicable-the Wompoo Fruit-dove is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Wompoo Fruit-dove is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Disturbance effects likely to operate on this species will largely be confined to human presence and noise operating some distance from the margins of forest blocks within the event footprint.

(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

No area of habitat for the Wompoo Fruit-dove is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (whether directly or indirectly)
There is no critical habitat for the Wompoo Fruit-dove at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

MAMMALS

5.2.17 Seven part test for the Common Planigale *Planigale maculata*
Life-cycle and background information

The Planigale is a tiny dasyurid marsupial which feeds upon insects and small vertebrates. It occurs in a range of vegetation communities, usually associated with water, but requires dense groundlayer vegetation, rock outcrops or similar groundcover under which to shelter. Planigales are sometimes found sheltering beneath debris (pers. obs.) and radiotracked Planigales in Suffolk Park used the burrows of other animals for shelter (P. Parker pers. comm.).

The species has not been found on Parklands where cattle grazing and trampling have degraded groundlayer habitats extensively. Cattle also disrupted small mammal trapping effort and limited areas where pitfall trapping could be undertaken. It is possible that the Common Planigale occurs on the site, in fenced forest to the east of the event areas, and outside Parklands in swamp forest of the Billinudgel NR.

The species is listed as vulnerable in NSW under the TSC Act, and threats include the clearance and fragmentation of habitat, predation by dogs, cats and Cane Toads, inappropriate fire regimes (NPWS 2002).

(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

Within the event footprint there is limited habitat present for the Planigale. Groundlayer habitats are degraded by cattle, severely in many areas, and there are few large logs or other ground cover structures present. This species may occur within the overall NBSP property, possibly in fenced areas where groundlayer habitats have been less degraded by cattle. Tall groundlayer vegetation fringing the parking area in the south of the site is also a location where this species might occur.

Assuming the possible presence of the Planigale in this latter area it is difficult to postulate an adverse effect, since the area used for parking is generally closely grazed and trampled ,the species is unlikely to venture into such an open and exposed high predator-risk area. Vehicle speeds will be limited throughout the site to 30km/h however a low potential risk exists of road kill for this species, which will likely operate at low intensity during primarily diurnal bump-in and bump-out and at a higher intensity at night during large events.

The proposal is considered unlikely 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.

(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

Not applicable-the Planigale is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Planigale is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Modification of habitat for the proposal for this species is limited to car parking adjacent to suitable tall groundlayer habitats in the extreme south of the site. A 30m vegetated buffer proposed for the interface between Parklands and the Billinudgel NR will provide potential habitat for this species and a buffer to swamp forests within the Billinudgel Nature Reserve.

(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

No area of known habitat for the Planigale is likely to become fragmented or isolated from other areas of habitat as a result of the proposal. More research is needed to increase confidence about the possible occurrence and distribution of the species at Parklands.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Planigale at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.18 Seven part test for the Greater Broad-nosed bat *Scoteanax rueppelli*
Life-cycle and background information

The Greater Broad-nosed Bat occurs at low elevations in "mature coastal forest, or rainforest….. gullies of open woodlands, wet and dry sclerophyll forests". Greater Broad-nosed Bats roost in tree hollows and buildings (Churchill 2008). This species flies slowly and feeds on slow-moving insect prey within 20m of the ground along creeks and edges of woodland. The Greater Broad-nosed Bat is known to eat other bats in Harp traps (Churchill 2008; pers. obs.) and may prey on other bats on the wild (Churchill 2008).

The species is not included in NSW Wildlife Atlas data for the nearby Billinudgel Nature Reserve, but is known from diverse coastal locations in Byron Shire (BSC database) and may occur in the vicinity of forested habitats of the property. It has not yet been recorded on Parklands. The species is listed as vulnerable in NSW under the TSC Act and threats to the species include the loss of habitat and of hollow-bearing trees and the use of pesticides (NPWS 2002).

(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

The forest habitats of the property comprise suitable potential foraging habitat for this species. It is not known to what extent the Greater Broad-nosed Bat is likely to be adversely affected by large scale human presence, noise and artificial illumination in the vicinity of foraging habitat.

Assuming that some foraging habitat may be temporarily alienated for this species where performance areas and other event infrastructure *e.g.* light towers are located close to forest, the impacts are likely to be restricted to few individuals and to be sub-lethal. Outside of the eight large event days proposed in year 1 of operation, these resources would remain available for the Greater Broad-nosed Bat, therefore the proposal is not considered likely to cause a viable local population to be placed at risk of extinction.

(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

Not applicable-the Greater Broad-nosed Bat is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Greater Broad-nosed Bat is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Habitat for this species which is potentially modified by the proposal includes forest blocks and forest edges located close to performance areas and other event infrastructure *e.g.* light towers.

(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,

No area of habitat for the Greater Broad-nosed Bat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Greater Broad-nosed Bat at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.19 Seven part test for the Large-footed Myotis *Myotis macropus*
Life-cycle and background information

The Large-footed Myotis occurs in a range of vegetation communities, usually near water, and is a cave roosting bat which also shelters by day in structurally similar shelter structures *e.g.* tunnels, bridge drains and tree hollows, (Churchill 2008). This species obtains its invertebrate and small vertebrate prey by raking the surface of waterbodies with its specialized feet, but also catches insects on the wing (Churchill 2008). It is not included in NPWS atlas records from nearby Billinudgel Nature Reserve but is known from Marshall's Creek (BSC database). It is not yet recorded from Parklands, but is considered likely to forage at times in larger waterbodies of the site.

The species is listed as vulnerable in NSW under the TSC Act and threats to the species include the disturbance and destruction of cave roosts, loss of tree hollows and other roost sites, use of pesticides and pollution of waterbodies (NPWS 2002).

(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

Potential habitat at the site includes the larger dams and those drains with sufficient water to comprise foraging habitat for this species. The Plague Minnow *Gambusia holbrooki* is abundant in larger drains of the site (pers. obs.) and is probably present in some of the dams; therefore suitable foraging resources for this species are present both within and outside the direct footprint of the proposal. Two small dams and many drains are located within the event footprint. Some of these are in close proximity to performance areas, restaurants and other event infrastructure.

It is not known to what extent the Large-footed Myotis is likely to be adversely affected by human presence, noise and illumination in the vicinity of foraging habitat. A breeding colony of females and young were found in the Pacific Highway bridge at Brunswick Heads so some noise and vibration disturbance is tolerated (pers. obs.).

It is possible that some foraging habitat may be temporarily alienated for this species where drains or dams are located close to performance areas and other event infrastructure; alternatively the bats may not be affected. Assuming some disturbance effect the impacts are likely to be restricted to few individuals and to be sub-lethal. Following large event days these habitats would return to being available for the Large-footed Myotis, therefore the proposal is not considered likely to cause a viable local population to be placed at risk of extinction.

(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

Not applicable-the Large-footed Myotis is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Large-footed Myotis is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Habitat which is potentially modified by the proposal includes drains or dams located close to performance areas and other event infrastructure.

(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

No area of habitat for the Large-footed Myotis is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Large-footed Myotis at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.20 Seven part test for the Long-nosed Potoroo *Potorous tridactylus*
Life-cycle and background information

The Long-nosed Potoroo is a nocturnal bandicoot-sized marsupial which feeds upon subterranean fungi, plant material and insects. The species occurs in a range of vegetation communities, often on sandy soils and relies upon the presence of dense tall groundlayer vegetation in which to shelter. There is one record of Long-nosed Potoroo from nearby Billinudgel Nature Reserve (NWS Wildlife Atlas), but a long history vegetation clearing and of modification of groundlayer vegetation associated

with pastoral activities on Parklands has adversely affected groundlayer habitats that this species depends upon. It has not been recorded from Parklands.

Pastoralism is reported to "lead to a substantial re-arrangement of the vertebrate fauna, and particularly so for reptiles and those mammals and birds associated with the ground and understorey layers" (Woinarski and Ash 2002).

Potoroos are listed as vulnerable in NSW under the TSC Act and vulnerable federally under the EPBC Act: threats include the clearance and fragmentation of habitat, roadkill, predation by foxes, dogs and feral cats, inappropriate fire regimes, grazing and pastoral activities (NPWS 2002).

(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

Within the event footprint there is limited habitat present for the Long-nosed Potoroo. Groundlayer habitats are degraded by cattle, severely in many areas, and groundlayer vegetation is sparse to absent. This species is recorded from Billinudgel NR but is unlikely to occur within the direct footprint of the event.

The current status of the species locally is not known, but the widespread presence of foxes, domestic and feral dogs and feral cats as evidenced in sand trap data from Marshall's Ridges (pers. obs.) demonstrate that feral predator pressures in the locality are high for this species and other native terrestrial mammals. Impacts from the proposal are probably limited to disturbance from activities in the southern car parking area. A 30m vegetated buffer proposed for the interface between this area and Billinudgel NR will likely screen visual and auditory intrusions and ultimately provide some additional habitat potentially suitable for this species.

Under these circumstances the proposal is considered unlikely to cause a viable local population of the species to be placed at risk of extinction.

(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

Not applicable-the Long-nosed Potoroo is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Long-nosed Potoroo is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Disturbance from activities in the southern car park area during 8 large event days proposed for year 1 of operation impinging on adjacent swamp sclerophyll forest.

(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

No area of habitat for the Long-nosed Potoroo is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Long-nosed Potoroo at the site of the proposal.

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

A specific recovery plan has been prepared for the Long-nosed Potoroo: the action proposed is not inconsistent with the objectives or actions of this recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

5.2.21 Seven part test for the Yellow-bellied Sheathtail Bat *Saccolaimus flaviventris*
Life-cycle and background information

The Yellow-bellied Sheath-tail Bat has been recorded in a wide range of habitat types, including wet and dry sclerophyll forests, open woodland and grassland. The species appears to require large foraging ranges and tends to be restricted to denser forest habitat (G. Richards pers. comm.). However it is also known from open forest habitat in *e.g.* the Pilliga region (pers. obs). It has been hypothesised that Yellow-bellied Sheath-tail Bat may be restricted to roosts in emergent trees because of its particular flight characteristics that require a cleared space below the roost for it to gain flight speed (Richards and Hall 1996).

Individuals roost mainly in tree hollows and are predominantly solitary. Small groups may form in winter and spring, and a group of 29 was once recorded from a felled 20m high tree in southeast Queensland (Rhodes and Hall 1997). The foraging habits of this species involve fast flight above the tree canopy and its diet comprises of beetles, grasshoppers and other insects.

The species is not included in NSW Wildlife Atlas data for the nearby Billinudgel Nature Reserve, but is known from coastal locations in Byron Shire (BSC database) and may occur on the property. It has not yet been recorded at Parklands. The species is listed as vulnerable in NSW under the TSC Act and threats to the species include the loss and degradation of habitat and use of pesticides (NPWS 2002). The direct footprint of the proposed event area includes some small tree hollows and therefore represents potential roosting and foraging habitat for this species.

(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

The forest canopy habitats of the property comprise suitable potential foraging habitat for this species; some small hollows are present within the interior of swamp sclerophyll forest and sub-tropical floodplain forest blocks and comprise potential roost shelter sites for individual or small groups of Yellow-bellied Sheath-tail Bats. It is not known to what extent the species is likely to be adversely affected by large scale human presence, noise and illumination in the vicinity of foraging habitat.

Assuming that some foraging habitat may be temporarily alienated for this species where performance areas and other event infrastructure are located close to forest canopies, the impacts are likely to be restricted to few individuals and to be sub-lethal. Outside large event days these resources would remain available for the Yellow-bellied Sheath-tail Bat, therefore the proposal is not considered likely to cause a viable local population to be placed at risk of extinction.

(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

Not applicable-the Yellow-bellied Sheath-tail Bat is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Yellow-bellied Sheath-tail Bat is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Habitat for this species which is potentially modified by the proposal includes forest canopies located close to performance areas and other event infrastructure.

(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

No area of habitat for the Yellow-bellied Sheath-tail Bat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Yellow-bellied Sheath-tail Bat at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

6.0 Threatened flora and EECS of the Parklands site

Six threatened flora species are known from the Parklands site. These are:

Davidson's Plum	*Davidsonia jerseyana*
Durobby or Coolamon	*Syzygium moorei*
Green-leaved Rose Walnut	*Endiandra muelleri ssp. bracteata*
Stinking Cryptocarya	*Cryptocarya foetida*
White Laceflower	*Archidendron hendersoni*

A Stinking Cryptocarya is present as a ~2m sapling in one of the swamp sclerophyll forest blocks within the event footprint (block "A/14"). Davidson's Plum, Durobby and Green-leaved Rose Walnut are located distant from the event area and outside the application area in the west of the site. A single Green-leaved Rose Walnut is located within the application area in an area where it will experience no direct impacts from the operation of year 1 of the proposal.

The sixth species Rough-shelled Bush-nut *Macadamia tetraphylla* was recently discovered (June 5th 2010) at Parklands remote from any event impacts. A seven part test prepared for this species in relation to a proposal for a water management system on the site is provided in Appendix K.

6.1 Endangered Ecological Communities of the Parklands site

No adverse effects are likely for vegetation outside Parklands therefore seven part tests have been prepared for the following communities on the property listed as endangered under the NSW *Threatened Species Conservation Act* 1995.

Swamp Sclerophyll Forest on coastal floodplains of the NSW north coast bioregion;

Sub-tropical Coastal Floodplain Forest of the NSW north coast bioregion;

Coastal Cypress Pine Forest of the NSW north coast bioregion, and:

Lowland Rainforest of the NSW north coast bioregion.

6.2 Seven part test for the Stinking Cryptocarya *Cryptocarya foetida*

Life-cycle and background information

Stinking Cryptocarya is a small to medium sized tree found in littoral rainforest on sandy and basaltic soils (NPWS 2002); plants are also known from metasediments in Byron Shire (BSC 1999). Originally common in littoral rainforest from Fraser Island to Iluka the species has been reduced by clearing and burning (BSC 1999).

Stinking Cryptocarya produces small black fruits which are reportedly eaten by Pied Currawongs (BSC 1999). Fewer than 100 mature trees are reported to exist, and the species was considered to be inadequately reserved (BSC 1999).

The Stinking Cryptocarya is listed as vulnerable in NSW under the TSC Act and vulnerable federally under the EPBC Act. Threats to the species include: small population size, clearing and fragmentation of habitat, weeds, fire, trampling (NPWS 2002) as well as agriculture and road construction (BSC 1999).

(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

A single ~ 2m high sapling Stinking Cryptocarya is located within the direct event footprint in the interior of forest block "A/14". This area is not planned for any usage, the forest edge will be barrier fenced and no event activities are expected to impact upon it. Even if patrons enter the forest there is a very low likelihood that this plant would be recognised or singled out for vandalism. Because it is located within the forest is not likely to be accidentally trampled, or damaged by the movement of machinery.

The action proposed is considered to be unlikely 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.

(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

Not applicable-the Stinking Cryptocarya is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Stinking Cryptocarya is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

No habitat for the Stinking Cryptocarya is expected to be modified as a result of the proposal.

(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

No area of habitat for the Stinking Cryptocarya is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Stinking Cryptocarya at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

6.3 Assessment for the remaining threatened flora species

Davidson's Plum	*Davidsonia jerseyana*
Durobby or Coolamon	*Syzygium moorei*
Green-leaved Rose Walnut	*Endiandra muelleri ssp. bracteata*

White Laceflower *Archidendron hendersoni*

Because the majority of these plants are located outside the application areas, and all are outside the direct footprint of the proposal, and levels of threat and management requirements are essentially similar, a single seven part test is provided below

6.3.1 Life cycle and background information—Coolamon or Durobby *Syzygium moorei*

The Coolamon or Durobby is a large tree found in lowland or riverine rainforest at low elevations in northeast NSW and south-east Queensland. It has high aesthetic values with large showy pink flowers followed by edible fruits. The species is listed as vulnerable in NSW under the TSC Act and federally under the EPBC Act. The species has been recorded from several mature trees in the west of the property. Threats to the species include: clearing of habitats, weeds, grazing and illegal collection.

6.3.2 Life cycle and background information—Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata*

The Green-leaved Rose Walnut is a subtropical rainforest tree from lower elevations (BSC 1999), which is poorly known. It is listed as Endangered under the TSC Act. Similar in some respects to the Rusty Rose Walnut, plants of both species flower infrequently. Floral and fruiting characteristics are fundamental to distinguishing these taxa, and determination of identity on the basis of leaf and stem morphology, is considered to be a much less reliable means of establishing the species identity (NPWS 2002). A combined recovery plan for this species and the Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata* has been prepared.

Two mature trees of this species are known from the site and additional seedlings and saplings are likely to occur. One tree is located in a patch of forest within the application area. This tree will be flagged and barrier fenced before any construction for the proposal takes place. Threats are poorly known but are assumed to include land clearing, habitat modification and low population sizes (BSC 1999).

6.3.3 Life cycle and background information—Davidson's Plum *Davidsonia jerseyana*

Davidson's Plum is a small rainforest tree which only occurs in NSW naturally in the Tweed and Brunswick valleys. The species has been widely planted as a garden plant in the northern rivers region. The species is listed as endangered under the TSC Act and EPBC Act, and a specific recovery plan has been prepared. Habitat is described as coastal and lowland subtropical rainforest and wet sclerophyll forest to 300m elevation, but most records are from < 100 m elevation (DEC 2004a). The species occurs on a variety of soils but is limited to 118 point locations representing 24 naturally occurring sub-populations (*ibid.)*. The southernmost confirmed record is from near Mullumbimby. Threats to the species are listed as seed collection, habitat alteration and fragmentation, road works, fire and genetic pollution (DEC 2004a).

6.3.4 Life cycle and background information—White Laceflower *Archidendron hendersoni*

The White Laceflower is a tree of riverine, littoral and sub-tropical lowland rainforest which occurs on a range of soil types from the Richmond River in northern NSW to north Queensland. The species is listed as Vulnerable in NSW under the TSC Act. Fifteen trees (15) and at least 23 seedlings or rootsuckers of this species have been located within the footprint of the proposal. Threats to the species are listed as loss of habitat through vegetation clearance, degradation of habitat by weeds and the illegal collection of seeds for horticulture (NPWS 2002).

6.3.5 Seven part test for remaining threatened flora species

(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

The four threatened species under consideration in this assessment are with one exception located remote from disturbances associated with the proposal. That Green-leaved Rose Walnut will be carefully protected from any impacts. Other plants will be monitored, weeded where necessary and seed will be ultimately collected to establish an insurance population elsewhere on the site. A S132C licence under the NPWS Act 1974 will be required for this work.

The action proposed is considered to be unlikely to have an adverse effect on the life cycle of these four species such that a viable local population of any of the species is likely to be placed at risk of extinction.

(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

Not applicable-the four threatened species under consideration are threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable- the four threatened species under consideration are threatened species, not an endangered ecological community or critically endangered ecological community.

(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

No habitat for the four threatened species under consideration is expected to be modified as a result of the proposal.

(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

No area of habitat for the four threatened species under consideration is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the four threatened species under consideration in the locality.

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

There is no critical habitat for the four threatened species under consideration at the site of the proposal.

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

Recovery plans have been prepared for the Green-leaved Rose Walnut (with Rusty Rose Walnut *E hayesii*), and the Davidson's Plum. The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses

beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

6.4 Seven part test for the endangered ecological community swamp sclerophyll forest on coastal floodplains of the NSW north coast bioregion
Swamp sclerophyll forest—background information

Swamp sclerophyll forest is present on the property in numerous distinct forest blocks. Many of these forest patches are variably infested with environmental weeds, especially Camphor Laurel and Lantana. Swamp Sclerophyll Forest is threatened by a large number of factors including but not restricted to: clearing, fragmentation, drain construction, weed invasion and degradation of habitats by filling, by feral pigs, by agricultural runoff, removal of dead wood and rubbish dumping. Inappropriate fire regimes and alteration of environmental flows or hydrology are also threats (NPWS 2004).

(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

Not applicable- swamp sclerophyll forest on floodplains of the NSW north coast bioregion (SSF) is an endangered ecological community, not a threatened species.

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

Not applicable- swamp sclerophyll forest on floodplains of the NSW north coast bioregion (SSF) is an endangered ecological community, not an endangered population.

(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

There may be a need to lop horizontal limbs of some trees in the narrow alleys between forest block "B" and "C" to install security fencing. These operations will be managed so as to minimise damage to any native trees involved. No adverse effects are considered likely for SSF EEC as a result of the proposal. Rehabilitation plantings and strategic removal of Camphor Laurels and Lantana identified in the draft VMBP for the site (Appendix M) will enhance the persistence of this EEC on the site.

Therefore the proposal is unlikely to have an adverse effect on the extent of the swamp sclerophyll forest ecological community, such that its local occurrence is likely to be placed at risk of extinction.

(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

The proposal will not substantially or adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The only future impact on the present composition of the SSF will ultimately be beneficial in the form of staged weed removal *e.g.* Camphor Laurel *Cinnamomum camphora* and Lantana, and the exclusion of cattle which will enable groundlayer and mid-layer vegetation to develop.

(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

No habitat for the SSF community will be removed or adversely modified.

(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

No fragmentation or isolation effects are likely to arise from the proposal for the SSF community.

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

No habitat for the SSF community is to be removed, adversely modified or fragmented or isolated by the proposal.

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

There is no critical habitat listed for the swamp sclerophyll forest EEC in the study area.

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

No specific recovery plan is available for the SSF community: the action proposed is not inconsistent with the objectives of any recovery plan or threat abatement plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition

of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

6.5 Seven part test for the endangered ecological community subtropical coastal floodplain forest on coastal floodplains of the NSW north coast bioregion
Subtropical coastal floodplain forest background information

Subtropical coastal floodplain forest is present on the property in several distinct forest blocks as depicted in Appendix A; ecological attributes of forest blocks are summarised in Appendix A. Many of these forest patches are infested with various environmental weeds, including Camphor Laurel, Bitou Bush and Lantana. Vegetation rehabilitation and management strategies provided in the draft VMBP (Appendix M) identify opportunities for effective rehabilitation effort within the event site and elsewhere.

It is estimated that <30% of subtropical coastal floodplain forest remains of the original extent of this community (NPWS 2004). Extensive areas that formerly supported this community have been cleared and modified for agriculture, including sugar cane, tea-tree plantation, and cattle grazing. Land clearing is listed as a continuing threat to this community which includes many highly fragmented patches. Drainage, inappropriate fire regimes and weeds affect much of the remaining subtropical coastal floodplain forest (NPWS 2004).

(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

Not applicable- sub-tropical coastal floodplain forest of the NSW north coast bioregion is an endangered ecological community, not a threatened species.

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

Not applicable- sub-tropical coastal floodplain forest of the NSW north coast bioregion is an endangered ecological community, not an endangered population.

(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

Subtropical coastal floodplain forest of the Parklands property is depicted in the Ecological Assessment and Response to DGRs document. Local occurrence of this EEC extends beyond Parklands, but no impact is likely. The event footprint also involves no direct adverse impact on this community. The proposal is unlikely to have an adverse effect on the extent of the endangered ecological community, such that its local occurrence is likely to be placed at risk of extinction.

(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

The proposal will not substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(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

No area of subtropical coastal floodplain forest will be removed or adversely modified by the proposal.

(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

Subtropical coastal floodplain forest in the event site is already highly fragmented by historical clearing and grazing regimes. The proposal will not further cause an area of habitat to become fragmented or isolated from other areas of habitat.

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

No subtropical coastal floodplain forest will be removed, adversely modified or fragmented by the proposal. The long term survival of the community is likely to be enhanced by appropriate rehabilitation works and strategic plantings at the site.

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

There is no critical habitat listed for the sub-tropical coastal floodplain forest EEC in the study area.

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

No specific recovery plan is available for the sub-tropical coastal floodplain forest EEC: the action proposed is not inconsistent with the objectives of any recovery plan or threat abatement plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

6.6 Seven part test for the endangered ecological community Coastal Cypress Pine Forest of the NSW north coast bioregion.
Background information

A small area (<1ha) of Coastal Cypress Pine Forest EEC is located in the extreme western portion of the Parklands property, just north of Jones Road. Its importance and fragility were recognised early and plantings were installed to buffer this relictual fragment of the EEC from further disturbance. The site is fenced and gated. CCPF is typically a coastal sandplain community occurring in a variety of structural forms which has a restricted occurrence in NSW, and which has undergone a large reduction in geographic distribution (DECC 2008). Threats to the community include: clearing fragmentation, habitat degradation and weed invasion (DECC 2008).

(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

Not applicable—the Coastal Cypress Pine Forest is a threatened species not an endangered ecological community.

(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

Not applicable—Coastal Cypress pine Forest is a threatened species not an endangered population.

(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

The proposal largely exploits existing pastoral areas within the property and entirely avoids impacts on the CCPF community. The combined effects of fencing, weed removal, restoration works and plantings will have a significantly positive influence on the long term persistence of the local occurrence of the CCPF community.

(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

The combined effects of fencing, weed removal, restoration works and compensatory plantings will help conserve the composition of the CCPF community and thus contribute to its local persistence.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal exploits existing pastoral areas within the property and entirely avoids impacts on the CCPF community. The only habitat modification is weed removal and planting of appropriate CCPF EEC species

(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

No area of CCPF habitat is likely to become fragmented or isolated from other areas of CCPF habitat as a result of the proposed action.

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

No CCPF habitat will be removed, modified, fragmented or isolated by the proposal. The small fragment of CCPF EEC at Parklands may represent a population because this vegetation community does not appear to be present elsewhere on the site or nearby.

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

Critical habitat will not be affected by the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

6.7 Seven part test for lowland rainforest endangered ecological community

Life cycle and background information—Lowland rainforest of the NSW north coast bioregion

The final determination listing lowland rainforest in the NSW north coast bioregion includes the following key themes. Lowland rainforest is a closed canopy forest, including subtropical and related structurally complex forms of dry rainforest. Lowland rainforest occurs on a variety of substrates and elevations

Typically lowland rainforest has three major strata, namely: emergents, canopy and sub-canopy elements which produce an irregular canopy structure and appearance. Constituent trees are taxonomically diverse and a range of plant growth forms may be present. Gully forest located in the northwestern hillslope forests includes examples of the lowland rainforest endangered ecological community (EEC) with minimal weed presence. An area of Camphor Laurel dominated forest where the underpass or at grade crossing of Jones Road is proposed includes some regenerating lowland rainforest species and was precautionarily considered as a marginal example of the EEC.

Guidelines issued by the NSW Department of Environment and Climate Change (DECC) to assist in identification of other endangered ecological communities emphasise the inclusion of remnant and degraded examples of the community.

(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

Not applicable: lowland rainforest is an endangered ecological community, not a threatened species.

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

Not applicable: lowland rainforest is an endangered ecological community, not an endangered population.

(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

The proposed crossing of Jones Road will involve the removal of a small number of regenerating rainforest trees, potentially representative of the LRF EEC. If an underpass design is used the tree removal involves 32 individual native trees, mainly Pink Euodia *Melicope elleryana*, Umbrella Cheese Trees *Glochidion sumatranum* and Sweet Pittosporum *Pittosporum undulatum*, and 27 Camphor Laurels *Cinnamomum camphora*. If the 'At Grade' crossing design is used ~44 lowland rainforest trees would be removed, essentially the same species mix, but including Willow Bottlebrush *Callistemon salignus,* Blackwood *Acacia melanoxylon* and Brown Kurrajong *Commersonia bartramia* and 21 Camphor Laurels.

The local occurrence of lowland rainforest EEC extends to other forest areas of the Parklands property and beyond. Some areas to be dedicated to DECCW include lowland rainforest and areas of this community retained within the Parklands property are outside any direct impacts from the proposal. Therefore the local occurrence of the lowland rainforest EEC will not be placed at risk of extinction by the proposal.

(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

The proposal is not 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.

(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

The proposed crossing of Jones Road will involve the removal of a small number of regenerating rainforest trees, potentially representative of the LRF EEC. If an

underpass design is used the tree removal involves 32 individual native trees, mainly Pink Euodia *Melicope elleryana*, Umbrella Cheese Trees *Glochidion sumatranum* and Sweet Pittosporum *Pittosporum undulatum*, and 27 Camphor Laurels *Cinnamomum camphora*. If the 'At Grade' crossing design is used ~44 lowland rainforest trees would be removed, essentially the same species mix, but including Willow Bottlebrush *Callistemon salignus,* Blackwood *Acacia melanoxylon* and Brown Kurrajong *Commersonia bartramia* and 21 Camphor Laurels.

(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

No area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposal.

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

Habitat removal for either crossing option is not likely to be important to the long-term survival of the lowland rainforest EEC in the locality.

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

The proposal will not affect any critical habitat.

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

The proposal is not inconsistent with the objectives or actions of any recovery plan or threat abatement plan.

(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

While some native vegetation is to be removed to construct the Jones Road crossing (~41 or 53 native trees depending upon the option used), it does not fit the definition of clearing of native vegetation as provided in the scientific committee determination of this key threatening process. Namely: "*Clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss or long term modification of the structure, composition and ecological function of a stand or stands".* From the scientific committee determination to list "Clearing of native vegetation" as a key threatening process (2001).

At Parklands 7400 trees have been planted since 2007, mainly in a key 9.2ha area between forested habitats of Billinudgel Nature Reserve, and fauna underpasses beneath Tweed Valley Way. Removal of Bitou Bush and Lantana will reduce the effect of these key threatening processes.

7.0 Conclusion of seven part tests

Seven part tests conclude that no significant adverse effect is likely for threatened species and endangered ecological communities from the first year of operation of the Parklands cultural events site.

The disturbance regime proposed is novel and unprecedented, and contains multiple and unpredictable factors. Similarly, biodiversity of the Parklands site is diverse and variable and likely to exhibit variable responses to these factors.

This impact assessment relies on assumptions concerning effective implementation of mitigatory strategies. In order to avoid minimise or reduce impacts on threatened fauna, flora and endangered ecological communities of the site the following measures will be undertaken:

- Limited large event days: 8 days in year 1 of operation;
- Limited direct event footprint: 60% of a 256ha site and essentially confined to grazed pasture;
- Effective traffic control, 30km/h vehicle speed limit, signage;
- Environmental Induction prior to, and Ecological Audit following large events;
- Environmental Health and Safety Management System;
- Minimum impact lighting according to site-specific lighting principles;
- Minimise time event fences are in place;
- Establish 30m vegetated buffer to Billinudgel NR prior to any event;
- Before-during and after monitoring of targetted fauna groups;
- Ongoing staged weed removal, control of pest species;
- Continued plantings for connectivity, visual and auditory screening, and:
- Continuation of a nestbox program.

Feedback from the ecological audit and targetted fauna monitoring is intended to provide direction for the mitigation of impacts, and to influence the layout and design of events, so as to further reduce impacts on biodiversity of the site.

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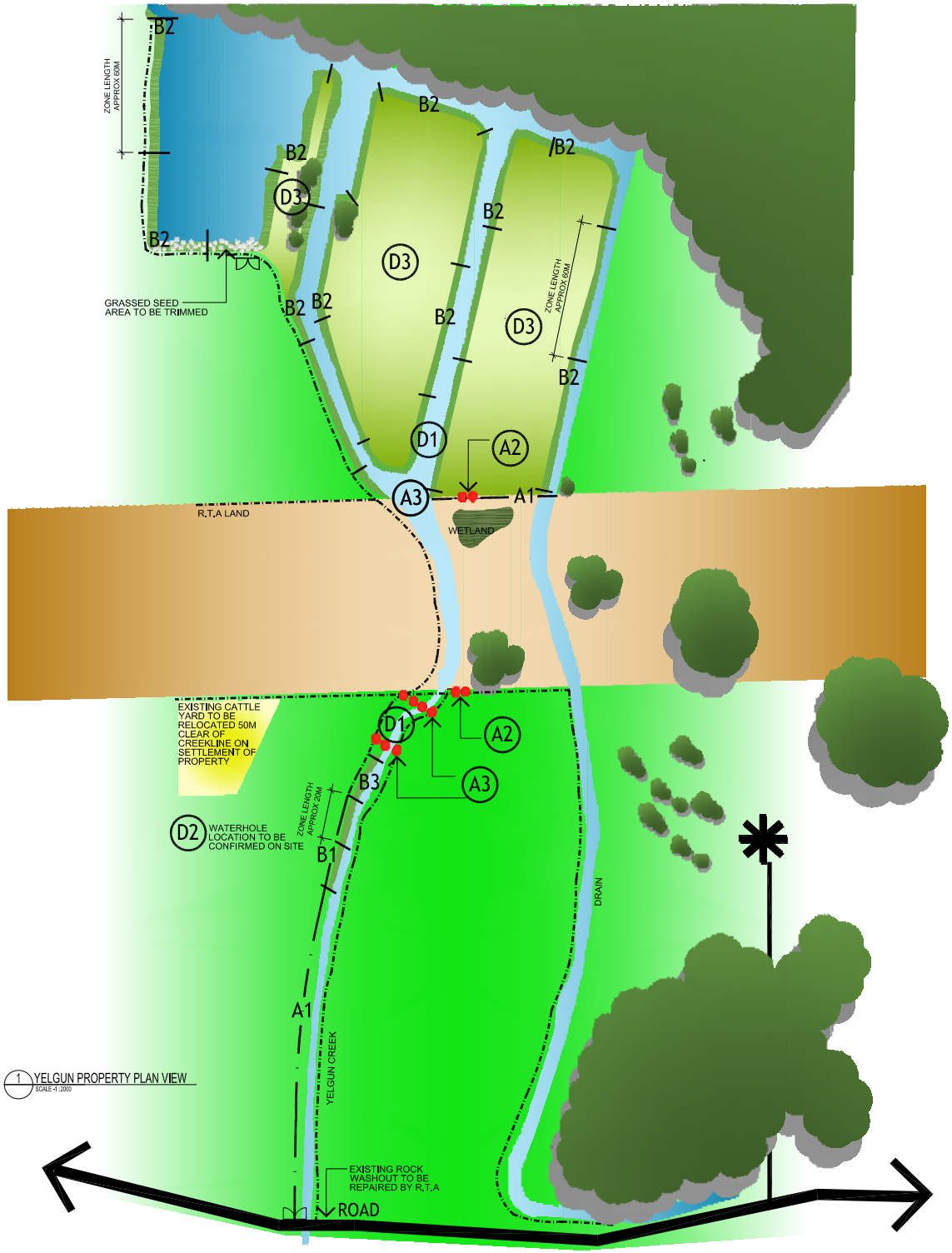

1 YELGUN PROPERTY PLAN VIEW
SCALE -1 :2000

Yelgun Property
Site Rehabilitation Schedule
Broad aims

Item No.	Description	Management Issue	Responsibility	Notes/Tasks
A	**Fencing**			Isolation will enable early regeneration of corridor vegetation and prevent damage to reveg areas from stock. Regeneration will stabilise exposed surface and prevent sedimentation entering the creek
A1	Fencing (Star Picket and Barb Wire)	Install fencing to keep stock away from watercourse	GFM	
A2	Gates	Install Galvanised steel gates	GFM	To control access to specific site areas for grazing spells
A3	Hinged fence sections	Install over flow lines to restrict cattle access but allow water flows	GFM	Ensure water flows are not impeded
B	**Vegetation Management and Rehabilitation**			
B1	Woody Weeds	Remove woody weeds such as camphor laurel saplings along watercourse	GFM	Remove potential competition from exotic species along banks of creek, prevent further weed incursion
B2	Rehabilitation Areas with grass cover	Provide reinforcement planting of macrophytes and shade tree planting as per rehabilitation plan	RC	Encourage natural regeneration and bolster with trees planting, aim to improve habitat value and provide shade and shelter along creek line
B3	Rehabilitation Areas without surface cover	Undertake minor reprofiling as required to provide suitable planting zone if batters are steep, avoid damage to existing native vegetation. Provide grass seeding and planting of macrophytes and shade tree planting as per rehabilitation plan.	GFM	Stabilise exposed surfaces to prevent sedimentation entering creek system. Encourage natural regeneration and bolster with trees planting. Aim to improve habitat value and provide shade and shelter along creek line
	Inspection	Undertake Inspection of completed works	LA, Fish, RC	
C	**Establishment**			
C1	Undertake establishment maintenance of rehabilitation areas for initial 12 weeks	Undertake ongoing site management issues as required prior to planting, ie fencing and stock water points. Provide initial watering of plants. Spot spray weed growth. Monitor grass and plant establishment	GFM	Monitor and maintain plants during establishment period and reduce competition from weed growth.
	Inspection	Undertake inspection at the end of the Establishment period	LA, GFM, Fisheries, RC	
		Any plants not established at the end of the twelve week period shall be replaced	LA, Fisheries	
C2	Undertake monitoring and maintenance over subsequent 12 week period	Spot spray weed growth. Monitor grass and plant establishment as well as natural regeneration	GFM	Monitor and maintain plants during establishment period and reduce competition from weed growth.
	Inspection	Undertake inspection at the end of maintenance period	LA, GFM, Fish, RC	
	Compliance	Fisheries to issue compliance certificate for completed works on final inspection	Fisheries	
D	**Ongoing site management**			
D1	Define creek crossing points	Provide safe and stable crossing point for vehicle and cattle access	GFM	Use existing crossing stable points where possible
D2	Provide alternative water source for stock	Provide bore and tough to water stock and take pressure of creek	GFM	Complete in conjunction with fencing creek
D3	Crash grazing	Allow for grazing of areas shown for weed control	GFM	To enable maintenance of island areas, ensuring creek crossing points are used for access

NOTES

Code	Role	Organisation	Contact	Phone
LA	Landscape Architect	SPLAT	Gerard McCormick	55 357 866
PM	Project Manager	Greenfields	Chum Vidgen	32631344
Fisheries	Conservation Officer	NSW Fisheries	Marcus Riches	0419 253 819

Yelgun Property
Plant Schedule

Code	Species	Common Name	Number	Pot Size	Stake
	TREES				
CAS cun	CASUARINA cunninghamiana	River Oak	11	75mm tube	single
GLO fer	GLOCHIDION ferdinandii	Cheese Tree	11	75mm tube	single
LOP con	LOPHOSTEMON suaveolens	Swamp Box	11	75mm tube	single
MEL qui	MELALEUCA quinquenervia	Five Vein Paperbark	11	75mm tube	single
WAT flo	WATERHOUSIA floribunda	Weeping Myrtle	11	75mm tube	single
	MACROPHYTES				
	Groundcovers/Clumping				
LOM hys	LOMANDRA hystrix	Matt Rush	40	virocell	nil
	Wetland Plants				
ISO nod	ISOLEPSIS nodosa	Knobby Club Rush	40	virocell	nil
JUN usi	JUNCUS usitatus	Common Rush	40	virocell	nil
GAH sie	GAHNIA sierberana	Sawsedge swordgrass	40	virocell	nil

notes
Plant macrophytes in clusters of 3 to 5 of the same species
Evenly distribute different species of trees over the whole area to be planted
Source plants from local Burringbar Range Nursery

Use figured dimensions in preference to scaled.

Notify the Landscape Architect before proceeding if any anomaly is found between this drawing and conditions on site.

AMENDMENT

Issue	Date	Details	Approved
A	09.08.05	CLIENT APPROVAL	GM
B	25.08.05	FISHERIES APPROVAL	GM
C	03.10.05	REVISION AS PER FISHERIES REQUEST	GM

REFERENCE

LEGEND (EXISTING)

- WATERCOURSE
- FENCELINE
- VEGETATION
- HOMESTEAD
- GATE
- D ONGOING SITE MANAGEMENT
  - D1 CROSSING POINTS

LEGEND (PROPOSED)

- A FENCING
  - A1 FENCELINE
  - A2 GATES
  - A3 HINGED FENCE
- B VEGETATION MANAGEMENT AND REHABILITATION AREA
  - B1 WOODY WEEDS
  - B2 REHABILITATION AREA WITH GRASS COVER
  - B3 REHABILITATION AREA WITHOUT SURFACE COVER
- D ONGOING SITE MANAGEMENT
  - D2 ALTERNATE WATER SOURCE
  - D3 CRASH GRAZING

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PROJECT PROJECT No. 053601
YELGUN PROPERTY

CLIENT
GREENFIELDS MOUNTAIN PTY LTD

DRAWING
REHABILITATION PLAN

DRAWN	GM/CM	CHECKED	GM
SCALE	as shown @ A1	DWG No.	053601-01
DATE	AUGUST 2005	ISSUE	C

Appendix K

Ecological Assessment

of a proposed on-site wastewater and

potable water management system

at Parklands.

Parklands-Application Number 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by Mark Fitzgerald

Ecological Consultant,

P.O. Box 237 Mullumbimby NSW 2482

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FIGURES

TABLES

1.0 Introduction

As part of the Part 3A application to operate the Parklands cultural events site at Yelgun for Billinudgel Property Trust (Billinudgel Property Pty Ltd), an ecological assessment is required for the proposed construction and operation of a potable water system and a wastewater treatment system.

While initial activities at the site are proposed to be based upon the importation of potable water and the export of wastewater for treatment offsite, it is proposed that later operation of the site relies upon internal water management, with provision of water from existing and new dams of the site being treated to a potable standard by an on-site water treatment plant. Wastewater generated from events and related activities is proposed to be treated in an on-site wastewater treatment plant, with treated effluent to be irrigated on areas of pasture and woodlot, and resultant grass harvested from pasture being for sale as hay.

1.0.1 Information relied upon

This assessment relies upon information and analyses provided in documents produced by agricultural, water and soil scientists and engineers, Gilbert and Sutherland, namely:

- DRAFT Integrated Water Cycle Assessment and Management Plan, North Byron Parklands, Tweed Valley Way and Jones Road, Wooyung , NSW. Prepared for Billinudgel Property Trust, and dated May 2010. Document reference number: GJ0926_IWCM_NZR1D[4] doc;

- Water Management Plan North Byron Parklands, Tweed Valley Way and Jones Road, Wooyung , NSW. Prepared for Billinudgel Property Trust, and dated May 2010. Document reference number: GJ0896-1_WMP_REH1F.doc, and:

- Noise and Physical Footprint Report for the North Byron Parkland Project, prepared by MidellWater (wastewater system consultants).

1.0.2 Surveys of the locations

Locations of the water management infrastructure were examined and photographed on May 26th and on June 5th 2010.

2.0 The proposal

The proposed water management systems are described in detail in the above documents. In brief, the proposal is to develop a sustainable and integrated water management system which exploits existing water harvest rights, a new dam and new technology to manage all water supply and treatment on the Parklands site.

The delivery of this system will rely *inter alia* upon the construction of a new 6ML dam; and extraction of water from the existing large dam; the construction and operation of separate reticulation systems and pumps to transport water from the dams

to a water treatment plant, and the use of pumps to transport treated water to an elevated storage tank.

Management of wastewater will also rely upon the construction of a holding or storage dam, and the construction of a wastewater treatment plant, artificial wetlands and irrigation infrastructure. The location of water infrastructure facilities is depicted in G & S drawing number GJ0926.1.7. The provision of electricity to both treatment plants is essential for their operation. Both potable water and wastewater treatment infrastructure will require adequate all-weather vehicular access.

The constructed elements of the water management system are listed in the following table.

Table 1: Constructed elements of the water management system

Element-Potable water system	**Attributes / functions**
Existing large dam	1.8ha multiple use; habitat value ~15.9ML capacity
New catchment and storage dam	6ML
Water treatment plant	15m X 10m shed
Elevated potable water storage tank	Capacity and design not specified; vehicular access to be upgraded
Reticulation: pipes, pumps	See G & S drawing GJ0926.1.7; soundproofing of pumps
Power supply	To be designed
The potable water treatment plant will need to be fenced.	To be designed
Element-Wastewater system	**Attributes / functions**
Screening Plant	20m X 30m shed gravity feed to aeration tank
Treatment plant	15m X 10m shed
Aeration Tank	25m diameter
Storage /effluent dam	40m X 50m
Wetlands	90m X 30m; 3 cells
Effluent irrigation areas	2.8ha of woodlots
Effluent irrigation areas	3.0ha of pasture
Power supply	To be designed
Reticulation: pipes, pumps	See G & S drawing GJ0926.1.7; soundproofing of pumps
The wastewater treatment plant will need to be fenced.	To be designed

A temporary resident operator is present and living in the potable water treatment plant when it is in use (bump-in, bump-out and event days).

The location of water management system infrastructure is depicted in Figures 1 & 2. Schematic diagrams of the Potable Water Treatment Plant (PWTP) and Wastewater Treatment Plant (WTP) are depicted in Figures 3 & 4 at the end of this report.

2.1 Water Cycle—Potable water

Water management is based upon episodic high demand use of the site for events and more extended use of the site at a low demand for the proposed cultural centre and conference centre. Water accumulated in the existing and new dams is pumped to the PWTP then pumped to an elevated storage tank for distribution to water supply points. All proposed buildings will be fitted with rainwater tanks and water saving fittings. G & S conclude that water supply will normally meet or exceed demand.

2.2 Water cycle–Wastewater

The proposed administration building and gatehouse building will each use a household effluent treatment plant and local irrigation. Once established the Wastewater Treatment Plant will receive wastewater from portable toilet and shower facilities through a reticulation system, store and treat wastewater to a satisfactory standard and then irrigate to selected woodlots (elevated) or pasture (low level). Irrigation will be triggered by a soil water deficit and no run-off of treated effluent is considered likely to occur. Pasture grasses in irrigated woodlots will be later harvested and baled to be sold.

3.0 Location of the water management infrastructure—wastewater

The location of the reticulation system is depicted in G & S drawing GJ0926.1.7 (see Figure 13). Location of other infrastructure is depicted in Figures 3 & 4. Apart from a 3.0ha pasture area proposed for irrigation in the south of the site; all other water infrastructure is located in the central northern section of the property.

Wastewater treatment plant, shed, tanks and buildings are proposed to be located on a grazed pasture area, surrounded by forest. The wetland cells will be located below this on the edge of a large pastoral area. Woodlot irrigation areas are proposed for grassy patches among hillslope vegetation in the far northwest of the property.

Locations of main proposed water management infrastructure elements are depicted in figures at the end of this Appendix.

4.0 Vegetation of the water management locations

Vegetation of the water management locations is described in brief below using the structural classification of Walker and Hopkins (1990). Locations affected by the proposed water management plan include, from south to north the following areas, listed in Table 2.

4.1 Vegetation of southern 3.0ha irrigation area pasture

This area is a level grazed pasture at < 10m AHD dominated by exotic species. Structurally this is a closed sod grassland (Walker and Hopkins 1990), dominant

pasture species include Carpet Grass *Axonopus sp.*, South African Pigeon Grass *Setaria sphacelata*, Broad-leaved Paspalum *Paspalum mandiocanum,* Kikuyu *Pennisetum clandestinum*, Rhodes Grass *Chloris gayana,* White Clover *Trifolium repens*, Siratro *Macroptilium atropurpureum* and Cuphea *Cuphea carthagenensis*.

Table 2: Locations affected by the proposed water management plan

Water management element	**Location / Figure**
3.0ha irrigation area-pasture	South of Jones Road / Fig. 2
New 6ML dam	Central west / Fig.1
Gravity Feed potable water tank	West / Fig. 1
Existing 15.9ML dam	Northwest / Fig. 1
Wastewater treatment plant & wetlands	Northwest / Fig. 1
Potable water treatment plant	Northwest / Fig. 1
1.86 wooded irrigation area	Northwest / Fig. 1
0.97 wooded irrigation area	North / Fig 1
Access roads	To be designed
Power supply routes	To be designed
Reticulation systems	See Figure 13

4.2 Vegetation of new 6ML dam area

The location of the proposed new 6ML dam is a gently sloping pasture area between 10-20m AHD, which is dissected by shallow riparian channels. Classified as a closed sod grassland, species of the pasture include: Carpet Grass *Axonopus sp.*, patches of Bracken *Pteridium esculentum* and Blady-grass *Imperata cylindrica*, Cuphea, Whiskey Grass *Andropogon virginicus* and occasional Fireweed *Senecio madagascariensis* and Narrow-leaved Cotton Bush *Gomphocarpus fruticosus*.

Channel species include Tall Flat Sedge *Cyperus exaltatus*, Parrot's Feather *Myriophyllum aquaticum* and a Knotweed *Persicaria strigosa*

Upper riparian areas are within remnant forest including Rose Myrtle *Archirhodomyrtus beckleri*, Flooded Gum *Eucalyptus grandis*, Brush Box *Lophostemon confertus*, Camphor Laurel *Cinnamomum camphora*, Guioa *Guioa semiglauca* and False Rosewood *Synoum glandulosum*.

Block #47 to the south is a Camphor Laurel *Cinnamomum camphora*-Pink Bloodwood *Corymbia intermedia* mid-high closed forest with occasional outlying Hoop Pin *Araucaria cunninghamii*. The endangered Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata* is present as a moderate sized tree in this patch.

4.3 Vegetation of gravity feed potable water tank area

The proposed location of the potable water tank is near the crest of a steep slope at ~70m AHD. This is close to the western property boundary and near the highest elevation of the Parklands property.
A grassy unformed road is located adjacent to the property boundary on the top of a steep slope which appears to have been used for banana cultivation. The slope has old

roading typical of banana plantation layouts and is covered with metasediment derived rocks. Closed grassland includes Whiskey Grass, Carpet Grass, Broad-leaved Paspalum, Molasses Grass *Melinus minutifolius*¸ Crofton Weed *Ageratum adenophora* and Mistflower *A. riparia.* Patches of Crofton Weed and Lantana *Lantana camara* form the groundlayer around regenerating forest species here including: Brush Box, and Brush Ironbark Wattle *Acacia disparrima*.

Forest to the south (block #38) is a Forest Red Gum *Eucalyptus tereticornis*-Small-fruited Grey Gum *E. propinqua*-Northern Grey Ironbark *E. siderophloia-Brush Box Lophostemon confertus* mid-high open forest and woodland. A dense low thicket of Brush Ironbark Wattle and Macaranga *Macaranga tanarius* is present along the western property boundary.

4.4 Vegetation of existing 15.9ML dam

The existing large dam is located just below the 10m AHD contour between two low ridges which are oriented northwest-southeast. The dam supports aquatic vegetation with Cape Waterlily *Nymphaea capensis,* Water Snowflake *Nymphoides indica*, Grey Sedge *Lepironia articulata* and Tall Flat Sedge. Fringing vegetation is affected by cattle grazing and trampling: cattle occasionally enter the dam to feed on aquatic vegetation.

Block #35 borders the dam to the north and is a Brush Box *Lophostemon confertus*-Small-fruited Grey Gum *Eucalyptus propinqua*-Turpentine *Syncarpia glomulifera* tall closed forest. A cattle pad extends along the northern dam margin and into this forest patch. Groundlayer vegetation includes Harsh Ground Fern *Hypolepis muelleri* and patches of leaf litter are present.

4.5 Vegetation of wastewater treatment plant & wetlands

This infrastructure is proposed to be located in a gently sloping area of pasture surrounded by forest to the north and west. Elevation varies across this area from ~10-15m AHD.

Surrounding forest blocks include block #1: Brush Box *Lophostemon confertus*-Blackbutt *Eucalyptus pilularis*-Broad-leaved White Mahogany *Eucalyptus carnea* very tall mid-dense to closed forest. Block #3 is a Northern Ironbark *Eucalyptus siderophloia*-Blackbutt *E. pilularis*-Turpentine *Syncarpia glomulifera* very tall mid-dense to closed forest, with Willow Bottlebrush *Callistemon salignus* and Broad-leaved Paperbark *Melaleuca quinquenervia* on the lower margins. Block #34 is a Blackbutt *Eucalyptus pilularis*-Pink Bloodwood *Corymbia intermedia*-Northern Grey Ironbark *E. siderophloia*- Broad-leaved White Mahogany *E. carnea* tall to very tall mid-dense to sparse open forest.

Pasture species are Carpet Grass, with Cuphea with occasional patches of Bracken and Blady-grass. An isolated Small-fruited Fig *Ficus obliqua* is present in the middle of the pasture.

4.6 Vegetation of potable water treatment plant

The potable water treatment plant is to be located within or on the site of an existing farm shed, slightly above the wastewater infrastructure area at ~15-20m AHD. The immediate area is trampled by cattle which at times enter the shed to shelter.

The shed is closely surrounded by forest and a main access track. Immediately to the east, forest block #3 is a Northern Ironbark *Eucalyptus siderophloia*-Blackbutt *E. pilularis*-Turpentine *Syncarpia glomulifera* very tall mid-dense to closed forest, with Willow Bottlebrush *Callistemon salignus* and Broad-leaved Paperbark *Melaleuca quinquenervia* on the lower margins.

Adjacent block #1 is a Brush Box *Lophostemon confertus*-Blackbutt *Eucalyptus pilularis*-Broad-leaved White mahogany *Eucalyptus carnea* very tall mid-dense to closed forest.

Pasture species are Carpet Grass, with Cuphea with occasional patches of Bracken and Blady-grass.

4.7 Vegetation of 1.86ha wooded irrigation area

Located in the far northwestern corner of the Parklands property this area is currently gently sloping grazed pasture with two isolated forest blocks (#32 & #33)

Block# 32 is a Broad-leaved White mahogany *Eucalyptus carnea*-Brush Box *Lophostemon confertus* very tall closed forest. Block # 33 is a Flooded Gum *Eucalyptus grandis*-Camphor Laurel *Cinnamomum camphora* very tall closed forest.

Pasture species include closely grazed Broad-leaved Paspalum, with Carpet Grass, Whiskey Grass, and patches of Blady-grass with Bracken.

The threatened Rough-shelled Bush-nut *Macadamia tetraphylla* is present as three small-medium sized trees and one seedling around an old shed. These trees are likely to have been planted.

4.8 Vegetation of 0.97ha wooded irrigation area

This area is pasture on sloping land between two large forest blocks. Forest block #31 to the north extends on to adjacent property and is a large Brush Box *Lophostemon confertus*-Small-fruited Grey Gum *Eucalyptus propinqua*-Tallowwood *E. microcorys* very tall closed forest patch.

To the south a large patch of forest includes forest blocks # 1, 2 & 34. Block # 1 is a Bruch Box *Lophostemon confertus*-Blackbutt *Eucalyptus pilularis*-Broad-leaved White Mahogany *Eucalyptus carnea* very tall mid-dense to closed forest
Block #2 is a Northern Grey Ironbark *Eucalyptus siderophloia*- Blackbutt *E. pilularis*-Broad-leaved White Mahogany *E. carnea*-Pink Bloodwood *Corymbia intermedia* very tall mid-dense forest. Block #34 is a Blackbutt *Eucalyptus pilularis*- Pink Bloodwood *Corymbia intermedia*- Northern Grey Ironbark *E. siderophloia*- Broad-leaved White Mahogany *E. carnea* tall to very tall mid-dense to sparse open forest.

Forest block #51 adjoins to the west, this is a Blackbutt *Eucalyptus pilularis*- Broad-leaved White Mahogany *E.carnea*- Pink Bloodwood *C intermedia* mid-high –tall open-closed forest and woodland.

Pasture species include: Carpet Grass, Broad-leaved Paspalum Whiskey Grass, with scattered eucalypt seedlings and saplings, Lantana and patches of Blady-grass with Bracken. Isolated trees within the pasture include Tallowwood, Bruch Box, Northern Grey Ironbark and a Water Gum *Syzygium francisi*. A drainage line is present near the northern property boundary.

4.9 Vegetation of the proposed reticulation systems

Conceptual planning for the reticulation systems is depicted in Figure 13. All reticulation for the wastewater and potable water infrastructure is designed to be located in pasture areas and no tree removal is proposed for this element of the water system infrastructure. Routes indicated for reticulation will be subject to ground-truthing to avoid impacts on native vegetation.

5.0 Habitat values of the water management locations

Habitat values at the various water management locations are described below. Habitat values normally vary over time, according to seasonal, climatic and other factors (*e.g.* variable pressure from cattle grazing; external resource fluctuations, changes in groundwater levels). Descriptions are based on data from survey activities at Parklands over the previous four years and are unavoidably incomplete, as additional fauna and flora species will be discovered across the Parklands property over time. Ecosystem dynamics also change according to maturation, senescence and succession of vegetation, stochastic events, and to faunal demographic processes, *e.g.* the seasonal irruption and collapse of small mammal populations, locusts, termite alates, grasshoppers, and the explosion in numbers of Cane Toad *Bufo (Rhinella) marinus* metamorphs (pers. obs.).

Changes in the condition of pasture occur cyclically as pasture growth overtakes grazing pressure and vice versa. The invertebrate resource (grasshoppers, crickets and moths) of cattle pasture which provides a significant resource for fauna also varies seasonally.

Habitat values of the various water management infrastructure locations also need to be considered in terms of their integration with adjacent and more distant areas of forest and pasture on the Parklands site and beyond. Movement of fauna throughout and between these areas is essential to the maintenance of local habitat connectivity.

5.1 Habitat values of southern 3.0ha irrigation area pasture

The southern pastoral irrigation area has the lowest habitat values of areas proposed to be used for water management infrastructure. It is a level and closely grazed area of pasture adjacent to the Tweed Valley Way and on the western edge of a large area of similar pasture. A large man-made drain is present and the Yelgun creek to the south has been highly modified. Fauna of the location include Cane Toads *Bufo (Rhinella) marinus,* Masked Plovers *Vanellus miles*, Common Mynahs *Acridotheres tristis*,

Australasian Pipit, *Anthus novaeseelandiae,* Magpies *Cracticus tibicen*, Pied Butcherbirds *Cracticus nigrogularis* Torresian Crow *Corvus orru* and other species characteristic of pastoral habitats.

5.2 Habitat values of new 6ML dam area

Habitats of the proposed 6ML dam include grazed pasture, stands of Blady-grass *Imperata cylindrica* and Bracken *Pteridium esculentum*, and the aquatic and semi-aquatic vegetation of natural drainage channels. These channels are natural features of the riparian system flowing southward from the forested catchment above. Vegetation is dominated by the Tall Flat Sedge *Cyperus exaltatus* forming closed stands to 1.5m in height over most of these channels. These stands comprise potential habitat for native frog and bird species likely to include the Brown-striped Marsh Frog *Limnodynastes peroni* and Eastern Froglet *Crinia signifera*, Fairy–wrens *Malurus spp.*, Red-browed Finches, Tawny Grassbird *Megalurus timoriensis,* Purple Swamphens and potentially the threatened Pale-vented Bush-hen *Amaurornis olivaceus.*

Pasture areas, including the taller Blady-grass/Bracken patches also likely support native fauna such as Garden Sun-skinks *Lampropholis delicata*, Bearded Dragons *Pogona barbata*, Eastern Brown Snakes *Pseudonaja textilis* and the exotic House Mouse *Mus musculus*. Brown Quail *Coturnix ypsilophora*, Pheasant Coucals *Centropus phasianinus* and Butcherbirds *Cracticus spp.* are also likely to forage in these areas, as is the Black-shouldered Kite *Elanus axillaris* and the threatened Grass Owl *Tyto capensis*.

5.3 Habitat values of gravity feed potable water tank area

The gravity feed potable water tank area has limited habitat value for fauna or flora, but is surrounded by native forest of much higher ecological importance. Shrubby regenerating forest supports a bird fauna adapted to this habitat, including Eastern Whipbird *Psophodes olivaceus*, Pheasant Coucal, Red-browed Finch *Neochmia temporalis*, Fairy-wrens and Golden Whistlers *Pachycephala pectoralis inter alia.*

The area is frequented by cattle.

5.4 Habitat values of existing 15.9ML dam

The existing large dam has been the subject of both opportunistic and timed bird surveys from 2007. The dam is not visible on a 1947 aerial photo of the Parklands property and was therefore constructed since that time. It has an area of ~1.8ha and supports a suite of aquatic and semi-aquatic fauna. The pest species Carp *Cyprinio carpio* is present, as large ~50cm fish are regularly seen in shallows of the dam. Saw-shelled Turtles *Elseya latisternum* are present, and the Eastern Long-necked Turtle *Chelodina longicollis* which has been observed in drains of the site is also likely to be in the large dam. Water Dragons *Physignathus leseuerii* are present and the margins of the dam support Masked Plovers *Vanellus miles*, White-faced Heron *Ardea novaehollandiae* and White-necked Herons *A. pacifica* and browsing and resting ducks.

Timed surveys show a consistent pattern of waterbird assemblages at the dam. On average this includes 1-3 individuals of larger species (Little Black *Phalacrocorax sulcirostris* or Little Pied Cormorant *P. melanoleuca*, Great Egret *Ardea alba* or Darter *Anhinga melanogaster*), from 5-45 individual ducks (Pacific Black Duck *Anas superciliosa*, Maned Duck *Chenonetta jubata*, Hardhead *Aytha australis* and Wandering Whistle Duck *Denrocygne arcuata*) and 3-6 residents each of Purple Swamphens *Porphyrio porphyrio*, Dusky Moorhens *Gallinula tenebrosa* and Australasian Grebes *Tachybaptus novaehollandiae*.

Other birds occasionally recorded include Azure Kingfisher *Ceyx azurea*, and Nankeen Night Heron *Nycticocorax caledonicus*. The White-bellied Sea-eagle *Haliaeetus leucogaster* is regularly seen over the property and may take fish from the dam. The threatened Comb-crested Jacana *Irediparra gallinacea* is also episodically present, and fringing vegetation of the dam is at times suitable for the threatened Pale-vented Bush-hen.

No recent records are currently available, but it is likely that the dam is used by various microchiropteran bats, potentially including the threatened Large-footed Myotis or Fishing Bat *Myotis macropus*.

5.5 Habitat values of wastewater treatment plant & wetlands area

This sheltered grassy slope is regularly grazed by cattle, and thus habitat values are higher in the surrounding forest and the forest-pasture ecotone. Pasture areas are grazed by local Swamp Wallabies *Wallabia* bicolor. The threatened Masked Owl *Tyto novaehollandiae* has been recorded in this area, and the threatened Grey-headed Flying-fox recorded foraging on blossom crops in the surrounding forest. The White-striped Freetail Bat *Austronomus australis* has been observed foraging over this area. Because rats *Rattus sp.* have also been observed active at night in the forest-pasture ecotone, the area may be used for foraging by the threatened Grass Owl *Tyto capensis*, which has been recorded from pasture areas elsewhere on the site.

Surrounding forest and isolated trees and stands of trees to the south support a suite of forest birds including insectivores and nectivores. Pasture areas also support a characteristic bird fauna, dominated by Masked Plovers. See Appendix B for a list of the vertebrate fauna recorded at Parklands since 2006.

5.6 Habitat values of potable water treatment plant area

The potable water treatment plant area is close to the wastewater treatment plant & wetlands area and its habitat values are essentially similar.

5.7 Habitat values of 1.86ha wooded irrigation area

Pasture areas are likely to be grazed by local Swamp Wallabies *Wallabia* bicolor. The upper woodlot area has not received much survey effort, being most distant from proposed event activities, and buffered by surrounding forest from visual or auditory disturbance regimes associated with the overall parklands proposal. Habitat present is suitable for the threatened Masked Owl and for numerous microchiropteran bat

species, potentially including threatened species. Surrounding forest is likely to support a suite of forest birds, including insectivores and nectivores.

The threatened Rough-shelled Bush-nut *Macadamia tetraphylla* is present as three small-medium sized trees and one seedling around an old shed.

5.8 Habitat values of 0.97ha wooded irrigation area

Pasture areas are likely to be grazed by local Swamp Wallabies *Wallabia* bicolor. This proposed woodlot area has not received much survey effort, being a pasture dominated area most distant from proposed event activities, and buffered by surrounding forest from visual or auditory disturbance regimes associated with the overall Parklands proposal. Habitat present is suitable for the threatened Masked Owl and for numerous microchiropteran bat species, potentially including threatened species. Surrounding forest is likely to support a suite of forest birds, including insectivores and nectivores as well as terrestrial and arboreal mammals.

5.9 Habitat values of the proposed reticulation system areas

Conceptual planning for the proposed reticulation systems indicates their location in grazed pasture. Initially mains can be located above ground, where this can be done securely, and later buried in trenches. Ground-truthing will be necessary to 'fine tune' pipeline locations, protect local habitat attributes and to ensure minimal impacts.

6.0 Threatened species and endangered ecological communities of the water management locations

A threatened Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata* is located within a remnant forest fragment to the southeast of the proposed new 6ML dam location.

The rare plant Pinkheart *Medicosma cunninghamii* is located within a forest block to the south-west. Wet sclerophyll and rainforest to the west support additional threatened flora species: Davidson's Plum *Davidsonia jerseyana*, Coolamon or Durobby *Syzygium moorei,* White Laceflower *Archidendron hendersoni* and Green-leaved Rose Walnut. These latter plants are well outside the footprint of the proposed water management infrastructure construction or operation phases.

The threatened Rough-shelled Bush-nut *Macadamia tetraphylla* is present as three small-medium sized trees and one seedling around an old shed in the northwestern 1.86ha woodlot irrigation area.

Potential threatened fauna species occurrences at the various water management locations, as noted in the above habitat descriptions, include the following fauna species listed in Table 3 below. No assessment is currently possible for reticulation system locations.

Table 3: Threatened species associated with the various water management locations

Location	Threatened species
southern 3.0ha irrigation area pasture	none
new 6ML dam area	Green-leaved Rose Walnut, Pale-vented Bush-hen, Grass Owl
gravity feed potable water tank area	none
existing 15.9ML dam	Comb-crested Jacana, Pale-vented Bush-hen, Large-footed Myotis or Fishing Bat
wastewater treatment plant & wetlands	Masked Owl Grey-headed Flying-fox Grass Owl
potable water treatment plant	Masked Owl Grey-headed Flying-fox
1.86ha wooded irrigation area	Grey-headed Flying-fox Rough-shelled Bush-nut
0.97ha wooded irrigation area	Grey-headed Flying-fox
Reticulation systems	Masked Owl Grey-headed Flying-fox Grass Owl

7.0 Impacts—construction

No tree removal is currently proposed for the construction of the water management infrastructure. It is assumed that the reticulation systems can be installed without tree removal by locating this element in pasture and/or on existing access tracks. Provision of power is also assumed to be possible without tree removal.

Excavation of a new 6ML dam is a significant earthmoving process which will in the short term create disturbance for fauna, and interrupt drainage in that area and downstream from the site until the dam begins to overflow. It is assumed that Acid Sulphate Soils are not present or that disturbance of ASS is adequately planned for. Based on a similar dam depth to the existing dam (15.9ML in a 1.8ha dam), this new 6ML dam excavation will remove up to ~0.5ha of pasture and channel vegetation, to accommodate the dam, dam wall and batters.

Excavation will also be required for the wetland system (90m X 30m containing three 30m X 30m cells. Additional minor excavation may be required to prepare areas for the wastewater infrastructure construction; gravity feed tank and provision of reticulation systems. Earthworks may be required to upgrade access tracks so that heavy vehicles and construction materials can be transported on to and within the site.

Construction noise, soil disturbance, vehicle movements and human presence will all contribute to a disturbance regime for fauna close to the within the water management infrastructure areas. This will presumably be diurnal in nature and persist for the duration of the construction phase.

Buildings, tanks and treatment areas will presumably need to be effectively fenced to exclude unauthorised persons.

Establishment and cultivation of rye grass pasture in the southern 3ha irrigation area and of timber plantations in the two northern woodlot irrigation areas will require site preparation, installation of irrigation delivery systems and ongoing weed removal.

7.1 Impacts—operational

Operational phase impacts will involve storage and pumping of wastewater from toilet and shower block locations to the wastewater treatment plant and pumping of liquids between the various treatment components areas. Potable water supply processes will also involve pumping 1ML/day from the existing and new dams to the water treatment plant and to the elevated gravity feed tank.

Movement of personnel and vehicles and noise will create a disturbance regime for local fauna. Irrigation of treated effluent will rely also on pumping which will produce unknown noise levels.

Table 4: Impacts—Construction phase

Location	Construction phase impacts
southern 3.0ha irrigation area pasture	Installation of irrigation pipes and delivery systems; establishment and cultivation of rye grass pasture; weed removal; installation of reticulation systems.
new 6ML dam area	Excavation, noise, soil disturbance; interruption to local drainage patterns
gravity feed potable water tank area	Earthworks to prepare site, construction of tanks and upgrade of access; installation of reticulation systems.
existing 15.9ML dam	Installation of reticulation systems
wastewater treatment plant & wetlands	Earthworks to prepare site, construction of wetlands, building, filters, tanks and upgrade of access; installation of pumps and reticulation systems.
potable water treatment plant	Construction of water treatment plant installation of pumps and reticulation systems.
1.86ha wooded irrigation area	Installation of irrigation pipes and delivery systems; establishment and cultivation of plantation timber species; weed removal; installation of reticulation systems.
0.97ha wooded irrigation area	Installation of irrigation pipes and delivery systems; establishment and cultivation of plantation timber species; weed removal; installation of reticulation systems.

Table 5: Impacts—Operation phase

	Impacts
southern 3.0ha irrigation area pasture	Irrigation, mowing , maintenance activities
new 6ML dam area	Availability of new aquatic habitat; opportunities for cane toad breeding
gravity feed potable water tank area	Occasional maintenance visits
existing 15.9ML dam	Changes in water level
wastewater treatment plant & wetlands	Noise, human presence, fencing, new aquatic habitats opportunities for cane toad breeding
potable water treatment plant	Noise, human presence, fencing
1.86ha wooded irrigation area	Irrigation; tree cultivation, weed control
0.97ha wooded irrigation area	Irrigation; tree cultivation, weed control

Table 6: Mitigation of Impacts

Location	Impacts	Mitigation
southern 3.0ha irrigation area pasture	Irrigation, mowing, baling, maintenance activities	Activities are episodic; irrigation only when there is a soil water deficit
new 6ML dam area	Availability of new aquatic habitat; opportunities for cane toad breeding	Erect fence and plant dense fringing vegetation to exclude Cane Toads. Rehabilitate vegetation in disturbed areas.
gravity feed potable water tank area	Occasional maintenance visits	None required: activities are episodic, low intensity
existing 15.9ML dam	Changes in water level	Withdraw water as a staged process to avoid major changes in water level; Activities are episodic;
wastewater treatment plant & wetlands	Noise, human presence, fencing, new aquatic habitats opportunities for cane toad breeding	Install low noise emission pumps, no barbed wire in fencing, episodic periods of operation. Erect fence and plant dense fringing vegetation to exclude cane toads. Rehabilitate vegetation in disturbed areas.
potable water treatment plant	Noise, human presence, fencing	Install low noise emission pumps, no barbed wire in fencing, episodic periods of operation
1.86ha wooded irrigation area	Irrigation; tree cultivation, weed control	Activities are episodic; irrigation only when there is a soil water deficit; Plant local native tree species to buffer Rough-shelled

		Bush-nuts from effects of irrigation.
0.97ha wooded irrigation area	Irrigation; tree cultivation, weed control	Activities are episodic; irrigation only when there is a soil water deficit; Plant local native tree species

8.0 Assessment of impacts for threatened species

Threatened species known or considered likely to occur at the locations proposed for installation of wastewater management infrastructure are listed above in Table 3. Assessment of the likely significance of impacts for these species follows. No endangered ecological communities are likely to experience adverse impacts from any aspect of the water management proposal. Threatened flora species in the western gully rainforest are also not likely to experience any adverse impacts form the proposal and are considered no further.

8.1 Seven Part Tests

"Under the *Threatened Species Conservation Amendment Act 2002* , the factors to be considered when determining whether an action development or activity is likely to significantly affect threatened species, populations or communities or their habitats (previously known as the 8-part test) have been revised (Threatened Species Assessment Guidelines, August 2005)." The revised factors are listed below:

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

(e) whether the action proposed is likely to have an adverse effect on critical habitat (whether directly or indirectly)
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan
(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

8.2 Seven Part Test for the Rough-shelled Bush-nut *Macadamia tetraphylla*
Life cycle and background information—Rough-shelled Bush Nut

The Rough-shelled Bush-nut is a coastal subtropical rainforest tree confined in distribution to the far north coast of NSW and to southern Queensland. This species is listed as vulnerable in NSW under the *Threatened Species Conservation Act* 1995 and federally under the EPBC Act. Hybrids of this species with *Macadamia integrifolia* form the basis for the commercial production of Macadamia nuts (NPWS 2002).

Three Rough-shelled Bush-nut trees and a seedling are located in the elevated 1.86ha northwestern woodlot irrigation area. Threats listed for the species include clearing and fragmentation of habitats, low population size, grazing, trampling, inappropriate fire regimes, weeds and loss of local genetic integrity by hybridisation with commercial varieties (NPWS 2002).

(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

The three Rough-shelled Bush-nut trees and seedling are located on the elevated southern margin of this proposed irrigation area, adjacent to an old shed and farm track. These trees will need to be excluded from and buffered from the proposed treated effluent irrigation regime.

The association with the old shed and lack of other plants of the species elsewhere on the Parklands property suggest that these may be planted specimens. Regardless of their origins these plants will be conserved. Camphor Laurel in the immediate vicinity will be removed in stages and a buffer planting of local native plants will be established to protect this species. The Rough-shelled Bush-nuts will be barrier fenced before any construction or irrigation activity take s place in this area.

Provided that they are properly barrier fenced and protected during the construction phase, and weeds are controlled within a buffer planting, the Rough-shelled Bush-nuts will survive the proposal unharmed.

(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

Not applicable: Rough-shelled Bush-nut is a threatened species, not an endangered population.

(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

Not applicable: Rough-shelled Bush-nut is a threatened species, not an endangered ecological community.

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

Not applicable: Rough-shelled Bush-nut is a threatened species, not an endangered ecological community.
(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,

The existing pasture area will be gradually transformed by plantings of native forest trees for a timber plantation woodlot. The irrigation regime and tree growth will change the site to a more sheltered forest environment which is favourable for the survival and persistence of the Rough-shelled Bush-nuts. The Bush-nut trees should be buffered from changes to soil fertility or soil moisture regimes from irrigation by a surrounding planting for this purpose.

(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

No area of habitat for the Rough-shelled Bush-nut is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

Habitat affected by the proposal is unlikely to be important for the long term survival of the Rough-shelled Bush-nut in the locality.

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

The proposal will not affect any critical habitat.

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

The proposal is not inconsistent with the objectives or actions of the Southern Macadamia Recovery Plan (Costello *et al* 2009) or any threat abatement plan.

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

8.3 Seven Part Test for the Green-leaved Rose Walnut *Endiandra muelleri ssp.bracteata*
Life cycle and background information—Green-leaved Rose Walnut

The Green-leaved Rose Walnut is a subtropical rainforest tree from lower elevations (BSC 1999), which is poorly known. It is listed as Endangered under the TSC Act. Similar in some respects to the Rusty Rose Walnut *E. hayesii*, plants of both species flower infrequently. Floral and fruiting characteristics are fundamental to distinguishing these taxa, and determination of identity on the basis of leaf and stem morphology, is considered to be a much less reliable means of establishing the species identity (NPWS 2002). A combined recovery plan for this species and the Green-leaved Rose Walnut *Endiandra muelleri ssp. bracteata* has been prepared (DEC 2004).

Two mature trees of this species are known from the site and additional seedlings and saplings are likely to occur. One tree is located in a patch of forest in the vicinity of the proposed new 6ML dam. This tree will be flagged and barrier fenced before any construction for the proposed dam takes place. The other mature tree is located in gully rainforest sufficiently distant from the proposed new dam that it will experience no adverse impact. Threats to the species are poorly known but are assumed to include land clearing, habitat modification and low population sizes (BSC 1999).

(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

Provided that the Green-leaved Rose Walnut in the vicinity of the proposed new dam is properly barrier fenced and protected during the construction phase, it will survive the proposal unharmed. It is recommended that this small forest patch be buffered by additional plantings.

(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

Not applicable: Green-leaved Rose Walnut is a threatened species, not an endangered population.

(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

Not applicable: Green-leaved Rose Walnut is a threatened species, not an endangered ecological community.

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

Not applicable: Green-leaved Rose Walnut is a threatened species, not an endangered ecological community.

(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,

A dam and dam wall to be constructed will result in the removal of pasture and channel vegetation from ~0.5ha at most. The forest patch containing the Green-leaved Rose Walnut is outside the disturbance area for this infrastructure. The Green-leaved Rose Walnut will likely be unaffected by the proposal provided that it is protected by barrier fencing.

(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,

No area of habitat for the Green-leaved Rose Walnut is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

Habitat affected by the proposal is unlikely to be important for the long term survival of the Green-leaved Rose Walnut in the locality.

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

The proposal will not affect any critical habitat.

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

The proposal is not inconsistent with the objectives or actions of any recovery plan or threat abatement plan.

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

8.4 Seven Part Test for the Pale-vented Bush-hen *Amaurornis olivaceus*
Life-cycle and background information

The Pale-vented Bush-hen is a shy species of tall dense groundlayer vegetation in riparian or swampy habitats. Bush-hens nest in tall grasses, reeds or rushes (Beruldsen 1980): a nest at Mullumbimby Creek was located close to a permanent creek suspended in tall South African Pigeon Grass *Setaria sphacelata* (pers. obs.). Bush-hens are mainly active at night and are seldom seen, but are readily detected by their distinctive calls. The species has not yet been recorded from Parklands.

Bush-hens are listed as Vulnerable under the TSC Act and may occur at times in swamp sclerophyll forest and around the large dam. Taller vegetation in the channels at the proposed new dam location may also be suitable habitat for this species. Threats to the species include degradation, pollution and loss of habitat and predation by feral cats and foxes (NPWS 2002).

(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

The Pale-vented Bush-hen is considered a potential occurrence at the large dam or in channel vegetation at the proposed new dam site. The main impacts of the proposal would be removal of channel vegetation habitat at the site of the proposed new dam. This comprises a small area of marginal habitat, and it is considered unlikely that the proposal would 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.

(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

Not applicable-the Pale-vented Bush-hen is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Pale-vented Bush-hen is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Modification of habitat involves the loss of a small area of wet channel vegetation dominated by Tall Flat Sedge *Cyperus exaltatus*. This comprises ~<0.01ha of marginal habitat. Following completion of the dam and wetlands constructed for the wastewater treatment plant, new areas of fringing semi-aquatic habitat will over time become available for the Pale-vented Bush-hen.

(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

No area of habitat for the Pale-vented Bush-hen is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Pale-vented Bush-hen at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

8.5 Seven Part Test for the Comb-crested Jacana *Irediparra gallinacea*
Life-cycle and background information

The Comb-crested Jacana or Lily-trotter is a bird of open waterbodies which occurs where surface vegetation is present. Jacanas forage, shelter and nest among floating

aquatic vegetation. This species is listed as Vulnerable under the TSC Act and has been recorded on several occasions from the large northern dam. Threats to the species are listed as drainage of waterbodies, removal of surface vegetation, altered water quality, pollution and weeds (NPWS 2002).

The Comb-crested Jacana has been recorded sporadically from the large northern dam in September 2006, August 2007 and again in February, May and June 2010, and it is possible that the species could nest at this site. Breeding in the eastern distribution of the species range is reported to occur from September to January (Lindsey 1992; McKean 2007).

(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

Extraction of water from the existing large dam is proposed to contribute to potable water supplies at the site. A maximum threshold of extraction (environmental reserve) has been quantified as ~ two thirds of the volume of storage (G&S Integrated Water Cycle Assessment and Management) to ensure that adverse effects on fauna of the large dam are avoided. Provided extraction rates are gradual and the environmental reserve is not exceeded, changes in the level of water in the dam should not create adverse effects for the species. Dam levels normally fluctuate according to rainfall, evaporation and dry climatic conditions. The proposal is considered unlikely to place a viable local population of this species at risk of extinction.

(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

Not applicable-the Comb-crested Jacana is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Comb-crested Jacana is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Extraction of water may result in a lowering of the dam surface level. Extraction quantities are dictated by an environmental reserve of approximately two thirds of stored volume.

(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

No area of habitat for the Comb-crested Jacana is likely to become fragmented, or isolated from other areas of habitat as a result of the proposed action. Construction of a new dam and wetlands may increase habitat available for this species.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality, since it appears to be irregularly used. Screen plantings and staged removal of cattle may ultimately improve the habitat quality of the large dam for this species.

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

There is no critical habitat for the Comb-crested Jacana at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

8.6 Seven Part Test for the Grass Owl *Tyto capensis*
Life-cycle and background information

The Grass Owl is a nocturnal predator of small mammals, insects and birds which inhabits tall rank vegetation in a variety of coastal and inland habitats. It roosts and nests on the ground by day and hunts from early evening by flying low over grassland and heathland sites and diving feet first to the ground in pursuit of prey. Grass Owls feed on a range of small mammals (Calaby 2007), birds and invertebrates (Fitzgerald and Thorstensen 1994). The species is listed as Vulnerable in NSW under the TSC Act and has been recorded at Parklands from call playback in August 2007 adjacent to central swamp sclerophyll forest blocks in the centre of the event area.

Threats listed for this species include: loss of habitat by grazing, agriculture and development, disturbance and habitats degradation by stock, use of rodenticides and inappropriate fire regimes (NPWS 20002).

(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

Areas of pasture that will be removed or modified by the construction of water management infrastructure are all potentially part of Grass Owl foraging habitat at the site. However over 150ha of grassland/pasture habitat is present within Parklands, and extensive landscapes of sugar cane in the broader locality also comprise potential forage and roost habitat for this species.

The proposal is not considered 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.

(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

Not applicable-the Grass Owl is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Grass Owl is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Irrigated pasture (3ha) in the south of the property will potentially remain suitable as forage habitat. Considering the footprint of the proposal in grassland is likely to comprise~1.5ha for the wastewater treatment plant, 0.5ha for the new 6ML dam, and 2.83ha for woodlot plantings, a total of < 5ha of grassland habitat will be modified by the proposal. This is ~3% of grassland habitat available on the Parklands property.

(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

No habitat for the Grass Owl is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The habitat which will be modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Grass Owl at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

8.7 Seven Part Test for the Masked Owl *Tyto novaehollandiae*
Life-cycle and background information

The Masked Owl is a nocturnal predator of a variety of vertebrate prey, including rats (NPWS 2002) and rabbits (Lindsey 1992). It roosts in a large tree hollow and occurs in a variety of forest and woodland types, but also forages on the edge of these communities (Kavanagh and Murray 1996). Home range size for a pair is reported to be from 500-1000ha (NPWS 2002).

Forests of Parklands contain suitable habitat for this species. Rats are seasonally abundant in parts of the site, Northern and Long-nosed Bandicoots are present at lower abundances, so a prey resource for Masked Owls is usually present.

Targetted call playback for Masked Owls produced a clear response and later series of responses from a probable Masked Owl on June 12th 2007 and a single response on July 3rd, in the north of the site and outside the direct event footprint. Subsequent call playback and survey effort in February 2009 did not result in detection of the species. There is a 1993 record of the Masked Owl from Jones Rd (BSC database).

The Masked Owl is listed as Vulnerable in NSW under the TSC Act. Threats to the species are listed as: loss of hollow-bearing trees, clearing and degradation of habitat, roadkill and reduced prey populations due to pesticide (NPWS 2002).

(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

The proposal involves the construction and operation of wastewater and potable water plants and associated infrastructure in an area known to be used by the Masked Owl on occasion. Some elements of the constructed water management infrastructure will remain available as potential forage habitat especially when not in use. Because the Masked Owl has a large home range, and much suitable habitat will remain away from the area modified by the proposal, the action proposed is considered unlikely to cause a viable local population of the species to be placed at risk of extinction.

(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

Not applicable-the Masked Owl is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Masked Owl is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Approximately 5ha of grassland habitats in a forest matrix will be affected by the proposal, this includes potential foraging habitat for the Masked Owl.

(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

No area of habitat for the Masked Owl is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The~5ha area of habitat which will be modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Masked Owl at the site of the proposal.
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan has been prepared for the 3 large forest owl species, including the Masked Owl (DEC 2006). The action proposed is not inconsistent with the objectives or actions of this recovery plan.

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

8.8 Seven Part Test for the Grey-headed Flying-fox *Pteropus poliocephalus*
Life-cycle and background information

The Grey-headed Flying-fox is reported from a wide range of forested habitats and cultivated areas, and is an important pollinator of native plant communities, as it feeds upon blossoms of a range of tree species and transfers pollen between plant populations. The fruits or blossoms of more than 80 species of plants are eaten; however the main food is eucalypt blossom (Churchill 2008). Grey-headed Flying-foxes aggregate in summer in large communal roosts or camps which often include other Flying-fox species. Small groups disperse long distances from camps during winter (Churchill 2008).

Grey-headed Flying-foxes currently roost with Black Flying-foxes *Pteropus alecto* at a camp in the Brunswick Heads Nature Reserve, and a temporary roost is reported for Marshall's Creek Nature Reserve (pers. comm., S. Hetherington, Ecologist, Byron Shire Council). Grey-headed Flying-foxes have been recorded feeding in flowering Pink Bloodwood *Corymbia intermedia* at Parklands in February 2007 (Appendix E(i)). On other occasions the species has been observed on blossoms of Swamp Mahogany and Forest Red Gum (Appendix E(ii)) and Blackbutt *Eucalyptus pilularis* (pers. obs.).

Threats include the clearance, degradation and or fragmentation of forest habitats and disturbance at camps (NPWS 2002). Flying-foxes also get impaled on barbed wire and in thorny foliage (pers. obs.).

(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

Impacts from the proposed construction and operation of water management infrastructure at Parklands are unlikely to produce adverse effects For the Grey-

headed Flying-fox. Woodlot plantings should include tree species which produce forage resources for the species.

A viable local population of the species is not likely to be placed at risk of extinction by the water management proposal.

(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

Not applicable-the Grey-headed Flying-fox is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Grey-headed Flying-fox is a threatened species, not an endangered ecological community or critically endangered ecological community.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

Flying-foxes forage at times in eucalypt and swamp sclerophyll forest surrounding the northern water management infrastructure. When the wastewater and potable water treatment plants are in active operation, and depending upon the type and level of noise produced, equipment noise may alienate forage habitats close to the source of noise. This infrastructure occupies ~ 1ha of land.

If noise levels are low enough alienation of forage habitats will be extremely localised. Flying-foxes exploit noisy urban environments *e.g.* in capital cities so will likely become habituated to novel noise disturbance. This tolerance and variability in both noise levels and Flying-fox behaviour make it difficult to predict the nature of impacts. During periods when the water management equipment is inactive, no adverse effect will occur for Grey-headed Flying-foxes.

(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

No area of habitat for the Grey-headed Flying-fox is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Grey-headed Flying-fox at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of the Grey-headed Flying-fox Recovery Plan (DECCW 2009).

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

8.9 Seven Part Test for the Large-footed Myotis or Fishing Bat *Myotis macropus*
Life-cycle and background information

The Large-footed Myotis occurs in a range of vegetation communities, usually near water, and is a cave roosting bat which also shelters by day in structurally similar shelter structures *e.g.* tunnels, bridge drains and tree hollows (Churchill 2008). This species obtains its invertebrate and small vertebrate prey by raking the surface of waterbodies with its specialized feet, but also catches insects on the wing (Churchill 2008). It is not included in NPWS atlas records from nearby Billinudgel Nature Reserve but is known from Marshall's Creek (BSC database). It is not yet recorded from Parklands, but is considered likely to forage at times in larger waterbodies of the site.

The species is listed as vulnerable in NSW under the TSC Act and threats to the species include the disturbance and destruction of cave roosts, loss of tree hollows and other roost sites, use of pesticides and pollution of waterbodies (NPWS 2002).

(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

Potential habitat at the site includes the larger dams and those drains with sufficient water to comprise foraging habitat for this species. The Plague Minnow *Gambusia holbrooki* is abundant in larger drains of the site (pers. obs.) and is probably present in

some of the dams; therefore suitable foraging resources for this species are present both within and outside the direct footprint of the water management proposal

Minor alterations to water levels in the large dam are unlikely to adversely affect this species, therefore the proposal is not considered likely to cause a viable local population to be placed at risk of extinction. Creation of additional waterbodies may enlarge the amount of available habitat for this species at Parklands.

(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

Not applicable-the Large-footed Myotis is a threatened species, not an endangered population.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community, such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable-the Large-footed Myotis is a threatened species, not an endangered ecological community or critically endangered ecological community.

(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

Episodic extraction of water from the large dam is the main habitat modification operating for this species. Creation of additional waterbodies may enlarge the amount of available habitat for this species at Parklands.

(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

No area of habitat for the Large-footed Myotis is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action

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

The habitat which will be temporarily modified by the proposal is unlikely to be important to the long-term survival of the species in the locality.

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

There is no critical habitat for the Large-footed Myotis at the site of the proposal.

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

The action proposed is not inconsistent with the objectives or actions of any recovery plan.

(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 action proposed is not a key threatening process and does not result in the operation of, or increase the impact of a key threatening process.

9.0 EPBC Act Assessment Grey-headed Flying-fox and Rough-shelled Bush-nut

The Grey-headed Flying-fox and Rough-shelled Bush-nut are listed nationally as a Vulnerable species under the federal Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

9.1 Significant Impact Criteria—Vulnerable species

Guidelines provided by DEWHA for Vulnerable species include the following Significant Impact Criteria:

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

Definitions
An 'important population of a species' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal;

- populations that are necessary for maintaining genetic diversity; and/or
- populations that are near the limit of the species range.

9.2 Application of significant impact criteria to vulnerable species

Grey-headed Flying-fox

Grey-headed Flying-foxes *Pteropus poliocephalus* have been recorded on the Parklands site foraging on the blossoms of Forest Red Gum, Pink Bloodwood, Broad-leaved Paperbark and on Camphor Laurel fruit. They are also likely to use other food trees at the site *e.g.* when figs are fruiting. Estimates of from 30-200 Grey-headed Flying-foxes have been made in census samples of this species, central forested areas, and many more flying-foxes overfly the site when moving to other feeding areas.

When operating at night, the noise from the wastewater and potable water treatment plants may temporarily alienate the nearest resources (*e.g.* blossom, fruit) for Grey-headed Flying-foxes. Given the behaviour of this species in urban and agricultural landscapes it appears likely that some habituation to disturbance is likely to occur, both in the short and longer term. Any disturbance effect is predicted to be localised, temporary and non-fatal.

No roost sites or camps for Grey-headed Flying-foxes are known from the Parklands site or nearby, and the nearest known communal roost is located ~ 6kms to the south at Brunswick Heads Nature Reserve. There are abundant foraging resources seasonally available for this species across the overall site and in its immediate vicinity.

Rough-shelled Bush-nut

Three Rough-shelled Bush-nut trees and a seedling are located on the edge of the upper 1.86ha irrigation area. Provided these plants are excluded from irrigation and adequately buffered, no adverse effect is likely for this species from the proposal.

9.3 Importance of populations

It is not possible to accurately assess the "importance" of the local Grey-headed Flying-fox population without detailed demographic data. It is possible that significant elements of the local Grey-headed Flying-fox population may at times be present in the vicinity of the site. The local Grey-headed Flying-fox population is not described as important in any recovery plan.

All naturally occurring populations of Southern Macadamias are considered important (Costello *et al* 2009). However the Rough-shelled Bush-nut trees at Parklands appear to have been planted and the importance of this artificial population is undetermined, as such planted trees are widespread in Byron Shire. Neither species occurrence matches the listed criteria for important populations, below.

- *key source populations either for breeding or dispersal;*
- *populations that are necessary for maintaining genetic diversity; and/or*
- *populations that are near the limit of the species range.*

9.4 Vulnerable species criteria and response

Table 7: Vulnerable species criteria and response

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criteria	Response
lead to a long-term decrease in the size of an important population of a species;	The proposal is unlikely to cause a long-term decrease in the size of the local populations of Grey-headed Flying-fox or Rough-shelled Bush-nut
reduce the area of occupancy of an important population;	The area of occupancy of an important population of either species considered will not be affected by the construction or operation of the water management infrastructure at Parklands
fragment an existing important population into two or more populations;	It is considered unlikely that the proposal will cause any fragmentation effect for local Grey-headed Flying-fox or Rough-shelled Bush-nut populations
adversely affect habitat critical to the survival of a species	Habitat effects are limited and extremely localised and considered insufficient to affect the survival of the local Grey-headed Flying-fox or Rough-shelled Bush-nut populations
disrupt the breeding cycle of an important population;	The proposal is not likely to disrupt the breeding cycle of the local Grey-headed Flying-fox population or Rough-shelled Bush-nut populations
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;	Some extremely localised foraging habitat may be rendered temporarily unavailable for foraging for the local Grey-headed Flying-fox population. This is considered insufficient to cause the species to decline. Habitat for Rough-shelled Bush-nut will be rehabilitated and contribute to the persistence of the species.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;	The proposal will not result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
introduce disease that may cause the species to decline	The proposal is not likely to introduce diseases to the site
interfere substantially with the recovery of a species	The proposal will not interfere with the recovery of the local Grey-headed

	Flying-fox or Rough-shelled Bush-nut populations.

10.0 Conclusion

A proposed water management system at Parklands provides for on-site supply and treatment of potable water and wastewater, eliminating the need for transport of wastewater and importation of potable water in and from the site. All known elements of the water management infrastructure are located in cleared pastoral areas of the site and no native vegetation removal is required.

It is assumed that reticulation systems (pipelines, pumps) required to separately transport wastewater, treated effluent and raw water within the site, and the provision of power and access for construction and operation can be provided without native vegetation removal or other adverse ecological impacts.

Construction of a new 6ML dam, potable water and wastewater treatment plants will involve excavation and fencing. The creation of new aquatic habitat (new dam, wetlands) creates ideal breeding habitat and thus an opportunity for irruption of local Cane Toad populations which will require control measures and management.

11.0 Recommendations

A specific ecologically focussed water system management plan (WSMP) should be prepared, once design details are finalised, but before any construction commences.

The plan should address the following matters:

- Toad-specific fencing (high quality well embedded sediment fence) and dense plantings fringing new aquatic habitat to prevent the irruption of cane toads;
- Development of a strategy to control or eliminate carp from the large dam and replace with local native fish species;
- Development of a list of native species for plantings for around the wastewater and potable water treatment plants;
- Identification of sensitive design features for buildings and other infrastructure to minimise impacts on fauna (modified exterior lighting, screened glass surfaces, no dogs or cats to be kept, fauna-safe fencing);
- Woodlot plantings should contribute to local ecosystem function, therefore planting species lists for the two woodlot effluent irrigation areas should be prepared to include local native species, relevant to the existing native forest communities;
- Woodlot plantings need to be managed to maximise the development of biomass and fixation of nutrients, so a planting and weed control strategy should be prepared before plantings are undertaken;

- Noise levels from the treatment plants and pumps should be monitored and recorded, to assist with monitoring and management of impacts on fauna;

- Woodlot plantings should also be monitored annually: for plant growth performance; and for fauna use, to identify contributions to biodiversity at the site;

- The forest patch containing Green-leaved Rose Walnut southeast of the proposed new 6ML dam must be barrier fenced before any construction takes place;

- Rough-shelled Bush-nuts are to be protected by buffer plantings and excluded from any irrigation of treated effluent.

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Appendix K: site photographs

Figure 1: Wastewater management locations–north

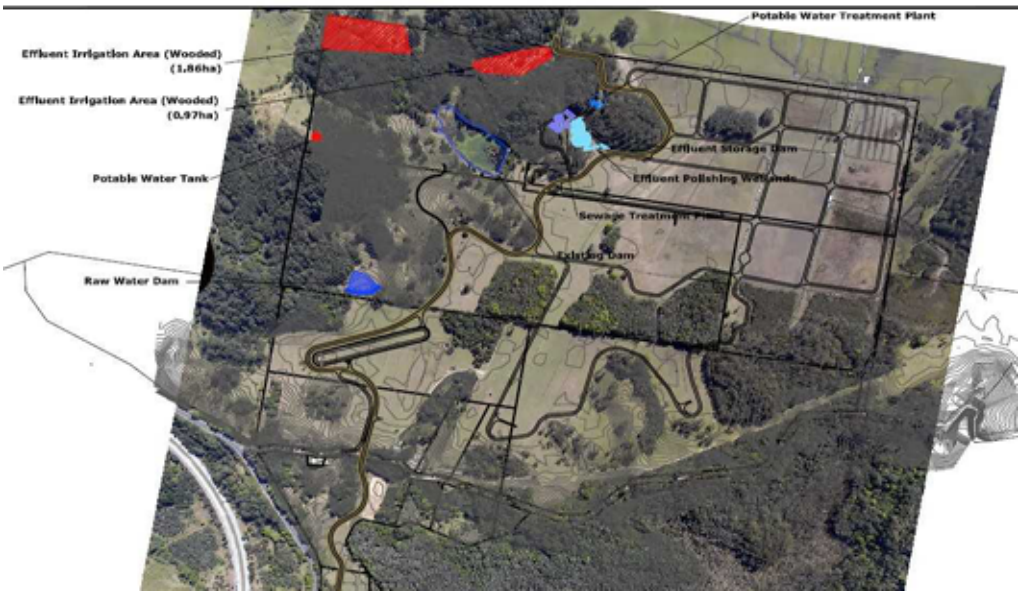


Figure 2: Wastewater management locations–south

Figure 3: Potable water treatment system schematic diagram

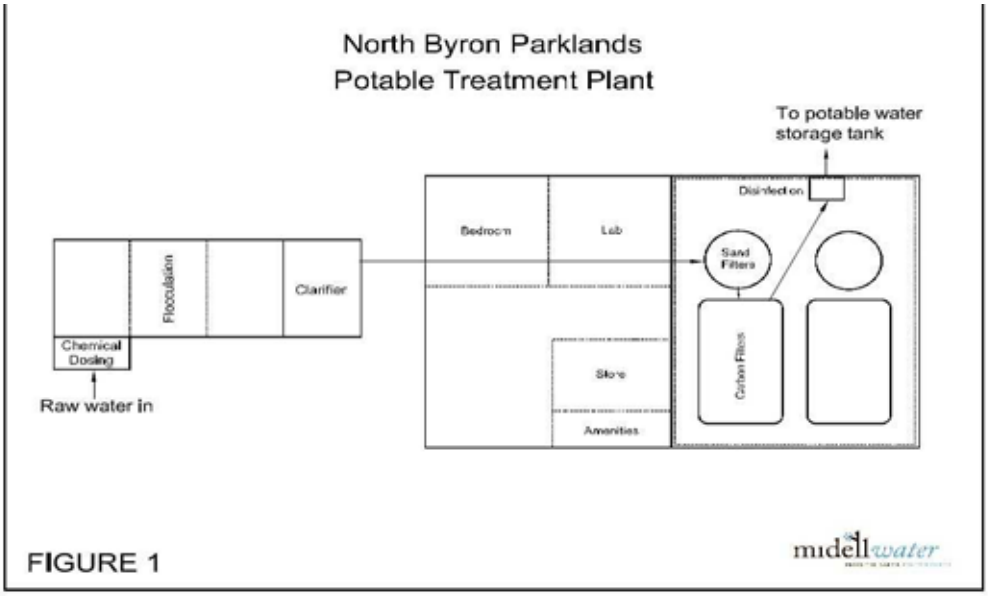


Figure 4: Wastewater treatment schematic diagram

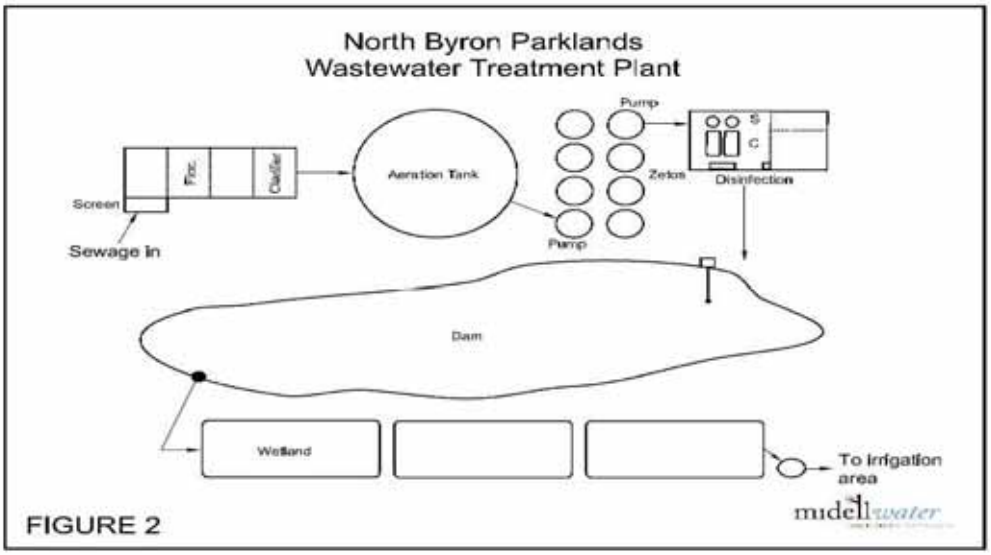


Figure 5: Southern pasture irrigation area

Figure 6: New 6ML dam site

Figure 7: Gravity feed potable water tank site

Figure 8: Existing 15.9ML dam

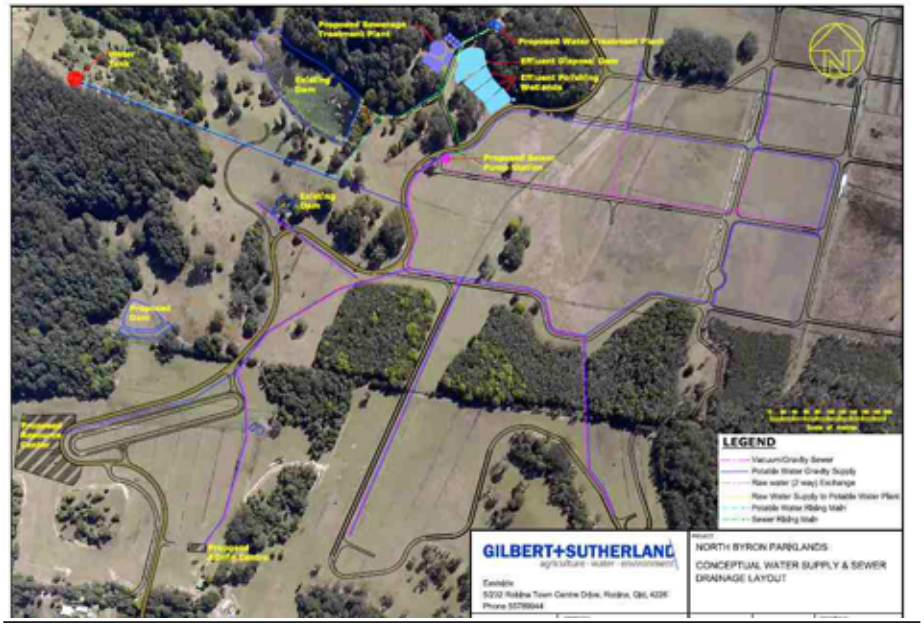
Figure 9: Proposed wastewater treatment plant location

Figure 10: Proposed potable water treatment site: existing shed

Figure 11: Upper Northwest 1.86 ha woodlot irrigation area

Figure 12: Northern 0.97ha Woodlot irrigation area

Figure 13: Reticulation System—Conceptual layout



Appendix L

Environmental Induction,

and

Ecological Audit

Parklands-Application Number 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by Mark Fitzgerald

Ecological Consultant,

P.O. Box 237 Mullumbimby NSW

North Byron Parklands Environmental Induction

1.0 Introduction to Site Values

The North Byron Parklands site (hereinafter Parklands) is a large rural holding in the far north of Byron Shire. It shares boundaries with the Billinudgel Nature Reserve (BNR) to the east and southeast and is located in an area formally recognised as a significant wildlife corridor. Land to the north in southern Tweed Shire is dominated by sugar cane and a rapidly developing coastal strip; land to the south includes extensive developed residential areas. Parklands is therefore in a unique position to contribute significantly by increasing the habitat available for wildlife in an important area.

Plantings have already begun which will re-connect fragmented native forest, improve opportunities for fauna movements and contribute to the maintenance and improvement of biodiversity values locally. Further plantings are planned, weed removal work has already commenced and Parklands is committed to ongoing habitat rehabilitation of the native ecosystems of the property, and the later conversion of key areas of grazed pasture into forest linkages.

However the process of habitat rehabilitation and habitats of the site generally can be adversely affected by inappropriate actions. It is vital that the people working on the site in any capacity are aware of the special significance of the site, its vulnerability to particular types of disturbance events, and the need for appropriate behaviour on the site.

The following code of conduct is designed to eliminate or prevent environmental damage on the site. The code will be read prior to entering the site, and the induction will include a code-site familiarising exercise, and will be signed by each worker-volunteer prior to undertaking any works on the site. Event Management will maintain a list of inductees.

INDUCTION FOR PARKLANDS EVENT WORKERS AND VOLUNTEERS

No.	Direction	Reasons
1	All personnel working and volunteering on site to have read and signed a copy of this induction.	Create awareness of the environmental risks and how to avoid damage to the site
2	No domestic dogs (or cats) to be taken on the site; sole exception is guide dogs	A small koala population on the site is vulnerable to predation and or disturbance by dogs
3	Ensure safe storage of fuels, chemicals and waste in accordance with relevant Australian Standards.	Protect water quality and avoid pollution effects
4	All vehicular traffic to be on existing formed roads, or in designated vehicle use areas, event laneways	Avoid damage to native vegetation, plantings and drains
5	Strict compliance with vehicle speed limits on site for all vehicle users:	Reduce the risk of killing local fauna, especially koalas

	30km/h maximum, except if areas of core koala habitat are located in the event area where limit is 15km/h*. This will be enforced by traffic control staff.	* if core koala habitat overlaps roads in the event site this will be clearly signposted
6	No fires to be lit on the site unless in designated and approved supervised bonfire locations	High risk of peat fires and of bushfires in native forest.
7	No burning of rubbish	High risk of peat fires and of bushfires in native forest
8	No dumping of any rubbish except in skips provided for that purpose	Minimise pollution in Parklands
9	Use only toilet facilities provided: no urinating or defecating in or near the forest	Minimise pollution in Parklands
11	No chainsaw or axe based collection of firewood;	Large logs are a scarce and important resource at the site, key shelter sites for fauna. Removal of dead wood is a key threatening process under the TSC Act.
12	No interfering, harming or killing of native fauna, including snakes Report roadkills and fauna incursions [PROVIDE CONTACT NUMBERS]	All native fauna on site are protected; biodiversity maintenance relies on conserving all elements of the local ecosystems
13	Comply with directions provided by eco-cops, bush regen. workers, ecologist, Biolink or other parklands personnel	Reduce damage and maintain biodiversity values
14	Persons breaching any element in this code of conduct will be cautioned and repeat offenders will be removed from the site	Reduce damage and maintain biodiversity values
15	Report to management immediately any breaches of environmental standards or safeguards*	Enable rapid responses to potentially damaging events
16	Report to management any roadkill or any issues with fauna, such as animals in fence, at the site during all activities relating to SITG09	Record impacts on fauna and contribute to improved traffic management

** Provide list of contacts and phone numbers relevant to on-site management.

ECOLOGICAL AUDIT

Design of an ecological audit of events largely relies on predictions concerning the nature of likely and potential impacts. These may or may not include: littering, damage to vegetation, unapproved or poorly managed fire, oil leaks in the car parking area, roadkill, introduction of sediment or other pollutants to drains, trampling of vegetation, noise and human activity altering fauna use of the site and illumination of forest canopy vegetation during the event. Other unpredicted impacts may occur. Management actions to address these and other ecological issues are described in Table 1 below.

Audit processes will involve a three phase approach. Inspection of the perimeter of all forest blocks, road drain crossings and the southern car park perimeter will be made before the staging of any event. Photopoints will be recorded by GPS and a written record of locations and reference photographs will be taken of the margins of each forest block, major drain crossing and the section of Billinudgel Nature Reserve adjoining the southern car park. These actions will provide records of the pre-event condition of likely impact areas.

This procedure will be repeated once during the staging of any event, in order to detect operational phase conditions and impacts. Opportunistic observations by Eco Cops that record impacts will be included in the audit reporting process. Following the event, a third inspection will take place of the same areas, with photographs being taken from the same photopoints and written descriptions and measurements made of any observed environmental damage.

To assess roadkill, the duty to report roadkill will be included in an environmental induction for all workers at the site (see above). In addition, all internal roads will be traversed regularly during and immediately following the event to check for, identify and record any animals killed by traffic movements.

A log of all environmental issues reported during the event (including bump-in and bump-out) will be kept by Parklands management. This log and a short report detailing the audit methods and results will be prepared within 30 days of the final bump-out day.

Please note: a detailed fauna monitoring program to detect impacts from the staging of events is separate from the audit described above.

The ecological audit planned to follow events will report on the status of management objectives listed in Table 1.

Table 1

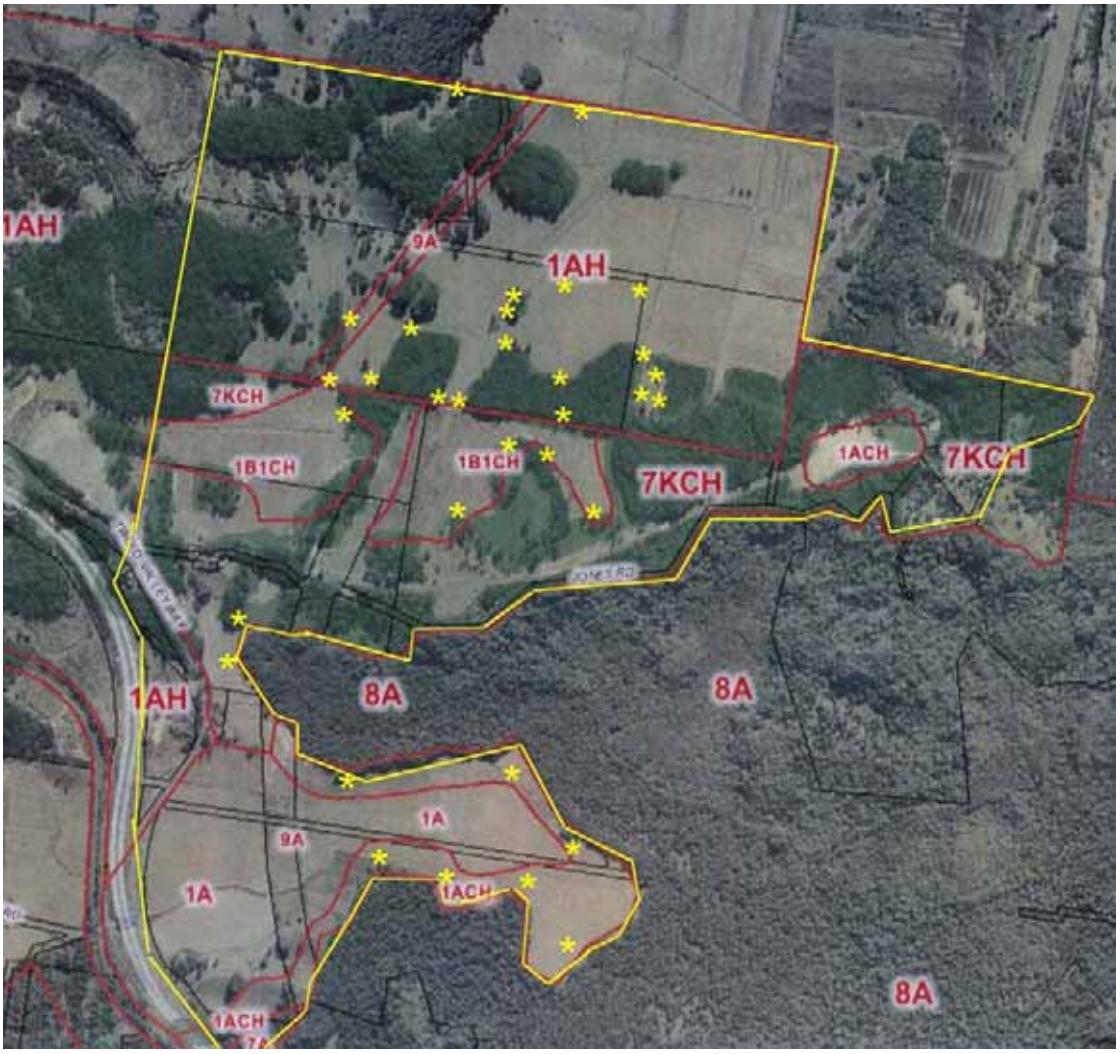
Management Action/measure	Performance criteria
Environmental induction for all volunteers and workers prior to entering the site	Environmental induction is delivered to all personnel prior to entering the site A register of the names of all inductees is obtained and kept by the event managers.
Drain crossings and water quality managed to avoid sediment, before and during construction	Ecological audit records any construction or event related declines in drain water quality or sediment entering water Photopoints before and after
Don't slash fringing car park vegetation: now protected by 30 m buffer	Ecological audit indicates this buffer was not slashed, and identifies any damage from event related activities. Photopoints before and after
Apply lighting principles identified in (Fitzgerald 2007a) • No illumination of forest blocks or their edges, or trees: if necessary implement a 5 m buffer between eastern edge of forest block A & restaurants; • Direct all lighting downwards; floodlights that point upwards are potentially harmful to fauna; • Use low pressure sodium vapour lights which do not attract insects or bats. • Any installations which rely on artificial lighting should be located in open areas away from forest or trees and be monitored for effects on fauna. • Minimise or avoid lighting throughout the entire night: *i.e.* once performances cease, lighting should be reduced or	Ecological audit indicates that lighting principles were implemented in accordance with (Fitzgerald 2007a), *viz*: • No forest blocks are illuminated; • No floodlights that point upwards; • Use low pressure sodium vapour lights; • Artificial lighting is located in open areas away from forest or trees; • Areas exposed to artificial lighting are monitored for effects on fauna; • No fireworks are used; • Overhead lighting is shielded and directed downwards to minimise light spill. Any deviations from the above lighting principles are recorded and corrected during

eliminated to allow a dark period for fauna to use or traverse the site. • No use of fireworks. • Use footlights instead of overhead lights where possible. • Overhead lighting should be shielded and directed downwards to minimise light spill.	the event. If not corrected, include report on circumstances.
Traffic control & reduced vehicle speeds restricted as prescribed in traffic plan	Traffic report and ecological audit indicate that vehicular movement on site was managed according to guidelines and the traffic plan; roadkill was reported and at a minor level.
Koala signage on roads	Koala signage is permanently installed on internal NBSP roads. A plan of locations for Koala signs is provided below
Fence western side of block A	Ecological audit indicates that fencing on the western side of polygon 14 was in place during the event; Stinking Cryptocarya was not damaged by event processes. photopoints
Minimise times temporary fences are in place	Ecological audit reports that fencing installation was finalised in consultation with ecologist, and disassembled as rapidly as required. Notes and photopoints
Fauna management crew on site during the event	WIRES/Wildlife carers attended the entire event, and reported on all fauna management issues which arose during the event
Compensatory plantings for each bonfire/carbon sequestration	Plantings will take place following issue of a construction certificate; plantings will be audited following the event.
Include koala feed trees in plantings	Plantings include koala food trees
Include fig trees in plantings	Plantings will take place following issue of a construction certificate; plantings will be audited following the event.

Maintain fencing of forest blocks to exclude cattle	Forest block fencing is in sufficiently good order to exclude cattle from forest blocks. Fence inspection, notes, photopoints
Deploy batboxes/nestboxes	Nest boxes are deployed Notes, photopoints, nestbox monitoring data
Do ecological audit after the event	Ecological audit is undertaken following all large events Audit report is produced following the event
Compensatory plantings; according to plan	Compensatory plantings are installed and are alive. See comment below.
Connectivity plantings	Connectivity plantings are installed and are alive.
Nestboxes	Nest boxes are deployed; Notes, photopoints, nestbox monitoring data
Marginal plantings of dams to reduce cane toad breeding	Marginal plantings are installed and maintained Notes, photopoints, monitoring data
Weed removal , timetabling and priorities	Weed removal is under way and documented in the ecological audit. See planting report
Implement lighting principles	Ecological audit indicates that lighting principles were effectively implemented.
Undertake Indian Mynah control program	Indian Mynah control program as described in the document has commenced, and is recorded in the ecological audit.
Management responsibility to ensure actions-measures implemented according to requirements, to manage non-compliance issues and to ensure delegation of responsibilities is managed.	Where breaches to induction management rectifies issue

Figure 1: Location of Koala Signage: yellow asterisks indicate locations of Koala signage

Figure 2: Photopoint Locations



Appendix M

DRAFT

Vegetation Management
and
Biodiversity Plan

North Byron Parklands

Parklands-Application Number 09_0028

prepared for

Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

by

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GLOSSARY

Biodiversity: the variety of life forms

Biota: living organisms, plants, animals, fungi and invertebrates

Cadastre: property title details

Connectivity: ability of organisms to move through habitat

Full habitat: native vegetation

Managed parklands: dual purpose plantings

New Full habitat: native plantings to restore forest in existing pasture areas

“Parklands”: cultural event property at Yelgun

Stochastic: random, conjectural

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1.0 Introduction: Aim and objectives

A vegetation management and biodiversity plan (VMBP) is an essential part of managing and restoring native vegetation at the Parklands site. The quantity and condition of habitats on this ~250ha site contributes to the state of biodiversity in the location. Responsible management of the site has the capacity to improve habitat connectivity and to maintain or improve ecosystem processes. While maintenance and expansion of native vegetation ('full habitat') on the site is a key element of the VMBP, the provision of additional tree cover in the 'managed parklands' will also improve the capacity of the site to support biodiversity. Delivery of feral animal and weed control, of a nestbox program, and conduct of ongoing fauna monitoring and surveys will also contribute to management and maintenance of biodiversity values.

It is recognised that the while the VMBP is essentially restricted to the Parklands cadastre, ecological linkages and processes can extend widely beyond the property boundaries. It is the intention of the plan to promote these linkages by maintaining and improving habitats and connectivity at the Parklands site.

Therefore, the aim of the VMBP is to maintain and improve habitat values at the Parklands site.

Objectives include:

- Maintain and improve conditions in existing native forest of the site;
- Restore native vegetation in identified new full habitat areas;
- Restore tree cover in managed parklands zones;
- Control and remove weeds from native forest and habitat areas.
- Deliver control programs for feral animals.

1.0.1 Limits of the plan

This draft VMBP will be augmented by inclusion of an up-to-date SEPP 44 Koala habitat assessment and the delivery of an up-to-date Koala Plan of Management (planned for late 2010–early 2011), since earlier surveys (Biolink 2007 & 2008: Appendix H) demonstrated that 'core koala habitat' at the site fluctuated significantly over that time period.

The draft VMBP will be further improved by the later inclusion of robust estimates of species abundance for target fauna groups, following monthly monitoring proposed for an annual period before any events take place on the site.

Finally, much remains unknown about population processes and ecosystems at the site and the significance of external and internal factors and influences. Influence of climate and stochastic events will produce unpredicted phenomena, so this plan and prescribed management measures will be modified following: the monitoring of

impacts from unforeseen events (*e.g.* drought, flooding, cyclones, fire, pathogens), and: changes in statutes (*e.g.* listing of additional threatened species and threatening processes, recovery and threat abatement plans).

1.0.2 Management principles

The various proposed uses of the Parklands property as a cultural events site are unprecedented for the location and the combination of activity regimes demands careful assessment and consideration in order to develop favourable management.

While ~60% of the site is currently dominated by grazed exotic pasture species, much vertebrate species biodiversity of the site is closely associated with the existing forest vegetation. Therefore, principles for the management of native forest are of key importance in developing appropriate management for the site. Valuable principles for management of forested and partly forested landscapes are described in a Rural Industries and Research Development Corporation document, "Management Principles and Strategies to Guide Biodiversity Conservation in Private Native Forests" prepared by Prof. David Lindemayer (RIRDC 2009).

Basic principles for the management of native forest from this document include:

The overarching goal for conserving forest biodiversity is the maintenance of suitable habitat. Five general principles can help meet this goal:

• *the maintenance of connectivity*

• *the maintenance of landscape heterogeneity*

• *the maintenance of stand structural complexity*

• *the maintenance of aquatic ecosystem integrity*

• *the use of natural disturbance regimes to guide human disturbance regimes.*

(RIRDC 2009)

Further important considerations from this document include the following:

"Each species responds differently to the same spatial scale of landscape change and human disturbance. Hence no single measure adequately reflects change for all biota".

Further: species loss is driven by habitat loss.

"*Therefore the overarching goal of conservation management must be to prevent habitat loss.*

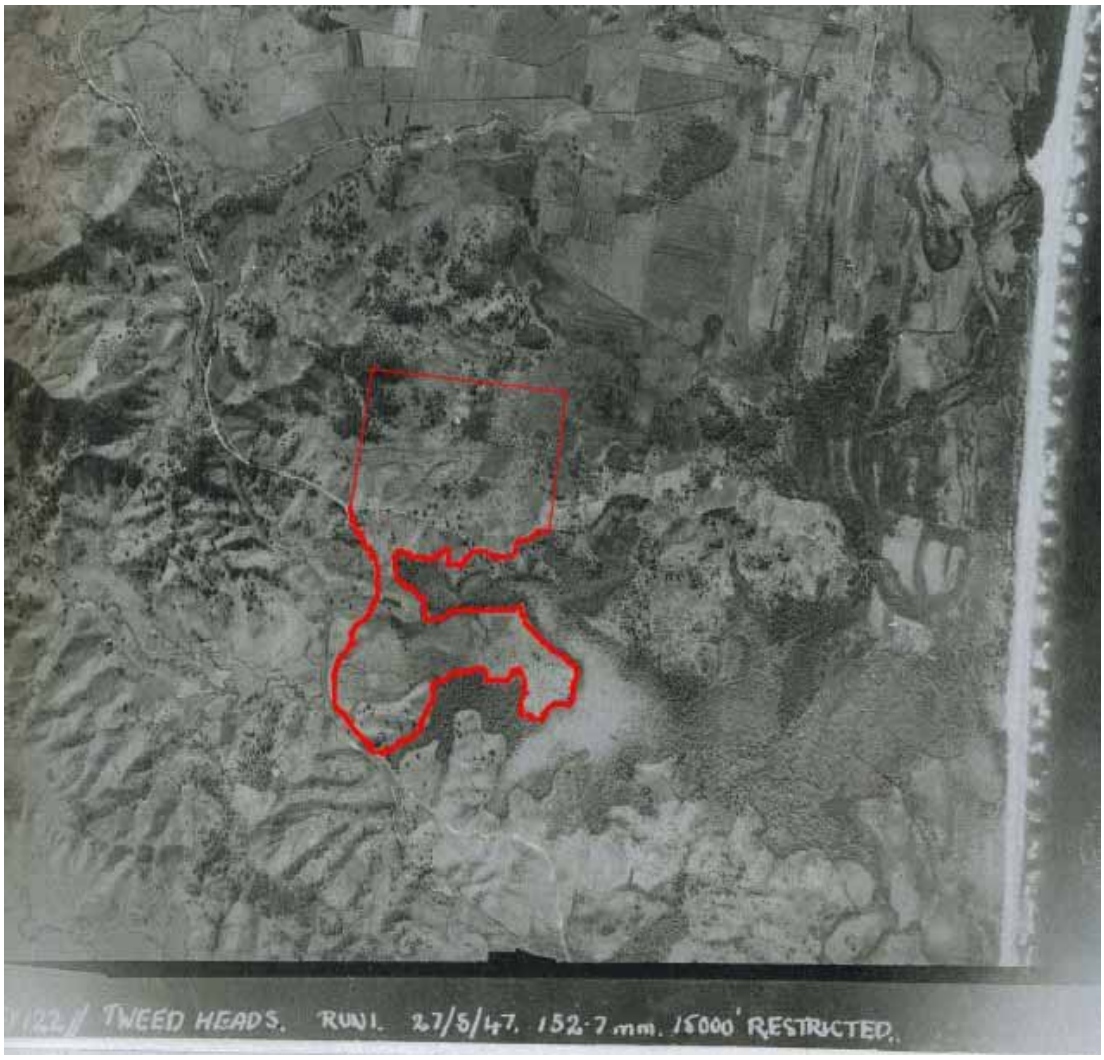
In the Parklands context much needs to be done to restore stand complexity and/ or to allow this to develop naturally (through forest stand maturation) and through management (*e.g.* by installation of nestboxes to supplement a scarce shelter resource;

and by staged exclusion of cattle to allow groundlayer habitats to recover and midlayer habitat to develop). Floodplain ecosystems have been drastically altered by drainage works, and an emphasis on restoration is an essential addition to the need for maintenance identified in the above principles.

1.0.3 Background site history—a summary

Examination of an aerial photograph from 1947 (Figure 1) reveals that much of the Parklands site was at this time devoid of forest cover. Hence much forest of the site has developed since that time, although older forest and much older trees are also present. More recent land uses have included cattle grazing (likely to pre-date the 1947 landscape), sugar cane and banana cultivation, apiary. Extensive man-made drains are present in the lower parts of the site, and Yelgun Creek in the south of Parklands has been severely modified by a previous owner.

Figure 1: Parklands in 1947



1.0.4 Landuse Zones

Current planning for Parklands includes the following land uses:

OPERATIONAL ZONES

- Event area includes resource centre/gatehouse
- Car parking and access roads, pathways
- Conference centre
- Infrastructure areas = Onsite STP and effluent irrigation areas
- Cultural Centre/Administration Uses

HABITAT ZONES

- Aquatic and riparian habitats, drains
- Full habitat
- New Full habitat
- Managed Parklands
- Land to be dedicated to DECCW

Aboriginal cultural heritage sites are located outside any event-related activities, and will be maintained as reserved land, subject only to weed removal and restoration of native vegetation, where necessary.

Table 1: Land use areas and management

Landuse	Activities / management
OPERATIONAL ZONES	
Event area, including resources centre & gatehouse	Event areas are dedicated to episodic uses for staging of cultural and musical events; Construction of access infrastructures: roads, resource centre gatehouse, bus parking area hardstand, drain crossings will precede any event. Between events: cattle grazing and/or grass mowing
Car Parking; access roads , pathways	Between events: cattle grazing and/ or grass mowing; during events, vehicle movements, traffic control, parking Pedestrian pathways will be mown where dry, clean gravel placed in boggy sections, untreated hardwood for drain crossings.
Infrastructure areas Onsite STP	Construct and operate an onsite sewage and wastewater treatment plant with associated dams and wetlands and reticulation system
Conference centre	Managed parkland plantings, and maintenance, weed removal
Cultural	Operation as a cultural / admin. area.

Centre/administration uses	
HABITAT ZONES	
Full habitat-existing	Forest vegetation where weed removal and staged exclusion from cattle through fencing are principal management actions; deployment and monitoring of nestboxes, fauna surveys and monitoring
Full habitat-new	Designated pasture areas for native forest plantings to restore habitats and connectivity. Plantings, assisted regeneration, weed removal, monitoring.
Managed Parklands	Plantings, assisted regeneration, occasional watering, weed removal, mowing, slashing, monitoring; tree guards may be used to assist in establishing plantings
Land to be dedicated to DECCW	Once ownership is transferred then management of these areas will be the responsibility of DECCW. Cooperative management of weeds and feral animals is likely to be ongoing

2.0 Description of the Parklands site

The overall North Byron Parklands (NBP) site holding comprises ~ 256 ha (see planning report for cadastral details) and is located to the north and south of Jones Rd., Yelgun. The property is bounded on its western margin by the Tweed Valley Way. Billinudgel Nature Reserve (BNR) adjoins to the south and south-east.

The southern portion of the site (south of Jones Rd.) is located in the Marshall's Creek floodplain, and the northern portion is in the Crabbe's Creek floodplain. The central portion of the overall site incorporates a low east-west oriented ridge upon which Jones Rd. is located. This ridge rises to ~30m asl (AHD). However, the majority of the property, including the parking, event and camping areas lies below the 10 m contour.

Soils vary from dark organic loams to grey metasediment derived clays.

A man-made 1.8 ha dam is located in the northwest of the property, but is outside the direct footprint of the proposal, as are other smaller dams. An established network of constructed drains is present in all lowland or floodplain areas. These vary from <1m to ~2m width and are up to 3m depth. Numerous drains are present in the proposed festival event area, camping and parking areas. Yelgun Creek is present (in a highly modified condition) in the south of the property.

2.1 Biodiversity values of Parklands

2.1.1 Site context

Approximately sixty percent of the Parklands property is cattle pasture. Native vegetation of the site comprises mainly fragmented floodplain forests and hillslope forests, which together contain much of the site's biodiversity. Parklands adjoins Billinudgel Nature Reserve and forested habitats are present on boundaries to the

northwest. Further to the west the Pacific Highway and its associated underpasses and fauna exclusion fencing influence the dynamics of habitat connectivity and barriers to terrestrial fauna movement in the locality.

2.1.2 Vegetation

Vegetation of the Parklands site varies greatly, including: aquatic and fringing vegetation of dams and drains, extensive grazed exotic pastures and coastal floodplain forest communities. Hill slope eucalypt forests of the northwestern slopes and gully rainforest are essentially outside the event footprint. The composition and condition of grassland communities reflect the history of previous pastoral activities and management, as well as more recent climatic influences and cattle stocking rates.

Forest communities vary considerably in their canopy species dominance, species composition and groundlayer characteristics according to diverse environmental influences. Native vegetation of the property has also been the subject of substantial survey effort, with recent plot survey samples (Kooyman 2009: Appendix G) providing quantified data on forest species composition and community structure across 22 plot locations.

Forest communities share several characteristics: most are regenerating communities < 70 years old. In most stands, few or no old growth trees are present, large logs and hollows are rare and very large trees are also rare or absent. Cattle are currently using most of the forest patches within the event footprint and this has clearly affected the stature and species composition of groundlayer plant communities, and the substrate, including for example, pugging of soil, trampled and grazed native species affecting regeneration and influx and concentration of nutrient from cattle camps.

Approximately three hundred plant species are recorded from the site, four of which are listed as threatened in NSW and three are ROTAP species (Briggs and Leigh 1996). Fifty-one exotic or non-native species are included in the flora species list (provided as Appendix C).

2.1.3 Threatened flora and endangered ecological communities

Four plant communities listed as endangered ecological communities under the NSW *Threatened Species Conservation Act* 1995 are present at Parklands, namely:

- Swamp sclerophyll forest on coastal floodplains of the NSW north coast bioregion;
- Sub-tropical floodplain forest of the NSW north coast bioregion;
- Lowland rainforest of the NSW north coast bioregion;
- Coastal Cypress Pine of the NSW north coast bioregion.

The latter two EECs are located well outside the event footprint. Distribution of EECs and threatened flora of the Parklands property are depicted in Figure 2.

Only one threatened plant species has been located in the vicinity of the event footprint:

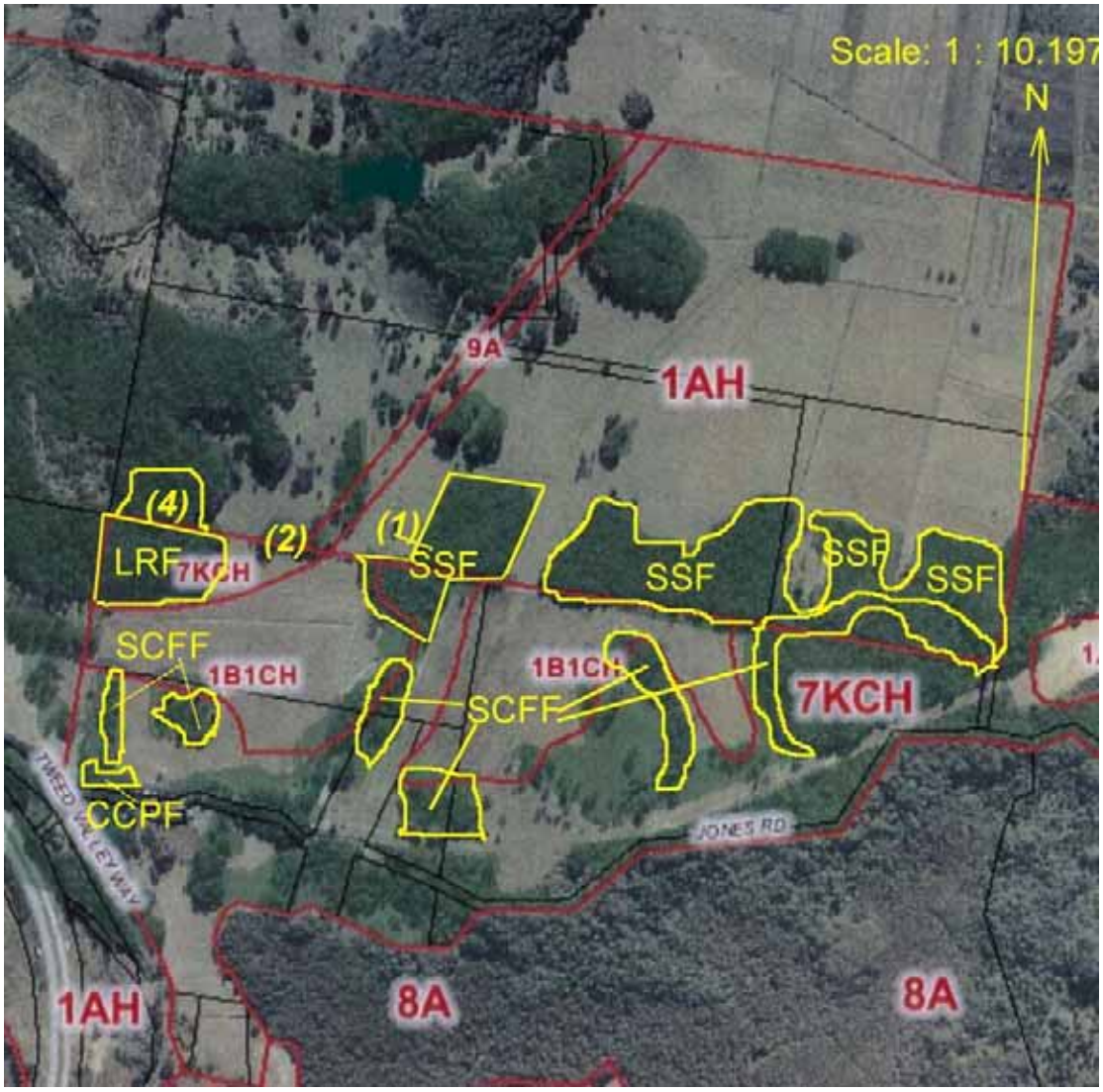
- a sapling Stinking Laurel *Cryptocarya foetida* was located in forest block B (13).

A second threatened plant Green-leaved Rose Walnut *Endiandra muelleri ssp bracteata* is located within the application area adjacent to a proposed western dam for the sewage and wastewater plant.

Durobby or Coolamon *Syzygium moorei,* Green-leaved Rose Walnut *Endiandra muelleri ssp bracteata,* White Laceflower *Archidendron hendersoni*, and Davidson's Plum *Davidsonia jerseyana* are recorded from outside the application area in the northwestern hill slope forests and nearby. Rare or Threatened Australian Plants recorded include: Black Walnut *Endiandra globosa*, Smooth Scrub Turpentine *Rhodamnia maideniana* and Veiny Laceflower *Archidendron muellerianum*.

Figure 2 below depicts the location of endangered ecological communities and threatened plants.

Figure 2: EECs and threatened flora occurrences on the Parklands property



SSF = swamp sclerophyll forest; LRF = lowland rainforest; SCFF =sub-tropical coastal floodplain forest; CCPF = Coastal Cypress Pine Forest endangered ecological communities. Location (1) = Stinking Cryptocarya *Cryptocarya foetida*; (2) = Green-leaved Rose Walnut *Endiandra muelleri ssp bracteata*; and (4) = Durobby or Coolamon *Syzygium moorei,* White Laceflower *Archidendron hendersoni*, Green-leaved Rose Walnut and Davidson's Plum *Davidsonia jerseyana.*

2.1.4 Vertebrate Fauna recorded on site

Substantial fauna survey effort from 2006 to present has resulted in records of 175 vertebrate fauna species from the Parklands site, of which eleven are listed as threatened under the NSW *Threatened Species Conservation Act* 1995. Six exotic species are included. A recent fauna species list is provided in Appendix B. See Fitzgerald 2009 (Appendix E(ii)), Fauna Survey Report for more detail on fauna surveys of the site.

Survey effort has been largely focussed on areas north of Jones Road. Areas south of Jones Road which are dominated by grazed pasture, have received less survey effort so far. Systematic surveys in August 2007 and February 2009 provide representative seasonal samples of faunal assemblages at the site (Appendices E(i) and E(ii)). However additional surveys, particularly standardised 20min/2 hectare bird surveys and flying–fox counts have provided additional information and species records for the site.

In table 2 the category "other" includes results from the following survey effort:

- Koala scat searches May-June 2007;
- Targetted rapid assessment surveys for threatened fauna February 2007;
- Targetted call playback surveys for forest owls June 2007,and:
- Bird and Flying-fox surveys July-September 2008.

Further survey effort is planned for the site and more vertebrate species are predicted to be added to the current total. More importantly, information on the patterns of occurrence and abundance of species will assist in the development of location-specific management strategies to improve habitat quality and overall biodiversity values of the site.

Table 2: Fauna species distributions according to habitats: 'other' refers to reptile species recorded from a house.

Species	CSSF & SCFF	NWHSF	Pasture	Drains/dams	Overhead /other
Frogs (n = 14)	6	6	7	7	0
Birds (n= 121)	70	59	29	21	11
Mammals (n =26)	22	10	2	0	0
Reptiles (n = 14)	7	2	2	3	3
Total (n = 175)	105	77	40	31	11
% of total	60.0	44.0	22.9	17.7	8.0
Threatened Species (n = 11)	7	4	1	1	0
% of total	63.6	57.1	9.0	9.0	

CSF = Central Swamp Sclerophyll Forest; SCFF = Sub-tropical Coastal Floodplain Forest; NWHSF = North-western Hillslope forests

2.1.5 Threatened fauna recorded on the Parklands site

Threatened fauna recorded from the site include the following species, all listed as Vulnerable on schedules of the NSW *Threatened Species Conservation Act* 1995 (TSC Act):

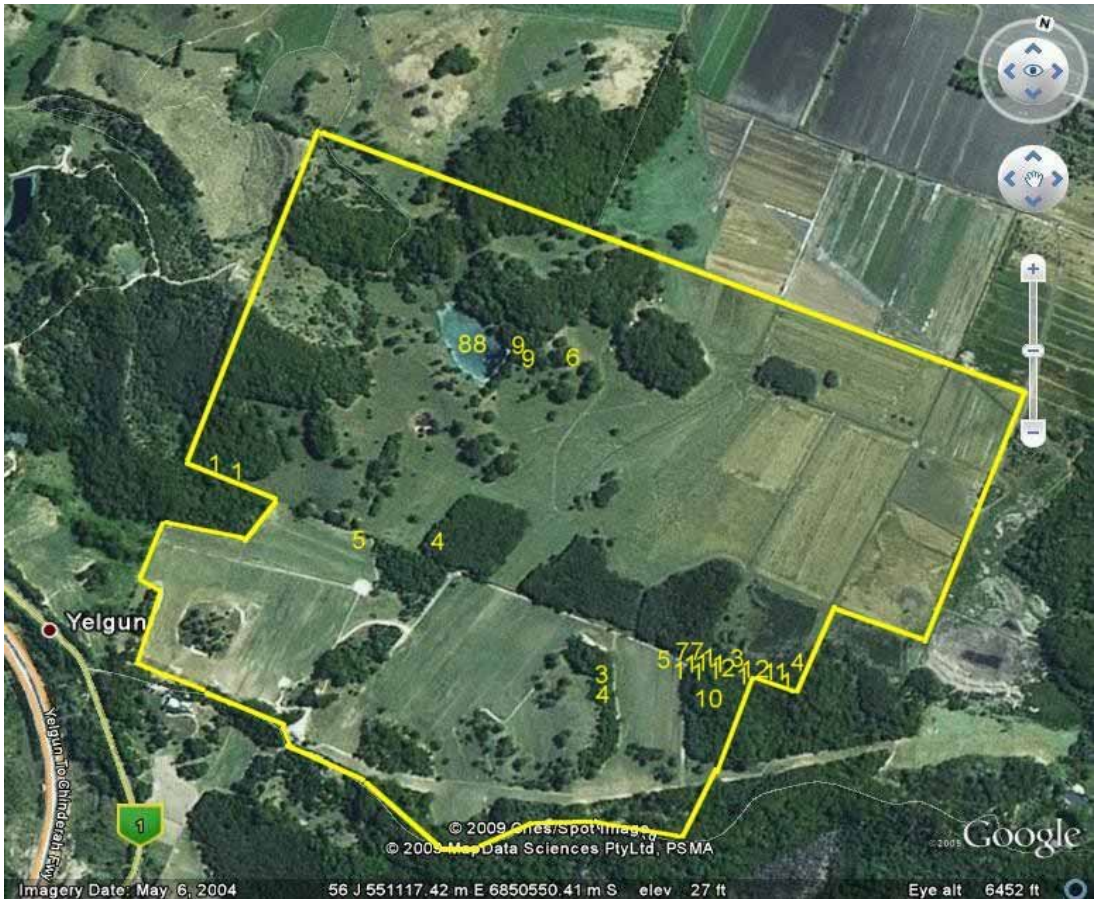
Koala	*Phascolarctos cinereus*
Little Bent-wing Bat	*Miniopterus australis*
Large bent-wing Bat	*Miniopterus orianae oceanensis*
Northern Long-eared Bat	*Nyctophilus bifax*
Blossom Bat	*Syconycteris australis*
Grey headed Flying-fox	*Pteropus poliocephalus*
Comb-crested Jacana	*Irediparra gallinacea*
Masked Owl	*Tyto novaehollandiae*
Grass Owl	*Tyto capensis*
Rose-crowned Fruit-dove	*Ptilinopus regina*
White-eared Monarch	*Carterornis leucotis*

With the exception of Comb-crested Jacanas recorded at the large dam, and the Grass Owl recorded over pasture, all other threatened fauna species records are from forested habitats. Grey-headed Flying-fox is also listed as vulnerable under the federal *EPBC Act* 1999.

Figure 3 below depicts the location of most threatened fauna records from 2007-2010.

Grey-headed Flying-fox occurs widely in forested habitats of the site and multiple scattered records for this species are not depicted.

Figure 3: Threatened fauna record locations 2007-2010



3.0 Vegetation mapping

Figure 4 shows forest vegetation mapping for the site. Table 3 below lists vegetation classifications for each of the numbered polygons.

Clear boundaries between communities are rarely apparent, with interdigitation or gradation of adjoining communities commonly occurring. Therefore boundaries depicted between associations should be regarded as approximate.

Classification of forest vegetation in mapped polygons is provided in Table 4 below. The vegetation classification used is that of Walker and Hopkins (1990). Exotic pasture is excluded. In general pasture is a closed sod grassland dominated by South African Pigeon Grass *Setaria sphacelata,* with numerous other pasture species varying in dominance in accordance with local influences (waterlogging, grazing, cattle trampling) as listed below. Pasture condition also varies annually and in response to rainfall.

Common pasture species include the following species (exotic*): Kikuyu *Pennisetum clandestinum**, Broad-leaved Carpet Grass *Axonopus compressus**, Whiskey Grass *Andropogon virginicus**, Broad-leaved Paspalum *Paspalum mandiocanum**, Giant Paspalum *Paspalum urvillei**, Paddy's Lucerne *Sida rhombifolia**, Blady-grass *Imperata cylindrica,* Bracken *Pteridium esculentum,* Sedges *Cyperus spp,* Blue Couch *Cynodon dactylon** a Sedge *Cyperus polystachyos**, Paspalum *Paspalum dilatatum* Tall Verbena *Verbena bonariensis** and Siratro *Macroptilium atropurpureum**.

Figure 4: Forest vegetation Mapping (2008)

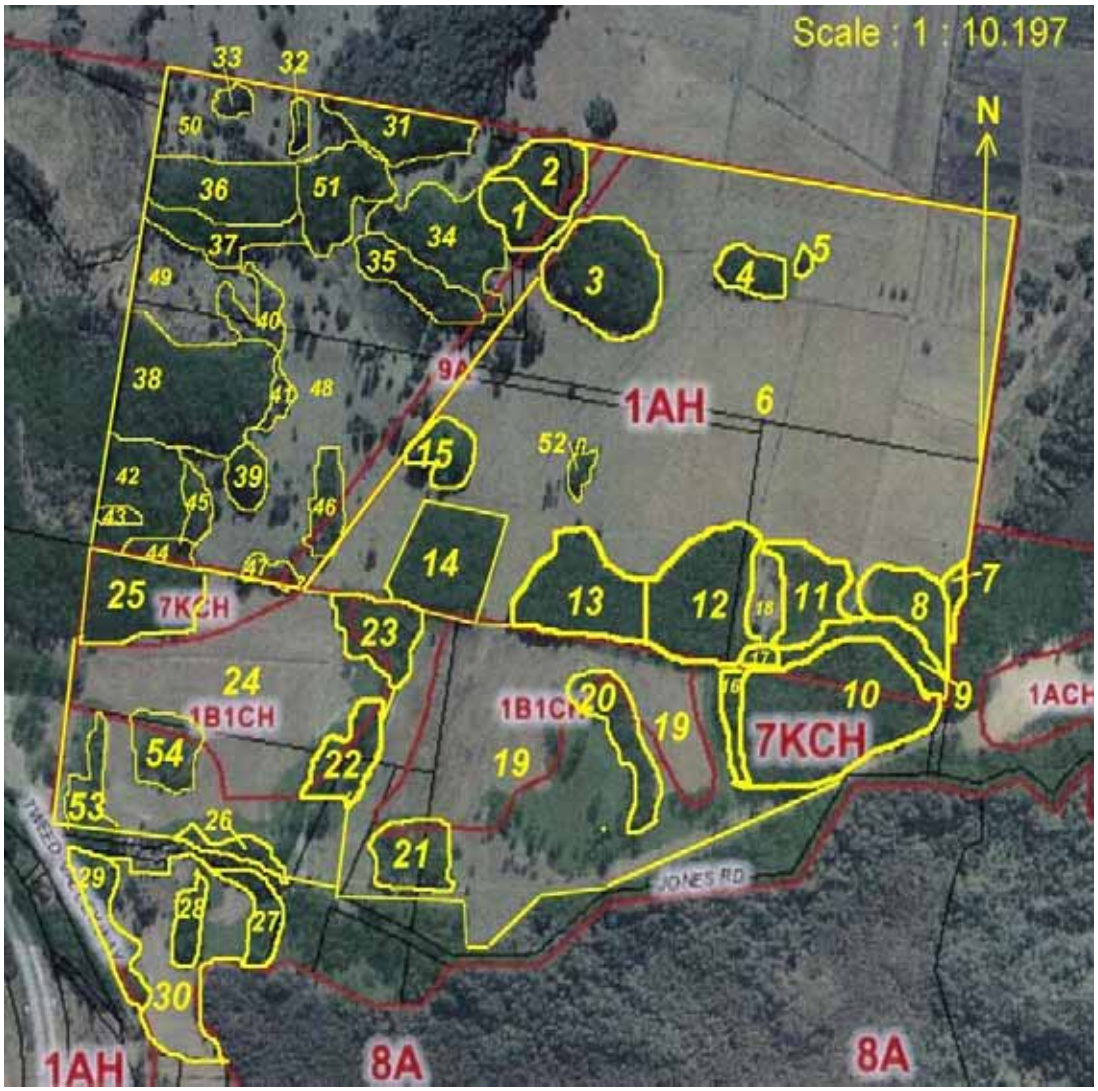


Table 3: Key to mapped polygons in Figure 3

Mapped polygon	Vegetation Classification (Walker and Hopkins 1990)
1	*Lophostemon confertus- Eucalyptus pilularis-Eucalyptus carnea* very tall mid-dense to closed forest
2	*Eucalyptus siderophloia-E. pilularis-E. carnea-Corymbia intermedia* very tall mid-dense forest.
3	*Eucalyptus siderophloia-E. pilularis* very tall mid-dense to closed forest
4	*Melaleuca quinquenervia* tall closed forest
5	*Melaleuca quinquenervia-Cinnamomum camphora* tall closed forest
6	Mixed exotic species closed grassland with scattered trees and clumps of trees.
7	*Melaleuca quinquenervia* low closed shrubland.
8	*Melaleuca quinquenervia* low closed forest: post peat fire
9	*Eucalyptus tereticornis* very tall mid-dense to closed forest
10	*Eucalyptus siderophloia-E. pilularis-E. tereticornis-Corymbia intermedia* very tall closed forest
11	*Melaleuca quinquenervia* low closed forest: post peat fire
12	*Melaleuca quinquenervia* tall closed forest
13	*Melaleuca quinquenervia* tall closed forest
14	*Melaleuca quinquenervia* tall closed forest
15	*Melaleuca quinquenervia-Cinnamomum camphora-Casuarina glauca* tall closed forest
16	*Lophostemon suaveolens* tall closed forest
17	*Casuarina glauca* tall closed forest
18	Mixed exotic species closed grassland with scattered trees and clumps of trees.
19	Mixed exotic species closed grassland with scattered trees and clumps of trees.
20	*Eucalyptus pilularis- Lophostemon suaveolens -Corymbia intermedia* tall to very tall closed forest
21	*Eucalyptus tereticornis* very tall mid-dense to closed forest
22	*Eucalyptus pilularis-Lophostemon confertus-Lophostemon suaveolens* tall mid-dense to closed forest
23	*Eucalyptus robusta-Melaleuca quinquenervia-Cinnamomum camphora*
24	Mixed exotic species closed grassland with scattered trees and clumps of trees.
25	*Lophostemon confertus- Cinnamomum camphora* very tall closed forest
26	*Eucalyptus pilularis* very tall mid-dense to closed forest
27	*Glochidion sumatranum-Cinnamomum camphora* mid-dense to closed tall forest
28	*Lophostemon confertus- Cinnamomum camphora* tall mid-dense to closed forest (fragmented)
29	*Lophostemon confertus- Cinnamomum camphora* tall mid-dense to closed forest (fragmented)

Mapped polygon	Vegetation Classification (Walker and Hopkins 1990)
30	Mixed exotic species closed grassland with scattered trees and clumps of trees.
31	*Lophostemon confertus-Eucalyptus propinqua-E. microcorys* very tall closed forest
32	*Eucalyptus carnea-Lophostemon confertus* very tall closed forest
33	*Eucalyptus grandis-Cinnamomum camphora* very tall closed forest
34	*Eucalyptus pilularis-Corymbia intermedia-E. siderophloia-E. carnea* tall to very tall mid-dense to sparse open forest
35	*Lophostemon confertus-Eucalyptus propinqua-Syncarpia glomulifera* tall closed forest
36	*Lophostemon confertus-Eucalyptus carnea E. siderophloia-E. propinqua* tall closed forest
37	*Lophostemon confertus-Eucalyptus pilularis-Araucaria cunninghamii* very tall closed forest
38	*Eucalyptus tereticornis-E. propinqua-E. siderophloia-Lophostemon confertus* mid-high open forest and woodland
39	*Lophostemon confertus-Eucalyptus grandis* tall closed forest
40	*Acacia disparrima-Cinnamomum camphora* mid-high woodland and open forest
41	*Lophostemon suaveolens-Corymbia intermedia-Eucalyptus siderophloia-Guioa semiglauca Mischocarpus pyriformis-Acacia disparrima* mid-high closed forest
42	*Eucalyptus propinqua-Araucaria cunninghamii* very tall closed forest
43	*Acacia disparrima* low-mid-high closed forest
44	*Eucalyptus grandis-Araucaria cunninghamii-E. propinqua* very tall closed forest
45	*Araucaria cunninghamii-Lophostemon confertus-Cinnamomum camphora* tall closed forest
46	*Eucalyptus grandis-Lophostemon confertus-Cinnamomum camphora* tall closed forest
47	*Cinnamomum camphora-Corymbia intermedia* mid-high closed forest
48, 49, 50	Exotic pasture with scattered trees
51	*Eucalyptus pilularis-E.carnea-C intermedia* mid-high –tall open-closed forest and woodland
52	*Melaleuca quinquenervia-Cinnamomum camphora-Casuarina glauca* low closed forest
53	*Acacia disparrima-Lophostemon confertus-Callitris columellaris* low open-closed forest
54	*Corymbia intermedia- Acacia disparrima-Glochidion sumatranum-Callistemon salignus* low open-closed forest

4.0 Ecological condition of central forest blocks

Central forest blocks closest to proposed event activities are significant components of habitats on the site and warrant priority consideration for management. Table 4 provides summaries of the ecological characteristics of central forest blocks

Table 4: Summary of vegetation and ecological characteristics of central forest blocks

Block/ Polygon #	Vegetation and Ecological characteristics Summary
A/14	Swamp sclerophyll forest on coastal floodplain EEC, with developing lowland rainforest elements. Closed forest of Broad-leaved Paperbark, Swamp Turpentine, Camphor Laurel, Willow Bottlebrush, Hard Quandong and Pink Doughwood over a tall rainforest second stratum with Bangalow Palms, Lilly-pillies, and Figs. Complex and speciose midlayer, with open sparse groundlayer. Threatened Stinking Cryptocarya located in this block. Some small hollows, lower weed intensity; cattle present
B/13	Swamp sclerophyll forest on coastal floodplain EEC Closed Broad-leaved Paperbark/Camphor Laurel forest, with occasional Small-leaved Fig, Swamp Mahogany, Blackwood, Pink Doughwood over sparse to open groundlayer affected by cattle grazing and trampling. Few small hollows present
C/12	Swamp sclerophyll forest on coastal floodplain EEC Closed Broad-leaved Paperbark/Camphor Laurel forest, with Swamp Oak, Swamp Turpentine, Blackwood and Brush Ironbark Wattle over sparse to open groundlayer affected by cattle grazing and trampling. Numerous mature epiphytes in patches, few small hollows in dead Swamp Oak spouts. Many collapsed Broad-leaved Paperbarks.
D/11	Swamp sclerophyll forest on coastal floodplain EEC Peat fire area with dense low regenerating Broad-leaved Paperbark and Swamp Turpentine with occasional Swamp Oak beneath a layer of dead standing stags. Tangled piles of fallen logs, open water where tree bases have been undermined by fire. Ferny understorey, low weed occurrence, cattle largely excluded by log tangles.
G/23	Swamp sclerophyll forest on coastal floodplain EEC Swamp Turpentine with Small-leaved and Moreton Bay Figs, Swamp Mahogany and Umbrella Cheese trees over Lantana

	dominated shrublayer. Recently fenced but previous cattle grazing and trampling. Large hardwood logs.
H/20	Subtropical coastal floodplain forest EEC Swamp Turpentine, Blackbutt, Broad-leaved Paperbark, Northern Grey Ironbark, and Pink Bloodwood over complex shrubby midlayer. Canopy species composition varies with elevation. Lantana, Bitou Bush, cattle. Active Brush Turkey mound.
I/10/18	Subtropical coastal floodplain forest EEC on lower margins; Blackbutt and Ironbark dry sclerophyll forest above. Swamp Turpentine, Umbrella Cheese Tree, Swamp Oak, Swamp Mahogany, Pink Bloodwood and Brown Kurrajong over weedy pasture and shrubs. Effects of recent fire apparent in lower southern portion. Cattle access previously through collapsed fence; now repaired.
J/21	Subtropical coastal floodplain forest EEC Fenced isolate with Forest Red Gum, Camphor Laurel, Swamp Turpentine, Broad-leaved paperbark and Willow Bottlebrush over variable shrubby understorey dominated by Cockspur. Extensive Lantana, dense tall clump of Ginger Lily; recent fire, rubbish dumping. Active Brush Turkey mound.
K/22	Part Subtropical coastal floodplain forest EEC Brush Box, Camphor Laurel, Figs, Forest Red Gum, Blackbutt over complex rainforest shrub midlayer. Slightly elevated and drier ridge, open understorey with *Xanthorrhea* and *Lepidozamia* at northern end.

4.1 Management of vegetation

While pasture of the Parklands property is an integral part of biodiversity processes at the site for some fauna, forested habitats of the site support the greater portion of vertebrate species and provide important resources. Pasture areas planned for event use will continue to be grazed by cattle and / or occasionally slashed. Pre-European vegetation of the site was almost certainly forest and future management will focus on increasing the amount of native forest and tree cover present, and on reducing the occurrence and extent of weeds.

Objectives for vegetation management include: maintain and improve conditions in existing native forest of the site; restore native vegetation in identified new full habitat areas; restore tree cover in managed parklands zones; control and remove weeds from native forest and habitat areas.

Tables 5 & 6 summarises vegetation management actions proposed for Parklands property across the various landuse zones.

Table 5: Vegetation management in operational zones

Operational zones	Vegetation Management
Event area includes resource centre/gatehouse	Pasture areas will continue to be grazed by cattle and /or slashed prior to peak event days. Remnant forest vegetation within the event area will be barrier fenced to exclude people and vehicles.
Car parking and access roads, pathways	Not required on roads, pedestrian pathways may be slashed.
Conference centre	Managed parkland plantings *include screen of native riparian vegetation along southern bank of large dam. Aesthetic plantings around the conference centre building and accommodation units. May include non-native species with minimal weed potential.
Infrastructure areas = Onsite STP and effluent irrigation areas	Rehabilitation of any vegetation disturbed during construction of STP, and reticulated pipelines. Dense marginal plantings of aquatic vegetation around all new dams and wetlands, and/or fencing to exclude cane toads.
Cultural Centre/Administration Uses	Aesthetic and culturally relevant plantings may include non-native species with minimal weed potential.

*Species lists for managed parkland plantings will be generated for specific areas as required. Local species from Brunswick Valley provenance will dominate plantings. Ultimately seed collection and propagation of plants from local vegetation will also take place. Some non-native plantings may occur in selected areas of the managed parklands zones, providing these have minimal potential to become environmental weeds/

Table 6: Vegetation management in habitat zones

Habitat zones	Vegetation Management
Aquatic and riparian habitats, drains	Existing vegetation of drains will be maintained
Full habitat (existing) Existing forest will be managed variably.	<u>Central forest blocks</u> Central forest blocks within and around the event area will be fenced with fauna-friendly fencing (no barbed wire) and cattle will be gradually excluded from these areas to enable recovery of groundlayer and understorey vegetation. Mature Camphor Laurels and any other woody weeds will be treated *in situ* with glyphosate. Standard bush regeneration techniques will be used to remove other classes of weeds. Threatened plants in the central forest blocks will be monitored 6 monthly and any developing weeds will be controlled at the time of monitoring. Seed collection from threatened plants will enable the establishment of insurance populations elsewhere on the property. This work requires a S 132C licence under the National Parks and Wildlife Act 1974.
Full habitat (existing)	<u>Northwestern hillslope forests</u> Northwestern hillslope forests will receive similar weed treatment aimed at controlling woody weeds where these occur. Threatened plants in these forests will be monitored 6 monthly and any developing weeds will be controlled at the time of monitoring. Seed collection from threatened plants will enable the establishment of insurance populations elsewhere on the property. This work requires a S 132C licence under the *National Parks and Wildlife Act* 1974.
Full habitat (existing)	<u>South of Jones Road</u> Remnant forest dissected by power line easements South of Jones Road is being augmented by extensive plantings to restore connectivity in this area. No threatened plants are currently known from this area.
Existing plantings	Existing plantings north and south of Jones Road will continue to be managed by controlling weeds through herbicide application and by slashing where plantings have been arranged in rows.
New Full habitat	Areas identified for full habitat plantings (11.1 ha) are designed to 'fill in' gaps where irregular forest edge configuration exposes forest interior to edge effects.

	New full habitat plantings also widen the area of vegetation along the Jones Road ridge to improve connectivity for forest fauna in this area. A list of locations for full habitat plantings and a schedule of works and species lists will be developed
Managed Parklands	Managed parklands are areas with a dual function, namely: to restore tree cover and connectivity for forest fauna, and to permit event related activities to take place in an enhanced environment more protected from sun and wind. In area where vehicular use is required, managed parkland plantings may be widely spaced rows of clusters. Where visual and/or auditory screening is required, plantings will occur at greater density. Pasture areas in managed parklands may be grazed by cattle once well established or slashed by tractor to minimise competition with pasture species. Native species will dominate managed parklands plantings, but non-native species may be used in selected areas of the managed parklands zones, providing these have minimal potential to become environmental weeds. A list of locations for managed parklands plantings and a schedule of works and species lists will be developed
Land to be dedicated to DECCW	Some lands to be dedicated to DECCW are being rehabilitated by plantings and removal of Camphor Laurel (*e.g.* south of Jones Road). Following allocation of lands to DECCW estate, responsibility for management also passes to DECCW. Parklands management will continue co-operative liaisons with DECCW in relation to weed and fence management and feral pest control on shared boundaries.

5.0 Management of impacts on biodiversity

5.1 Construction elements

Activities associated with the establishment of the cultural events site at Parklands include the following:

- Construction of 'at grade' or underpass crossing of Jones Road
- Construction of Spine road and access infrastructure, gatehouse, bus hardstand area
- Construction of a Resource Centre

- Construction of a Conference centre and Cultural Admin centre
- Construction of a Sewage Treatment Plant
-

Construction impacts and mitigation measures are listed in summary in Table 5.

Table 7: Construction activity impacts, management and mitigation

Construction activity	Impacts	Management / mitigation
Construction of 'at grade' or underpass crossing of Jones Road	Tree removal, disturbance from machinery and people, sediment movement, noise; disruption to connectivity	Compulsory environmental induction prior to any construction activity for all personnel. Supervision of tree removal, retain all biomass on site; compensatory plantings. Monitor fauna use of underpass if built.
Construction of Spine road and access infrastructure, gatehouse, bus hardstand area	Disturbance from machinery and people, sediment movement, noise	Diurnal hours only, install culverts beneath Spine road if at grade crossing of Jones Road used. Apply ecological principles for gatehouse construction: screened windows, minimal outdoor lighting, native plantings only.
Construction of Resource Centre	Disturbance from machinery and people, sediment movement, noise	Apply ecological principles for construction of any buildings: screened windows, minimal outdoor lighting, native plantings only.
Construction of Conference centre and Cultural Admin centre	Disturbance from machinery and people, sediment movement, noise	Apply ecological principles for construction of any buildings: screened windows, minimal outdoor lighting, native plantings only.
Construction of STP, associated dams, pipelines, wetlands	Disturbance from machinery and people, sediment movement, noise	Ensure pipeline routes do not impact on native vegetation. Buffer plantings wherever possible, minimise fencing; design for cane toad exclusion

5.2 Impacts of operation

Operation of the cultural events site includes the installation and dismantling of temporary infrastructure (bump-in & bump-out) and conduct of the peak activities of the event days. Impacts of ancillary operational activities and mitigation measures are listed in Table 6.

Table 8: Impacts of operation of the cultural events site and management

Operation activity	Impacts	Management / mitigation
Operation of 'at grade' or underpass crossing of Jones Road	Movement of vehicular and pedestrian traffic, lighting, noise	Minimise and direct lighting away from forested habitats. Use low pressure sodium vapour lights which are less attractive to insects where possible. Monitor fauna use of underpass, if built.
Operation of Spine road and access infrastructure, gatehouse, bus hardstand area	Disturbance from vehicles and people, noise, risk of roadkill; disruptions to connectivity	Minimise event days; Limit vehicle speeds to 30km/h; signage for koalas at selected locations, audit roadkill; identify hot spots for fauna movement and reduce traffic speed if and where necessary.
Operation of Resource Centre	Disturbance from vehicle movements and activity of people, noise, illumination	Minimise and direct lighting away from forested habitats. Use low pressure sodium vapour lights which are less attractive to insects where possible. Monitor roadkill in this area
Operation of Conference centre and Cultural Admin centre	Disturbance from vehicle movements, roadkill; disturbance from presence of people, noise, external lighting, window strike	Ensure screened windows, minimal outdoor lighting, native plantings only; screen planting of the southern margins of the large dam.
Operation of STP and wastewater plant, pumping wastewater, irrigation of treated effluent, operation of wetlands	Disturbance from machinery and people, noise; novel aquatic habitats can support cane toad breeding	Rehabilitate any pipeline routes with plantings of native species where possible. All new dams and wetlands to be made unavailable for

		cane toads, either by installation of fencing or by dense plantings of waterbody margins or both.

Table 9: Impacts of the conduct of musical events

Event activity	Impact	Management / mitigation
Camping	Presence of people and cars will alienate this area so that grassland fauna must forage and move elsewhere.	30% of Parklands pasture remains outside the event area. Short duration of disturbance.
Parking	Presence of people and cars will alienate this area so that grassland fauna must forage and move elsewhere.	30% of Parklands pasture remains outside the event area. Short duration of disturbance.
Vehicular traffic	High levels of traffic will create noise and disturbance to connectivity for fauna	Restricted to a maximum of 20 event days per year; speed limits, monitor roadkill;
Pedestrian traffic	Presence of people will disturb shy fauna; people may encounter and handle fauna (*e.g* Echidna, python)	Fauna rescue crew; security; green cops. Sixty % of the Parklands property remains outside the event area
Musical performances	Noise, lighting disturbance of nocturnal fauna in habitats close to stages.	Restricted to a maximum of 20 event days per year. Noise will be directed away from most forested habitat; acoustic and fauna monitoring will identify adverse effects on fauna. If consistent adverse effects identified, then noise barriers, visual screening or other mitigatory measures may need to be deployed.
Wastewater management Initially pumpout to tankers and off site treatment	Truck movements Risk of roadkill	Speed limits; signage environmental induction for all drivers and operators
Security Fencing	Interruption of movement	Minimise amount of

	patterns for larger terrestrial fauna	fencing and the time it is joined together, dismantle at earliest opportunity.
Special event lighting	Attraction and death of flying invertebrates	Use lighting principles where possible, monitor compliance. Ecological audit
Bonfires	Risk of starting a wildfire	Fire wardens will control and attend any bonfire, a tanker truck will be present during the event No large logs to be collected from the Parklands site, or used for firewood

6.0 Fauna monitoring

Regular monitoring of target fauna groups as described in Appendix F will assist in identifying behavioural and abundance changes. Management responses to detected changes will attempt to mitigate adverse effects.

7.0 Ecological Induction and Ecological audit

An ecological induction notifies all staff and volunteers entering the Parklands site of a number of measures to be taken to minimise adverse effects on habitats and biodiversity. An ecological audit proposed for events will identify breaches of environmental standards. See Appendix L

8.0 Environmental Health and Safety Manual

An Environmental Health and Safety Management Manual has been developed for the site which identifies environmental risks and provides management responses.

9.0 Timing of management actions for events

An environmental induction is mandatory for all workers and volunteers, engaged in any aspect of the proposal and must be completed before any actions take place on the Parklands site. Following the issue of a construction certificate, work will begin on constructing the infrastructure needed for events. Construction of the underpass or at grade crossing and internal roads will commence at this stage. The gatehouse will also be constructed. Precise timing for these actions is not currently available and will be affected by weather conditions and other logistic variables.

Cattle will be removed from the property before the bump-in phase begins and remain off site for 3 months. The following table lists event-related management actions and indicates approximate time frames in which these actions are to be implemented.

Table 10: Summary timing of management actions

Management action	Before event	During event	After event
Environmental Induction	X	X	
Temporary removal of all cattle	X	X	
Manage drain crossings	X	X	X
Conserve buffer to BNR/no slashing	X	X	X
No illumination of forest		X	
Traffic control: reduce vehicle speeds	X	X	X
Koala signage	X	X	X
Fence western side block 'A'		X	
Minimise time temporary event fences are in place		X	
Fauna Management crew on site		X	
Fauna Monitoring	X	X	X
Include Koala feed trees, forest oaks and figs in plantings	X	X	X
Tree plantings compensating for CO_2/bonfires	X		
Fence sensitive vegetation areas		X	
Maintain stock fencing around forest blocks	X	X	X
Fauna survey	X	X	X
Koala survey	X		
Ecological audit	X	X	X

10.0 Best practice guidelines for habitat restoration workers

This Planting summary and Guidelines for habitat restoration workers was prepared by Bush Regenerator Dave Rawlins.

To ensure that appropriate techniques are undertaken by restoration workers, plans and agreements have been developed. Excerpts of these follow.

As part of the works agreement between Billinudgel Property Trust and the local indigenous rehabilitation team, Madhima Gulgan, all bush regeneration workers comply with the following –

- Before any works commence the team supervisor will undertake a risk assessment and ensure OH& S requirements are met;
- Team has appropriate public liability and workers compensation/accident cover insurance;

- Team Supervisor will fill out a daily record sheet including chemical user chart as provided
- Team members have a current Chemical Application Users Certificate;
- Team will supply their own tools and safety equipment;
- Team will report any issues or concerns with the project to NBSP personnel.
- Team members all have attained a certificate in Conservation and Land Management (CLM) TAFE course.

A Plan for on ground restoration works has been developed for workers to implement. Some relevant information from this plan follows.

The purpose of this project is to restore degraded farmland into local native forest. Species planted will vary according to elevation: Swamp Sclerophyll Forest on coastal floodplain, sub-tropical coastal floodplain and lowland rainforest communities will be planted, thus restoring these diverse Endangered Ecological Communities in the locality. Revegetating this site will join two disjunct areas of Billinudgel Nature Reserve which is part of the NPWS regional corridor. By linking the two areas of nature reserve we aim to enhance fauna movement, including for threatened species. By permanently removing cattle and through revegetation we also aim to improve the water quality particularly run off, which drains directly into Billinudgel Wetland and estuary, in the Nature Reserve

Activities to undertake. To rehabilitation of 9.4 Ha of grazing land, by planting 7,000 plants and undertake bush regeneration to remove weeds and facilitate natural regeneration in areas of regrowth vegetation. Ten (10) nest boxes will be installed and monitored for use by fauna. To hold 2 community participation days for plantings and ecological workshops. To conduct monitoring by means of photo points and transects. After cattle have been excluded, the 700 metres of barbed wire boundary fence along the nature reserve will be removed after further consultation with DECC. The Madhima Gulgan indigenous CDEP team will be involved in the project which will assist in knowledge sharing and increase our understanding of cultural issues.

Justification of approach. The project site has been identified and prioritised for revegetation as it comprises grazed pasture which is generally poor quality habitat for fauna in the NPWS regional corridor. Enhancing this corridor between the coast and hinterland forests will improve the potential for movement of species, assist in the maintenance of diversity and the long term viability of plant and animal populations on the coast. This is particularly important for the threatened species of fauna (listed under the TSC Act) recorded in the immediate local area. Species selected for planting will contain a high proportion of important food trees for threatened species including frugivorous birds and koalas.

Removing stock and planting trees will preserve soil, increase filtration and minimise the risk of exposing acid sulphate soils all which mitigate threats to the 2 flood prone Endangered Ecological Communities (swamp sclerophyll and subtropical coastal floodplain forest) in the nature reserve. Tree planting and bush regeneration will improve habitat and allow for natural recruitment of native plant species. Nest boxes will likely provide habitat for hollow dependent fauna as the site has very few naturally occurring hollows. Barb wire fencing has been identified as a threat to fauna

in the Nature Reserve plan of management. Once cattle have been removed from the site the fence is no longer needed.

This project meets objectives/targets for biodiversity, water quality and community engagement objectives from the Byron Biodiversity Conservation Strategy and Northern Rivers Catchment Action Plan. The project also strengthens aims and mitigates threats outlined in the NPWS key habitats and corridor projects, Billinudgel Nature Reserve Plan of Management, NSW Govt groundwater policy as well as Dept of Environment & Conservation recovery plans for threatened species found in the local area.
Specific examples include removing stresses from Endangered Ecological Communities, enhancing areas of HCV (High Conservation Value), limiting the spread and abundance of environmental weeds, improvement and maintenance of riparian zones and wetlands actively manage Acid Sulphate Soil risk areas and integrate projects to achieve holistic coastal flood plain management.

There are significant cultural sites such as a bora ring and shell middens in the Nature Reserve. It is believed our revegetation efforts outside the reserve will have no foreseen impact on these areas. There are no known specific cultural heritage sites in the project area. However, discussions and planning for this project has included the Tweed Byron Lands Council and Madhima Gulgan CDEP team. Their support and involvement in the project should limit the possibility of causing any adverse impacts on cultural heritage sites.

Maintaining the Project. We are very committed to the ecological restoration of our property and will continue to fund maintenance to ensure revegetation success is assured. As we implement our property plan we envisage expanding these current works to maximise biodiversity outcomes, by enlarging the area of forested habitats present on the site.

Effects on surrounding areas. Plantings and weed removal are designed to have a positive effect on the surrounding environment and biodiversity. The adjoining Nature Reserve will benefit particularly with improved water quality of run off entering the reserve (by eliminating cattle from this area), reduction of weed invasion and increased habitats and habitat connectivity for fauna.

Monitoring and Evaluation (M&E).

The success of revegetation will be measured by monitoring including sampling to determine the survival of trees planted. Species planted will be recorded. Nest boxes will be monitored to establish occupancy by animals and remove any feral fauna (e.g. Honey Bees *Apis mellifera*).

Five Photo points will be established before works commence and at the end of the project. Photo points will cover both planting sites and regeneration areas

Four 20 m transects will be established. All flora species will be recorded at a 2 metre width along the transect. An area 1m diameter will be surveyed at the 0m, 10m and 20m points to assess species composition and abundance at the ground layer, midstorey (2m) and canopy. Percentage cover (exotic and native) will be also

assessed at these three heights. Monitoring will be conducted prior to works, 6 months after works commence and each year following (if resources are available).

Proposed Works.

Tree Planting.

Over 50 species associated with swamp sclerophyll forest, subtropical flood plain forest and low land rainforest species including pioneers, secondary, mature phase and understorey species of the latter community will be planted. Some of these species are:

Melaleuca quinquenervia Broad leaf paper bark, *Eucalyptus robusta* swamp mahogany, *Melicope elleryana* Pink Euodia, *Glochidion sumatranum* Umbrella Cheese tree, *Casuarina glauca* swamp oak, *Lophostemon suaveolens* Swamp box, *Acmena smithii,* Lilly Pilly, *Callistemon salignus* Pink Bottle brush, *Commersonia bartramia* Brown Kurrajong, *Ehretia acuminata* koda, *Cyclosorus interruptus* Swamp Fern, *Ficus obliqua* Small leaved Fig, *Ficus watkinsiana* Strangling Fig, *Glochidion ferdinandii*, Cheese Tree, *Alocasia brisbanensis* Cunjevoi, *Melastoma affine* Blue tongue, *Macaranga tanarius* Macaranga, *Myrsine howittiana* Muttonwood, *Polyscias elegans* celery wood.

7,000 local endemic species of either Brunswick Valley or Parklands provenance ,as listed in the preliminary vegetation management plan, are needed to be planted across a minimum work area of 9.4Ha.

Bush Regeneration

All patches of vegetation in the project area are regrowth and contain high levels of weed invasion. These areas will have to have primary weed control undertaken - see attached weed control guidelines. Commence works in early 08 and maintenance will be required beyond the length of this project.

The proposed target condition by March 2009 is to reduce the impacts of weeds throughout the project area. In particular, to have removed all woody weeds with only maintenance spray runs required to control new weed recruitment. Some Camphor Laurels may be retained due to their importance for habitat. Large mature camphors (individual trunks > 60 cm DBH) will be recorded and removed in a staged approach after assessment.

In some areas a staged approach to weed control will also be needed to prevent over exposure to light and the subsequent weed infestation this causes. However, all of the most invasive weeds will be completely removed such as ochna, privet and senna.

After M&E has been undertaken, on ground works should be carried out working through areas systematically. Primary works will require the treatment of weeds in the ground layer once these weeds have been controlled canopy weed species such as Camphor Laurel can be removed. A regime of maintenance spraying, cut and paint herbicide application and hand weeding is needed to prevent the re-establishment of weeds and to ensure native seedling germination and growth is not impacted upon.

Threatened species may occur in the work areas, hand weed a buffer to avoid the use of herbicides in their immediate vicinity. Record all threatened species encountered on daily record sheet.

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Planting Summary valid to end of 2008

	June 07	July 07	Oct 07	May 08	Sept 08	Oct 08	totals
Acacia disparrima		25		90		15	130
Acacia melanoxylon	20	25		10		10	65
Acmena hemilampra				10			10
Acmena ingens				5			5
Acmena smithii	35	13	60	60	10	10	188
Acronychia oblongifolia				30		5	35
Allocasuarina torulosa				75			75
Alpinia caerulea	10						10
Archontophoenix cunninghamiana	40		40	5	10		95
Auranticarpa rhombifolia				25			25
Austromyrtus dulcis	10						10
Breynia oblongifolia	10						10
Callistemon salignus	50	42	100	35	50	10	287
Callitris columellaris				60			60
Casuarina glauca	30	30	40				100
Commersonia bartramia	35	25	60	0	15	30	165
Cordyline petiolaris	10						10
Corymbia intermedia	10	12	20	45		15	102
Cryptocarya glaucescens				30			30
Cryptocarya obovata				30			30
Cryptocarya rigida	0	12	10	30			52
Cryptocarya triplinervis triplinervis	10	12					22
Cupaniopsis anacardioides	10		10	30			50
Duboisia myoporoides				10			10
Dysoxylum fraserianum				15			15
Dysoxylum mollissimum				25			25
Dysoxylum muelleri		12					12
Ehretia acuminata				5			5
Elaeocarpus grandis	10	12					22
Elaeocarpus obovatus	0	12		10			22
Eucalyptus acmenoides				15			15
Eucalyptus microcorys				45			45
Eucalyptus pilularis				20			20
Eucalyptus propinqua				20			20
Eucalyptus siderophloia				10			10

Eucalyptus tereticornis	25	12	40	65			142
Eucalyptus resinifera	0	12					12
Eucalyptus robusta	50	42	100	50	20		262
Ficus coronata	10		20	25	10		65
Ficus fraseri	10	12		10		10	42
Ficus macrophylla				5		2	7
Ficus obliqua	10		5	5		1	21
Ficus virens				8			8
Ficus watkinsiana	10		5	7		2	24
Flindersia australis				10			10
Flindersia schottiana				10		10	20
Geissois benthamii				10			10
Glochidion ferdinandi	25	12		60		25	122
Glochidion sumatranum	40	25	60	20	20		165
Gmelina leichhardtii				10			10
Guioa semiglauca	25	12	20			20	77
Homalanthus nutans				40		10	50
Hymenosporum flavum				10			10
Jagera pseudorhus	25	12	20	55		15	127
Livistona australis	40		50		10		100
Lophostemon confertus				80		30	110
Lophostemon suaveolens				10	10		20
Macaranga tanarius	25	12	20				57
Mallotus discolor						10	10
Mallotus phillippensis				30			30
Melaleuca quinquenervia	300	75	240		120	30	765
Melastoma affine	25						25
Melia azedarach var. australasica				40			40
Melicope elleryana	50	30	60	20	25	20	205
Neolitsea dealbata				5			5
Pilidiostigma glabrum	25			5			30
Pittosporum undulatum				0		10	10
Polyscias elegans	15	12	20	0		5	52
Pouteria australis				5			5
Rhodamnia rubescens				10		5	15
Sarcopteryx stipata				5			5
Syncarpia glomulifera				20			20
Syzygium australe				20			20
Syzygium crebrinerve				10			10
Syzygium luehmannii				20			20
Toona ciliata				10			10
Trema aspera				65			65

TOTALS	1000	500	1000	1500	300	300	4600
4600							

Details of post 2008 plantings (another 3000 plants) are to be provided.

11.0 Performance criteria

Performance criteria are listed in Table 14. While it is noted that performance criteria need to be measurable wherever possible, in some cases the measurement can only operate in terms of the identification of changes in condition observable due to and during or following the event.

For example the buffer areas to Billinudgel Nature Reserve in the extreme south of the Parklands property will be fenced and cattle will be removed from these areas prior to the event. Likely changes to the buffer areas may include littering, and regrowth of pasture due to removal of cattle. Such changes can be recorded through photography for the ecological audit, but some may be difficult to measure (time taken to collect litter; number of bags of litter collected, changes in height of pasture, and of dominant pasture species).

Similarly the large dam varies seasonally in the extent of exotic water lily *Nymphaea capensis* cover, due to lack of growth in winter, and to cattle entering the dam to graze on this plant. Measurement of changes to bird assemblages on this dam is probably the only practical measure for estimation of impacts.

An ecological audit process proposed for event activities is described in Appendix L.

Table 11: Performance criteria for management actions/measures

Management Zone	Performance criteria
OPERATIONAL ZONES	
Event area, including resources centre & gatehouse	Ecological audit reports on conduct of the event and identifies areas damaged requiring improved or specific management responses. Audit report to be provided within 6 weeks of event completion. Fauna monitoring analyses indicate levels and directions of any response by targetted fauna groups. Fauna monitoring report to be provided within 6 weeks of event completion.
Car Parking; access roads , pathways	Ecological audit indicates koala signage is present, access zones have been adequately managed during the event; identifies areas needing management responses. Roadkills will be monitored and any hotspots identified will be reported and signed and have speed limits reduced.
Infrastructure areas	Ecological audit indicates that infrastructure delivery

Onsite STP	has not caused damaged to vegetation or soils, no hazardous material spills, erosion, or unmanaged sediment movement. See Appendix K for an assessment of the onsite STP
Conference centre	To be provided in an updated version of this draft plan.
Cultural Centre/administration uses	To be provided in an updated version of this draft plan.
Full habitat-existing	Full habitat areas identified in the Ecological Structure Plan are intact; weed removal issues have been addressed as planned, nest boxes are installed
Full habitat-new	Planting areas specified in the Ecological Structure Plan have commenced and a ~ 90% success rate in plantings has been achieved after 12 months following planting. A report on the progress and status of plantings has been provided.
Managed Parklands	Planting areas specified in the Ecological Structure Plan have commenced and a ~ 90% success rate in plantings has been achieved after 12 months following planting. A report on the progress and status of plantings has been provided.
Land to be dedicated to DECCW	Ownership of these lands is transferred to DECC as per any executed land transfer agreement between NBSP and DECC

12.0 Reporting

An audit report will be prepared after each event. The principle mechanisms for assessing the delivery of management actions described above are as follows:

- the ecological audit (Appendix L) proposed for the all large events;
- fauna monitoring designed to assess impacts on fauna and habitats of events and subsequent analyses and reporting;
- the Bush Regeneration team has a monitoring and reporting program covering all activities undertaken in relation to planting and weed control.
- Koala surveys and updated Koala Plan of Management to be prepared before any large events take place at parklands.
- Recommendations for adaptive management-corrective action where the monitoring reveals that the action-measure was not successful, or was in part a failure.

13.0 Person(s) responsible for implementing management

Persons involved in the delivery of management at the North Byron Parklands site include the following:

Mat Morris is Parklands general manager and carries overall responsibility for delivery of management and integration of reporting.

Bush regeneration activities on the site including installation and management of plantings are managed by the Madhima Gulgan bush regeneration team with experienced bush regenerator David Rawlins.

Koala surveys, SEPP 44 assessments and preparation of an updated Koala Plan of management are the responsibility of specialist koala consultants Biolink Consultants, principal biologist is Dr. Steve Phillips.

Mark Fitzgerald Ecological Consultant manages fauna surveys and fauna monitoring and co-ordinates fauna and flora survey activities on the site by other ecologists, assist planning for plantings and bush regeneration activities.

Robert Kooyman of Earth Process Ecological Services provides specialist botanical services, and statistical support.

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Appendix N

References

from all

Ecological Assessment

Appendices

Parklands-Application Number 09_0028

Prepared for Billinudgel Property Trust

(Billinudgel Property Pty Ltd)

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