PLANNERS NORTH

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7 March 2016
Our reference: 1287-541

Ms Lynelle Briggs AO, Ilona Miller and Prof. Zada Lipman
Planning and Assessment Commission
PO Box 3415
Sydney
NSW 2001

Email: pac@pac.nsw.gov.au

Dear PAC Members

RE: D399/16 Cultural Events Site, Tween Valley Way and Jones Road, Yelgun

Messrs Morris, Doolan and the writer met with Planning and Assessment Commission (PAC) Members Briggs, Miller and Lipman together with Commission Secretariat staff on Tuesday 23rd February 2016. By way of email dated 3rd March 2016, the Commission requested further details in relation to the following matters:

1. The type of minor community events that are desired to be allowed at the North Byron Parklands site (the Commission feels this needs to be more clearly defined);
2. How noise emanating from these minor community events will be managed (the music event noise limits outlined by Condition B3 are unlikely to be considered appropriate)?;
3. What would be the specific eligibility criteria for a small community events to have access to the site free of charge (the Commission feels this needs to be more clearly defined)?;
4. What are the flora species that have already been planted and are planned to be planted at North Byron Parklands?; and
5. What is the proposed timing of the rehabilitation and monitoring program in relation to the large event dates? (the Commission seeks to know the number of weeks or days prior/post the large events).

In relation to those items we advise as follows:

1. Type of Community Events

The Department of Planning and Environment (DPE) has recommended to the PAC modifications to the project and concept approvals MP09_0028. In relation to the matter of 'a minor community event' the DPE has recommended to the PAC a definition being *'minor community event' is an outdoor trial event of up to 1,500 persons that is non-music focused, provides an educational purpose or a cultural experience for the community and operates between the hours of 9 am to 10.30 pm.* Our section 79W modification application request of May 2015 sought the definition of suggested operational parameters to limit potential impacts as being:

- Non-music focused;
- Small enough not to require external traffic management;

- and conformity with the applicable Parklands general management protocols and consent conditions.

We advise that the proponent has no issue with the refinement of the minor community event definition proposed by DPE to specifically exclude objectionable noise events such as motocross and monster trucks and the like.

2. Noise Management of Small Events

The types of community events proposed are activities that do not rely heavily on amplification equipment (like music type events do). The proposed consent conditions drafted by the Department of Planning and Environment (DPE) require the development of a Minor Community Event Management Plan that must be prepared in consultation with various State and Local Government agencies and address noise management.

Importantly, approval of ongoing minor community events is subject to Parklands obtaining a further approval of the Secretary, following the consideration of the 'Performance Report for Minor Events' report required by Condition B7(7).

This means that the proposed 5 small community events are of a trial nature inferring that no further approval would be granted by the Secretary unless these 5 community events operated in a manner that did not impact on residents outside the venue.

Finally, to put this in some perspective, both Splendour in the Grass and the Falls Music and Arts Festival commence building or "bumping in" their respective events up to 21 days before the event is held. In each of these cases, and particularly closer to show days, upwards of 500 vehicle movements take place each day with anywhere between 300 and 2,000 workers on site. The same "bump out" activities occur for up to 7 days post each event. For each of the 6 events held to date Parklands has never received a noise complaint from adjoining neighbours, other community members or the Byron or Tweed Shire Councils during these times.

3. Eligibility Criteria for Small Community Events

The specific eligibility criteria for a small community event to have access to the site free of charge is that they must be either:

- A registered not-for-profit organisation; or
- An accredited educational institution (i.e. primary and secondary schools, universities, TAFE, etc).

4. Flora Species Planted at Parklands

As per the requirements of the approved Vegetation Management and Biodiversity Plan all of the surveyed flora species present on the site have been tabulated (refer **Annexure A**). The Habitat Restoration Team when undertaking tree planting works as part of the approved Ecological Structure Plan use this list as a planting guide.

All flora species are either propagated onsite (at our nursery) using endemically sourced seed from various native trees on site or from one of three local nurseries that specialise in flora species endemic to the region.

The latest Ecological Restoration Report is provided in **Annexure B** and provides details of the location of habitat restoration works undertaken in 2014/15 and the overall progress or restoration against the approved ecological structure plan.

5. Flora and fauna Monitoring and rehabilitation Program at Parklands

Objectives of Monitoring

The objectives of the Flora and Fauna Monitoring program (which have been conducted for each of the 6 events held to date) are to: *monitor and assess the impact of the project* (North Byron Parklands Cultural events site) *on flora and fauna within and adjacent to the site.* Monitoring was undertaken using a range of Event Impact Monitoring techniques (EIM), described below.

Methods—Monitoring Techniques

Transect selection

The fauna monitoring strategy (EIM =Event Impact Monitoring) is based on the Before-After-Control-Impact design of Underwood (BACI: 1994), based on 3 Control and 2 Impact locations. Because the 'Impact' from events is predictable, the sampling design used is a before-during- after (BDA) pattern. Locations sampled are floodplain forest habitats at similar low elevations within the study area. Two 200m/2ha bird transects were measured and marked with flagging tape at each of the five locations, and one transect at each location was used for hair funnel sampling. Three Control and 1 Impact locations (8 transects) are within Billinudgel Nature Reserve and 1 Impact location is within the Parklands site (23 transects).

Anabat detectors were deployed at two waterbodies in Parklands and at the edge of a paperbark swamp in BNR. The location of transects is shown in Figure 1.

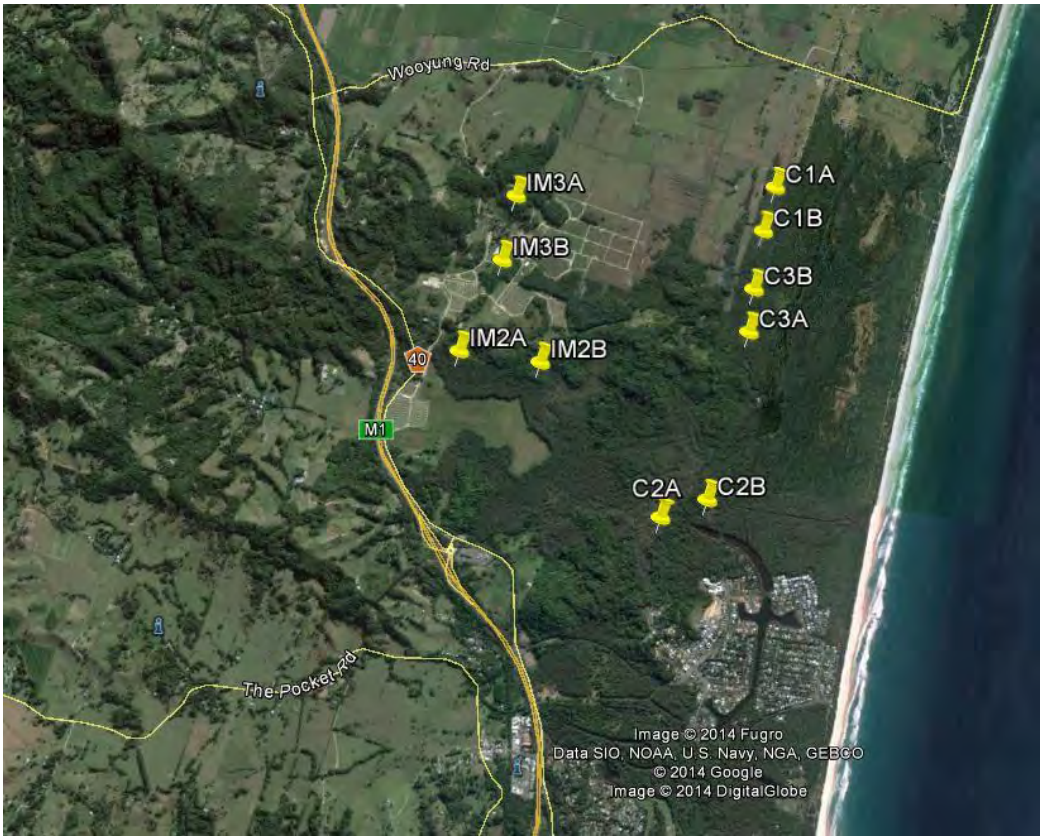

Figure 1: EIM bird and Hair Funnel transects IM are Impact transects; C are Control transects Source: GoogleEarth.

Monitoring Methodologies

Forest Birds

It was initially considered that forest birds were likely to be exposed to disturbance from event processes, ranging from increased noise, human presence and vehicle movements close to central swamp sclerophyll forest blocks in Parklands, and that event impacts could result in birds leaving these sites or avoiding them during or after events. Therefore a sampling strategy was developed based on standardised 20 minute/2ha transect surveys recording all birds observed or heard within a 50m distance from the marked 200m transect centreline at 6 Control and 4 Impact transects on each of three consecutive days.

Typically events run for three consecutive days, therefore EIM provided survey effort over a similar and comparable time period. Three experienced observers surveyed simultaneously and were rotated through different transects daily.

Temporally constrained area searches are commonly used in bird census (*e.g.* Bibby 2007, Birds Australia atlassing) and are based on a number of assumptions. These include that individual birds are counted once, that birds outside the area are not included, and observers are capable of recognising most if not all of the local birds on the basis of their calls. The general consistency of data between observers over three years indicates that surveys for forest birds were repeatable and reliable.

Visibility and detectability of birds varied between transects based in part on ground layer and mid-layer vegetation structural complexity. In practice the majority of records are call-based, and in previous summer surveys cicada noise was observed to substantially affect bird and species counts.

Bird surveys for the Falls Festival were affected by logistical difficulties with 2 observers (SP & MF) sampling over 5 days to get 30 'before' site samples. Flash flooding reduced the 'during' sample to 20 site samples. Three observers operated over 3 days to get 30 'after' site samples. This asymmetrical data base complicated analyses

Sampling for SITG 2015 using three qualified observers took place from in June, July and August.

Bird Survey Protocols are listed below.

- At each of 2 transects at each EIM location a 200m line transect is flagged with tape labelled every 20m.
- Three observers simultaneously sample birds at each of the 2 sub-sites at each EIM location, while walking along the flagged transect line for 20 minutes
- Birds within ~50m of this line are recorded, thus sampling a 2ha area.
- Birds are counted only within 50m of the line, once inside the forest. A five minute waiting period may be used before commencement.
- Birds overhead within the 2ha area are counted.
- Individual birds are counted only once: *i.e.* if a bird moves within the sample area it is only counted when first detected.
- Unknown species are recorded as Sp A or sp B and later researched until a name can be given to the bird.
- Observers are rotated through the EIM locations each day to balance variations in observer performance.
- All bird surveys must be completed within ~2 hours of dawn.
- Severely windy or wet weather is avoided where possible.
- Notes are made describing the date, time, location and conditions of survey: wind, temperature, cloudcover, rain, cicada noise

- Date of survey commencement is determined by using a random number sequence, where possible.
- 'Before" surveys take place before bump-in; 'After' surveys take place after bump-out.
- All data is entered into an excel spreadsheet

Microchiropteran Bats (Anabat call detection)

Three Anabat call detectors (2 SD2s, I SD1 with ZCAIM: Titley Scientific) were used during Event Impact Monitoring (EIM). Anabats were used at 3 fixed Impact locations for the 2014-15 Falls Festival and for SITG 2015. Anabat detectors were deployed for a minimum of 3 nights each month and were placed on wooden platforms fixed to trees ~1.5m above the ground, and were either directed at waterbodies (Northwestern Dam wall, or 'Miniopterus dam', or on the edge of a paperbark swamp (IM2). Anabat sampling was usually undertaken simultaneously with bird sampling. Call data stored on compact flash cards was downloaded using CFC reader and examined with AnalookW before being dispatched to Biosis, Newcastle for analysis.

Small and medium sized mammals (Hair Funnel Sampling)

Fifty hair funnels (Faunatech, Vic) were set out over a minimum of 4 nights and were baited with oats, peanut butter, honey and white truffle oil (Simon Johnson, Melbourne). Ten hair funnels were placed 20m apart along bird transects at each of 3 Impact and 2 Control locations during each month of sampling, and usually occurred simultaneously with bird sampling Wafers were examined for the presence of hairs and dispatched to Georgeanna Story (Scats About, Major's Creek) for analysis.

Terrestrial fauna movement (Sand Traps)

Sand traps at each end in three small culverts on the internal Spine Road in Parklands were sampled in December to identify patterns of fauna movement in this area. Flash flooding on January 1st and May 2nd resulted in abandonment of the sand traps and adoption of infra-red motion sensor cameras (Reconyx & Scoutguard) to monitor fauna activity on this location.

Flying-fox surveys (Walking Spotlights)

Flowering trees within the event area in Parklands were opportunistically surveyed for the presence of Flying-foxes one night during both the Falls 2014-15 and SITG 2015 events.

Waterbirds (Dam Birds)

Twenty-minute point surveys with binoculars (Steiner Skyhawk 10 X 42) were undertaken from a partially hidden location on the wall of the large northwestern dam (~1.8 ha) on six occasions from December 2014 to August 2015. A total of 38 samples have been undertaken at this location since 2007. Dam birds were generally sampled opportunistically, but included before- during and after samples for each event.

As an example of the extensive monitoring programs undertaken before, during and after each event **Annexure C** provides the Environmental Performance Report: Ecology – Year 3 2014-15 and **Annexure D** provides the Results and Analyses of Event Impact Monitoring Data 2014-15.

With respect to rehabilitation (habitat restoration), as drafted by the DP&E in its proposed Project consent conditions, Parklands is committed to implementing a revised ecological structure plan within the trial period (i.e. by 31 December 2017).

Should the Commission require any additional information or wish to clarify any matter raised by this letter, please feel free to contact the writer or Mr Morris of North Byron Parklands.

Yours faithfully,

PLANNERS NORTH

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Annexure A

Vegetation Management and Biodiversity Plan

Vegetation Management

and

Biodiversity Plan

North Byron Parklands

prepared for

North Byron Parklands

by

Mark Fitzgerald
Ecological Consultant

P.O. Box 237 Mullumbimby

NSW 2482

GLOSSARY

Application area: that part of the overall Parklands property subject to the NSW Department of Planning and Infrastructure (DoPI) Concept and Project Approval number: MP 09_0028

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

Event area: the defined parts of the property approved for conduct of events and event-related activities

Full habitat: existing native vegetation

Managed parklands: plantings that provide a level of connectivity and habitat while simultaneously being of a planting density that allows other uses of these areas (*i.e.* camping, market stalls, etc)

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; scope

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 ~ 256 ha site contributes to the state of biodiversity in the location. Responsible management of the site has the capacity to improve local habitat connectivity and to maintain or improve ecosystem processes. While maintenance and expansion of native vegetation ('full habitat') on the site is a key factor in the VMBP, the provision of additional tree cover in approved 'managed parklands' areas will also improve the capacity of the site to support biodiversity. See Figure 1.

Delivery of feral animal and weed control, 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.

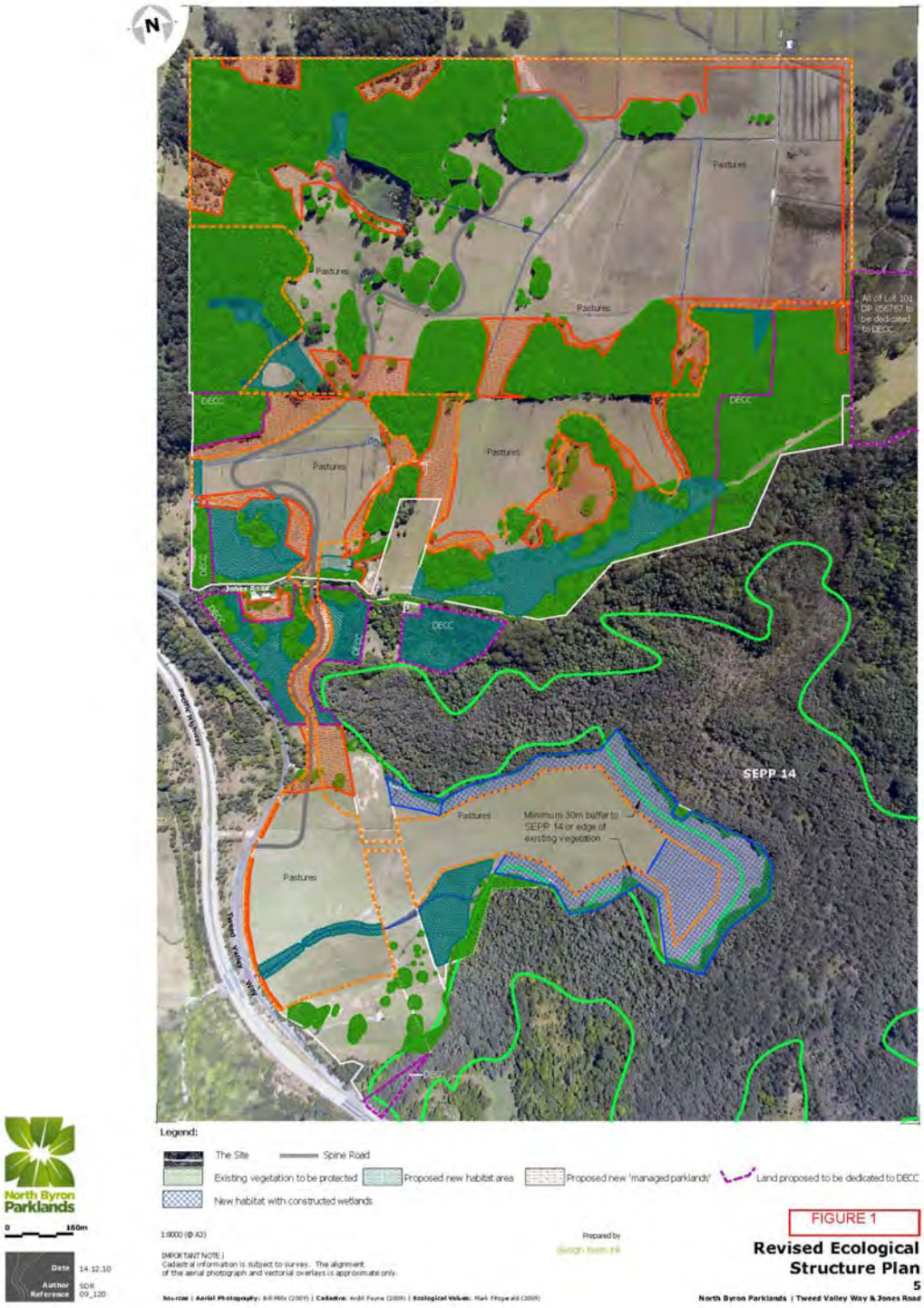
Therefore, the aim of the VMBP is to maintain and improve habitat values at the Parklands site.

Objectives include:

- Maintain and where possible improve conditions in existing native forest of the site;
- Restore native vegetation in new habitat areas (as mapped in the approved Revised Ecological Structure Plan 1.3 at Figure 1);
- Provide low density tree cover in managed parklands zones (as mapped in the approved Revised Ecological Structure Plan 1.3 at Figure 1);
- Control and remove weeds from native forest and habitat areas.
- Deliver control programs for feral animals.

The VMBP applies to the first five years of the approved project and may be updated to reflect the development of adaptive management measures, and consultation with the Regulatory Working Group (RWG).

Figure 1: Latest Ecological Structure Plan



1.0.1 Updates to the draft plan

Measures proposed in the VMBP may be modified by feedback from current and future investigations at the site. It is necessary to re-visit assessment of 'core Koala habitat' as defined by SEPP 44, especially given changes to Koala distribution and abundance reported in the recently completed Byron Coastal Koala Habitat Study (Biolink 2012: see http://www.byron.nsw.gov.au/publications/k).

Management of 'core Koala habitat' (*e.g.* by establishment of a buffer zone if any is present within the Parklands site) is best delivered with contemporary data. Re-assessment of 'core Koala habitat' is proposed no later than 90 days prior to the staging of the first event at Parklands, therefore no later than May 30th 2013.

Consent condition C19 requires a Flora and Fauna Management Plan to be prepared in order to manage the impacts to flora and fauna arising from the carrying out of events at the site. Monitoring of flora and fauna proposed at the site is to be described in a Flora and Fauna Monitoring Program required under DoPI approval consent condition C20. Both plans are to be prepared in consultation with the Regulatory Working Group (RWG) and are to be submitted for approval at least 60 days prior to the commencement of the first event.

The Flora and Fauna Monitoring Program and Flora and Fauna Management Plan will include provisions addressed in the VMBP.

Influences of climate and stochastic events will produce unpredicted phenomena, so this plan and prescribed management measures will need to be able to be modified in order to react to 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).

1.0.1.1 Updates to the project

The approved components of the project are as follows:

(a) Stage 1

(1) Outdoor Event Approval

i) A trial of outdoor events up to the end of 2017, including car parking; ancillary camping; and, erection of temporary structures and facilities within the Event Usage Area defined within Plan 1.2 – Revised Event Area and Land Use Structure accompanying the Preferred Project Report dated February 2011.

ii) Car parking usage within the Car parking Area defined within Plan 1.2 – Revised Event Area and Land Use Structure, accompanying the Preferred Project Report dated February 2011.

(2) Infrastructure Approval

i) Construction of the spine road;

ii) Construction of an underpass beneath Jones Road, car parking areas, pedestrian walkways and boardwalks, shuttle bus turnaround area;

iii) Upgrading of the western 340 metres of Jones Road to a two lane sealed road with a service entrance (Gate S);

iv) Construction of the intersections associated with Gates A, B and C;

v) Construction event laneways, resource centre, hard stand areas, drain crossings, stormwater management, regrading for positive drainage and associated works;

vi) Construction of laneways and drain crossings within car parking area; and

vii) Construction of entry treatment and signage.

(3) Vegetation Management Works Approval

i) Implementation of natural area protective fencing; constructed wetlands; new habitat area plantings; managed parkland plantings and Yelgun Creek rehabilitation; and

ii) Implementation of a comprehensive Vegetation Management Plan.

(b) Stage 2:

(1) Infrastructure Approval

i) Construction and landscaping of an administration building with 175m² of floor area;

ii) Construction and landscaping of a gatehouse building with 100m² of floor area;

iii) Construction of a water treatment plant; and

iv) Construction of a wastewater treatment plant.

Key changes to the ecological restoration components plan of the project since original public exhibition of the VMBP are:

- Additional dense vegetation (5.9ha) is to be provided north of Jones Road and fauna friendly box culverts installed under the Spine Road.

- The institution of extensive (12.9 ha) habitat restoration in the area between the SEPP 14 boundary and the southern car park with the buffer to the SEPP 14 Wetlands creating endemic wetland and riparian vegetation.

Changes to project infrastructure include:

- Elevation of the Spine Road to flood proof the access to the 1% event.

As the conference centre, cultural centre/administration building and onsite wastewater treatment components of the project are not to be constructed in the five year approved trial period, specific management of these is not addressed in this VMBP.

The approved Event Area and the Application Area are depicted in Figure 2.

1.0.2 Management principles

The various proposed uses of the Parklands property as a cultural events site have not previously occurred at this location and the combination of activity regimes demands careful assessment and consideration in order to develop favourable management. While the site comprises ~ 256 ha, the event area is 97ha, and event activities occur over a maximum of 10 event days in any of the first five years. Direct habitat loss for the project is less than 0.035ha and an additional 50ha of tree cover will be established.

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*

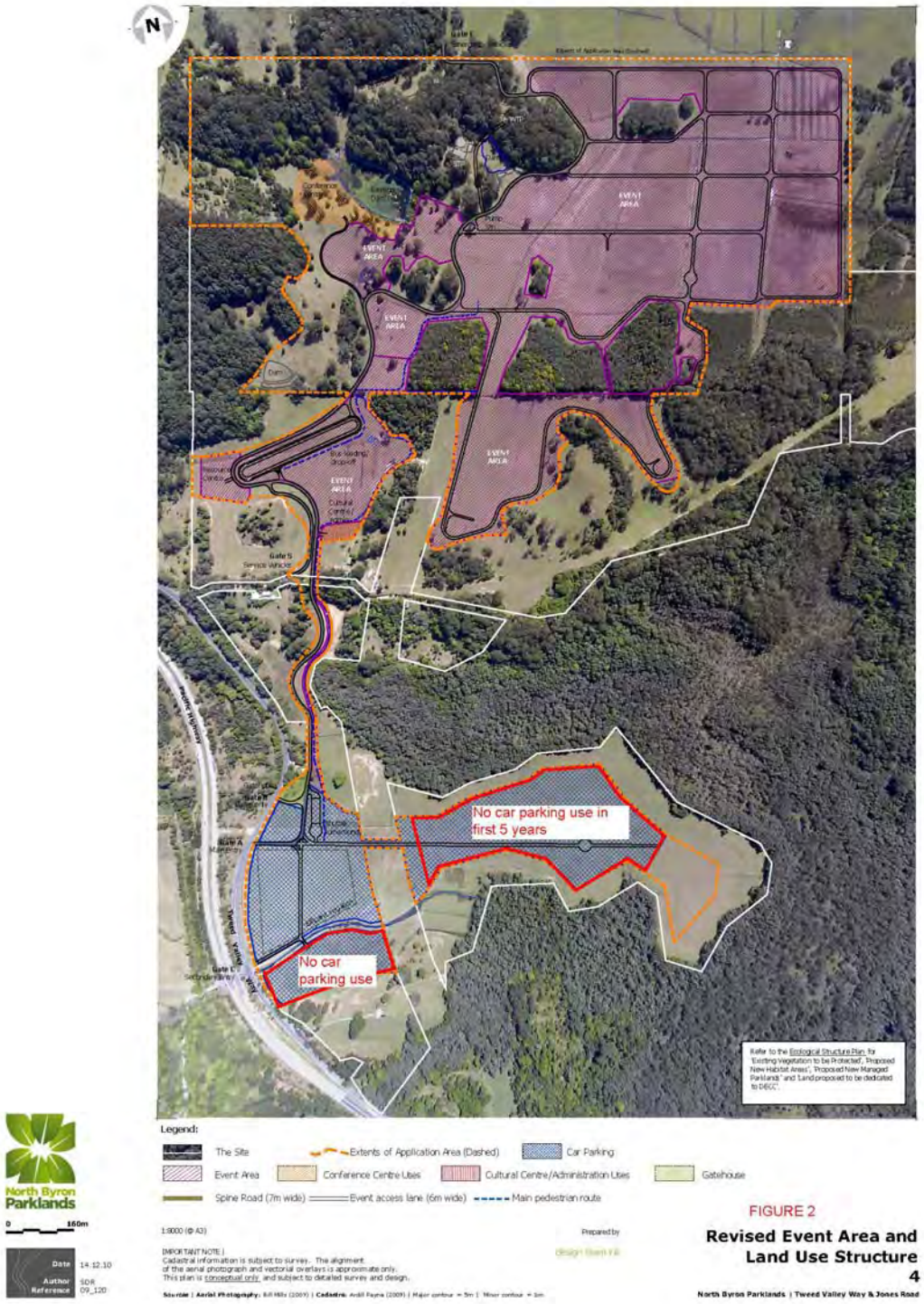
• *the use of natural disturbance regimes to guide human disturbance regimes.*

(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".

Figure 2: Application area and event areas



Further: species loss is driven by habitat loss.

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

Restoration of stand structural complexity in Parklands where cattle have modified forest structure will be achieved by management and by allowing this to develop naturally (through forest stand maturation). Management measures include: installation of nestboxes to supplement a scarce shelter resource; staged exclusion of cattle to allow groundlayer habitats to recover and midlayer habitat to develop and weed removal. Local 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 3) 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 outside the approved application area. More recent land uses have included cattle grazing (likely to pre-date the 1947 landscape), sugar cane and banana cultivation and 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 prior to the proponent's purchase of the property.

1.0.4 Landuse Zones

Current planning for Parklands includes the following land uses:

OPERATIONAL ZONES

- Event area including resource centre; and
- Car parking, access roads, bus area and pedestrian pathways.

HABITAT ZONES

- Aquatic and riparian habitats,
- Existing Full habitat
- New Full habitat
- Managed Parklands
- Land to be dedicated to DECCW

Zone uses are detailed in Table 1.

HERITAGE AREAS

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.

Figure 3: Parklands in 1947

Table 1: Land use areas and management

Landuse	Activities / management
OPERATIONAL ZONES	
Event area, including resource centre	The event area is dedicated to episodic uses for staging of cultural events; Construction of access infrastructure: roads, resource centre, bus parking area, hardstand areas, and of drain crossings will precede the first event. Between events: managed parklands plantings, cattle grazing and/or grass mowing
Car parking; access roads, pathways	Between events: cattle grazing and/or grass mowing, and habitat plantings; During events: vehicle movements, traffic control, parking and pedestrian usage. Pedestrian pathways will be mown, with dry, clean gravel or untreated hardwood chips placed in boggy sections for drain crossings, where necessary.
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	Low density 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 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 60% 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, and in the south east. 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) 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 A).

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. Proposed management of EECs is detailed in the Flora and Fauna Management Plan. Distribution of EECs and threatened flora of the Parklands property are depicted in Figure 4.

Only one threatened plant species has been located in the vicinity of the event footprint:

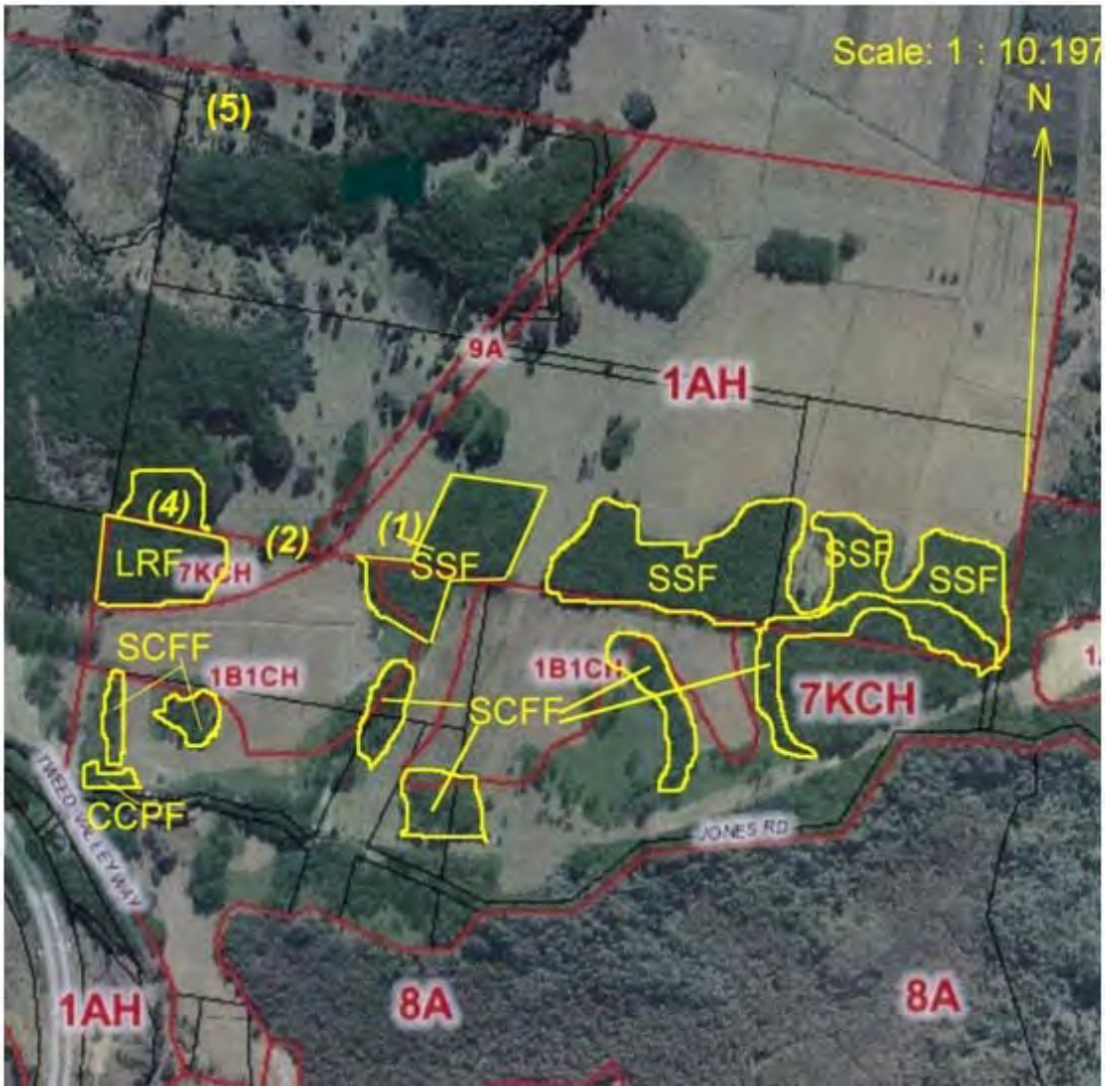
- a sapling Stinking Laurel *Cryptocarya foetida* was located in forest block B (13).

A second threatened plant Green-leaved Rose Walnut *Endiandra muelleri ssp bracteata* is located within the application area but remote from any event processes.

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*.

Management of threatened flora is based on biannual inspections and reactive management following those inspections *e.g.* weed removal. Figure 4 below depicts the location of endangered ecological communities and threatened plants.

Figure 4: 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*; (5) = Rough-shelled Bush-nut *Macadamia tetraphylla*

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 fauna species list for Parklands is provided in Appendix B.

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. 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 and fauna monitoring 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

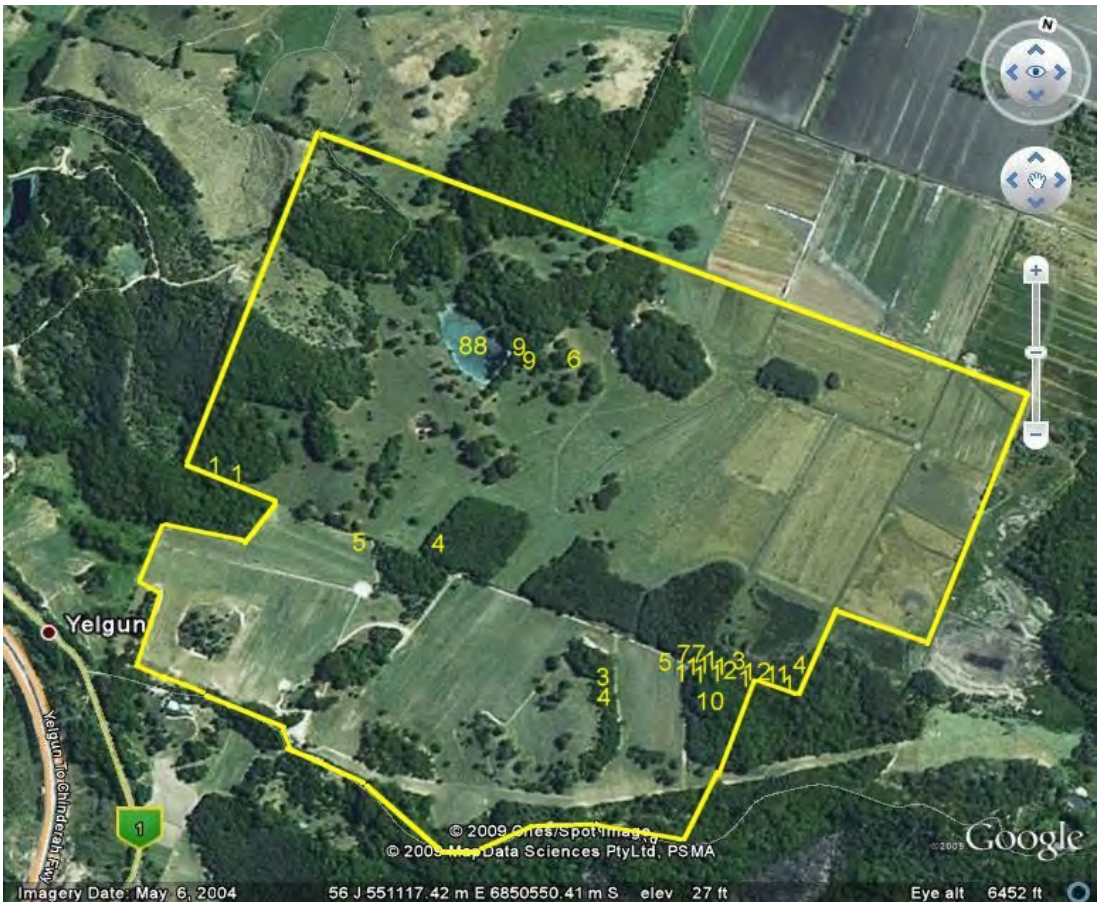
2.1.5 Threatened fauna recorded on the Parklands site

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 schreibersii 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*
Eastern Grass Owl	*Tyto longimembris*
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 Eastern 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 5: Threatened fauna record locations 2007-2010



Key to Threatened fauna species records:1 = Little Bent-wing Bat *Miniopterus australis*; 2 = Large Bent-wing Bat *Miniopterus schreibersii oceanensis*; 3 = Eastern Long-eared Bat *Nyctophilus bifax*; 4 = Rose-crowned Fruit-dove *Ptilinopus regina*; 5 = Eastern Grass Owl *Tyto longimembris;* 6 = Masked Owl *Tyto novaehollandiae;* 7 = Blossom Bat *Syconycteris australis*; 8 = Comb-crested Jacana *Irediparra gallinacea*; 9 = White-eared Monarch *Carterornis leucotis;* 10 = Koala *Phascolarctos cinereus.* Widespread locations for Grey-headed Flying-fox are not depicted.

3.0 Vegetation mapping

Figure 6 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 3 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 6: Forest vegetation mapping (2008)

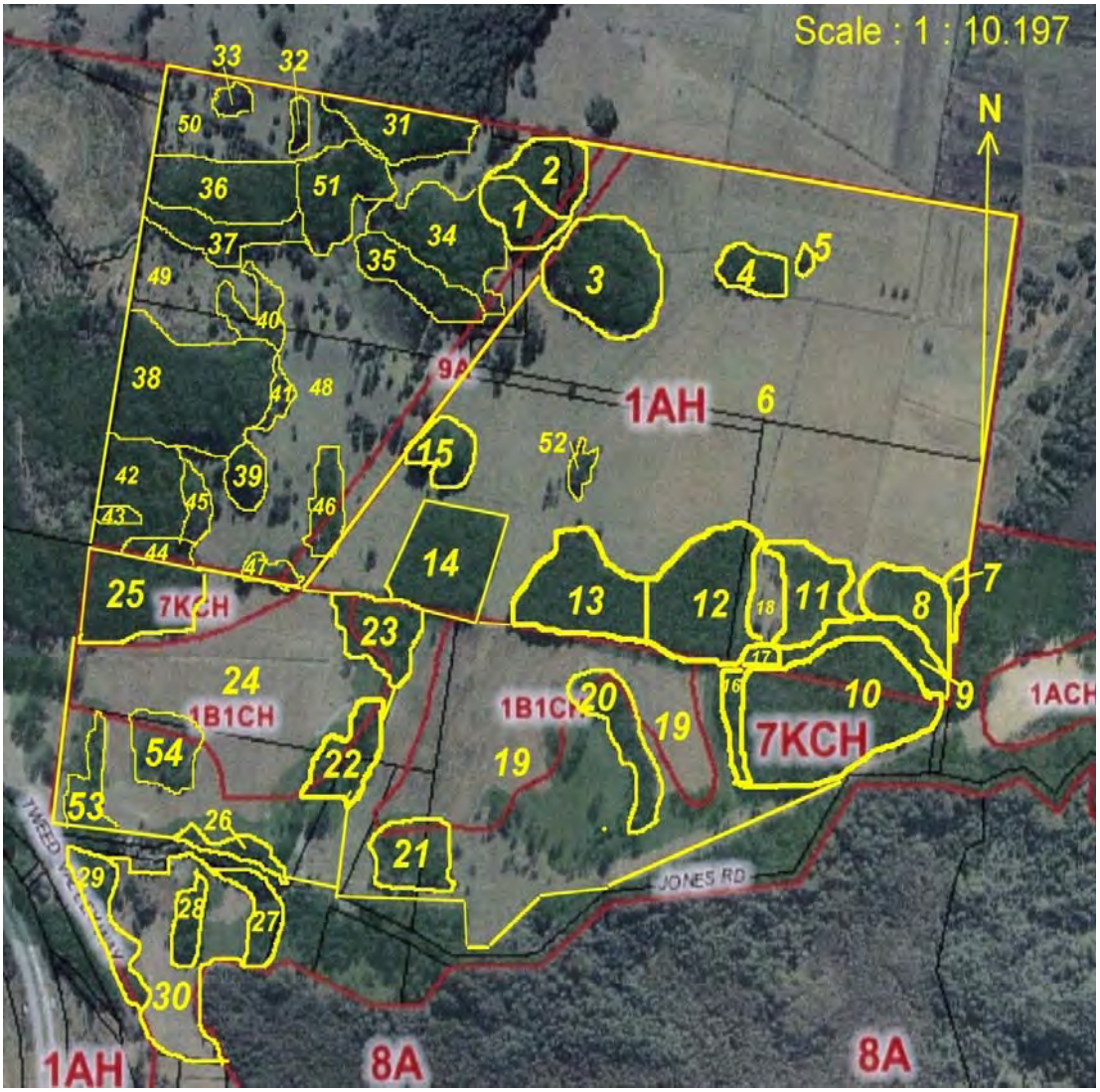


Table 3: Key to mapped polygons in Figure 3

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)
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	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. Weed removal in forest.
Car parking and access roads, pathways	Not required on roads, pedestrian pathways may be slashed.

*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,	Existing vegetation of creeks and fringing vegetation of the large dam will be maintained Yelgun Creek will be rehabilitated
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 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 S132C 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 has been 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 (~30ha) are designed to 'fill in' gaps where irregular forest edge configuration exposes forest interior to edge effects. New full habitat plantings will also widen the area of vegetation along the Jones Road ridge to improve connectivity for forest fauna in this area. Locations for approved full habitat plantings are shown in Figure 1 and a draft schedule of work areas for year 1 is provided as Appendix D. Species lists and planting details will be developed prior to works.
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 areas where vehicular use is required, managed parkland plantings may be widely spaced rows or 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.

	Locations for managed parklands plantings are shown in Ecological Structure Plan 1.3, provided as Figure 1 and a draft schedule of work areas is provided as Appendix D. Species lists and planting details will be developed prior to works.
Land to be dedicated to DECCW	Some lands to be dedicated to DECCW have been 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 underpass crossing of Jones Road
- Construction of Spine road and access infrastructure, bus hardstand area
- Construction of a Resource Centre

Construction impacts and mitigation measures are listed in summary in Table 7.

Table 7: Construction activity impacts, management and mitigation

Construction activity	**Impacts**	**Management / mitigation**
Construction of underpass crossing of Jones Road	Limited approved tree removal, disturbance from machinery and people, sediment movement, noise; disruption to connectivity	Pre-clearing survey. Barrier fence retained vegetation. Environmental induction prior to any construction activity for all relevant personnel. Supervision of tree removal, retain non-weed biomass on site; compensatory plantings. Monitor fauna use of underpass
Construction of Spine	Disturbance from	Pre-construction surveys of

road and access infrastructure, gatehouse, bus hardstand area	machinery and people, sediment movement, noise	pasture. Diurnal hours only, install culverts beneath Spine road
Construction of Resource Centre	Disturbance from machinery and people, sediment movement, noise	Include in the environmental audit process

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 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
Operation of Spine road and access infrastructure, , 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

Table 9: Impacts of the conduct of 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. Reliance on shuttle buses to limit parking needed. Short duration of disturbance. Minimum 30m wetland buffer to be established
Vehicular traffic	High levels of traffic will create noise and disturbance to connectivity for fauna	Restricted to a maximum of 10 event days per year* for the first five years; traffic control, 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; 60% 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 10 event days per year for the first five years 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.

		60% of the Parklands property remains outside the event area
Wastewater management Pump out 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 patterns for larger terrestrial fauna	Minimise amount of 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

* Variable levels of vehicle traffic also occur during bump-in and bump-out days.

6.0 Fauna monitoring

Monitoring of flora and fauna at the site is to be described in a Flora and Fauna Monitoring Program required under DoPI approval consent condition C20, to be submitted for approval at least 60 days prior to the commencement of the first event This plan is to be prepared in consultation with the Regulatory Working Group (RWG).

Monitoring has various aims, and various techniques are proposed.

Monitoring of fauna movement in the area to demonstrate continued use of the east-west vegetated link along Jones Road can be accomplished by monitoring strategically placed sand traps. This method has successfully been used to monitor fauna movement in dedicated crossing structures over and beneath the Pacific Highway (Fitzgerald 2005) and elsewhere.

Monitoring of the condition of native vegetation habitats on the site will be accomplished by the use of transects and photopoints sampled before and after events. Existing vegetation plots will be re-sampled in the event of any damage to vegetation. Monitoring of faunal biodiversity within the Parklands site is proposed to be undertaken in Years two and four of the project (2014 and 2016), and to involve

systematic sampling of the vertebrate fauna, similar to surveys undertaken in 2007 and 2009, in order to identify changes to faunal assemblages.

A SEPP 44 Koala habitat Assessment is proposed no later than 90 days before the first event proposed at Parklands (Splendour in the Grass in July 2013). This will provide contemporary data on the presence and location of 'core Koala habitat' if any occurs within the Parklands site, and enable appropriate buffer areas to be implemented.

Monitoring to specifically identify the impacts of events will be based on an asymmetric BACI design (Underwood 1993b), designed to detect changes in faunal abundance. In summary, three sites are selected, one in forest in or close to the event area (Impact) where potential impacts are expected, and two additional forest sites where impacts are not expected, or considered likely to be minimal (Controls). One of these latter sites must be in Billinudgel Nature Reserve, and the other may be in Parklands or elsewhere. The three sites are sampled simultaneously on three days prior to any event-related activity, over the three event days, and over three days following the cessation of any event-related activity. A number of methods are considered for quantifying faunal presence: these include fixed Anabat detection; standardised spatially defined and timed bird surveys (preferably simultaneously and by different observers), hair funnels and sand traps. These methods are considered because they allow for reduced sampling bias and independence of samples.

Monitoring as described above will occur in association with any event undertaken at the site. A series of monthly samples(on each of three days) of the three sample sites will be undertaken leading up to the event to further establish information on the variability of patterns of faunal abundance at the sample locations.

Opportunistic sampling is also proposed, in response to significant resource events (*e.g.* mass flowering or fruiting events). Monitoring of pest species and of roadkill are also proposed using transect counts. Nestboxes will be monitored 6 monthly.

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. Details of the induction and ecological audit are provided as Appendix C.

8.0 Environmental Health and Safety Manual

An updated 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 workers and volunteers, engaged in any aspect of the proposal which has the potential for producing ecological impacts and

must be completed before any actions take place on the Parklands site. Bar staff and office personnel may not need to be inducted. Following the issue of a construction certificate, work will begin on constructing the infrastructure needed for events. Construction of the underpass and internal roads will commence at this stage. 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. 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 best practice guidelines for habitat restoration workers was prepared by Bush Regenerator Dave Rawlins, and edited in August 2012 by Mark Fitzgerald.

To ensure that appropriate techniques are undertaken by restoration workers, plans and agreements have been developed. Excerpts of these follow.

As part of the work arrangements between Parklands 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 NBP 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 from forested areas and through revegetation Parklands also aim to improve the water quality particularly run off, which drains directly into Billinudgel Nature Reserve.

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. Enhancing connectivity 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 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 from forested areas and planting trees will preserve soil, increase infiltration and minimise the risk of exposing acid sulphate soils all which mitigate threats to the two 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 southeastern portion of the Yelgun Flats the fence is no longer needed and may be removed in consultation with NPWS

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.

Maintaining the Project. Parklands are committed to the ecological restoration of the property and will continue to fund maintenance to ensure revegetation success is assured. As the property plan is implemented it is envisaged that these current works to maximise biodiversity outcomes will be expanded 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 runoff 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 lowland rainforest species including pioneers, secondary, mature phase and understorey species of the latter community have been 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, have been planted across a minimum work area of 9.4Ha.

11.0 Performance criteria

Performance criteria are listed in Table 11. While 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.

Likely temporary changes in the site for example 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 C.

Table 11: Performance criteria for management actions/measures

Management Zone	**Performance criteria**
OPERATIONAL ZONES	
Event area, including resources centre	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 has not caused damaged to vegetation or soils, no hazardous material spills, erosion, or unmanaged sediment movement.
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, and monitored
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 NBP 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 C) 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 habitat re-assessment and updated Koala Plan of Management to be prepared before the first event takes 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.

- Additional detail in relation to reporting may result from consultation with the RWG.

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 environmental 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, assists 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 A: 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 diosmiifolius*	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 mandiocanum**	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		
				51

Appendix B: Parklands fauna species list (2010)

The fauna species list tabled below 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 lanceolata*	1					
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				
ESTRILDIDAE							
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)

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Appendix C: Environmental Induction and Environmental Audit

Appendix C (i): Parklands Environmental Induction

1.0 Introduction to Site Values

The North Byron Shire 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 ensure 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 relevant workers prior to undertaking any works on the site. Event Management will maintain a list of inductees or persons responsible for inducting staff.

CODE OF CONDUCT FOR PARKLANDS EVENT WORKERS AND VOLUNTEERS

No.	Direction	Reasons
1	All field personnel working on site on site to have read and understood the 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; exceptions are guide dogs, or dogs used for security, in both cases the dog must be on a leash.	Any Koalas in the locality may be 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	Avoid damage to native vegetation, plantings and drains

	vehicle use areas	
5	Strict compliance with vehicle speed limits on site for all vehicle users: 30km/h maximum, except in areas of core koala habitat where limit is 15km/h*. This will be enforced by traffic control staff.	Reduce the risk of killing local fauna, especially koalas * 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;	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 NUMBER]	All native fauna on site are protected; biodiversity maintenance relies on conserving all elements of the local ecosystem
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 event activities	Record impacts on fauna and contribute to improved traffic management

** Provide list of contacts and phone numbers relevant to on-site management.

Appendix C (ii): Ecological Audit

Design of an ecological audit of an event 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, marked with a labelled stake 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 three days of 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 within a week of the conclusion of bump out, 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 Appendix C(i)). 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.

Please note: a detailed fauna monitoring program to detect impacts from events is being developed 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
Fitzgerald 2007a (EA report)	
Environmental induction for all volunteers and workers prior to entering the site	Environmental induction is delivered to relevant workers all field personnel prior to entering the site A register of the names of all inductees or

	managers responsible for inducting workers 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 30m buffer	Ecological audit indicates this buffer was not slashed, and identifies any damage from event related activities. Photopoints before and after A 30m wetland buffer is now approved for this location
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 eliminated to allow a dark period for fauna to use or traverse the site. • No use of fireworks.	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 the event. If not corrected, include report on circumstances.

• Use footlights instead of overhead lights where possible. • Overhead lighting should be shielded and directed downwards to minimise light spill.	
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 NBP 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 block A / 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 available during events	WIRES/Wildlife carers available during events; all fauna management issues which arose during the event reported on
Compensatory plantings for each bonfire/carbon sequestration	Plantings will take place and are audited annually.
Include koala feed trees in plantings	Plantings will take place and are audited annually.
Include fig trees in plantings	Plantings will take place and are audited annually.
Fence sensitive areas	Ecological audit indicates that sensitive areas identified have been fenced. Photopoints
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 events Audit report is produced following the event
Fitzgerald 2007c (PVMP)	
Compensatory plantings; according to plan	Compensatory plantings are installed and are alive. See comment below. See planting report
Connectivity plantings	Connectivity plantings are installed and are alive. See planting report
Fence sensitive areas	Ecological audit indicates that sensitive areas identified have been fenced Fence inspection, notes, photopoints
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.
Fitzgerald 2007b (response to council)	
Implement lighting principles	Ecological audit indicates that lighting principles were effectively implemented.
Lot 101 included in future koala surveys;	Biolink report of summer 2008 survey included sampling of Lot 101.
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

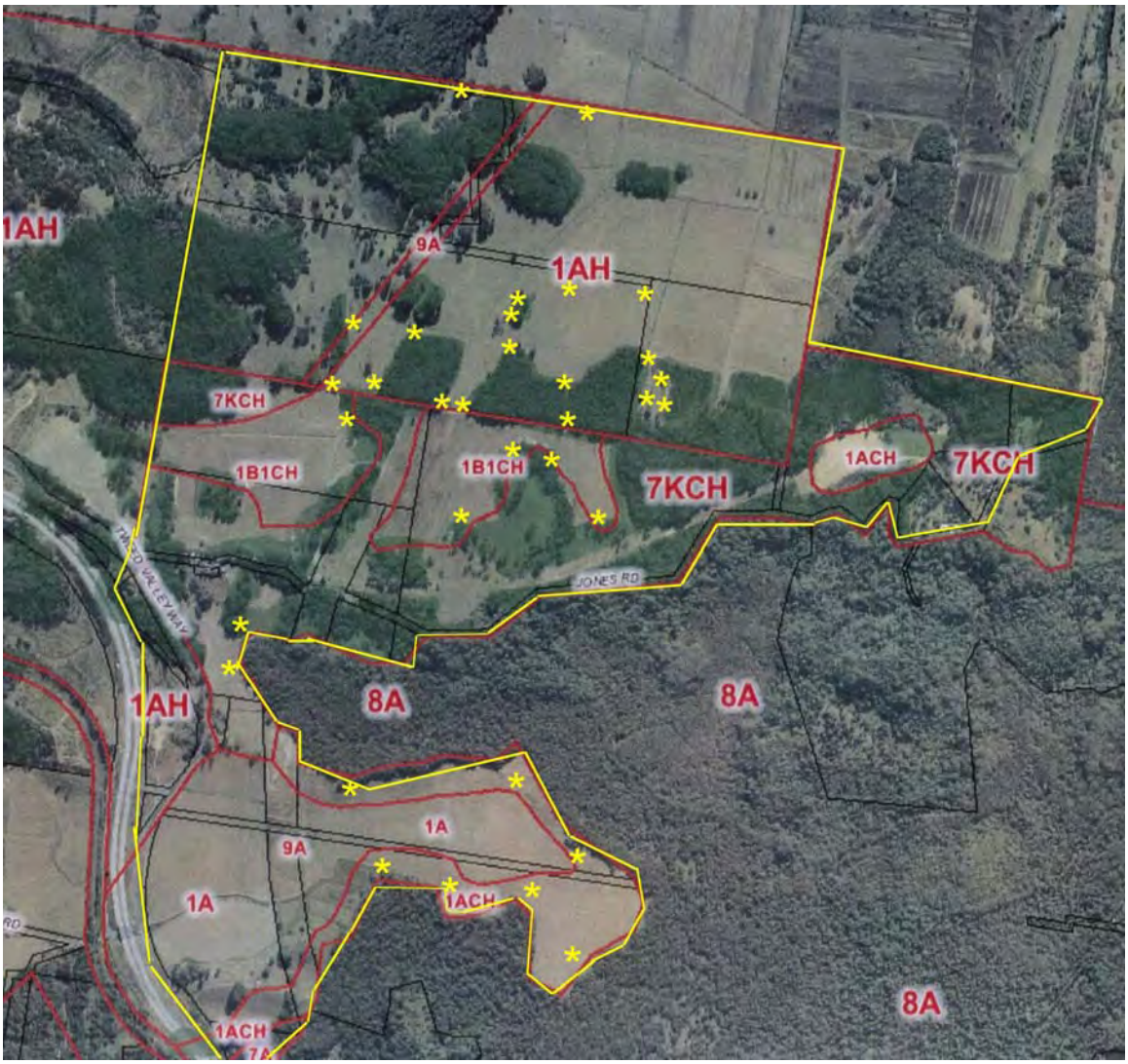
REFERENCE

Rich C. and Longcore T. (eds) (2006) Ecological Consequences of Artificial Night Lighting Island Press. Washington USA.

Figure 1: Location of Koala Signage

Yellow asterisks indicate locations for Koala signage

Figure 2: Photopoint Locations



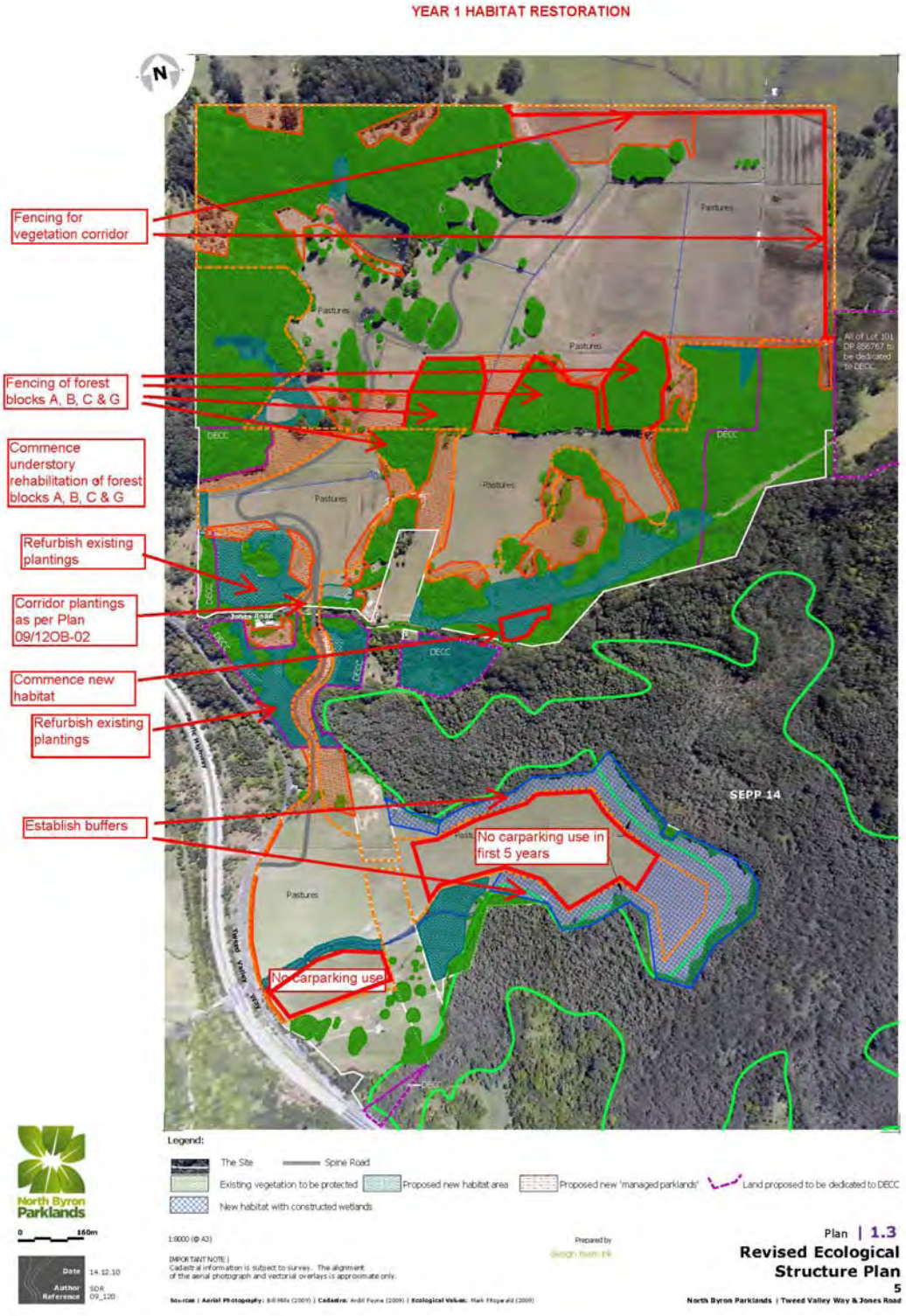
Locations are selected on the basis that they provide views of the edges of native vegetation where it adjoins event areas or areas proposed for plantings. Photopoints provide a basis for identifying changes to the condition of vegetation. The use of photopoints may vary where event coverage within the application area varies.

Appendix D: Draft Year 1 ecological restoration works plan

YEAR 1 –ADOPTED PROGRAM	DETAILS
South of Jones Road	
"Establish Buffers" in Yelgun Flat	Exclude cattle by repairing internal fencing, allowing tall closed grassland to develop. Tall grassland can be harvested to provide mulch bales for plantings (or for sale).
"refurbish existing plantings"	Slash and weed existing plantings, replacement plantings where necessary; salvage tree guards for use in other areas.
Feral animal control	Trap Indian Mynahs, collection of cane toads
North of Jones Road	
"Corridor plantings as per Plan 09/12OB-02"	Underpass related plantings on north of Jones Road Plan 02 is the species list Plan 01 shows locations of planting areas Approx. 1000 plants
"refurbish existing plantings"	Narrow band of existing plantings on drier upper slopes and along western boundary. Slash and weed existing plantings, replacement plantings where necessary;
"Fencing of Forest Blocks"	New fencing of blocks A, B & C including repair existing fencing to block G
"Commence understorey rehabilitation of Forest Blocks"	Remove seedlings and saplings of Camphor Laurel, Small-leaved Privet and Lantana, and any other woody weeds in blocks A, B, C & G.
"Fencing for vegetation corridor"	Fence 20 metre wide strip along specified northern and western boundaries for creation of vegetation corridor.
Feral animal control	Trap Indian Mynahs, collection of cane toads
"Commence new habitat" to widen Jones Road corridor ~3750 square metres	Exclude cattle and assist existing native seedling regeneration. Careful herbicide application to release the potential for emergence of existing plants and the

	seedbank.
YEAR TWO - ADOPTED TASKS	**DETAILS**
Commence Yelgun Creek rehabilitation	Given commencement of work in this area, it would be practical to also commence work on a suitable sub-section of the extensive 30m constructed wetlands, thus both variations in B12 could be underway by the end of year two.
YEAR TWO - CANDIDATE TASKS	**DETAILS**
Establish additional nest boxes	
"understorey rehabilitation of forest blocks A, B and C"	Commence staged poisoning of mature Camphor Laurel.
New habitat area to widen Jones Road corridor ~3750 square metres	Plantings with sub-tropical floodplain forest species mix.

Figure a: Appendix D:



Annexure B

Ecological Restoration Report

PLANNERS NORTH

North Byron Parklands Ecological Restoration

Report 2014/15

Prepared by
Dave Rawlins

North Byron Parklands

Overview

This report outlines ecological restoration activities undertaken in the financial year 2014/15. This is now the 3rd year of restoration works addressing the "Ecological Structure Plan".

This year the majority of works undertaken were maintenance of existing areas, additional tree planting and the commencement of bush regeneration in forest blocks north of Jones Road.

Maintenance and supplementary tree planting

All planting areas since commencement of works in 2007 were inspected and weed control was undertaken. To date over 13,000 trees and shrubs have been planted.The majority of these plantings are well established with greater than 90% establishment rate and many areas having gained site control with trees in excess of 5m in height. The earlier plantings are now developing excellent habitat structure and facilitating native regeneration and an understory. Most plantings only need once yearly follow up to prevent the establishment of woody weeds such as Senna and Camphor laurel.

The area north west of Jones Road that borders OEH lands was planted with 1500 trees in 2008. Due to establishment issues including Setaria grass competition and cattle damage a significant amount of trees had been lost. Supplementary planting commenced last year and another 20 seedlings were planted this year.

Around 120 mixed seedlings and 60 large brush cherries were planted along the 'Spine Road' and adjoining areas to continue landscape works and in-fill the largest gaps.

New Tree Planting Areas

A total of 3,725 trees, shrubs and understory seedlings were planted this year in new areas.

The Yelgun creek area was planted with another 660 seedlings (345 Spring, 320 Autumn) expanding on the NSW DPI fisheries restoration order. The restoration order stated 55 trees and 120 grasses and sedges were to be planted. To date we have now planted over 1,140 trees and 320 grasses and sedges, with further planting areas prepared. See the "Yelgun Creek Rehabilitation Project Restoration Order Report" for more information.

A small area approximately 0.25 Ha North of Billinudgel Creek was planted out. Staff from Parklands bush regeneration team conducted a bush regeneration and ecology training day for students from the Global College University. With students assistance the bush regeneration team have now planted 260 swamp sclerophyl tree seedlings in this area.

Additional new plantings included:

- Enhancement of forest blocks 4 & 5 with 105 edge plants and understory seedlings planted;
- Splendour in the Grass 2014 event facilitated the planting of 1,700 trees in the Jones Rd bite area; and
- Falls Festival 2014/15 event facilitated the planting of 1000 understory sclerophyll grasses and shrubs east of forest block 35.

Propagation Activities

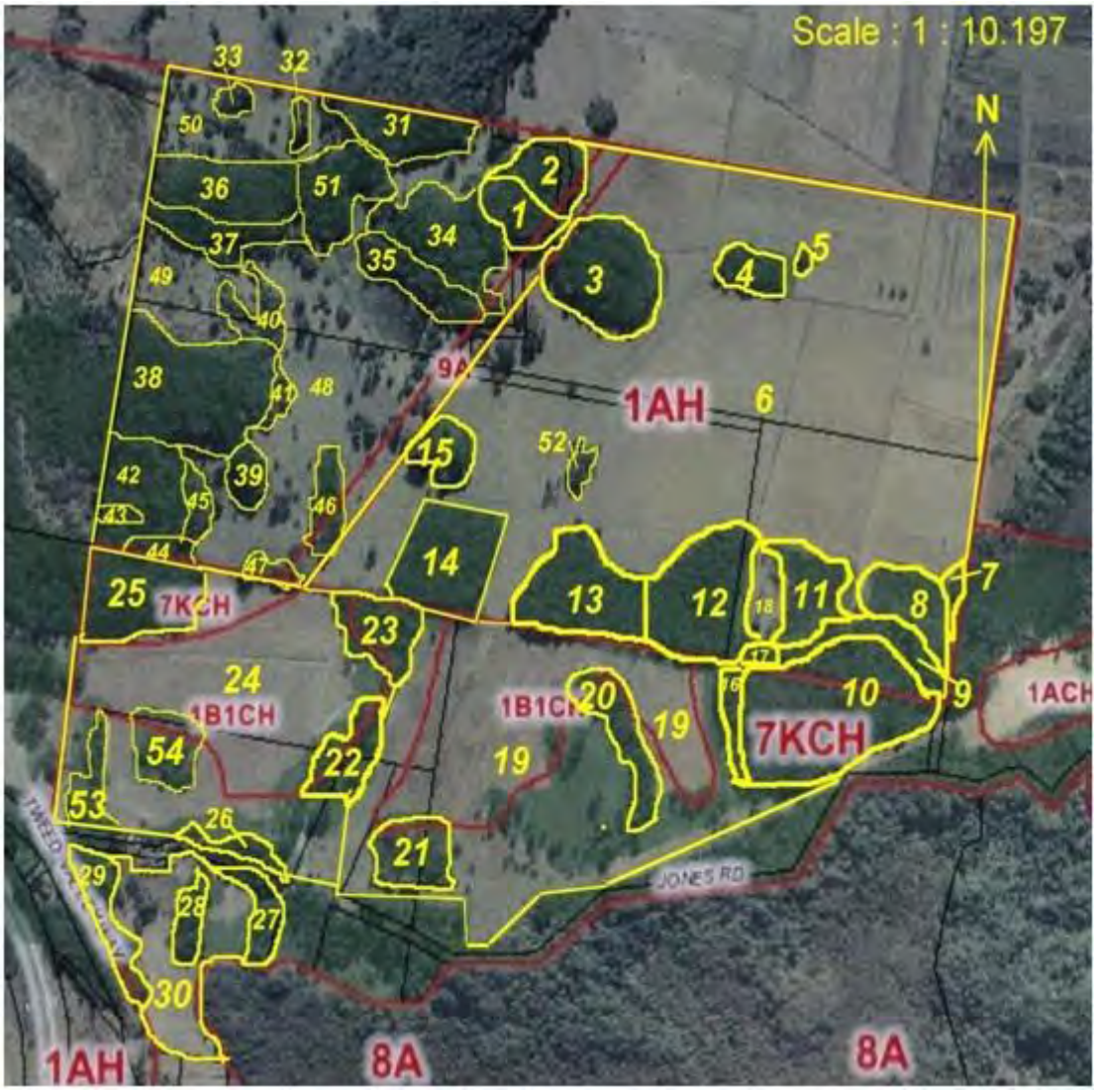
The shade house remains invaluable for keeping nursery bought plants. This year the bush regeneration team also successful grew several hundred plants. The main species were *Lomandra hystrix, Callistemon salignus* and *Melaleuca quinquenervia.*

Weed Control and Bush Regeneration Activities

Bush regeneration activities occurred in several areas. This included primary (initial) weed control works as well as maintenance. The blocks worked this year -

- **Block 3.** The north and eastern perimeter (approx 20 metres wide) has had camphors removed and other weeds controlled. Follow up work to eradicate coastal morning glory continues. The SITG 15 planting adjoins this area.
- **Block 4.** All priority weeds controlled, remaining camphors have been injected and exotic grasses removed. Understory planting and direct seeding undertaken to improve plant species diversity.
- **Block 5.** This small block has been completely worked. This enhances the 2013 SITG planting between blocks 4 and 5.
- **Block 12.** Coastal morning glory and Singapore daisy targeted on western edge.
- **Block 13.** All priority weeds removed, ready for camphor injection next year
- **Block 14.** All priority weeds removed, around 1/3 of camphors injected.
- **Block 23.** The entire block was worked to remove priority woody weeds. This area is now ready for staged camphor removal. Understory planting and seed dispersal done in western 1/4.
- **Block 26.** All but a central strip of this block has had limited work and maintenance targeting priority weeds.
- **Block 27.** Partial maintenance completed.
- **Block 28**. Japanese Honeysuckle follow up works.
- **Block 46.** Stage camphor injection commenced.
- **Block 47.** Stage camphor injection commenced.
- **Block 53**. Maintenance and expansion to enhance the area around the 1500 trees planted in 2008.

Forest Block Numbering Key.



Target weeding.

The bush regeneration team leader re-contacted NPWS regarding the old road house site. NBP contractors have continued maintenance of Madeira vine and cats claw creeper. Need to encourage NPWS staff to control Japanese honey suckle in Billinudgel Nature Reserve.

Other Activities

Maintenance of the Macadamia nut trees near block 31, removal of more fencing along Yelgun Creek, Jones road office garden. Indian myna trapping organised to commence September 2015.

Maintenance of 2015 Yelgun Ck (above) & SITG 2014 (below)

Block 4, camphor removal & understory enhancement (above & below)

Understory plantings (above) Billi Creek planting (below)

SITG 2014 planting expansion area

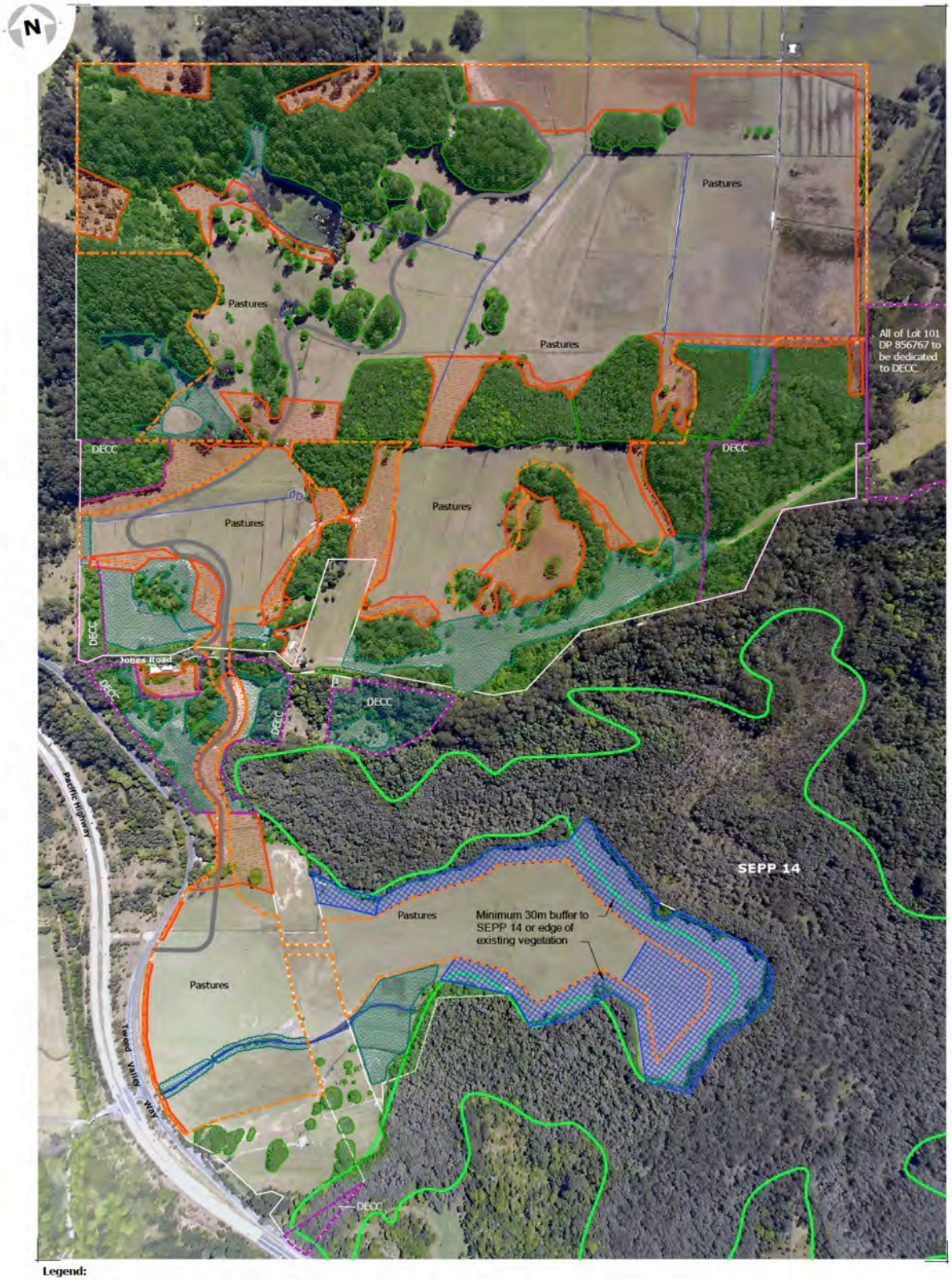
Managed Parklands Planting (above) Camphor control (below)

Old roadhouse weed control (above) sclerophyl planting (below)

Ecological Structure Plan outcomes, October 2015

South of jones Rd (excl. Yelgun Ck)	Aprox Total Area	Area of works	Aprox % of target
New Habitat with constructed wetlands	10 Ha	0 Ha	0%
Proposed new habitat areas	6.5 Ha	6.5 Ha	100%
Proposed new 'managed parklands'	2.8 Ha	2.0 Ha	70%
Exisiting Vegetation protected (cattle exclusion)	1.5 Ha	1.5 Ha	100%
Exisiting Vegetation protected (weed management)	" "	1.5 Ha	100%
Yelgun Creek			
Proposed new habitat areas	3.5 Ha	1.75 Ha	50%
Exisiting Vegetation protected (cattle exclusion)	4 Ha	4 Ha	100%
Exisiting Vegetation protected (weed management)	" "	0 Ha	0%
North of jones Rd, east of spine rd			
Proposed new habitat areas	5.5 Ha	1.5 Ha	30%
Proposed new 'managed parklands'	14.5 Ha	2.5*	15%*
Exisiting Vegetation protected (cattle exclusion)	28.5 Ha	28.5 Ha	100%
Exisiting Vegetation protected (weed management)	" "	8 Ha	28%
North of jones Rd, west of spine rd			
Proposed new habitat areas	7 Ha	3.5 Ha	50%
Proposed new 'managed parklands'	7 Ha	4.5 Ha*	60%*
Exisiting Vegetation protected (cattle exclusion)	33 Ha	33 Ha	100%
Exisiting Vegetation protected (weed management)	" "	2 Ha	6%
TOTALS			
New Habitat with constructed wetlands	10 Ha	0 Ha	0%
Proposed New Habitat areas	22.5 Ha	13.25	53%
Proposed new 'managed parklands'	24.3 Ha	9 Ha*	37%*
Exisiting Vegetation protected (cattle exclusion)	67 Ha	67 Ha	100%
Exisiting Vegetation protected (weed management)	" "	11.5	17%

* = includes natural regeneration



Legend:

The Site — Spine Road

Existing vegetation to be protected | Proposed new habitat area | Proposed new 'managed parklands' | Land proposed to be dedicated to DECC

New habitat with constructed wetlands

1:8000 (@ A3)

IMPORTANT NOTE |
Cadastral information is subject to survey. The alignment of the aerial photograph and vectorial overlays is approximate only.

Prepared by
design team ink

Plan | 1.3
Revised Ecological Structure Plan
5
North Byron Parklands | Tweed Valley Way & Jones Road

Sources | Aerial Photography: Bill Mills (2009) | **Cadastre:** Ardill Payne (2009) | **Ecological Values:** Mark Fitzgerald (2009)

Annexure C

Environmental Performance Report: Ecology – Year 3 - 2014-15

NORTH BYRON PARKLANDS

Environmental Performance Report: Ecology

Year 3

2014-2015

Prepared by Dr Mark Fitzgerald

TWEED VALLEY WAY & JONES ROAD

YELGUN

October 2015

Acknowledgements

NSW Office of Environment and Heritage provided approval to conduct surveys in Billinudgel Nature Reserve. Dr. Steve Phillips and John Callaghan (Biolink Consultants, Uki) and Graeme Lloyd (Wildlife Services, Tweed Heads) carried out bird transect surveys for Event Impact Monitoring. Dr. Robert Kooyman (Earth Process Ecological Services, Myocum) undertook Photopoint surveys vegetation assessment and carried out statistical analyses of EIM bird and bat data. Amy Rowles (Biosis, Waratah) carried out Anabat call analyses. Georgeanna Story (Scats About, Major's Creek) undertook analysis of hair samples.

Declaration

The information provided in this report was accurate and reliable at the time of writing.

27/10/15

Citation: This report should be referenced as: Fitzgerald, M. (2015b). Year 3 Environmental Performance Report: Ecology. A report prepared for the NSW Department of Planning and Environment on behalf of North Byron Parklands.

Table of Contents

1. Executive Summary

Monitoring of flora and fauna in the third year of operation of the North Byron Parklands (Parklands) site provided ~4700 records of ~90 species of birds and >7500 records of ~20 species of microchiropteran bats.

Threatened species data from Event Impact Monitoring of two events held at Parklands in 2014-15 include 40 records of three threatened bird species, and 3413 records of five threatened bat species. No significant adverse effects from events were identified for any flora or fauna monitored.

Event Impact Monitoring over the first three years of operation has produced 5842 records of 15 threatened fauna species (4 birds, 2 megachiropteran and 9 microchiropteran bat species): of these 4337 are calls from the Little Bent-wing Bat Miniopterus australis.

Examination of the Before-During-After patterns of EIM data reveal no significant adverse impacts for any of the fauna groups monitored at North Byron Parklands over the current monitoring period as a consequence of the conduct of the Falls Festival 2014-15 or of Splendour in the Grass 2015

No significant adverse effects on flora, threatened flora species or Endangered Ecological Communities of the site were detected as a consequence of the two events. Adverse event-related ecological effects observed included sediment movement, littering and trampling of grass within the event areas.

Patterns of data indicate the possible development of increased wariness in local Swamp Wallabies, and possible habituation or increased tolerance may contribute to increased numbers of waterbirds at the large northwestern dam since 2013.

The development during the reporting period of a site-specific sensitive ecological Drain Management Procedure (002 V3) which forms part of the Environmental Health and Safety Management Manual will improve management of “within drain” vegetation in sensitive areas of Parklands.

The development of a management protocol for light towers and their maintenance should enable safer, more rapid and more efficient reduction of light spill during events.

1. Introduction

An environmental performance report is required to fulfil North Byron Parklands (Parklands) performance reporting obligations under consent condition B7 of the Planning and Assessment Commission Project Approval granted on 24 April 2012. The reporting period for the third year of operation covers November 2014 to August 2015 and includes two events held during this period. The Falls Festival Byron was staged from December 30th 2014 to January 2nd 2015. Splendour in the Grass 2015 was staged at Parklands from July 24th to 26th 2015.

1.1 Environmental Consent Conditions

C19 FLORA AND FAUNA MANAGEMENT PLAN

A Flora and Fauna Management Plan was prepared by a suitably qualified ecologist, in order to manage the impacts to flora and fauna arising from the carrying out of events at the site. The Plan was prepared in consultation with the New South Wales Office of the Environment and Heritage (NSW OEH), Byron Shire Council (BSC) and the Regional Working Group (RWG) having regard to 1) the Ecological Assessment and Response to NSW Department of Planning and Infrastructure Director-General's Environmental Assessment Requirements – prepared by Mark Fitzgerald, Ecological Consultant, June 2010; and 2) Parklands Environmental Health and Safety Management Manual.

The Flora and Fauna Management Plan included all requirements specified in the Project Approval and was submitted for the approval of the Director-General within 60 days prior to commencement of the first event. The Flora and Fauna Management Plan was approved by NSW Department of Planning and Infrastructure (DPI) on July 18th 2013.

C20 FLORA AND FAUNA MONITORING PROGRAM

A Flora and Fauna Monitoring Program was prepared prior to the commencement of the first event by a suitably qualified ecologist. The Flora and Fauna Monitoring Program was implemented with monitoring of the impact of the project on flora and fauna within and adjacent to the site from before March to September 2013. The Program was prepared in consultation with the RWG and was approved by NSW DPI on July 18th 2013.

The Program addressed requirements provided in the Project Approval.

C21 UPDATED KOALA PLAN OF MANAGEMENT

A SEPP 44 Koala Survey and habitat reassessment carried out by Biolink Consultants in April 2013 followed earlier assessments in 2007 and 2008. An interim Koala Plan of Management was earlier prepared after the location of a small area of 'core' Koala habitat 'on the Parklands site in 2007. However the 2008 reassessment *"…documented a decline in the extent of Koala activity within the aforementioned Core Koala Habitat area over the intervening 12 month period to the extent that the level of use was considered to be relic and/or transient, while no other evidence of Koala activity was recorded elsewhere on the site* (Biolink 2013).

The absence of any evidence of Koala activity on the site means that there is no Core Koala Habitat present on the Parklands site at this point in time. This finding thus precludes the need for either a management plan to be prepared or any Koala-specific adaptive and/or ameliorative management measures to be enacted on the Parklands site (Biolink 2013).

Given this situation, Biolink (2013) made the following recommendations:

In the context of the (current working draft of) the Byron Coast CKPoM, provision is being made for an annual Koala census in the Billinudgel – Ocean Shores area as a means of monitoring population status. To this end it is recommended that further biennial Koala surveys of the Parklands site during the trial approval period would have utility in terms of regularly informing management of Koala population status on the Parklands site, while also assisting the broader recovery effort envisaged by the CKPoM. This recommendation remains qualified by a fall back to annual survey effort in the event that a Koala is sighted on the Parklands site at any time during the trial approval period.

C22 HUMAN EXCLUSION FENCING

Temporary human exclusion fencing closely bordering (within 10m of) designated forest blocks (Fitzgerald 2007a, 2007c) and other native vegetation was provided around the perimeter of the event area during events and incorporated " a minimum 250 mm continuous gap at the base of the fence or 250mm square gaps at 10m intervals along the base of the fence" as required.

C23 GRASSY OWL SEARCHES

Searches for Eastern Grass Owls *Tyto longimembris* including physical site searches (walk through tall grasslands) and call playback were undertaken prior to slashing of event areas. No Eastern Grass Owls were found.

C49 DOGS

No dogs (with the exception of trained assistance dogs) were permitted on the site. Trained security guard dogs are allowed at all times, while under the control of an authorised person.

2. Results

2.1 Implementation of the Flora and Fauna Management Plan

The Flora and Fauna Management Plan, Flora and Fauna Monitoring Plan and 2010 Ecological Assessment overlap considerably in terms of impact predictions and descriptions of ameliorative measures. To avoid duplication such predictions and measures are described in the following section, and not repeated where they feature in other documents assessed in this report.

Assessments of performance are based on observations made by the author unless otherwise acknowledged and are supported by photographs and/or field notes. Parklands General Manager Mat Morris contributions are acknowledged as MM.

Table 1. Implementation of measures from the flora and fauna management plan

Recommended Measure	Performance
A program of monthly fauna monitoring	Event Impact Monitoring (EIM) took place in a Before-During-After pattern for each event. Monitoring samples for Falls were undertaken in December, early and late January. Due to flash flooding and other logistics only 20 during sitesamples were acquired for birds (*vs.* usual *n* = 30). Monitoring samples for SITG 2015 were undertaken in June, July and August 2015.
Parkland's Environmental Induction	The Induction was delivered to and signed by over 950 contractors, staff and volunteers for the Falls Festival. For the SITG 2015 event the Induction was delivered to and signed by over 2,300 contractors, staff and volunteers.
No dogs allowed on site	Implemented.
No activities (including slashing) to occur within the 30m buffer surrounding the Billinudgel Nature Reserve;	Implemented, cattle were removed in April 2014.
All temporary drain crossings shall be managed to minimise sedimentation and potential discharge of contaminants;	Roads and drain crossings were managed to minimise sedimentation and potential discharge of contaminants. Severe flash flooding on two occasions (January 1st and May 2nd) caused unavoidable sediment movement within the drainage systems of the site. A Drain Management Procedure was developed to minimise impacts on "within drain" fauna in sensitive areas.
No illumination of forest blocks or their edges,	Poorly directed light towers were re-positioned

or trees. Implement a suitable buffer between edge of forest blocks and any event lighting wherever possible;	and re-aligned during both events. Falls Festival infrastructure included light installations directed at trees and stands of trees. Festival Management co-operated in directing lights low on to the trunks of trees, and into the lower canopy of trees without blossom or fruit resources.
Direct all event lighting downwards;	Poorly directed light towers were re-positioned and re-aligned during both events.
Use low pressure sodium vapour lights which are less attractive to insects or bats, where possible;	Not implemented
Any installations which rely on artificial lighting should be located in open areas away from forest or trees;	Falls Festival infrastructure included light installations directed at trees and stands of trees. Festival Management co-operated in directing lights low on to the trunks of trees, and into the lower canopy of trees without blossom or fruit resources.
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;	Generally complied once corrective measures to light towers were implemented. Occasional light towers operated all night.
No use of fireworks;	Complied
Use footlights instead of overhead lights where possible;	Footlights were used during events where practicable & safe to do so.
Overhead lighting should be shielded and directed downwards to minimise light spill;	Generally complied; repeated repositioning of lighting was required for both events in the current reporting period.
All internal traffic not to exceed 30 km/h;	Generally complied
Minimise the time that temporary fencing is erected to reduce barriers to fauna and conduct fauna search prior to securing fenced area;	Time fences were up was minimised No fauna search to my knowledge: but levels of disturbance at the site for a prolonged period (several weeks) prior to fence installation, so fauna unlikely to have been present in the event areas while fences were being installed
Experienced fauna management crew to be onsite for the duration of the event.	Complied.

Wastewater disposal	Council approved on-site wastewater storage and treatment was developed and used.
Parking: Barrier fence all sensitive vegetation, establish buffer to BNR, environmental audit.	Complied
An Environmental Health and Safety Plan specifies measures for mitigation of impacts	Complied
Install signage on roads warning of the presence of Koalas, especially at night	Complied
Develop and update Vegetation Management and Biodiversity Plan	VMBP has not been updated at the time of writing
Plant trees to sequester carbon produced by bonfires: 100 trees for every bonfire	Details of plantings are provided in the 2014-15 Habitat Restoration Report (over 3,700 trees planted during this reporting period). Widespread regeneration of native sclerophyll forest trees is evident in various areas north of Jones Road.
Manage fire risk; human exclusion fencing, security patrols fire fighting equipment; fire safety officers; fire management plan	Complied
Include Koala food trees in planting	Complied
Include forest oak *Allocasuarina torulosa* in plantings	Complied with in new plantings along spine road in north of site.
Include local native figs in plantings *e.g. Ficus obliqua, F. macrophylla*	Complied
Fence sensitive vegetation	Complied
Maintain stock fencing around existing fenced forest blocks	Complied, but total removal of cattle from entire NBP property makes this measure somewhat redundant.
Install bat-boxes in forest areas outside the event footprint	Complied
Targetted fauna surveys for threatened fauna	Complied Biennial Fauna Survey undertaken in September 2014.
Threatened flora monitoring	Complied
Perform an ecological audit following completion of the event.	Complied
Pest species control programs for Cane Toad and Common Myna	Common Myna control is described in the 2014-15 Habitat Restoration Report. Cane Toad exclusion fencing is planned to be installed around a new dam in the west of Parklands in October 2015.

2.2 Implementation of Flora & Fauna Monitoring Program

The intention of the Flora and Fauna Monitoring Program was to:

"…identify impacts from operation of the North Byron Parklands Cultural Events site".

Methods

The approved Flora and Fauna Monitoring Program (the Program) was implemented generally as described. Additional surveys of birds in established native plantings took place in June and July 2015. Sand traps within culverts on the Parklands site were established to identify fauna movements within the Marshall's Ridge area. Sand traps were adversely affected by flash flooding and wildlife cameras have now been introduced to provide data on fauna movement. Monitoring of waterbird numbers at the large north-western dam was undertaken (*n* = 38 point surveys, with 6 samples in the current reporting period).

The Program currently investigates patterns of occurrence and abundance of the following fauna groups at two transects at each of three Control and two Impact locations.

Table 2. Event Impact Monitoring Methodology

Fauna Group	Sampling methodology
Forest Birds	Monthly samples over three consecutive days of ten X 20minute/200m transects usually undertaken by three experienced observers from November 2014 to August 2015. Due to logistic problems, sampling for the Falls Festival involved 2 observers for the 'during' phase and the 'during' sample, which was also disrupted by flash flooding.
Forest Birds	Birds are being monitored at two sites in established (~8 year old) native plantings in the Marshall's Ridges area.
Terrestrial Mammals	Ten hair funnels were deployed at each of 5 locations at 20m intervals along a bird transect. Sampling period 4 nights, in three months (before-during-after) for each event from November 2014 to August 2015.
Terrestrial Mammals	Two motion sensor wildlife cameras (Scoutguard & Reconyx) were deployed in July 2015 in the Marshall's Ridges area to monitor fauna presence.
Microchiropteran Bats	Three locations were sampled by Anabat Call detectors for each event monitored. Two locations are within the event area and the third nearby within Billinudgel Nature Reserve.
Microchiropteran Bats	Anabat Call detectors were used to survey two stags within the event area in April 2015.

3. Results

Results of monitoring are presented as summaries in this report. For more details of data and analysis methods see Appendix A. EIM = Event Impact Monitoring.

3.1 Bird Surveys For EIM

Bird surveys associated with the operation of events at Parklands over three years of activity has resulted in ~17 700 records of ~114 bird species.

Bird Surveys at transects – EIM Falls Festival 2014-15

Event Impact Monitoring for Falls 2014-15 provided 1740 records of 73 species of birds. Apart from the mainly nectivorous Lewin's Honeyeater (313) the most frequently recorded species were all insectivores: Large–billed Scrubwren (81), Grey Fantail and Silvereye (79 each). The only threatened species recorded was the Rose-crowned Fruit-dove with 18 records from 5 transects; all locations are outside the Parklands site. Cicada noise frequently affected counts.

Analysis of EIM bird surveys relies on an asymmetric sample, due to flash flooding preventing a second 'during' sample. Analyses were done both using the raw data (30 before transects-20 during-30 after) and using a reduced matrix sample where the second before and after samples were deleted for a 20 before-20 during-20 after comparison.

Neither analysis provided evidence of adverse effects on birds from the conduct of events.

Table 3: Summary statistics Bird Counts Falls Festival 2014-15

During adjusted* values are during values X 1.5 to account for sample size difference.

Parameter	Before	During	During Adjusted*	After
Total bird count	704	488	732*	548
$\bar{x}$ count per transect	70.4	48.8		54.8
SD	26.7	17.0		5.2
Min	33	18		33
Max	120	73		84
Range	87	55		51
Sample size	30	20	30*	30

See Appendix A for more detail and analyses of bird data.

4. Anabat Call Results-Historical Summary

Anabat sampling was initially (2013) distributed among four locations. Low returns from C1 and C2 transect locations combined with the more westerly positioning of the Falls 2013-14 event area, led to sampling on the large dam wall and a dramatic increase in bat numbers and species recorded. See Appendix A for more detail.

Table 4: Historical Summary Anabat Call data

Event	Number of Anabat calls recorded	Locations Monitored
SITG 2013	762	IM2A Miniopterus dam C1 creek C2 drain
Falls Festival 2013-14	5070	Dam Wall IM2A Miniopterus dam
SITG 2014	2336	Dam Wall IM2A Miniopterus dam
Falls Festival 2014-15	2743	Dam Wall IM2A Miniopterus dam
SITG 2015	4805	Dam Wall IM2A Miniopterus dam

5. Anabat Call Results-Falls Festival

Analysis of bat calls results in some multiple species categories where species cannot be reliably distinguished from each other, resulting in a total of 18 spp./categories (and 2743 calls) recorded during the Falls Festival 2014-15, including the category bat call no ID possible. Anabat call results from the Miniopterus dam site were too low for meaningful analyses or for comparisons with the other two sampling locations (Dam Wall & transect IM2A). Table 5 provides summary data from Anabat monitoring of Falls 2014-15. Anabat call data are analysed by Amy Rowles, Biosis, Waratah NSW).

Table 5: Summary Anabat call data Falls festival 2014-15

Location & Data	Before December	During Late Dec/Jan	After Late Jan
Dam Wall Calls	977	1001	642
Dam Wall Spp./categories	16	14	13
IM2A Calls	26	47	43
IM2A Spp./categories	6	4	4

Analysis of Before-During-After data from two sampling locations (Dam Wall & transect IM2A) indicates no significant difference in either species recorded or total number of calls during or after the Falls Festival sampling period. See Appendix A for details of bat data analyses.

Summary data for the three locations are presented below

Table 6. Number of bat species/categories recorded per night Falls Festival

Parameter	Dam Wall	Miniopterus Dam	IM2A
Mean	10.5	n/a	2.3
Standard Deviation	2.1	n/a	0.97
Range	4-12	n/a	0-4
95% Confidence Interval	1.3	n/a	0.85
Total	19	4	6
Nights	5	4	4

Table 7: Number of bat calls recorded per night Falls Festival

Parameter	Dam Wall	Miniopterus dam*	Impact 2A
Mean	201.5	n/a	9.7
Standard Deviation	83.4	n/a	6.1
Range	48-374	0-2	0-20
95% Confidence Interval	50.4	n/a	3.8
Total	2620	7	116
Nights	5	4	4

6. Hair Funnel Results-Falls Festival 2014-2015

Hair Funnel data from the Falls Festival provided a total of 71 records comprising hair from: Antechinus (59 samples) Rat (9), Bandicoot (1) and Brushtail Possum (2) for 600 funnel/nights effort. See Appendix A for details. Hair Funnel data comprised broadly similar results for each month of sampling with before (22),-during (22) and after (26), with similar species represented. Bandicoot hair was detected only once, continuing the pattern of lower than expected representation of this fauna (both Northern Brown and Long-nosed Bandicoots are known from the locality) from hair funnel sampling. Motion sensor cameras have provided more information on Bandicoot presence: see Appendix A.

7. Falls Festival 2014-15 Sand Traps Results

Sand traps in two culverts south of Jones Road and one culvert north of Jones Road were monitored in December 2014 before flash flooding severely damaged all sand traps on January 1st 2015.

Fauna recorded in culvert sand traps included the native Lace Monitor, the Cane Toad, Rats and Small Mammals. The latter two categories are likely to include both native and exotic species on the basis of previous fauna surveys and hair sample analyses. A second flash flood event on May

2nd further damaged sand traps and a decision was made to subsequently adopt monitoring of terrestrial fauna in the area south of Jones Road by the use of motion sensor activated cameras.

8. Falls Festival 2014-15 Walking Spotlight

No fauna were detected during spotlighting of the event area during the Falls festival.

9. Falls Festival 2014-15 Dam Birds

Three survey samples of the waterbirds of the large northwestern dam took place. Counts of waterbirds were above average in the 'before' sample (59) and declined at the large dam to below average numbers 'during' (28) and 'after' (18) the Falls Festival 2014-15. Species counts (6-7) were average. Both total bird counts and species counts returned to above average levels by the next round of sampling for SITG 2015 in June 2015. See Appendix A for details.

10. Splendour in the Grass 2015 (SITG 2015) Results

10.1 SITG 2015 Bird Surveys

The SITG 2015 EIM data included 2979 records of 83 bird species. The most frequently recorded species were Lewin's Honeyeater (421), Scarlet Honeyeater (340), Grey Fantail (230) and Australasian Figbird (193). This generally reflects observations on the abundance of nectar and fruit resources for birds during the sampling period (June, July & August 2015). See Appendix A for more detail.

Three threatened species are reported from the EIM samples. These include 15 records of the Rose-crowned Fruit-dove from three transects, including one record from within Parklands and the remaining 14 from the two nearest transects in Billinudgel Nature Reserve (BNR: transects IM2A and IM2B). Three records of White-eared Monarch are from two transects in BNR (IM2B and C3A: this species is also recorded (*n*= 4) from planting surveys in Parklands. Additional records of the third species: Barred Cuckoo-shrike, are unconfirmed.

Considering the merged values (combined counts) (*e.g.* C3B_tb = total of three samples counts 'before' SITG15 (June) over 3 consecutive days at transect C3), there is no statistically significant difference between before, during and after counts. See Appendix A for results of binomial deviance analyses.

Lower than average species counts at transect IM3B likely reflect its habitat values, small size, isolation (as a ~2ha patch) and resource availability. It is also the transect most exposed to event influences and bird counts may reflect adverse influences of noise and close human presence during events, including intrusion into the centre of the patch. A 50% lower than average count of insectivorous birds (total 3 month count of 71 insectivores *cf.* average overall count of 142 insectivorous birds) and possibly related to the dominance of Camphor Laurel in IM3A) influences lower than average total count values for this patch.

Analyses of the patterns of trophic guilds in the bird count data is provided in Appendix A.

11. Anabat call results-Splendour in the Grass 2015

Anabat call results from monitoring SITG 2015 recorded 4319 calls from 19 species/categories. Spp./categories includes the category 'bat call no id possible' as it is an indicator of bat activity. Only one bat call (from an Eastern Horseshoe Bat) was recorded at the Miniopterus dam. Patterns of calls at the two remaining locations similarly increased in number over the three recording samples, particularly from the July (during) to August (after) samples.

Table 8: Bat calls and species recorded June-August 2015

Location & Data	Before June	During July	After August
Dam Wall Calls	180	483	4142
Dam Wall Spp./categories	13	14	17
IM2A Calls	25	37	276
IM2A Spp./categories	6	3	5

Neither the number of calls nor the number of species/categories were significantly positively correlated with climatic factors, but the number of calls and of species at the Dam Wall were significantly positively correlated with the day of the year. See Appendix A for more detail.

Despite the clear pattern of increase in call numbers from the 'during' to 'after' samples, the difference between the before-during-after samples was not statistically significant (Single Factor ANOVA with sampling period as the factor: Dam Wall $F_{2,78} = 2.2$, $P = 0.12$; IM2A: $F_{2,9} = 1.6$, $P = 0.25$).

Other sampling parameters are provided in Tables 9 & 10.

Table 9. Number of bat species/categories recorded per night SITG 2015

Parameter	Dam Wall	Miniopterus dam	Impact 2A
Mean	10.6	n/a	2.7
Standard Deviation	3.2	n/a	1.5
Range	4-15	n/a	0-4
95% Confidence Interval	2.0	n/a	0.95
Total	16	1	6
Nights	4	4	4

Table 10. Number of bat calls recorded per night SITG 2015

Parameter	Dam Wall	Miniopterus dam*	Impact 2A
Mean	400.4	n/a	28.2
Standard Deviation	475.7	n/a	58.3
Range	14-1172	1	0-211
95% Confidence Interval	302.2	n/a	37.1
Total	4805	1	338
Nights	4	4	4

11. Hair Funnel Results-Splendour in the Grass 2015

Hair funnel sampling recorded 70 samples for 600 funnel/nights over the EIM period (June-July-August 2015). Antechinus dominated the results with 50 records, Rats included 18 records and Brushtail Possum: 2 records. Overall sample sizes were similar for the 'before' (21) and 'during' (19) samples increasing to 30 samples in the 'after' period. The presence of 7 Bush Rat samples in the after period at IM3 may reflect an increase in food availability for rats at this site. See Appendix A for more details of hair sampling results.

12. Sand Trap Results-Splendour in the Grass 2015

Sand traps in two culverts south of Jones Road and one culvert north of Jones Road were irregularly monitored in December 2014 before flash flooding severely damaged all sand traps on January 1st 2015.

Fauna recorded in culvert sand traps then included the native Lace Monitor, the Cane Toad, Rats and Small Mammals. The latter categories are likely to include both native and exotic species. A second flash flood event on May 2nd further damaged sand traps and a decision was made to subsequently implement monitoring of terrestrial fauna in the Marshall's Ridges area south of Jones Road by the use of two motion sensor activated cameras.

Two wildlife cameras (Scoutguard & Reconyx) recorded numerous images of Northern Brown Bandicoot, Swamp Wallaby, Brush Turkey and Fox.

See Appendix A SITG Sand Trap/Camera Results for more details.

13. Dam Birds Results-Splendour in the Grass 2015

Counts of waterbirds (n = 38) at the large dam have been taking place opportunistically since 2007. The 3 samples from June to August 2015 were all above average bird counts, including the highest bird count recorded (62 before). Species numbers are at or above average.

Table 11: Dam bird counts SITG 2015

Overall Average	Before SITG	During SITG	After SITG
Count	1/7/15	27/7/15	10/8/15
30.5	62	33	41
Average No. Spp.			
6.1	8	6	9

Lowest bird counts (11 & 12) in the overall sample (*n* = 38samples) were during SITG 2013, the first event on the site, and probably reflect unprecedented disturbance processes (including people swimming in the dam). Subsequent counts repeatedly return to pre-disturbance levels or greater.

Comparison of the numbers of birds and of bird species recorded at the dam before events began in July 2013, and those recorded in the period since events began reveal that for both factors there are significant differences between average counts from the two periods.

Summaries of the two periods are shown in Table 12

Table 12: Dam waterbird and species counts before and after events started in July 2013.

Parameter	Pre SITG2013	Post SITG2013	Pre SITG2013	Post SITG2013
	Birds	Birds	Species	Species
$\bar{x}$ (mean)	25.6	34.5	5.4	6.7
SD	10.4	15.8	1.3	1.4
Ra.	13-57	11-62	4-8	4-10
95% CI	5.4	7.2	0.7	0.7
n =	17	21	17	21

Comparing the data for bird and species counts from August 2007 to July 2013 and post July 2013 to August 2015 using a single factor ANOVA (Analysis of Variance) with the sampling period as the factor, results fall just short of statistical significance for mean bird counts ($F_{1,36}$ =4.00; P = 0.053) and well within statistical significance for mean species numbers ($F_{1,36}$ =8.6; P < 0.001).

While species counts at the dam fluctuate relatively little, total bird counts are more variable and attributable to a range of factors (flooding, drought, local and migratory movements). Total bird counts during the two events reported in this document were close to average, indicating that whatever disturbance effects arose from these event processes, these appear to have diminished in magnitude since the first event in July (SITG 2013) which saw the lowest count (11) in the overall sample (Range 11-62) and occurred when some patrons were swimming in the dam.

14. Comparison of the environmental impacts and performance of the project against environmental impacts and performance of the project predicted in the Environmental Assessment (Fitzgerald 2010).

Table 13: Impact predictions and performance

Predicted Impact	Performance
Underpass or at grade access construction across Jones Road will require a small area of vegetation removal	Conforms with prediction
Road construction, upgrading and use will produce barrier effects and roadkill risks for particular terrestrial fauna,	Barrier effect likely to have operated particularly by day, and especially where extensive sub-surface drainage works, and site hardening for parking were undertaken.

	Road kill reported on internal roads included: Cane Toads
Outside event days, function of the Marshall's Ridge wildlife corridor will operate under better than previous conditions, because of the increased area of native vegetation present.	Sand trap data recorded use by small mammals only (likely House Mouse) in a culvert north of Jones Road. Sand traps in two culverts south of Jones Road have been used by a wider range of vertebrates including dog, cat, echidna, possum, bandicoot, lace monitor, rat and small mammal. Recent survey and camera data record Swamp Wallabies, Northern Brown Bandicoots and Brush Turkeys active in this area. The Fox was also recorded on camera images. Surveys of native plantings reveal >30 species of birds including threatened White-eared Monarchs and Rose-crowned Fruit-dove in this regenerated area.
Disruption of flying-fox foraging patterns	Earlier observations confirmed the validity of this prediction. Flying-foxes avoided brightly illuminated blossom but exploited this resource soon after lights were switched off, and in the interior of less brightly illuminated trees at variable distances from light towers. However, flying-foxes were not observed in event areas during the two events monitored.
High levels of human presence on the site with associated lighting and noise are likely to disturb shy fauna species.	Evidence from cameras indicates presence of Swamp wallabies in BNR close to Spine road, but not recently seen within event areas.
A risk of arson	No fires were observed in the reporting period.
Artificial lighting has the capacity to trap and kill invertebrate fauna	Not observed. Areas around light towers were inspected, but no insect kill was recorded
Artificial lighting has the capacity to attract insectivorous vertebrate fauna (*e.g.* bats, frogmouths).	Not observed.
Trampling of vegetation through illegal attempts to access the site	Minor disturbance to groundlayer vegetation, and littering observed in some areas from illegal attempts to access the site
Unspecified alteration to fauna communities from episodic disturbance	Not observed: See discussion of EIM results in Appendix A
Scavenging bird species may increase in	Observed after SITG2015 in proximity to the

abundance through exploitation of food scraps,	waste and recycling centre on site (~100 Torresian Crows); after other events flocks of 20-40 Ibis foraged over disturbed soil. See Appendix A.
Time between events (up to several months) will allow time both for recovery and for 'normal' ecological functions to occur at the Parklands site	Forest fauna monitored do not appear to be significantly affected by event processes. Birds within event areas are displaced during events and forage outside the intensively disturbed areas, some remain in marginal and quieter areas. Following bump-out birds return to event areas.
Mobile species such as Swamp Wallabies will leave the vicinity	Swamp Wallabies have not been recorded in event areas, but observations in BNR from cameras during SITG 2015 provide evidence of the presence of Swamp Wallabies, Bandicoots and Brush Turkeys within ~350m of the event area throughout July and into August 2015.
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	Largely correct All bird species mentioned were noted to be absent from event areas during the event, but returned soon after.
Butcherbirds, Crows, Ibis and Magpies will likely exploit the availability of food scraps	Observed after SITG2015 in proximity to the waste and recycling centre on site (~100 Torresian Crows); after other events flocks of 20-40 Ibis exploited disturbed soil.
Patrons handling wildlife	Not observed
Alienation of habitats may operate for frugivorous and nectivorous birds, wherever human presence, vehicle movements or amplified music produce disturbance effects' These effects are likely to operate for the central swamp sclerophyll forests and adjacent sub-coastal floodplain forest habitats	Lower than average numbers of species and birds were observed close to disturbance processes in transect IM3B during SITG 15.
Birds attempting to nest close to the event areas may abandon their nests, eggs or fledglings, or may persist regardless.	Not observed
Movements of herbivorous Swamp Wallabies in pasture will be affected by the security fencing.	Swamp Wallabies have not been observed in the Parklands site for some time but camera data indicate they are present nearby. No evidence of fencing affecting movement, but increased wariness may explain paucity of observations of this species in grassland areas, where scats indicate they are at times present.
Impacts on Threatened fauna species	No impacts on threatened fauna species were detected. See discussion of EIM results in Appendix A.

15. Other Survey Activities

15.1 Bird Surveys in Plantings

Four point surveys of birds in two established planting locations have provided records of 161 birds of 31 species, including two threatened species. The Rose-crowned Fruit–dove (*n*= 1) and White-eared Monarch (4) were observed in these ~8 year old stands of native plantings south of Jones Road.

15.2 Anabat call detector surveys of stags

Surveys of two stags within event areas in April 2015 provided 386 additional call records of 11 species/categories already recorded from Parklands, including 133 calls from four threatened species: Little Bent-wing Bat (76), Eastern bent-wing Bat (53), Large-eared Pied Bat (3) and Southern Myotis (1).

15.3 Koala Survey

A Koala Plan of Management was prepared for the site in 2007 when a small area of Core Koala Habitat was identified in the east of the site. Subsequent surveys indicated that this habitat no longer exhibited signs of occupation by Koalas. Biolink 2013 report indicates that no Core Koala Habitat as defined under SEPP 44 is present on the Parklands site.

After local reports of Koalas on Jones Road, a search for Koalas took place in Parklands focussed on forested areas between Jones Road and the Parklands event areas. No Koalas or scats were found. Koala Feed trees on transects are incidentally checked for scats during bird surveys, no scats were found in the reporting period.

15.4 Vegetation Monitoring-Photopoints

In order to identify impacts on forest vegetation from the event a series of photopoints were established and photographs taken on principal axes (NSEW) before, during and after both events reported on in this document. Photopoint assessment and reporting was undertaken by Dr. Robert Kooyman (Earth Process Ecological Services), reports and images are available on request.

Italicised text excerpts below derive from vegetation assessment reports provided for each event.

15.5 Falls Festival 2014-15 Vegetation Monitoring-Photopoints

The photo series comparison presented here shows only minor changes to non-native grassy (pasture) areas. Grass growth in the weeks since the event fully restored any ground layer (grass) trampled in open areas. Soil aeration was conducted between photo series, and site levelling was in progress (WP1, 2,4) at the time of the final photo series (25_01_2015). Heavy summer rain has resulted in rapid recovery of all areas, with some minor road erosion the only visible impacts in that case.

No indication of measurable impacts or decline of native vegetation (forest) from the event were detected or apparent using the photo point method (or from observations) during the period of this study. Strong winds associated with storm activity resulted in the blowdown of several Melaleuca quinquenervia (Paperbark) and the loss of a large limb from a Eucalyptus pilularis (Blackbutt) in the central north of the site.

15.6 Splendour in the Grass 2015 - Vegetation Monitoring - Photopoints

Direct impacts on native vegetation detected by the photo series comparison presented here were minimal (minor trampling). Extensive surface hardening and woodchip coverage of pasture

grassed areas makes grass recovery difficult to assess. In general grass areas closer to performance areas were reduced.

No directly measurable impacts on native vegetation (forest) from the event were detected or apparent using the photo point method (or from observations) during the period of this study.

15.7 Roadkill

Personnel working on the site were encouraged to report roadkill and an informal search for roadkill took place during movement to and around the site for other monitoring activities. Cane Toads were frequently recorded as roadkill.

16. Environmental Audit

Many components of the environmental audit are already listed above. Those not already tabulated include the following:

Table 14: Environmental Audit Measures

Audit Measure	Compliance
Fence on western side of forest block A is in place	Complied
Maintain fencing to exclude cattle from central forest blocks	Cattle were removed in April 2014
Marginal plantings of dams to reduce cane toad breeding	To be done
Weed removal and timetabling	Complied: weeds in plantings are being managed
Undertake Common Mynah and Cane Toad Control	To be done

Environmental performance goals not met

Flash flooding on two occasions in the reporting period exceeded the capacity of sediment interception structures in place. Excessive herbicide application in some drains was observed on one occasion and led to the review of Herbicide use in drains and development of Drain Management Procedure (with a focus on appropriate herbicide use in sensitive areas).

Table 15: Environmental Performance Goals Not Met

Environmental Performance Goals Not Met	Reasons	Action taken to prevent re-occurrence
Sediment movement into internal drains and off-site January 1st and May 2nd 2015	Flash Flooding damaged sediment interception structures	Re-installed sediment interception structures
Excessive herbicide application in some drains	Drain management	A Drain Management Procedure has been developed to restrict and to minimise herbicide use in sensitive areas
30m buffer to SEPP14 Wetland and Billinudgel Nature Reserve	Cattle have been removed and no activities other than rehabilitation works take place in this area.	A tall closed grassland over ~25ha comprises an effective buffer. Restoration works on Yelgun Creek have been undertaken. See Appendix A.
Poor placement and direction of Light towers	Inadequate implementation of lighting principles, by event operator.	Problems with several light towers were fixed by consultation with SITG environmental manager over 2 event nights. Lighting for the Falls Festival was also modified to reduce

		spillage. A lighting tower management protocol is being developed to improve management of light towers to minimise light spill
Inappropriate illumination of foraging resource for Flying-foxes	Oversight	Generally corrected during both Festival events
Full habitat plantings north of Jones Road may present an increased bushfire risk to a neighbouring landholder.	Community safety and welfare	Install fire break in this area. Design suitable fire retardant plantings and dedicate another equivalent area to full habitat plantings.

Environmental Trends

Transformation of previously variable pasture conditions has altered the structure of grassland habitats. Where a previous regime of cattle grazing produced temporally alternating variations from closely grazed to tall closed grassland habitats, recent management treatment has resulted in closely mown low open habitats, and habitats partially hardened by the deposition of sand and fill for roads and parking areas. Species of tall rank grassland habitats such as Tawny Grassbird, Golden-headed Cisticolas, finches and Fairy-wrens have been replaced in these areas by species adapted to more open conditions such as Australasian Pipit, White-necked Heron, Straw-necked and Australian White Ibis and Masked Lapwing.

Regional scale changes in Grey-headed Flying-fox abundance, and local fluctuations/declines in Koala, Swamp Wallaby and Bandicoot abundance are important background influences to be considered in evaluating monitoring data.

17. Discussion

Event Impact Monitoring (EIM) for the reporting period began in December 2014 with the number of observers temporarily reduced to two for the before sample, extending the Falls Festival before and during sampling over 5 days (normally 3 days). High temperatures produced significant cicada noise at most bird transects over the entire Falls sampling period, with cicadas often calling loudly before first light. The combination of cicada noise and ocean noise affected call detection by masking bird calls in coastal Control transects. A similar effect was observed in western transects where cicada calls and freeway noise also produced an auditory masking effect.

Flash flooding on January 1st damaged sand traps and prevented the second 'during' bird sample as a result of road closures. Flash flooding on May 2nd further damaged sand traps. Both flood events caused runoff to exceed the capacity of sediment interception structures at one location adjacent to the Billinudgel Nature Reserve.

Event Impact monitoring results continue to provide evidence of the importance and influence of food resources for birds, especially blossoms, insects and fruit, and of seasonal variation for microchiropteran bats. Lower than average bird and species counts at transect IM3B may reflect

some influence of event disturbance processes. Patrons at each event enter this forest patch leaving behind, clothing, food containers, removing transect flagging and destroying a hair funnel. However the patch is also dominated by Camphor Laurel and has a poorly developed understorey due to a long history of soil compaction from cattle.

Evidence from cameras showing Swamp Wallabies, Northern Brown Bandicoots and Brush Turkeys active within BNR close to the Marshall's Ridges area may indicate that Swamp Wallabies have developed increased wariness in the locality, as the only evidence of their presence on Parklands recently has been in the form of occasional scats and skeletal material.

Conversely, the increased number of waterbirds recorded at the large northwestern dam since the onset of events may reflect development of tolerance for the recent disturbance regime.

The incidental discovery during bird surveys (by Graeme Lloyd) of the endangered Mitchell's Rainforest Snail *Thersites mitchellae* in Billinudgel Nature Reserve appears to be the second record for this species in the reserve. Threatened bird and bat species continue to be recorded from monitoring in Parklands and in Billinudgel Nature Reserve.

18. Conclusion

Monitoring of flora and fauna in the third year of operation of the North Byron Parklands site provided ~4700 records of ~90 species of birds and >7500 records of ~20 species of microchiropteran bats.

Threatened species data from Event Impact Monitoring of two events in 2014-15 include 40 records of three threatened bird species, and 3413 records of five threatened bat species. No significant adverse effects from events were identified for any flora or fauna monitored.

Event Impact Monitoring over the first three years of operation has produced 5842 records of 15 threatened fauna species (4 birds, 2 megachiropteran and 9 microchiropteran bat species): of these 4337 are calls from the Little Bent-wing Bat *Miniopterus australis*.

Examination of the Before-During-After patterns of EIM data reveal no significant adverse impacts for any of the fauna groups monitored at North Byron Parklands over the current monitoring period as a consequence of the conduct of the Falls Festival 2014-15 or of Splendour in the Grass 2015

No significant adverse effects on flora, threatened flora species or Endangered Ecological Communities of the site were detected as a consequence of the two events. Adverse event-related ecological effects observed included sediment movement, littering and trampling of grass within the event areas.

Patterns of data indicate the possible development of increased wariness in local Swamp Wallabies, and possible habituation or increased tolerance may contribute to increased numbers of waterbirds at the large northwestern dam since 2013.

The development during the reporting period of a site-specific sensitive ecological Drain Management Procedure should improve management of within drain vegetation in sensitive areas of Parklands.

The development of a management protocol for light towers and their maintenance should enable safer, more rapid and more efficient reduction of light spill during events.

19. Recommendations

Review of EIM data will assist in identifying any changes required to monitoring techniques, location and/or survey effort.

- A Light Tower Management Plan to expedite efficient modification of light spill needs to be produced and issued to event management, prior to events taking place.
- Early ecological consultation is needed where event layouts, infrastructure or operation vary significantly from previous assessments. The placement of temporary mobile phone towers and of lighting infrastructure need continuing revision and consultation.
- Use of temporary mobile phone towers needs to be preceded by timely surveys to identify any maternal bat roosts, frog breeding habitat or nesting birds in the vicinity of proposed tower locations.
- A review of the Parklands Vegetation Management and Biodiversity Plan needs to be undertaken to reflect spatial changes in land use.
- The exclusion of event-related activities (*e.g.* slashing and vehicle movements) from areas designated for full habitat plantings needs to be implemented, or landuse classification in the VMBP modified.

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Annexure D

Results and Analyses of Event Impact Monitoring Data 2014-15

PLANNERS NORTH

Appendix A

Results and Analyses of Event Impact Monitoring Data 2014-2015

Prepared by Dr Mark Fitzgerald

TWEED VALLEY WAY & JONES ROAD

YELGUN

October 2015

Acknowledgements

NSW Office of Environment and Heritage provided approval to conduct surveys in Billinudgel Nature Reserve. Dr. Steve Phillips and John Callaghan (Biolink Consultants, Uki) and Graeme Lloyd (Wildlife Services, Tweed Heads) carried out bird transect surveys for Event Impact Monitoring. Amy Rowles (Biosis, Newcastle) carried out EIM Anabat call analyses. Georgeanna Story (Scats About, Major's Creek) undertook analysis of hair samples.

Methodologies for multivariate statistical analyses of avifauna and microchiropteran data, and binomial deviance ordination for these groups are provided by Dr. Robert Kooyman (Earth Process Ecological Services, Myocum), who also provided assessments of vegetation condition.

Declaration

The information provided in this report was accurate and reliable at the time of writing.

M. Fitzgerald

26/1/15

Citation: This report should be referenced as: Fitzgerald, M. (2015c). Appendix A: Results and Analyses of Event Impact Monitoring data. A report prepared for the NSW Department of Planning and Infrastructure on behalf of North Byron Parklands.

Table of Contents

1. Introduction

This Appendix was prepared as a supporting document for the Year 3 Environmental Performance Report—Ecology which summarises results of monitoring of flora and fauna during the third year of operation of the North Byron Parklands site (Parklands). Events monitored include the Falls Festival (December 2014-January 2015) and Splendour in the Grass 2015 (July 2015).

This Appendix provides details of the monitoring data collected, methodologies used, and variations. An explanation of analyses undertaken is provided, with a discussion of the results.

Fauna species lists, including threatened fauna species recorded for the Parklands site are also provided.

2. Objectives of Monitoring

The objectives of the Flora and Fauna Monitoring program are to: *monitor and assess the impact of the project* (North Byron Parklands Cultural events site) *on flora and fauna within and adjacent to the site.* Monitoring was undertaken using a range of Event Impact Monitoring techniques (EIM), described below.

3. Methods—Monitoring Techniques

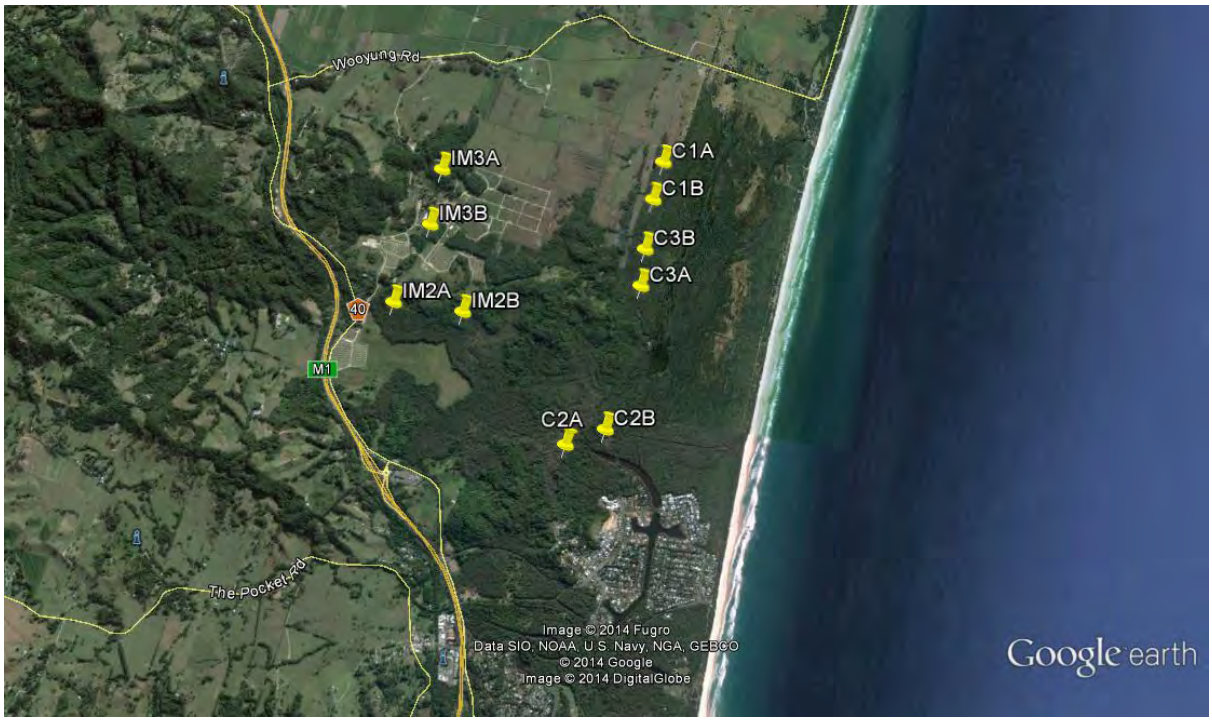
Transect selection

The fauna monitoring strategy (EIM =Event Impact Monitoring) is based on the Before-After-Control-Impact design of Underwood (BACI: 1994), based on 3 Control and 2 Impact locations. Because the 'Impact' from events is predictable, the sampling design used is a before-during-after (BDA) pattern. Locations sampled are floodplain forest habitats at similar low elevations within the study area. Two 200m/2ha bird transects were measured and marked with flagging tape at each of the five locations, and one transect at each location was used for hair funnel sampling. Three Control and 1 Impact locations (8 transects) are within Billinudgel Nature Reserve and 1 Impact location is within the Parklands site (23 transects).

Anabat detectors were deployed at two waterbodies in Parklands and at the edge of a paperbark swamp in BNR. The location of transects is shown in Figure 1.

Figure 1: EIM bird and Hair Funnel transects

IM are Impact transects; C are Control transects



Source: GoogleEarth. Scale ~ 1: 4 600

4. Monitoring Methodologies

Forest Birds

It was initially considered that forest birds were likely to be exposed to disturbance from event processes, ranging from increased noise, human presence and vehicle movements close to central swamp sclerophyll forest blocks in Parklands, and that event impacts could result in birds leaving these sites or avoiding them during or after events. Therefore a sampling strategy was developed based on standardised 20 minute/2ha transect surveys recording all birds observed or heard within a 50m distance from the marked 200m transect centreline at 6 Control and 4 Impact transects on each of three consecutive days. Typically events run for three consecutive days, therefore EIM provided survey effort over a similar and comparable time period. Three experienced observers surveyed simultaneously and were rotated through different transects daily.

Temporally constrained area searches are commonly used in bird census (*e.g.* Bibby 2007, Birds Australia atlassing) and are based on a number of assumptions. These include that individual birds are counted once, that birds outside the area are not included, and observers are capable of recognising most if not all of the local birds on the basis of their calls. The general consistency of data between observers over three years indicates that surveys for forest birds were repeatable and reliable.

Visibility and detectability of birds varied between transects based in part on groundlayer and mid-layer vegetation structural complexity. In practice the majority of records are call-based,

and in previous summer surveys cicada noise was observed to substantially affect bird and species counts.

Bird surveys for the Falls Festival were affected by logistical difficulties with 2 observers (SP & MF) sampling over 5 days to get 30 'before' sitesamples. Flash flooding reduced the 'during' sample to 20 sitesamples. Three observers operated over 3 days to get 30 'after' sitesamples. This asymmetrical data base complicated analyses

Sampling for SITG 2015 using three observers (JC, GL & MF) took place from in June, July and August.

Bird Survey Protocols are listed below.

- At each of 2 transects at each EIM location a 200m line transect is flagged with tape labelled every 20m.
- Three observers simultaneously sample birds at each of the 2 sub-sites at each EIM location, while walking along the flagged transect line for 20 minutes
- Birds within ~50m of this line are recorded, thus sampling a 2ha area.
- Birds are counted only within 50m of the line, once inside the forest. A five minute waiting period may be used before commencement.
- Birds overhead within the 2ha area are counted.
- Individual birds are counted only once: *i.e.* if a bird moves within the sample area it is only counted when first detected.
- Unknown species are recorded as Sp A or sp B and later researched until a name can be given to the bird.
- Observers are rotated through the EIM locations each day to balance variations in observer performance.
- All bird surveys must be completed within ~2 hours of dawn.

- Severely windy or wet weather is avoided where possible.

- Notes are made describing the date, time, location and conditions of survey: wind, temperature, cloudcover, rain, cicada noise

- Date of survey commencement is determined by using a random number sequence, where possible.

- 'Before" surveys take place before bump-in; 'After' surveys take place after bump-out.

- All data is entered into an excel spreadsheet

5. Anabat call detection

Microchiropteran Bats

Three Anabat call detectors (2 SD2s, I SD1 with ZCAIM: Titley Scientific) were used during Event Impact Monitoring (EIM). Anabats were used at 3 fixed Impact locations for the 2014-15 Falls Festival and for SITG 2015. Anabat detectors were deployed for a minimum of 3 nights each month and were placed on wooden platforms fixed to trees ~1.5m above the ground, and were either directed at waterbodies (Northwestern Dam wall, or 'Miniopterus dam', or on the edge of a paperbark swamp (IM2).

Anabat sampling was usually undertaken simultaneously with bird sampling. Call data stored on compact flash cards was downloaded using CFC reader and examined with AnalookW before being dispatched to Biosis, Newcastle for analysis.

6. Hair Funnel Sampling

Small and medium sized mammals

Fifty hair funnels (Faunatech, Vic) were set out over a minimum of 4 nights and were baited with oats, peanut butter, honey and white truffle oil (Simon Johnson, Melbourne). Ten hair funnels were placed 20m apart along bird transects at each of 3 Impact and 2 Control locations during each month of sampling, and usually occurred simultaneously with bird sampling Wafers were

examined for the presence of hairs and dispatched to Georgeanna Story (Scats About, Major's Creek) for analysis.

7. Sand Traps

Terrestrial fauna movement

Sand traps at each end in three small culverts on the internal Spine Road in Parklands were sampled in December to identify patterns of fauna movement in this area. Flash flooding on January 1st and May 2nd resulted in abandonment of the sand traps and adoption of infra-red motion sensor cameras (Reconyx & Scoutguard) to monitor fauna activity on this location.

8. Walking Spotlights

Flying-fox surveys

Flowering trees within the event area in Parklands were opportunistically surveyed for the presence of Flying-foxes one night during both the Falls 2014-15 and SITG 2015 events.

9. Dam Birds

Waterbirds

Twenty minute point surveys with binoculars (Steiner Skyhawk 10 X 42) were undertaken from a partially hidden location on the wall of the large northwestern dam (~1.8 ha) on six occasions from December 2014 to August 2015. A total of 38 samples have been undertaken at this location since 2007. Dam birds were generally sampled opportunistically, but included before-during and after samples for each event.

10. Results – Falls Festival

Results of Event Impact Monitoring for each event are presented separately and in chronological order, with Falls Festival 2014-15 first, followed by SITG 2015 results.

10.1 Falls Festival 2014-15 Bird Surveys—Assemblage characteristics

Bird surveys for the Falls Festival were affected by logistical difficulties with 2 observers (SP & MF) sampling over 5 days to get 30 'before' sitesamples. Flash flooding reduced the 'during' sample to 20 sitesamples. Three observers operated over 3 days to get 30 'after' sitesamples. This resulted in a total of 80 sitesamples *vs.* the usual 90, and necessitated dual analyses: of the

raw data (30before-20during-30after); and of a reduced matrix (20b-20d-20a), in order to compare before-during-after patterns of bird and species abundance.

Event Impact Monitoring for Falls 2014-5 provided 1740 records of 73 species of birds. The most frequently recorded species were: Lewin's Honeyeater (313), Large-billed Scrubwren (81), Grey Fantail and Silvereye (79 each). The only threatened species recorded was the Rose-crowned Fruit-dove with 18 records from 5 transects; all locations are outside the Parklands site.

Patterns of records for the bird trophic guilds are presented in Table 1. Two values are provided for the reduced 'during' sample; raw data in the left column; and in the right column data adjusted to correct for sample size variation (= raw data X 1.5).

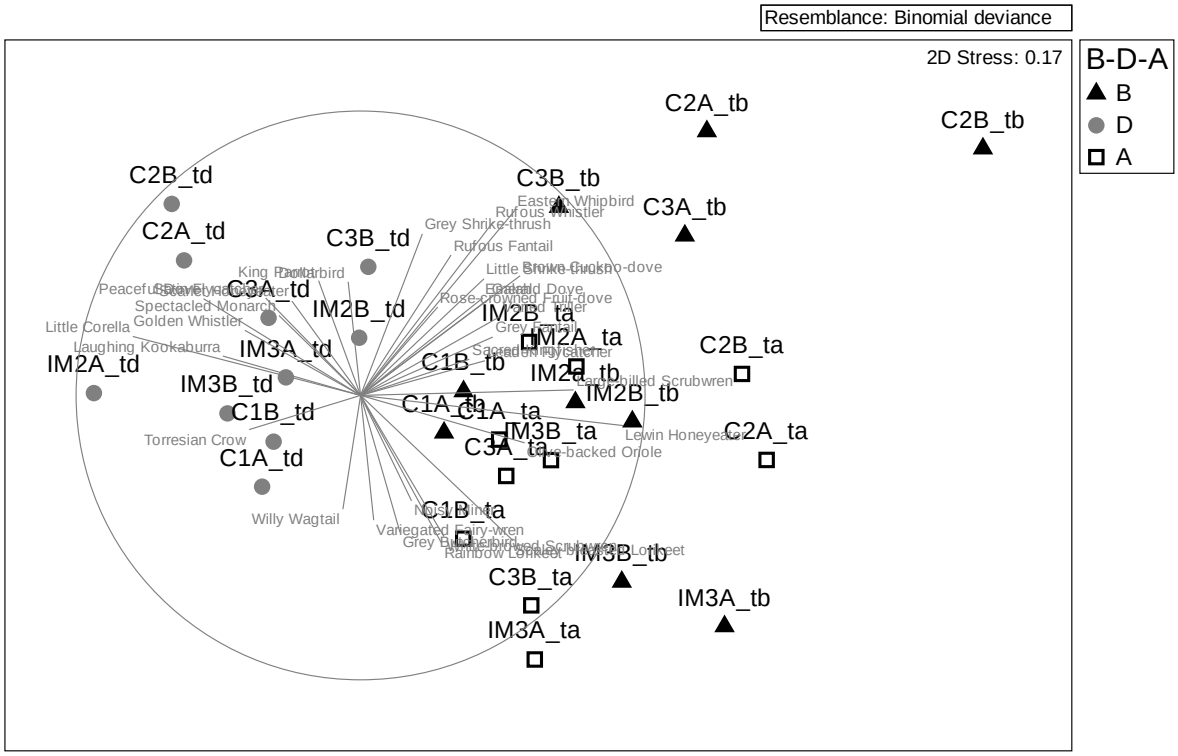
Table 1: Bird Trophic guilds before-during-after Falls 2014-15

Trophic Guild	Before	During raw	During adjusted	After
Sample size	30	20	30	30
Frugivores	45	45	67	39
Granivores	37	27	40	28
Insectivores	416	271	406	282
Carnivores	32	24	36	35
Nectivores	170	120	180	162
Omnivores	4	1	1.5	0
Herbivores	0	0	0	2
Totals	704	488	730.5	548

Falls Festival 2014-15 Bird Surveys Before-During-After Multivariate analyses

Multivariate analysis methodologies are described in Appendix A. Two analyses were undertaken, first with the raw data with asymmetric sample sizes (before 30-during 20-after 30). In order to adjust for the reduced 'during' sample, the second before and after samples were omitted to produce a b20-d20-a20 reduced matrix analysis.

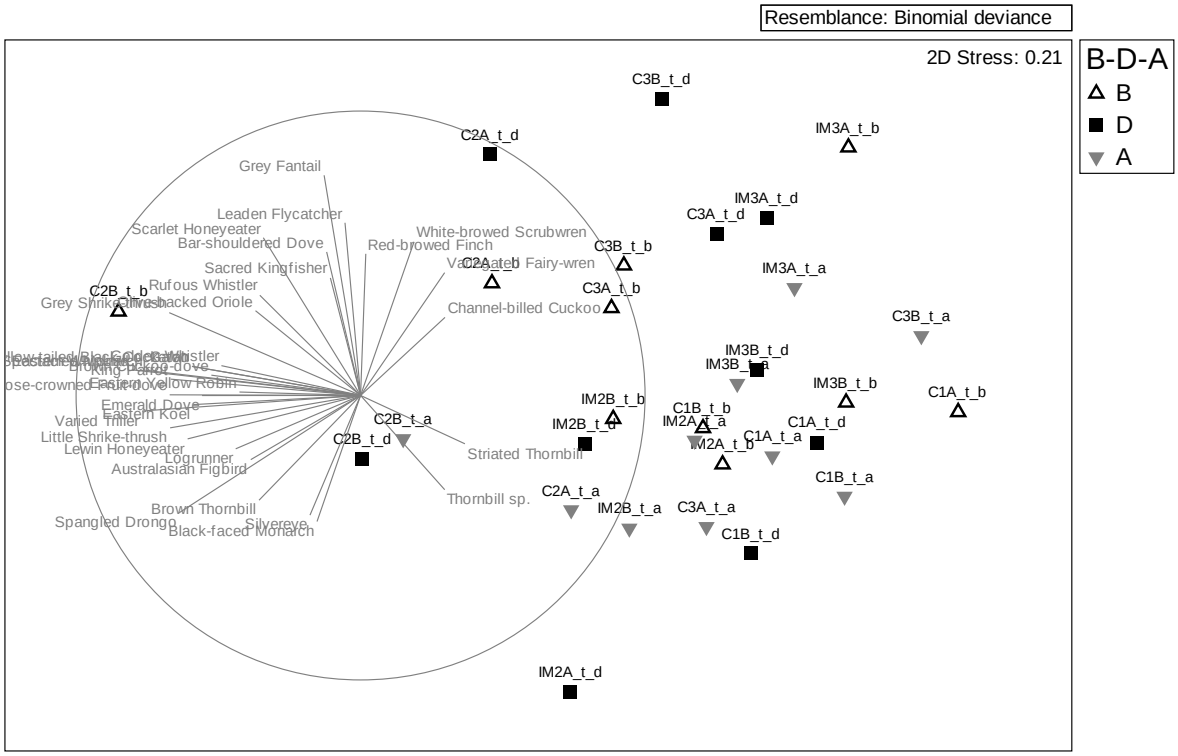
Figure 1: Raw data binomial deviance analysis before-during-after. C2B_tb is the total before count (3 samples) at control transect C2. Species are depicted according to their contributions to variance.



Most 'during' samples (_td) are close to mean values for number of species and number of birds. The outlier C2B-tb sample includes higher than average counts (30) for species (overall mean of 20.1) and for birds (120 *cf.* overall average of 58).

Binomial deviance analysis for a reduced sampleb20-d20-a20, presented in Figure 2, reveals a similar pattern with C2B_tb an outlier because of higher than average values and IM2A_td also an outlier due to lower than average species count (16 *cf.* overall mean of 20.1 and higher than average bird count 67 *cf.* overall average of 58).

Figure 2: Binomial deviance analysis for a reduced matrix sample (second of three before and after samples are excluded to result in a b20-d20-a20 matrix).



See Appendix C for bird species lists.

10.2 Falls Festival 2014-15 Anabat Results

Analysis of bat calls results in some multiple species categories where species calls cannot be reliably distinguished from each other, resulting in a total of 18 spp./categories and 2743 calls recorded during the Falls Festival 2014-15, including the category 'bat call no ID possible'. To reduce complexity and for the purpose of this analysis all calls whether classified as definite, probable or possible are treated as equally valid records. Anabat call results from the 'Miniopterus dam' site (7 calls from 4 spp./categories) were too low for meaningful analyses, or for comparisons with the other two sampling locations (Dam Wall & transect IM2A).

Threatened species recorded included Southern Myotis or Fishing Bat (367 calls), East Coast Freetail Bat (134), Little Bent-wing Bat (106), Golden-tipped Bat (4), and Large-eared Pied Bat (3). Summaries of Anabat results are presented in Table 2. See Appendix C for details.

Table 2: Anabat result summaries, Dam Wall and IM2A: Falls 2014-15

Location & Data	Before December	During Late Dec/Jan	After Late Jan	Totals
Dam Wall Calls	977	1001	642	2620
Dam Wall Spp./categories	16	14	13	18
IM2A Calls	26	47	43	116
IM2A Spp./categories	6	4	4	8

10.3 Falls Festival 2014-15 Binomial Deviance Analysis Dam Wall Anabat calls

Considering the pattern of nightly calls at the dam wall, three samples appear as outliers on the Binomial Deviance Chart (Figure 3, below).

Maximal species counts shown in Table 3 explain the position of these outlier samples in the ordination space.

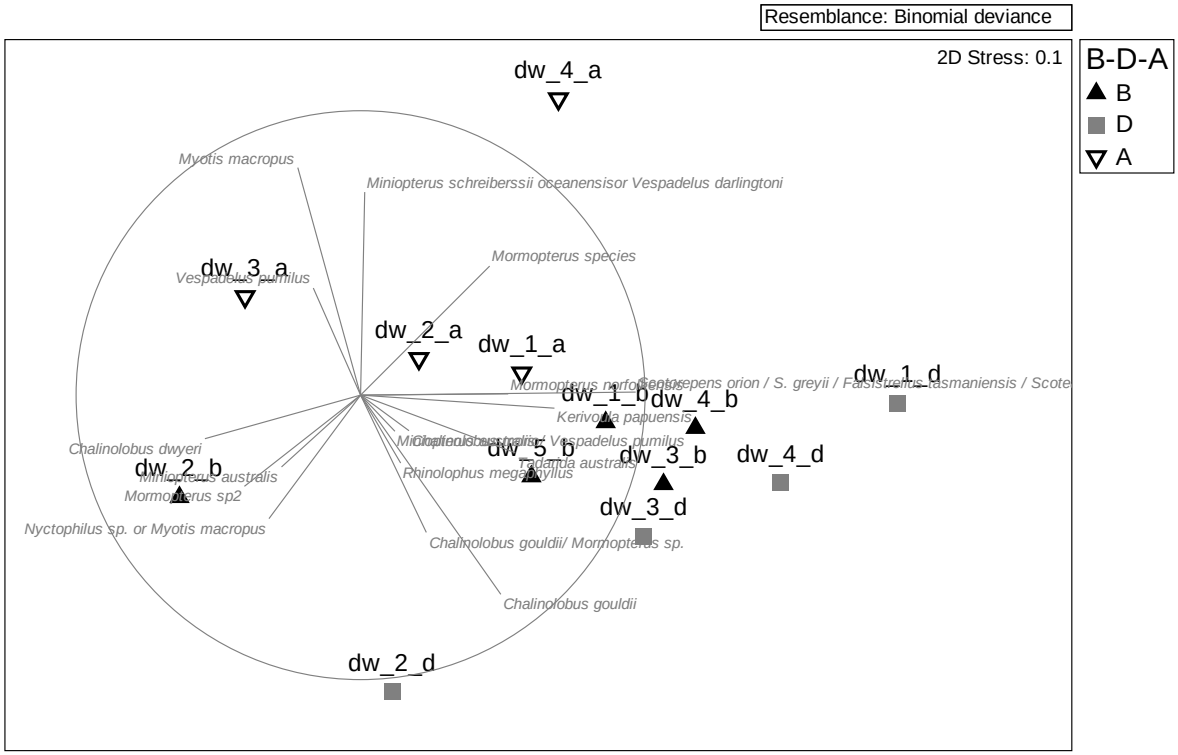
Table 3: Outlier sample attributes: Falls 2014-15

Dam Wall Nightly stats	Overall parameters	Dw_1_d	Dw_2_d	Dw_4_a
$\bar{x}$ (Mean) species/categories	10.5	11	12	12
Range	4-12			
$\bar{x}$ (Mean)	201.5	374	151	275

No. of calls				
Range	48-374			

Figure 3: Binomial Deviance Analysis Dam Wall Anabat calls.

Species and samples are depicted according to their contributions to variance.



10.4 Falls Festival 2014-15 Results Hair Funnel Sampling

Examination of hair sample data from the Falls 2014-15 monitoring period reveals that there was no significant difference between the samples acquired in December 2014 (before 20), Late Dec2014-January 2015(during 19) or February after (23).

Samples were mainly from Antechinus and rats, with one bandicoot sample at C1 before the event. Bandicoots have been poorly represented in hair funnel sampling. Camera data are proving to be more successful at detecting this species.

Table 4: Falls Festival 2014-15 Hair Funnel Results

Before-During-After	B	B	D	D	A	A	A	A	A
Species/category									

Transect Location	C1	IM3	C1	IM3	C1	IM3	IM2	C2	C3
Antechinus sp.							1		
Antechinus stuartii	10	9	10	9	10	10			
Rattus sp.				2				2	2
Rattus fuscipes		2	1						
Isoodon macrourus/Perameles nasuta	1								
Trichosurus sp.					1			1	
Period total		22		22					27
Total	11	11	11	11	11	10	1	3	2

10.5 Falls Festival 2014-15 Sand Traps Results

Sand traps in two culverts south of Jones Road and one culvert north of Jones Road were irregularly monitored in December 2014 before flash flooding severely damaged all sand traps on January 1st 2015.

Fauna recorded in culvert sand traps included the native Lace Monitor, the Cane Toad, Rats and Small Mammals. The latter two categories are likely to include both native and exotic species on the basis of previous fauna surveys and hair sample analyses. A second flash flood event on May 2nd further damaged sand traps and a decision was made to subsequently resume monitoring of terrestrial fauna in the area south of Jones Road by the use of motion sensor activated cameras.

Table 5: Falls Festival 2014-15 Sand Traps Results

Sand trap ID	North I	North 1	South 2	South 2
End	East	West	East	West
17/12/14	nil	nil	SM x 15	Rat 2
19/12/14	Cane Toad	SM 1	Lace Monitor 1 Rat 2	Rat 4
30/12/14	nil	nil	Rat 6	Rat 3

10.6 Falls Festival 2014-15 Walking Spotlight Results

No flying-foxes were detected within event areas during Falls 2014-15. Blossoms and fruit were noted to be scarce on Parklands, and disturbance effects made flying-fox calls inaudible.

10.7 Falls Festival 2014-15 Dam Birds

The counts of waterbirds declined at the large dam to below average numbers during and after the Falls Festival 2014-15. Both counts and species returned to above average levels by the next round of sampling for SITG 2015. See results, below.

Table 6: Falls Festival 2014-15 Dam Bird Counts

	n =38	17/12/14	2/1/15	27/1/15
	Overall	before	during	after
	Means	17/12/14	2/1/15	27/1/15
Bird Count	38	59	28	18
Range	18-62			
No. Species	7.2	7	7	6
Range	6-9			

11. Results – Splendour in the Grass

11.1 Splendour in the Grass 2015 (SITG 2015)

Event Impact Monitoring for SITG 2015 included standard sampling effort for birds, bats and Hair Funnels, spotlighting and dam birds. Sand traps were not sampled, due to repeated damage from flooding. Instead, two motion sensor activated fauna cameras were deployed.

11.2 Splendour in the Grass 2015 Bird Surveys—Assemblage characteristics

The SITG 2015 EIM data included 2979 records of 83 bird species. The most frequently recorded species were Lewin's Honeyeater (421), Scarlet Honeyeater (340), Grey Fantail (230) and Australasian Figbird (193). This generally reflects observations of the abundance of nectar and fruit resources for birds made during the sampling period (June, July & August 2015).

Three threatened species are reported from the EIM samples. These include 15 records of the Rose-crowned Fruit-dove from three transects, including one record from within Parklands and the remaining 14 from the two nearest transects in Billinudgel Nature Reserve (BNR: transects

IM2A and IM2B). Three records of White-eared Monarch are from two transects in BNR (IM2B and C3A: this species is also recorded (*n*= 4) from surveys of native plantings in Parklands.

The remaining threatened species recorded was the Barred Cuckoo-shrike with 6 records from 5 transects, including one record each from two transects within Parklands (IM3A and IM3B). However, records for this species are all call-based and remain unconfirmed until sightings are obtained, as it has not previously been recorded at Parklands, or in BNR (NSW Office of Environment and Heritage, Bionet Atlas Search, October 2015).

An overall pattern of decline in counts from 'before' to 'during' is influenced by the significant decline in nectivore numbers, which rose slightly in the 'after' sample, as presented in Table 7, below. This pattern was also evident in previous SITG EIM samples as the winter blossom crop in Swamp Mahogany, Broad-leaved paperbark, and to a lesser extent Blackbutt, varies, often declining over the three month sampling period. Variations in patterns of trophic guild counts reflect the distribution of food resources at transects. See Appendix B for more details.

Table 7: SITG 2015 Before-During-After patterns in bird counts

Trophic Guild	Before	During	After
Sample size	30	30	30
Frugivore	104	139	104
Granivore	28	41	27
Insectivore	480	465	480
Carnivore	41	29	18
Nectivore	519	217	248
Omnivore	17	9	13
TOTALS	1189	900	890

11.3 Splendour in the Grass 2015 Bird Surveys Before-During-After Multivariate analyses

Considering the merged values (combined counts) (*e.g.* C3B_tb = total of three samples counts before SITG15 (June) over 3 consecutive days at transect C3), there is no statistically significant difference between before, during and after counts, with most during counts clustered towards the central or mean values. Species and bird counts for outliers depicted in Figure 4 are provided in Table 7, below.

Figure 4: SITG2015 Binomial Deviance ordination, merged values

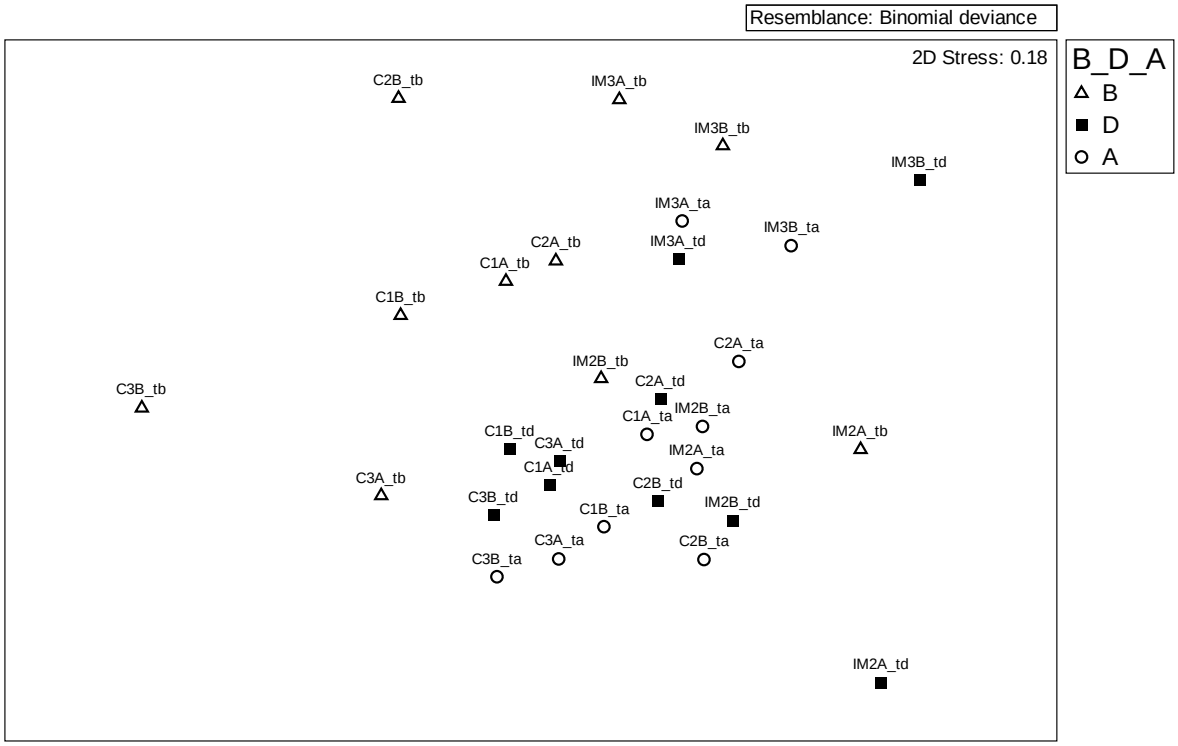


Table 7: Outlier sample attributes-merged values

Parameter	Overall values	C3B_tb	C2B_tb	IM3A_tb	IM2A_td	IM3B_td
Species						
$\bar{x}$	24.6	31	22	21	25	20
Ra.	20-31					
Bird Counts						
$\bar{x}$	99.3	181	161	98	119	93
Ra.	69-181					

Values for C3B_tb were highest in the overall sample for both species numbers and bird counts. Values for C2B_tb were below average for the species count but higher than average for total birds counted. Values for IM2A_td were average for the species count, but higher than average for total birds counted. For the remaining outlier samples: IM3A_tb and IM3B_td, both species counts and total bird counts are lower than average values.

Lower than average species counts at transect IM3B likely reflect its habitat values, small size, isolation (as a ~2ha patch) and resource availability. It is also the transect most exposed to event influences and bird counts may reflect adverse influences of noise and close human presence. A 50% lower than average count of insectivorous birds (total 3 month count of 71

insectivores *cf.* average overall count of 142 insectivorous birds) and possibly related to the dominance of Camphor Laurel in IM3A) accounts for lower than average total count values for this transect. See trophic data in Appendix C.

11.4 Splendour in the Grass 2015 Anabat Results

Anabat call results from monitoring SITG 2015 included 4805 calls from 19 species/categories. Spp./categories includes the category 'bat call no id possible' as it is an indicator of bat activity. Only one bat call (from an Eastern Horseshoe Bat) was recorded at the Miniopterus dam. Patterns of calls at the two remaining locations (dam wall and IM2A) similarly increased in number over the three recording samples, particularly from the July (during) to August (after) samples. Considering nightly samples at the dam wall, there was a positive correlation between the number of bat calls ($R_{1,10}$ =0.82) and bat species/categories (R =0.76), with the day of the year, indicative of a seasonal influence, which was not evident in considerations of either average daily or average nightly temperature. Insufficient numbers of bat calls were recorded at IM2A to perform multivariate or correlation analyses.

Total threatened species recorded included: Little Bent-wing Bat (2598 calls), Southern Myotis (139 calls) and East Coast Freetail Bat (62 calls). See Appendix C for details.

Table 8: Bat calls and species recorded June-August 2015

Location & Data	Before June	During July	After August
Dam Wall Calls	180	483	4142
Dam Wall Spp./categories	13	14	17
IM2A Calls	25	37	276
IM2A Spp./categories	6	3	5

11.5 Splendour in the Grass 2015 Binomial Deviance Analysis Dam Wall Anabat calls

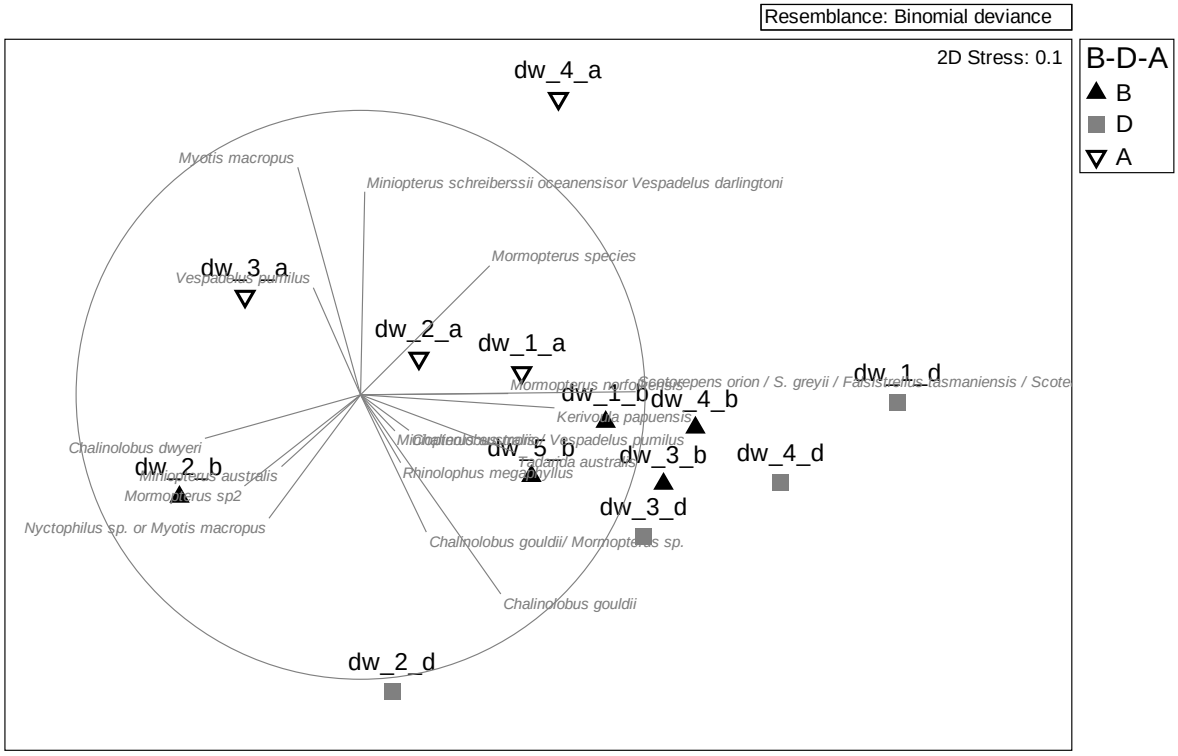
Outlier samples identified in Binomial Deviance Ordination (Figure 5) include higher than average nightly call counts for dw_4_a, and lower than average call counts for dw-1_d and dw_2_d, as depicted in Table 8. See Appendix C for details.

Table 9: Outlier values for nightly counts at the dam wall.

Parameter	Overall values	Dw_4_a	Dw_1_d	Dw_2_d

No. of calls				
$\bar{x}$	400.4	1088	98	106
Range	14-1172			
No. Spp./categories				
$\bar{x}$	10.6	11	11	10
Range	4-15			

Figure 5: Anabat call results Binomial Deviance ordination.



11.6 Splendour in the Grass 2015 Results Hair Funnel Sampling

The number of samples are similar in the before (21) and during (19) periods, and rose to 30 samples in the after period. This increase was mainly due to an increase in native Bush Rat numbers at Transect IM3B.

Table 10: SITG 2015 Hair Funnel Results

Sample Period: B = before (June); D = During (July) A = After (August).

Sample period	B	B	B	D	D	A	A	A	Sum
Transect	IM3	C1	C2	C1	IM3	IM3	C1	IM2A	
Sp./category									
Antechinus	5	10		9	7	8	10	1	50
Rat	3	2	1	1	1	8	1	1	18
Brushtail Possum					1		1		2
Period Sum			21		19			30	
Taxa	2	2	1	2	3	2	3	2	
Total samples									70

11.7 Splendour in the Grass 2015 Sand Traps replaced by Cameras Results

Sand traps in two culverts south of Jones Road and one culvert north of Jones Road were irregularly monitored up to December 2014, before flash flooding severely damaged all sand traps on January 1st 2015. A second flash flood event on May 2nd caused further damage to sand traps and a decision was made to monitor fauna movement in this location by the use of two motion sensor fauna cameras. Two cameras (Reconyx and Scoutguard) were deployed in forest in Billinudgel Nature Reserve ~350m southeast of the sand trap culverts on July 2nd 2015. The operation of these coincided with the conduct of the SITG 2015 event, camera images being downloaded on August 16th 2015.

Despite being deployed within ~30m of each other, there was a significant variation in the number of images captured. Of 33 Scoutguard wildlife images, three included a Brush Turkey; and two show Swamp Wallabies interacting. The Reconyx camera recorded 333 files including >200 wildlife images. Closely timed sequences of 3 consecutive images provided by the Reconyx camera provided some fauna behavioural data, and included foraging and escape behaviour, as well as interactions between Northern Brown Bandicoots. Swamp Wallabies were also recorded singly, as well as in pairs interacting in apparently pre-copulatory behaviour. The Fox was recorded moving through the area.

11.8 Splendour in the Grass 2015 Walking Spotlight Results

No flying-foxes were detected within event areas during SITG2015. Blossoms and fruit were noted as being scarce on Parklands and disturbance effects made flying-fox calls inaudible.

11.9 Splendour in the Grass 2015 Dam Birds

Waterbirds at the large northwestern dam have been monitored since 2007. The before count of 62 was the highest in 38 samples. While the during sample declined, bird numbers in the after sample had recovered to slightly above average, and species numbers were high.

Table 10: SITG 2015 Before-During-After patterns dam birds.

	Overall	Before SITG	During SITG	After SITG
	Means	1/7/15	27/7/15	10/8/15
Bird Count	38	62	33	41
Range	18-62			
No. Species	7.2	8	6	9
Range	6-9			

Increases in both bird and species counts at the large dam are evident in Figure 1. Lowest bird counts at observations 18 and 19 mark the SITG2013 event (and patrons swimming in the dam). Comparison of the pre-event and post event period dam bird data indicate that the mean species count is significantly greater in the post-SITG2013 period compared to pre-SITG2013: this difference is statistically significant ($F_{1,36}= 8.64$; $P =0.006$). Bird counts are also greater on average, but just below the threshold for statistical significance ($F_{1,36}= 3.99$; $P =0.053$).

Figure 1: Dam Birds increase over time: Observations 18 & 19 occurred during SITG2013.

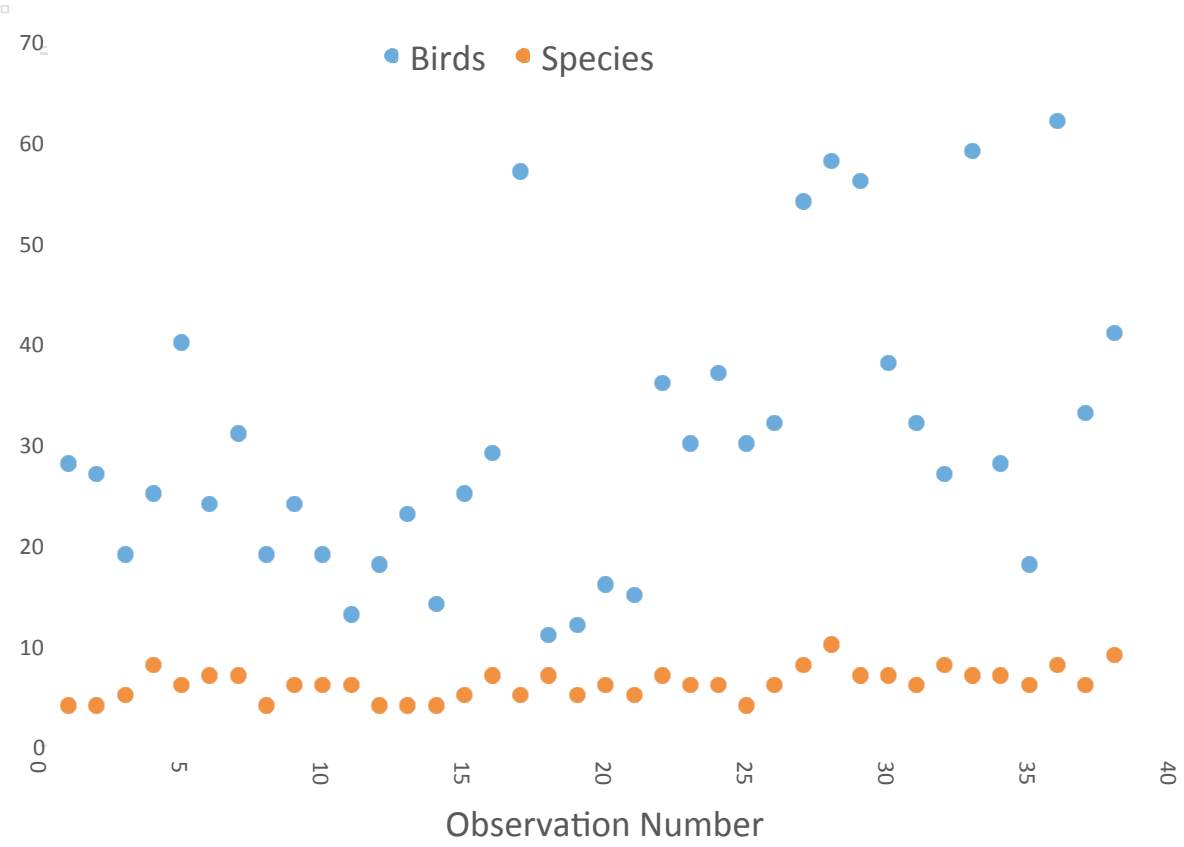

Birds
Species
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
Observation Number

Table 11: Waterbird and species counts at the large dam. Falls2014-15 & SITG15

Observation Number		***33***	***34***	***35***	***36***	***37***	***38***
Scientific Name	Common Name	17/12/14	2/1/15	27/1/15	1/7/15	27/7/15	10/8/15
Anas superciliosa	Pacific Black Duck	19	2	2	22	2	1
Aythya australis	Hardhead	18	6	4	25	4	9
Chenonetta jubata	Maned Duck				1		
Porphyrio porphyrio	Purple Swamphen	2	4	6	3	3	3
Gallininula tenebrosa	Dusky Moorhen		2		1	1	2
Fulica atra	Eurasian Coot	16	12	4	6	11	7
Irediparra gallinacea	Jacana						
Tachybaptus novaehollandiae	Australasian Grebe	1	1	1			1
Phalacrocorax sulcirostris	Little Black Cormorant	2	1	1			2
Microcarbo melanoleuca	Little Pied Cormorant						1
Dendrocygna arcuata	Wandering Whistleduck				3	12	15
Ceyx azurea	Azure Kingfisher						
Ardea novaehollandiae	White-faced heron						
Ardea pacifica	Pacific heron				1		
Egretta alba	Great White Egret						
Hirundo neoxena	Welcome Swallow						
Grallina cyanoleuca	Mudlark						
Anhinga melanogaster	Darter	1					
Threskiornis molucca	Australian White Ibis						
	Birds	59	28	18	62	33	41
	Species	7	7	6	8	6	9
		before falls	during falls	after falls	before SITG	during SITG	after SITG

Appendix A: Multivariate Analyses of Event Impact Monitoring Data

Methods and analyses below were developed and provided by Dr. R. Kooyman (EarthProcess Ecological Services, Myocum).

METHODS

Sampling Design

Definitions

Sitesample: a bird transect survey undertaken at a particular site on a particular day (with defined duration, and within specific periods of day).

Control site: control site in larger area of forest of same or similar type in proximate areas.

Impact site: a site proximate to and reasonably expected to be impacted by an 'event'.

Temporal sample: time of year and the month of samples relative to the timing of the 'event'.

Analytic methods

Explanation of the analyses

The structure and scheduling of event impact sampling is based on Underwood's 'Before After Control Impact' BACI design (Underwood 1994). The statistical methods used to recognise impacts (in this case, on bird species abundance within the sitesamples) were based on those described in Clarke and Gorley (2006) and Anderson et al., (2008). Initial tests of the methods were undertaken using the software program Primer v6 and four months of earlier trial bird transect data (Nov. 2012- Feb 2013: not presented).

Consistent with Underwood (1994), an impact may be evidenced in the data when a sitesample is compared to other sitesamples through time, and at one such time falls outside the levels of variance exhibited previously across the individual (sitesamples) and the aggregated three day 'Before' 'After' and 'Control' samples. This effectively takes account of seasonal variation within and among sites, while allowing detection of site 'responses' to an impact from a specific event.

Explanation of Methods

Control versus Impact site differences prior to 'event'

To establish the baseline levels of variation between Control and Impact monitoring sites tests of significance for differences between Control versus Impact monitoring sites prior to the event were undertaken using Permanova (and 999 permutations). Both Monte Carlo and standard significance tests based on permutation methods were used.

Data inclusive of event; multivariate methods

Data were first entered into a repeated measures Site by Species (abundance matrix). A triangular resemblance matrix using pairwise binomial deviance as the resemblance measure was then generated using all available sitesamples. The relationships among sites and samples and species abundance were then visualised in a non-metric multidimensional scaling ordination (NMDS) (e.g. Fig. 1). The position of sitesamples in ordination space shows at a glance their underlying similarity (or dissimilarity) and any grouping of similar sites, or sites that have (as an example) low or high values relative to others. It also shows the pattern of variation relative to the timing of samples (e.g. seasonality across the landscape), and if these patterns are similar or different among sites. A second matrix of Site by Species using total abundance was created based on repeat measures merged by site, and the process above was repeated (e.g. Fig. 2).

Vectors (in this case representing bird species) were generated using Pearson Correlation and added to visualise the relationship of variables to the position of sitesamples and ordination axes. Pearson values provide a measure of the extent of co-occurrence of species and provide a directional measure of the strength of their influence on the position (similarity) of assemblages in the ordination. Pearson Correlation values vary from 0-1 (where 0 equates with no influence and 1 with maximum possible influence).

The triangular resemblance matrix based on binomial deviance and the repeated measures matrix (merged site data) was then used as the basis for the generation of a Principal Coordinates Analysis (PCO) (Gower 1966; Legendre and Legendre 1998). PCO (like Principal Components Analysis) is a projection of the data onto axes, but (unlike PCA) does so in the space of the dissimilarity measure chosen. The usefulness of the method is that it maximises the projection of variance of points along the axes allowing the most salient patterns and structures in the data to be observed. Individual eigenvalues (representing site by species variance) along the principal axes are an output of the method and allow further interrogation of results and detection of impacts on specific species (and/or guilds).

Quantifying variance across repeated measures is central to the methods described by Underwood (1994). The method allows for both a test of the null hypothesis of 'no effect' from events, and provides a measure of any 'other' effects (as variance).

Using the rectangular matrix of between site-sample variance (as eigenvalues from the PCO), a triangular resemblance matrix was then generated using Euclidean distance. An NMDS ordination positioned sitesamples (Controls and Impact monitoring) in relation to total variance. A distance based redundancy analysis (dbRDA) was then used to perform an ordination of the pairwise variance values and find linear combinations of the predictor variables (bird species) which explained the greatest variation in the data cloud (Anderson and Legendre 1999).

Taxonomic structure

Significant changes in taxonomic patterns within samples (e.g. those potentially caused by an increase or disappearance of particular taxa within the samples) can be identified in a Taxonomic analysis that compares samples against average taxonomic distinctness (AvTD) at a particular level of species richness. The method described here used 999 random draws from the pool of available species listed in an Aggregation (taxonomic) matrix (species, genus, family)

to generate a null (no taxonomic structure) and 95% Confidence Intervals. Values outside the 95% CIs for an assemblage (in this case a sitesample) represent significant deviation from the null expectation. Baseline versus 'event' comparisons allow for quantification and interpretation of potential taxonomic impacts (Clarke and Gorley 2006). Site values with high taxonomic distinctness (outside 95% CI's) at a given richness suggest species within the sample are less related than by chance; while values lower and outside 95% CI's suggest species are more related (similar) than expected by chance. Such values could reflect factors such as a concentration of more related species in times where food resources (e.g. nectar or fruit) are available; or where certain types of species are more vulnerable to specific factors than others, resulting in shifts in taxonomic structure at a site.

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Appendix B: EIM data

Falls 2014-15 Data

Falls 2014-15 Bird Trophic Analysis by transect

Guids: F'vore = frugivore; G'vore = granivore; I'vore = insectivore; C'vore = carnivore;

N'vor = nectivores; O'vore = omnivore' H'vore = herbivore

Transect	F'vore	G'vore	I'vore	C'vore	N'vore	O'vore	H'vore	total
IM2A	10	6	100	14	41	0	0	171
IM2B	13	4	96	4	36	2	0	155
IM3A	9	6	113	8	59	2	0	197
IM3B	10	1	53	4	66	0	2	136
C1A	5	8	42	9	30	1	0	95

C1B	5	1	56	15	32	0	0	109
C2A	26	9	129	14	58	0	0	236
C2B	32	20	152	13	60	0	0	277
C3A	9	11	113	3	46	0	0	182
C3B	10	26	115	7	24	0	0	182
TOTAL	129	92	969	91	452	5	2	1740

Falls 2014-15 Bat species and calls Dam Wall

Falls 2014-15 Dam Wall	Before	During	After	Total
Miniopterus australis	33	102	172	307
Vespadelus pumilus	100	4	35	139
Miniopterus australis / Vespadelus pumilus	52	14	15	81
Vespadelus spp.	2		8	10
Chalinolobus morio	0		3	3
Chalinolobus gouldii	63	464	72	599
Chalinolobus gouldii/ Mormopterus sp.	53	290	144	487
Chalinolobus dwyeri	1	0	0	1
Mormopterus norfolkensis	16	6	3	25
Mormopterus species	13	44	36	93
Mormopterus sp2	171	208	142	521
Rhinolophus megaphyllus	2	8	3	13
Nyctophilus sp. or Myotis macropus	2	21	17	40
Myotis macropus	58	481	82	621
Falsistrellus tasmaniensis			4	4
Scotorepens orion / S. greyii / Falsistrellus tasmaniensis / Scoteanax rueppellii	578	316	149	1043
Miniopterus s. oceanensis	1		5	6
M. s. oceanensis or Vespadelus darlingtoni			1	1
Saccolaimus flaviventris		4		4
Kerivoula papuensis		1	4	5
Bat call no ID possible	400	211	138	749
Totals	1545	2174	1033	4752

Falls 2014-15 Bat calls and species at IM2A and the Miniopterus dam

Falls 2014-15 IM2A and Miniopterus dam data								
Location	IM2	IM2	IM2	IM2	MD	MD	MD	MD
SITE	B	D	A	Total	B	D	After	Total
Miniopterus australis	22	2	18	42		3	4	7
Vespadelus pumilus					3	1	3	7
Miniopterus australis / Vespadelus pumilus	44	52	73	169	10	3	7	20
Vespadelus spp.								
Chalinolobus morio								
Chalinolobus gouldii						4	3	7
Chalinolobus gouldii/ Mormopterus sp.		1		1	3	3	3	9
Chalinolobus dwyeri								
Mormopterus norfolkensis								
Mormopterus species								
Mormopterus sp2		1		1			4	4
Rhinolophus megaphyllus	2		5	7		1		1
Nyctophilus sp. or Myotis macropus	3			3	1			1
Myotis macropus	1			1		1		1
Falsistrellus tasmaniensis								
Scotorepens orion / S. greyii / Falsistrellus tasmaniensis / Scoteanax rueppellii					1	8	2	11
Miniopterus s. oceanensis								
M. s. oceanensis or Vespadelus darlingtoni								
Saccolaimus flaviventris								
Kerivoula papuensis								
Bat call no ID possible	9	13		22	2	1	1	4
Totals	81	69	96	246	20	25	27	72

SITG 2015 Bird Trophic Analysis

SITG2015 Bird Trophic Analysis by transect

Transect	Frugivore	Granivore	Insectivore	Carnivore	Nectivore	Omnivore	t_bda
IM2A	65	8	158	8	76	5	320
IM2B	30	9	140	5	57	5	246
IM3A	31	16	79	14	108	3	251
IM3B	94	9	71	14	91	5	284
C1A	17	8	137	11	112	5	290
C1B	7	11	170	3	117	3	311
C2A	24	10	120	24	78	4	260
C2B	50	4	188	7	97	5	351
C3A	11	4	186	2	98	2	303
C3B	18	17	176	0	150	2	363
Totals	347	96	1425	88	984	39	2979

SITG 2015 Dam Wall Before-during-after call data

SITG 2015 Dam Wall	**before**	**during**	**after**	**All**
total number of bat calls				
SPECIES				
Tadarida australis	4		1	5
Miniopterus australis	62	57	2572	2691
Vespadelus pumilus	52	2	266	320
Miniopterus australis / Vespadelus pumilus	11	99	234	344
Vespadelus vulturnus				
Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	4	9	256	269
Chalinolobus morio/ Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	1		112	113
Chalinolobus morio			1	1
Chalinolobus gouldii		11	22	33
Chalinolobus gouldii/ Mormopterus sp.	2	21	135	158
Chalinolobus dwyeri / Chalinolobus gouldii			2	2
Mormopterus norfolkensis			62	62
Mormopterus species (sp 2 or norfolkensis)	10	40	266	316
Mormopterus sp2				0
Rhinolophus megaphyllus		1		1
Nyctophilus sp. or Myotis macropus	4	5	13	22
Myotis macropus	7	124	8	139
Scotorepens orion (only probable as could be *F. tasmaniensis*)				0
Falsistrellus tasmaniensis				0
Scotorepens orion / S. greyii / Falsistrellus tasmaniensis / Scoteanax rueppellii (35-37khz)		3		3
Scotorepens orion / S. greyii / Falsistrellus tasmaniensis / Scoteanax rueppellii / Mormopterus (35-37khz)	5	25	13	43
Miniopterus schrieberssii oceanensis				0

Miniopterus schreiberssii oceanensis or *Vespadelus darlingtoni*	6	76	125	207
Saccolaimus flaviventris				0
Kerivoula papuensis				0
Bat call no ID possible	12	10	54	76
Totals	180	483	4142	4805

SITG 2015 IM2A Before-during-after call data

SITE	IM2A	IM2A	IM2A	
DATE				
Number of files				
total number of bat calls				
	before	during	after	
SPECIES				
Tadarida australis				
Miniopterus australis	6		26	32
Vespadelus pumilus				
Miniopterus australis / Vespadelus pumilus	2	2	140	144
Vespadelus vulturnus				
Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni				
Chalinolobus morio/ Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni				
Chalinolobus morio				
Chalinolobus gouldii				
Chalinolobus gouldii/ Mormopterus sp.				
Chalinolobus dwyeri / Chalinolobus gouldii				
Mormopterus norfolkensis				
Mormopterus species (sp 2 or norfolkensis)	1		1	2
Mormopterus sp2	1			1
Rhinolophus megaphyllus	8	34	34	76
Nyctophilus sp. or Myotis macropus				
Myotis macropus				
Scotorepens orion (only probable as could be F. tasmaniensis)				
Falsistrellus tasmaniensis				

Scotorepens orion / S. greyii / Falsistrellus tasmaniensis / Scoteanax rueppellii (35-37khz)				
Scotorepens orion / S. greyii / Falsistrellus tasmaniensis / Scoteanax rueppellii / Mormopterus (35-37khz)				
Miniopterus schriebersii oceanensis				
Miniopterus schreibersii oceanensis or Vespadelus darlingtoni				
Saccolaimus flaviventris				
Kerivoula papuensis				
Bat call no ID possible	7	1	75	83
	25	37	276	338

Threatened Species Records from Parklands Event Impact Monitoring

		Nos.
Threatened Fauna		
BIRDS		
Barred Cuckoo-shrike	*Coracina lineata*	2
Eastern Osprey	*Pandion cristatus*	1
Rose-crowned Fruit-dove	*Ptilinopus regina*	1
White-eared Monarch	*Carterornis leucotis*	7
MAMMALS		
Blossom Bat	*Syconycteris australis*	1
Eastern Bent-wing Bat	*Miniopterus schreibersii oceanensis*	70
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	5
Eastern Freetail Bat	*Mormopterus norfolkensis*	109
Golden-tipped Bat	*Kerivoula papuensis*	8
Grey headed Flying-fox	*Pteropus poliocephalus*	13
Large-eared Pied Bat	*Chalinolobus dwyeri*	17
Large-footed Myotis	*Myotis macropus*	1261
Little Bent-wing Bat	*Miniopterus australis*	4337
Northern Long-eared Bat	*Nyctophilus bifax*	6
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	4
Total		5842

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Appendix C: Species List Bird Surveys

The following species list includes bird species detected on EIM transect surveys and surveys of the waterbirds of the large dam. The survey categories Fairy-wren sp. and Thornbill sp. are not included.

MEGAPODIDAE	
Brush-turkey	*Alectura lathami*
ANATIDAE	
Maned Duck	*Chenonetta jubata*
Pacific Black Duck	*Anas superciliosa*
Hardhead	*Aythya australis*
Wandering Whistleduck	*Dendrocygne arcuata*
PODICIPEDIDAE	
Australasian Grebe	*Tachybaptus novaehollandiae*
PHALACROCORIDAE	
Little Black Cormorant	*Phalacrocorax sulcirostris*
Little Pied Cormorant	*Phalacrocorax melanoleucos*
ANHINGIDAE	
Darter	*Anhinga melanogaster*
ARDEIDAE	
White-faced Heron	*Egretta novaehollandiae*
Pacific Heron	*Ardea pacifica*
Great Egret	*Egretta alba*
Cattle Egret	*Ardea ibis*
Straw-necked Ibis	*Threskiornis spinicollis*
ACCIPITRIDAE	
Pacific Baza	*Aviceda subcristata*
White-bellied Sea-Eagle	*Haliaeetus leucogaster*
Brown Goshawk	*Accipiter fasciatus*
Eastern Osprey	*Pandion cristatus*
Grey Goshawk	*Accipiter novaehollandiae*
Whistling Kite	*Haliastur sphenurus*
RALLIDAE	
Dusky Moorhen	*Gallinula tenebrosa*
Purple Swamphen	*Porphyrio porphyrio*
CHARADRIIDAE	
Masked Lapwing	*Vanellus miles*
COLUMBIDAE	
White-headed Pigeon	*Columba leucomela*
Emerald Dove	*Chalcophaps indica*
Bar-shouldered Dove	*Geopelia humeralis*
Wonga Pigeon	*Leucosarcia melanoleuca*
Brown Cuckoo-dove	*Macropygia amboinensis*

Peaceful Dove	*Geopelia striata*
Rose-crowned Fruit-dove	*Ptilinopus regina*
Topknot Pigeon	*Lopholaimus antarcticus*
CACATUIDAE	
Galah	*Cacatua roseicapilla*
Sulphur-crested Cockatoo	*Cacatua galerita*
PSITTACIDAE	
King Parrot	*Alisterus scapularis*
LORIDAE	
Rainbow Lorikeet	*Trichoglossus haematodus*
Scaly-breasted Lorikeet	*Trichoglossus chlorolepidotus*
Eastern Rosella	*Platycercus eximius*
Crimson Rosella	*Platycercus elegans*
CUCULIDAE	
Brush Cuckoo	*Cacomantis variolosus*
Fan-tailed Cuckoo	*Cacomantis flabelliformis*
Pheasant Coucal	*Centropus phasianinus*
Horsfield's Bronze-cuckoo	*Chalcites basalis*
Shining Bronze-cuckoo	*Chalcites lucidus*
Eastern Koel	*Eudynamys orientalis*
Channel-billed Cuckoo	*Scythrops novaehollandiae*
STRIGIDAE	
Southern Boobook Owl	*Ninox novaeseelandsiae*
ALCEDINAE	
Azure Kingfisher	*Alcedo azurea*
HALCYONIDAE	
Laughing Kookaburra	*Dacelo novaeguineae*
Sacred Kingfisher	*Todirhamphus sanctus*
CORACIIDAE	
Dollarbird	*Eurystomus orientalis*
MEROPIDAE	
Rainbow Bee-eater	*Merops ornatus*
AEGOTHELIDAE	
Australian Owlet-nightjar	*Aegotheles cristatus*
PITTIDAE	
Noisy Pitta	*Pitta versicolor*
APODIDAE	
White-throated Needletail	*Hirundapus caudacutus*
HIRUNDINIDAE	
Welcome Swallow	*Hirundo neoxena*
CAMPEPHAGIDAE	
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*

Cicadabird	*Coracina tenuirostris*
Varied Triller	*Lalage leucomela*
White-bellied Cuckoo-shrike	*Coracina papuensis*
PETROICIDAE	
Rose Robin	*Petroica rosea*
Eastern Yellow Robin	*Eopsaltria australis*
Pale Yellow Robin	*Tregellasia capito*
PACHYCEPHALIDAE	
Grey Shrike-thrush	*Colluricincla harmonica*
Little Shrike-thrush	*Colluricincla megarhyncha*
Golden Whistler	*Pachycephala pectoralis*
Rufous Whistler	*Pachycephala rufiventris*
MONARCHIDAE	
Grey Fantail	*Rhipidura fuliginosa*
Willie Wagtail	*Rhipidura leucophrys*
White-eared Monarch	*Carterornis leucotis*
Black-faced Monarch	*Monarcha melanopsis*
Restless Flycatcher	*Myiagra inquieta*
Magpie-lark	*Grallina cyanoleuca*
Leaden Flycatcher	*Myiagra rubecula*
Satin Flycatcher	*Myiagra cyanoleuca*
ORTHONYCHIDAE	
Australian Logrunner	*Orthonyx temminckii*
ORTHONYCHIDAE	
Eastern Whipbird	*Psophodes olivaceus*
PTILINORHYNCHIDAE	
Regent Bowerbird	*Sericulus chrysocephalus*
Satin Bowerbird	*Ptilinorhynchus violaceus*
MALURIDAE	
Red-backed Fairy-wren	*Malurus melanocephalus*
Superb	*Malurus cyaneus*
Variegated Fairy-wren	*Malurus lamberti*
ACANTHIZIDAE	
Brown Thornbill	*Acanthiza pusilla*
White-browed Scrubwren	*Sericornis frontalis*
White-throated Gerygone	*Gerygone olivacea*
Striated Thornbill	*Acanthiza lineata*
Large-billed Scrubwren	*Sericornis magnirostra*
MELIPHAGIDAE	
Brown Honeyeater	*Lichmera indistincta*
Noisy Friarbird	*Philemon corniculatus*
Noisy Miner	*Manorina melanocephala*

Lewin's Honeyeater	*Meliphaga lewinii*
Yellow-faced Honeyeater	*Lichenostomus chrysops*
Eastern Spinebill	*Acanthorhynchus tenuirostris*
Scarlet Honeyeater	*Myzomela sanguinolenta*
Brown Honeyeater	*Lichmera indistincta*
Little Wattlebird	*Anthochaera chrysoptera*
Red Wattlebird	*Anthochaera carunculata*
ZOSTEROPIDAE	
Silvereye	*Zosterops lateralis*
DICAEIIDAE	
Mistletoebird	*Dicaeum hirundinaceum*
PARDALOTIDAE	
Spotted Pardalote	*Pardalotus punctatus*
Striated Pardalote	*Pardalotus striatus*
ESTRILDIDAE	
Red-browed Finch	*Neochmia temporalis*
ORIOLIDAE	
Australasian Figbird	*Sphecotheres vieilloti*
Olive-backed Oriole	*Oriolus sagittatus*
DICRURIDAE	
Spangled Drongo	*Dicrurus bracteatus*
ARTAMIDAE	
White-breasted Woodswallow	*Artamus leucorhynchus*
CRACTICIDAE	
Grey Butcherbird	*Cracticus torquatus*
Pied Butcherbird	*Cracticus nigrogularis*
Australian Magpie	*Cracticus tibicen*
Pied Currawong	*Strepera graculina*
CORVIDAE	
Torresian Crow	*Corvus orru*

Appendix D: Illustrations

Swamp Wallabies in Billinudgel Nature Reserve

Northern Brown Bandicoot Billinudgel Nature Reserve

Brush Turkey Billinudgel Nature Reserve

Fox in Billinudgel Nature Reserve