Attachment 3: Bruce Highway (Cooroy to Curra) Upgrade Section C (Traveston Road to Keefton Road) Project Job No. 232/10A/2

Residual Impact Assessment and Federal Environmental Offsets Proposal for the Koala and Grey-headed Flying-fox

June 2015

Contents

Table of Figures

Table of Tables

1. Introduction

1.1 Purpose of this Report

This Residual Impact Assessment and Federal Environmental Offsets Proposal for the Koala and Grey-Headed Flying-Fox Report (herein referred to as 'the Report') has been prepared to respond to the request for additional Information (RFI) issued by the Department of the Environment (DoE) for *Environmental Protection and Biodiversity Act 1999* (EPBC Act) referral 2014/7394, namely item (c):

> *(c) An assessment of the likelihood of residual significant impacts of the project, and where residual significant impacts are determined likely to occur, submit an offset proposal in accordance with the EPBC Act Environmental Offsets Policy October 2012.*

This Report:

- Identifies the anticipated residual impacts to Matters of National Environmental Significance (MNES), specifically the koala (*Phascolarctos cinereus*) and the grey-headed flying-fox (*Pteropus poliocephalus*), resulting from the construction and operation of the Bruce Highway (Cooroy to Curra) Upgrade Section C (Traveston Road to Keefton Road) Project (the Project).
- Outlines the Department of Transport and Main Road's (TMR) commitment to provide offsets in accordance with the EPBC Act and the *EPBC Act Environmental Offsets Policy 2012* (the EPBC Act Offsets Policy), in response to the residual impact generated as a result of construction and operation of the Project.
- Is to be read in conjunction with the *Bruce Highway (Cooroy to Curra) Upgrade Section C (Traveston Road to Keefton Road) Fauna Management Plan – Koala and Grey-headed Flying-Fox Project Job No. 232/10A/2* (Fauna Management Plan) (included as Attachment 1 to the Preliminary Documentation), which documents the mitigation and management measures included in the assessment of residual impacts.

The residual impacts and offsets identified in this Report are specific to the koala and grey-headed flying-fox. Potential impacts to the Mary River turtle and Mary River cod are considered in the *Bruce Highway (Cooroy to Curra) Upgrade Section C (Traveston Road to Keefton Road) Impact Assessment and Erosion and Sediment Control Plan Project Job No. 232/10A/2* (Erosion and Sediment Control Plan) (included as Attachment 2 to the Preliminary Documentation). As no residual impacts were identified, no offsets are proposed for the Mary River turtle and Mary River cod. The DoE concurs with this assessment.

The MNES residual impact assessment for the koala and grey-headed flying fox is documented in Section 2 of this Report. The offsets proposal is documented in Sections 3 to 5 and the selection of the preferred offsets option is provided in Section 6 of this Report.

The EPBC Act Offsets Policy and Offsets Assessment Guide have been used to determine the offset requirements for the Project.

TMR Program Management and Delivery – Environmental, Cultural Heritage and Corridor Management Team is looking to ensure more strategic approach for EPBC offsets for future TMR projects.

1.2 Scope of this Report

The residual impact assessment is based on the impact on habitats of the relevant species following the avoidance of habitat and the implementation of the mitigation measures included in the Fauna Management Plan. The offset proposal described in this Report is proposed to counterbalance the residual impacts that remain after avoidance and mitigation measures and provide for a conservation benefit and environmental value to the koala and grey-headed flying-fox.

The 'Project area' in this Report is defined as the area within the resumption boundary to accommodate a six-lane highway, which will be converted to State-controlled Road Reserve following completion of the construction of the proposed highway upgrade. The current Project will only deliver a four-lane highway and in this regard clearing of the entire footprint of the Project area will not be required at this stage. Notwithstanding, as the Project area may be subject to clearing for future upgrades, maintenance and access reasons, TMR proposes to include all koala and grey-headed flying-fox habitat mapped within the resumption boundary in the calculation of offset requirements.

2. Residual Impact Assessment

2.1 Impact Area

The Fauna Management Plan identified that 45.9ha of potential koala habitat and 45.9ha of suitable foraging habitat for the grey-headed flying fox will be impacted as a result of the Project, referred to as the 'impact area' (refer to Figure 1 and Figure 2 respectively). This a reduction from the 48 ha of koala habitat originally documented in the EPBC Act Referral submitted for the Project in November 2014 as a result of the refinement of the construction footprint and Project area in the Detailed Design phase of the Project.

As outlined in the Fauna Management Plan both the koala and grey-headed flying-fox utilise similar habitat features for foraging and breeding and do not directly compete i.e. koalas utilise the foliage while grey-headed flying-fox rely on the flowers and fruits. However, their use of the habitat is different in that the koala will have some ground surface movement. Therefore the impact areas and offset site were identified on the basis that they can provide suitable habitat for both species.

2.2 Description of the Impact Area

The total impact area has been divided into impact sites located within individual habitat patches as illustrated in Figure 4. A description of each of the habitat patches is provided in Table 1.

Table 1 Description of Individual Habitat Patches

Patch	Patch Detail	Habitat Patch size	Impact Site in the Patch	Habitat Description
Patch 1	Traveston Creek, part of Lot 1RP176437 and Lot 20SP254364	1.3ha	1.09ha	Isolated patch of habitat located on Traveston Creek. This patch is not mapped as a regional ecosystem, contains predominantly *Eucalyptus tereticornis*, with *Corymbia intermedia*, *Eucalyptus siderophloia*, *Lophostemon suaveolens* and mixed rainforest species. Primary food trees (koalas) are present, comprising 17% of the 100x20m plot within the habitat patch. Winter and Spring flowering species present. Contains a number of exotic species including Rhodes Grass, Basket Grass, Blady Grass, Grounsel Bush, Blue Billy Goats Weed and Farmers Friend. 83% of the habitat patch is impacted, leaving a small remnant on the eastern side of the Project area. No evidence of koalas observed during surveys.

Patch 2	South of Tandur Road, part of lot 3RP208996	14.2ha	1.18ha	Habitat on the south side of Tandur Road, adjacent to the Powerlink easement. Kybong Creek crosses under Tandur Road and through this habitat patch. The patch is mapped as RE 12.11.3, but was observed to contain RE 12.3.11. Contains predominantly *Eucalyptus tereticornis* and *Corymbia intermedia*, with *Lophostemon suaveolens*. *Eucalyptus crebra*, *Eucalyptus propinqua*, *Acacia maidenii* and *Melaleuca salignus* also recorded. Winter and Spring flowering species present. Recruitment of canopy species was apparent. Primary food trees are present. Some exotic species present including Lantana, Kangaroo Grass and Blady Grass. No evidence of koalas observed during surveys. Less than 10% of this habitat patch is directly impacted, along its western edge.
Patch 3	North of Tandur Road, part of Lots 4RP139458, 3RP139458, 2RP124936 and local Road Reserve	15.09ha	7.30ha	Habitat on the north side of Tandur Road, adjacent to the Powerlink easement and the former aquaculture farm. Clearing for agricultural activity either side, with a vegetated corridor following Kybong Creek. A small dam located on Kybong Creek is within this habitat patch. The patch is mapped as RE 12.3.11 at southern end, with no evidence of recruitment. RE 12.11.3/12.11.14 is mapped at the northern end. Contains *Eucalyptus tereticornis*, *Lophostemon suaveolens, Lophostemon confertus*, *Eucalyptus propinqua* and *Eucalyptus siderophloia* with *Corymbia intermedia* also recorded to a lesser extent. *Acacia disparrima*, *Allocasuarina littoralis* and *Syncarpia glomulifera* were also recorded. Winter and Spring flowering species present. Primary food trees are present. Evidence of koalas identified in the mid and northern section of the habitat patch, observed away from primary food trees, utilising *Syncarpia glomulifera* (Turpentine). 64% of this habitat patch is affected, with smaller habitat patches remaining on either side of the Project area. Some Lantana observed.

Patch 4	North of Tandur Road, part of Lot 1281M37577 and Lot 1459M37678	13.6ha	6.80ha	Habitat north of the larger dam, adjacent to the Powerlink easement. Some clearing with orchards located to the west of the patch, large continuous patch of RE located to the east of the Powerlink easement. The patch is mapped as RE12.11.3/12.11.14, with RE 12.3.11 and RE 12.11.3/12.11.14 at its northern extent. Contains *Corymbia intermedia*, *Lophostemon suaveolens, Lophostemon confertus*, *Eucalyptus propinqua, Eucalyptus acmenoides* and *Eucalyptus siderophloia* with *Eucalyptus microcorys, Melaleuca salignus, Alphitonia excelsa*, *Acacia disparrima* and *Syncarpia glomulifera* also recorded. Winter and Spring flowering species present. Primary food trees are present. Evidence of koalas identified in the mid and southern part of the habitat patch. 50% of this habitat patch is affected, with residual areas either side of the Project area. Evidence of logging and weeds observed.
Patch 5	Traveston State Forest, part of Lot 1459M37678, 950FTY1293, 416CP882034 and local Road Reserve	99.9ha	12.60ha	Habitat patch along the eastern edge of Traveston State Forest, and to the south of the State Forest. Traveston State Forest is mapped as RE 12.11.3/12.11.14, with the smaller southern area mapped as RE 12.11.3. Contains predominantly *Eucalyptus acmenoides*, and *Lophostemon confertus*, with *Angophora leiocarpa*, *Corymbia intermedia*, *Eucalyptus pilularis*, *Eucalyptus propinqua*, *Lophostemon suaveolens*, *Melaleuca salignus* and *Syncarpia glomulifera*. Also *Allocasuarina torulosa*, *Acacia disparrima*, and *Angophora leiocarpa*. Winter and Spring flowering species present. No primary food trees identified at survey points, with no evidence of koala present. Some evidence of logging in the last 5-20 years, and evidence of fire within the last 5 years. 12% of habitat patch impacted.
Patch 6	Cobbs Gully, part of Lot 416CP882034	2.5ha	2.00ha	Habitat patch associated with Cobbs Gully, not mapped as RE. Contains *Eucalyptus tereticornis*, *Eucalyptus resinifera*, *Corymbia intermedia* and *Lophostemon suaveolens* with *Acacia disparrima*, *Lophostemon confertus*, *Allocasuarina torulosa*, *Syncarpia glomulifera*, *Corymbia torelliana*, *Tristaniopsis laurina*, *Acmena smithii* and *Melaleuca salignus*. Primary food trees present. Winter and Spring flowering species present. No evidence of koala observed. Some Lantana observed. 80% of habitat patch impacted, with small areas to the east and west of the Project area.
Patch 7	North of Cobbs Gully, part of Lot 1382M371313 and 416CP882034	1.8ha	0.42ha	Small area, mapped as RE 12.11.3. Considered to contain similar species to Area 6.

Patch 8	South of Jackass Creek, part of Lot 1382M371313 and local Road Reserve	2.4ha	2.29ha	Habitat patch located south of Jackass Creek, mapped as RE 12.11.3. Contains predominantly *Eucalyptus acmenoides* and *Corymbia intermedia*, with *Eucalyptus propinqua, Eucalyptus siderophloia, Lophostemon suaveolens* and *Acacia leiocalyx*. No primary food trees recorded, Winter and Spring flowering species present. No evidence of koala observed. Some evidence of weeds and logging observed. Over 90% of habitat patch impacted, with very small residual areas outside the Project area.
Patch 9	Jackass Creek, part of Lot 2RP840266 and 1RP173216	Part of habitat patch connected along Jackass Creek to RE areas to the east	1.66ha	Area along Jackass Creek, not mapped as RE and observed to be acacia regrowth with some scattered eucalypts along Jackass Creek. No primary food trees recorded, however this habitat patch contributes to the movement corridors identified across the Project area.
Patch 10	South of Woondum Road, part of Lot 2RP138810 and 1RP173216	Part of habitat patch connected along Jackass Creek to RE areas to the east	5.71ha	Area to the south of Woondum Road, with commercial activity either side. Large dams located either side of habitat patch, which is mapped as RE 12.3.11 and RE 12.11.3. Contains predominantly *Eucalyptus acmenoides*, with *Lophostemon confertus*, *Corymbia intermedia* as well as *Eucalyptus propinqua*, *Eucalyptus siderophloia*, *Syncarpia glomulifera*, *Lophostemon confertus*, *Allocasuarina littoralis*, *Acacia disparrima*, *Eucalyptus microcorys*, *Allocasuarina torulosa*, *Melaleuca salignus*, *Celtis sinensis* and *Beckea lagata*. Winter and Spring flowering species present. Primary food trees recorded in areas mapped as RE 12.3.11, with evidence of koalas observed at two KSAT locations. Some minor evidence of weeds observed. The loss of this habitat patch reduces the available habitat on the western side of the Project area.
Patch 11	North of Woondum Road, part of Lot 2RP213686 and local Road Reserve (within PowerLink easement)	Woondum State Forest and adjacent RE	0.26ha	This habitat patch is located within road reserve, adjacent to Woondum State Forest. The area was too small to survey, but is mapped as RE 12.11.3. A record from the KoalaTracker indicates koala presence in Woondum State Forest.
Patch 12	South of Woondum Interchange, part of Lot 3RP165151	1.7ha	0.90ha	This small habitat patch is located on a tributary of Jackass Creek, north of Woondum Road and is not mapped as a regional ecosystem. Contains predominantly *Eucalyptus grandis*, with *Eucalyptus propinqua*, *Eucalyptus siderophloia*, *Eucalyptus tereticornis*, *Lophostemon confertus* and *Melaleuca salignus.* Winter and Spring flowering species present. Primary food trees present, though no evidence of koala was recorded during surveys. The western half of this habitat patch is impacted.

Patch 13	North of Woondum Interchange, part of Lot 1RP35055 and existing Bruce Highway State-controlled Road Reserve	3.8ha	3.72ha	This habitat patch is located adjacent to the existing Bruce Highway, at the northern end of the Project area. The habitat patch is isolated, but connected via riparian vegetation to the east. It is not mapped as a regional ecosystem, but contains predominantly *Lophostemon confertus*, also with *Eucalyptus propinqua*, *Corymbia intermedia*, *Eucalyptus tereticornis*, *Eucalyptus siderophloia*, *Acacia disparrima*, *Celtis sinensis*, *Mallotus philippensis*, *Alphitonia exelsa* and *Jagera pseudorhus*. Winter and Spring flowering species present. The habitat patch contains primary food trees, though no evidence of koala was recorded during surveys. The majority of this habitat patch is impacted.

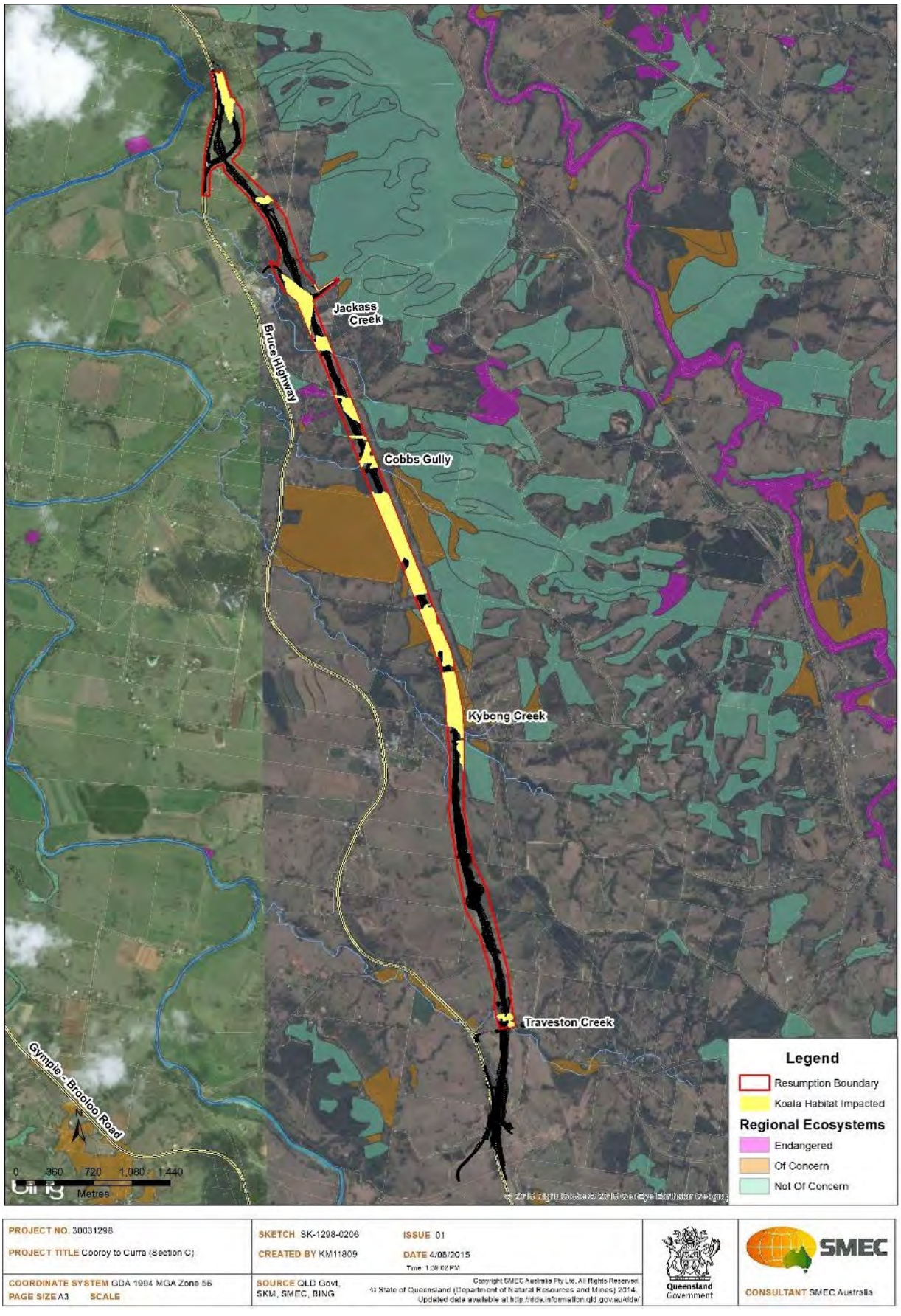

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Figure 1: Potential Koala Habitat in the Project Area

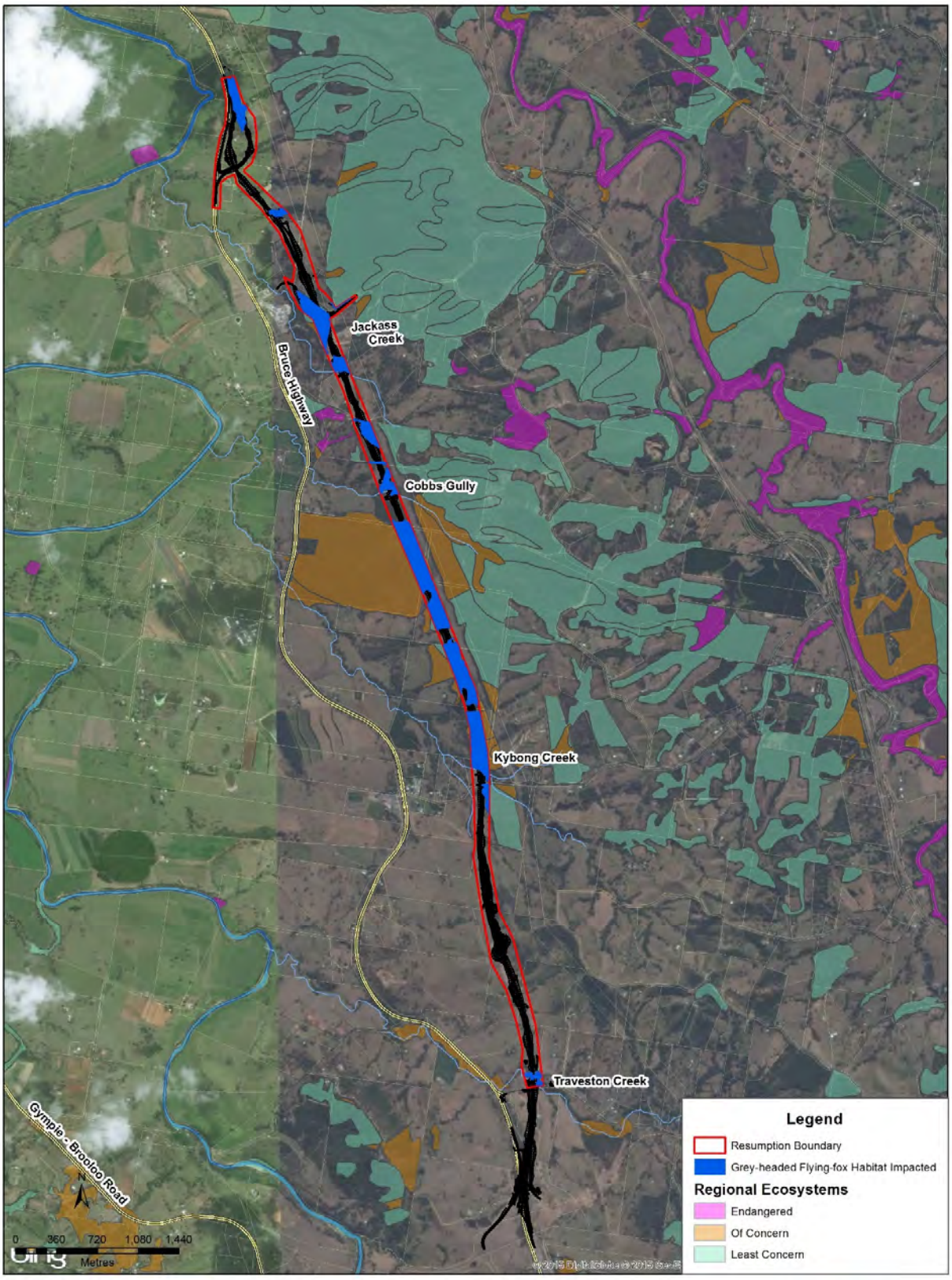

Figure 2: Grey-Headed Flying-fox Habitat within the Project Area

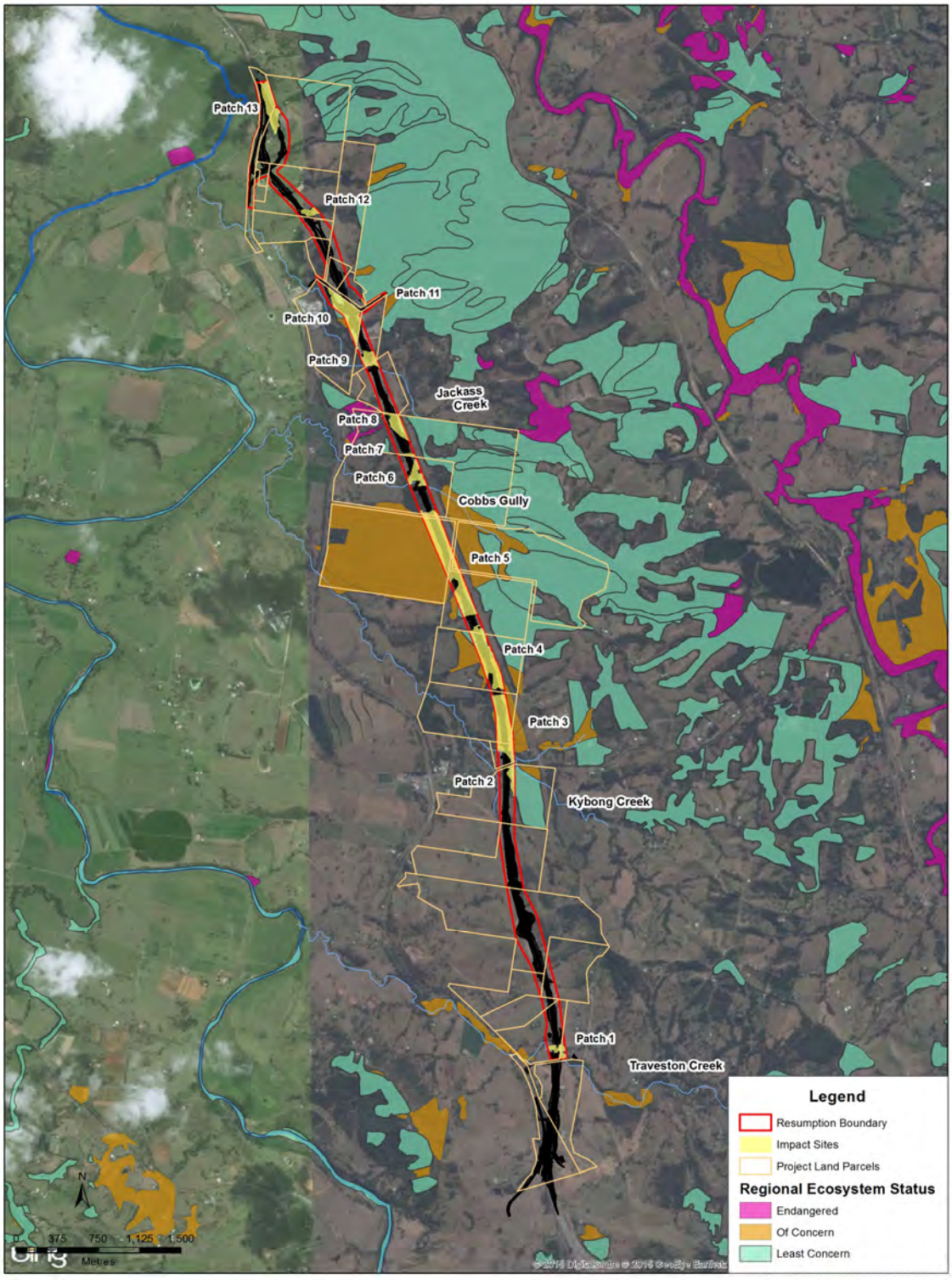

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Figure 3: Impact Area and Individual Habitat Patches

2.3 Significant Impact Assessment

The potential impacts of the Project to the koala and grey-headed flying fox were identified in the Fauna Management Plan to be as follows:

- Habitat removal
- Habitat fragmentation and loss of connectivity
- Disease and pathogens
- Vehicle strike for koalas
- Predation by wild dogs for koalas

The potential impacts have been assessed against the Significant Impact Criteria for Vulnerable species in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* to determine whether the impacts on matters of national environmental significance are likely to be significant. The outcome of this assessment, with reference to the proposed mitigation and management measures contained within the Fauna Management Plan, is provided in Table 2.

Table 2 Significant Impact Assessment

Significant Impact Criteria	Species		Residual Impact to be addressed?	
	Koala	**Grey-headed flying-fox**	**Koala**	**Grey-headed flying-fox**
Lead to a long-term decrease in the size of an important population of a species	Through review of desktop and field investigations, the Project area has been considered to support a small population of koalas. Habitat removal has been identified as a residual impact, with indirect impacts also noted. With the implementation of mitigation measures including koala fencing, fauna furniture and sequential clearing, the Project is not expected to cause a long-term decrease in the size of the existing population.	Through review of desktop and field investigations, the Project area has been determined to provide intermittent foraging resources for the grey-headed flying-fox, and not support a resident population. The Project will not result in a long-term decrease in the size of an important population.	Yes, habitat removal	Yes, habitat removal
Reduce the area of occupancy of an important population	The Project will remove a total of 45.9ha of koala habitat, thereby reducing the area of occupancy of the population. The provision of offsets will be required to mitigate this residual impact.	The Project will remove a total of 45.9ha of foraging habitat for the grey-headed flying-fox, thereby reducing the area of occupancy for the population. The provision of offsets will be required to mitigate this residual impact.	Yes, habitat removal	Yes, habitat removal

Significant Impact Criteria	Species		Residual Impact to be addressed?	
	Koala	**Grey-headed flying-fox**	**Koala**	**Grey-headed flying-fox**
Fragment an existing important population into two or more populations	The Gympie Region, including the Project area, is a fragmented landscape in which the koala population exists. Construction of the road will further fragment the habitat and population. However, fauna crossings and furniture have been incorporated into the design at selected locations to maintain connectivity. As such, the road will not fragment the existing population into two or more populations.	The Project area does not support an important resident population of grey-headed flying-foxes, as no roost sites or camps have been discovered. Given that the species is highly mobile and moves as resources become available, a population will not be fragmented into two or more populations as a result of the Project.	No	No
Adversely affect habitat critical to the survival of a species	In accordance with the Koala Habitat Assessment Tool contained within the *EPBC Act referral guidelines for the vulnerable Koala*, the Project area has been determined to constitute habitat critical to the survival of the koala, discussed in the Fauna Management Plan. The impact of habitat removal requires the provision of offsets.	Winter and spring flowering species are noted as critical habitat to the survival of the species. The Project will remove areas containing such trees, thereby requiring the provision of offsets.	Yes, habitat removal	Yes, habitat removal

Significant Impact Criteria	Species		Residual Impact to be addressed?	
	Koala	Grey-headed flying-fox	Koala	Grey-headed flying-fox
Disrupt the breeding cycle of an important population	The Project is not expected to disrupt the breeding cycle of the existing population. Impacts of habitat fragmentation will be mitigated through the construction of fauna crossings and furniture, while stress impacts will be managed through sequential clearing, as detailed in the Fauna Management Plan.	The Project is not expected to disrupt the breeding cycle of the existing population. Mating commences in early autumn, with young produced in October. No roost sites or camps have been observed in the Project area.	No	No
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	A total of 45.9ha of koala habitat is likely to be removed for the Project. Mitigation measures include fauna crossings and furniture to maintain connectivity, while offsets are proposed for the residual impacts of habitat removal. The removal of habitat is not expected to cause the species to decline.	45.9ha of suitable foraging habitat for the grey-headed flying-fox is likely to be cleared. Offsets are proposed for the residual impact of this habitat removal. As such, it is not expected to cause the species to decline.	Yes, habitat removal	Yes, habitat removal
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	There is potential for the spread of invasive weeds, such as Lantana, to occur during construction. Mitigation measures during construction are intended to limit impacts to koala habitat.	There is potential for the spread of invasive weeds, such as Lantana, to occur during construction. Mitigation measures during construction are intended to limit the spread of weeds in foraging habitat.	No	No

Significant Impact Criteria	Species		Residual Impact to be addressed?	
	Koala	**Grey-headed flying-fox**	**Koala**	**Grey-headed flying-fox**
Introduce disease that may cause the species to decline	It is noted above that vegetation clearing and resultant stress have the potential to increase the expression of chlamydia in koalas, however the implementation of mitigation measures such as sequential clearing will reduce the risk of disease. The project is not anticipated to introduce disease that may cause the species to decline.	The Project is not anticipated to introduce any diseases that may cause the species to decline.	No	No
Interfere substantially with the recovery of the species.	The implementation of fauna crossing structures, fauna furniture and koala fencing, in addition to offsets, will remove the potential for the Project to interfere with the recovery of the koala.	Given that the species is highly mobile and moves with the availability of resources, the Project is not expected to interfere with the recovery of the species.	No	No

The significant impact assessment has identified the residual impact associated with the Project is the direct removal of 45.9ha of habitat for the koala and grey-headed flying-fox. As this impact cannot be completely mitigated through the measures defined in the Fauna Management Plan, offsets are proposed in accordance with the EPBC Act Environmental Offsets Policy. Given that the habitat requirements for both species are not mutually exclusive, a combined offset for both the koala and grey-headed flying-fox habitat is proposed.

3. Determining Offset Options

3.1 Development of Options

In determining the most suitable offset proposal for the Project TMR has taken consideration of a number of aspects, including the following:

- Availability of suitable data with regard to the existing habitat and population dynamics of the koala and grey-headed flying fox within the Project and immediate surrounding areas.
- The characteristics of the Project and immediate surrounding areas and its suitability for providing offset for the protection of the species with respect to suitable habitat, existing land uses, presence of existing linear infrastructure, presence of residential and urban areas and the extent of fragmented habitat.
- Availability of suitable habitat for use as an offset for the protection of the koala and grey-headed flying fox in the region.
- Availability of data and proven methodologies to assist in the selection of suitable offset sites for the protection and viability of healthy koala and grey-headed flying-fox populations

Consideration of these aspects identified a number of factors to be considered in the development of the offsets proposal as outlined in Table 3 below.

Table 3 Development of Options

Aspect	Influencing factors
Availability of suitable data	• Data on the species was limited to a small number of records on relevant database searches, anecdotal records from local residents and field investigation results. The presence of koala and grey-headed flying-fox and their population health and dynamics within the Project area and immediate surrounds are unknown. • Desktop and field verification of suitable habitat for both the koala and grey-headed flying fox was completed for the Project area. • The presence of koalas was identified during the field surveys from scats and claw marks at a number of the survey sites. Direct sightings of koala and grey-headed flying fox were not reported in any of the surveys undertaken for the Project. • The highest activity of koala was identified during the field surveys to be between Kybong Creek and Traveston State Forest. As this vegetation corridor detected the highest level of koala activity during the surveys it is considered to be a significant movement corridor for koala within the Project area. At this stage little is known about the number of koala present in this area, their movement, population dynamics or health. • The field surveys indicate that a low-density sedentary koala population is considered likely to be present in the area. Due to limited data this has not been confirmed. • The Fauna Management Plan notes that numerous ecological surveys have been undertaken within the Project area and surrounds but no direct observations of koalas have been recorded. In this regard it is difficult to comprehensively quantify the size of the koala population in the Project area. • There is no data available about the presence of Chlamydia and Koala retrovirus in local koala populations.
Characteristics of the Project area	• A review of historic aerial imagery has identified that substantial areas of forest and vegetation have been cleared to provide vehicle access and enable grazing. • Fragmented habitat due to the presence of the existing Bruce Highway to the west of the proposed alignment, the Powerlink easement to the east of the proposed alignment and the presence of other local roads, cleared areas for agricultural and residential purposes. • It is unknown if the presence of the Powerlink easement impacts the movement of koala and grey-headed flying-fox. • The immediate Project area contains a small area of contiguous habitat.

Availability of suitable habitat	• As identified in the Fauna Management Plan, due to the presence of barriers and lack of habitat connectivity, the vegetation within the immediate Project area is not expected to be significant for the recovery of the koala. • Habitat fragmentation can limit food and shelter availability for koalas, result in reduction of habitat connectivity, and subsequently impact the ability for genetic transfer between existing populations. Habitat fragmentation may also result in koalas travelling further between areas of suitable habitat, increasing the risk of predation due to the increased distances travelled on ground by koala.
Selection of suitable offset sites	• There is limited data available to inform the selection of suitable offset sites for the protection and rehabilitation of koala and grey-headed flying-fox populations.

3.2 Offset Proposal Options

On the basis of the aspects outlined above, two offset options have been developed

- Option 1 – Non-direct offset proposal comprising the following:
  - Part a - Funding of two koala detection dogs to assist in improving field survey in the identification and presence of koalas within defined locations
  - Part b – Funding a research program at the University of the Sunshine Coast entitled *'Non-invasive monitoring of fragmented and rehabilitated koala habitats using detection dogs: maximising koala conservation outcomes from mitigation strategies (e.g. offsets)'.*
- Option 2 – Direct land offset

TMR have consulted with Gympie Regional Council (GRC) regarding the potential for wild dog attacks on koalas within the Project area. Council have advised that there are wild dog issues within the local government area and potentially within the Project area. TMR will further consult with GRC to potentially fund a contractor under council's current wild dog abatement program to locate and capture wild dogs within the Project area and surrounds. It is proposed that $25, 000 will be provided to fund this program. The funding will be applicable to both Options 1 and 2.

Details of both options are provided in Sections 4 and 5 respectively.

4. Option 1 – Non-Direct Offset Proposal

4.1 Details of Proposal

4.1.1 Part 1a – Koala Detection Dog Program

Ecological assessments completed during the Preliminary and Detailed Design phases of the Project identified that due to the difficulty in identifying koala and the migratory nature of the grey-headed flying fox it was not possible to clearly determine the population numbers of each of the species, their movement through the area or their health. The University of the Sunshine Coast (USC) has developed a Koala Detection Dog Program whereby professionally trained koala detection dogs are used to detect koala scats, and in the future detect koalas. Detection dogs have been used for many years in ecology, however they have only recently become popular in Australia. Koalas are a perfect candidate for detection dogs due to their cryptic nature, which makes direct surveys slow and yielding few data. This has been demonstrated in the surveys completed for the Project where koalas are understood to be found at low densities. Furthermore during standard field surveys reliant on human observation techniques koala scats can be easily missed or obscured by litter, impacting the results of the assessment and any conclusions made about the density of the population in the area.

A detection dog has the advantage of not relying on visual cues, instead the odour of the scats, which is much larger than the scat itself (called the scent cone), is what is used to locate scats. Maya, a female border collie cross, was professionally trained to help koala researcher Dr Romane Cristescu in her koala habitat surveys. Maya was then scientifically tested to determine her relative accuracy (how many scats she found compared to humans) and efficiency. Maya was 150% more accurate and 20 times quicker than the human surveys (Cristescu, 2015). The gain in time means more ground can be covered and the surveys are more cost effective. Even more importantly, the gain in accuracy means that Maya can collect data that is more robust which increases the confidence in the surveys and subsequent analyses of koala habitat.

In this regard TMR are proposing to fund the training of two koala detection dogs (one koala scat detection dog and one direct koala detection dog) to assist in future habitat surveys to provide improved and more robust data for the presence of koalas in a survey area. The dogs will be trained and managed by the dedicated team at USC and will be available to the public for use in koala surveys. It is considered that by funding this program, data from future surveys of koalas in the region will provide a more detailed and robust knowledge as to the location and density of local populations. This is particularly important in Queensland where the species is declining in numbers and details of the range and density of populations are not well understood. Being able to better determine the location and density of koala populations will assist in the design of future development projects including linear infrastructure to minimise impacts to koalas and koala habitat.

TMR proposes to provide $88,000 in funding for the two koala detection dogs.

4.1.2 Part 1b – Research Program

Due to the characteristics of the landscape and the fragmented nature of the remaining habitat areas the selection of appropriate offset areas to compensate for the residual adverse impacts of the construction of the highway resulted in isolated parcels of land being considered for the direct offset. The land parcels were fragmented and provided limited connectivity to existing habitat. In this regard alternative options were considered and consultation with the USC was undertaken to determine if koala populations were known to recover in fragmented areas of habitat in this region. The consultation identified that there was limited research in this area and that whilst koalas may utilise fragmented habitat there was limited knowledge on the fine scale population dynamics of the species in this area and if the provision of fragmented habitat as an offset enabled a viable

population to survive. In this regard a proposal has been developed to research the long term viability of koala populations in fragmented habitat areas and the suitability of these areas for use as an offset. Preliminary details of the proposed research program have been developed in consultation with USC and are provided in Appendix A. Curriculum vitae for the lead researchers Dr Celine Frere and Dr Romane Cristescu are provided in Appendix B.

As outlined in the research proposal, development and urbanisation is inevitable to accommodate the current and projected human population growth and the use of offsets is a mechanism to protect species impacted by clearing of habitat. Offset impacts are a hotly debated biodiversity conservation topic, with suggestions that they can produce perverse incentives and exacerbate biodiversity decline (Walker et al. 2009, Gordon et al. 2015). Conversely, others see offsets as a holistic approach incorporating loss and gain of habitat in an effort to provide the best conservation outcome (Madsen et al. 2010). Notwithstanding this debate, it is agreed that if offsets are to be undertaken, their design is critical to achieving the most efficient conservation outcomes for the impacted species (Quétier and Lavorel 2011). Surprisingly, no research, to date, has been undertaken about what factors should be considered when choosing koala offsets to ensure the best conservation outcomes for the long-term survival of koalas. This is despite evidence from other species that indicates that evaluating and comparing the benefit of different actions is the most effective strategy in a world of limited conservation investments (McDonald-Madden et al. 2009). In this regard minimising the impact of urbanisation on koalas requires an understanding of how to best mitigate anthropogenic impacts on the fine scale population dynamics of koalas (e.g. genetics, survival, reproductive success and disease).

In the context of the koalas, offsetting land may not result in the best conservation outcomes. For instance, Cristescu et al. (2013) showed that flora rehabilitation did not correlate with koala recolonization of mine sites on Stradbroke Island. This highlights the urgent need to measure whether or not koalas do in fact recolonise rehabilitated offsets and if those provide long-lasting sustainable koala ecosystems. In addition, there is a need to investigate which offset design may be most cost-effective; rehabilitating a larger area in lower koala habitat quality or smaller area in higher koala habitat quality more efficient? It is not yet know whether offsets would in fact have better conservation outcomes for the koala than maintaining connectivity between existing fragmented koala habitats. For instance, there are no studies completed to date that have investigated the extent to which koala habitat fragmentation impacts on the fine-scale population dynamics of koalas (genetics, disease and health). While councils and government bodies are trying to build corridors between fragmented koala habitats, there is no research to date that has shown 1) whether these corridors are used and 2) whether the utilisation of these corridors do in fact help maintain genetic diversity. The World Conservation Union (IUCN) recognizes the need to conserve genetic diversity as one of three global conservation priorities (McNeely et al. 1990). This is because populations which can retain high levels of genetic diversity have increased potential for adaptation to changes in habitat, climate change or pathogens (Reed and Frankham 2003, Frankham 2005).

To ensure the future of koala conservation, it is therefore critical that we understand these trade-offs to maximise the benefit of the EPBC Offsets for koalas. Only when we increase our understanding of how fragmentation, connectivity and offset impact fine scale koala population dynamics over time can we ensure our strategies deliver an ecologically defensible mechanism to balance conservation and development (Gardner et al. 2013).

Studies on the fine-scale population dynamics of koalas have to date been limited by their behavioural ecology. Koalas are generally found at low density, low activity and cryptic, nocturnal habits (Cristescu et al 2012). It is proposed that this research program will use new, innovative and non-invasive methodologies (detection dogs, (Cristescu et al. 2015)) to allow for the fine-scale population dynamic monitoring of fragmented and rehabilitated koala habitats across a number of replicates within the Cooroy to Curra Project and surrounding area where appropriate to:

1. Measure the long-term effects of habitat fragmentation on koala health dynamics and how these may be mitigated by the introduction of corridors (underground passages etc).

2. Measure the long-term recolonization patterns of koalas into rehabilitated landscape to assess whether rehabilitated landscapes can support sustainable populations of koalas.
3. Cost-effective analyses of 1 against 2.

To do so, the researchers at USC will combine their expertise in koala ecology, genetics and disease to measure the following ecologically relevant traits from fresh faecal samples collected for the next five years across fragmented and rehabilitated habitats along the Cooroy to Curra project.

Whilst this research program focuses on the koala additional species including the grey-headed flying-fox are likely to be included into the data collected and the outcomes of the research will be relevant to other species where appropriate.

It is proposed that local community groups including the Gympie Koala Action Group will be consulted and invited to participate in field investigations where appropriate throughout the research project. USC are familiar with working with community groups and TMR have been consulting with a number of community groups and other relevant stakeholders throughout the development of the Project.

TMR proposes to provide $555,000 in funding for the research program.

4.2 Compliance with EPBC Act Offsets Policy

Section 4.2.1 of the EPBC Act Offset Policy outlines that deviation from the 90% direct offset requirements will only be considered where:

- It can be demonstrated that a greater benefit to the protected matter is likely to be achieved through increasing the proportion of other compensatory measures in an offsets package, or
- Scientific uncertainty is so high that it isn't possible to determine a direct offset that is likely to benefit the protected matter.

Furthermore the research program is required to comply with the criteria outlined in Appendix A of the EPBC Act Offset Policy. Compliance with these criteria have been documented in Table 4 below.

Table 4 Compliance with Section 4.2.1 and Appendix A of the EPBC Act Offsets Policy

Reference	Criteria	Proposal Details
Section 4.2.1	A greater benefit to the protected matter is likely to be achieved through increasing the proportion of other compensatory measures in an offsets package.	The aims of the research program will provide greater scientific evidence as to be most suitable approach for providing offset land for future planning, design and construction of infrastructure for the conservation of the species in comparison to offsetting an isolated parcel of land as a direct offset as outlined below. As outlined above, in the context of koalas, offsetting land may not result in the best conservation outcomes. There is an urgent need to measure whether or not koalas do in fact recolonise rehabilitated offsets and if those provide long-lasting sustainable koala ecosystems. In addition, there is a need to investigate which offset design may be most cost-effective; rehabilitating a larger area in lower koala habitat quality or smaller area in higher koala habitat quality more efficient? It is not known if offsets would in fact have better conservation outcomes for the koala than maintaining connectivity between existing fragmented koala habitats.
	Scientific uncertainty is so high that it isn't possible to determine a direct offset that is likely to benefit the protected matter	In the preparation of the research proposal it has been identified that no research, to date, has been undertaken about what factors should be considered when choosing koala offsets to ensure the best conservation outcomes for the long-term survival of koalas. In this regard Option 1 is deemed to be the most suitable offset proposal for this Project.

Appendix A	The research program will improve the viability of the impacted protected matter	The proposed research program identifies that to ensure the future of koala conservation, it is critical to understand the loss of habitat and provision of a direct land offset to maximise the benefit of the EPBC Act Offsets Policy. When there is increased understanding of how fragmentation, connectivity and offset impact fine scale koala population dynamics over time, strategies can be delivered in an ecologically defensible mechanism to balance conservation and development (Gardner et al. 2013).
	Be targeted toward key research/ education activities	The research program has been developed in consultation with USC and identified the need for development, policy and scientific development in the research of koala populations in the region.
	Be undertaken in a transparent, scientifically robust and timely manner	The development of the research program is in the preliminary stages but the need for the research has been supported by scientific literature. The methodology is being prepared to ensure suitable data sets are provided to produce a robust scientific outcome. It is proposed that the research program will be approximately five years in duration.
	Consider best practice approaches	The research program will be led by Dr Celine Frere and Dr Romane Cristescu who work for the USC and will complete the research in accordance with the university procedures. All papers resulting from the research will be required to undergo peer review prior to publication.

5. Option 2 – Direct Offset Proposal

5.1 Introduction

A direct land-based offset prepared in accordance with the DoE Offsets Assessment Guide has been proposed as Option 2. This option is not preferred by TMR's as it is not considered to provide the next environmental outcome for the species but has been developed for consideration by DoE. The proposal has identified a parcel of land that will be legally secured as a direct offset for the loss of 45.9 ha of koala and grey-headed flying-fox habitat as a result of the Project. A range of other areas were assessed but were not considered in the offset proposal as they provided low quality habitat that would have minimal long term benefit to the species.

5.2 Assessment of Potential Direct Offset Areas

5.2.1 Desk-top Assessment

A desktop assessment and gap analysis was undertaken to identify the existing research and results, identify suitable survey locations and determine a suitable survey effort at the impact areas and potential offset sites. This included a review of local, State and Federal Government planning instruments and databases to assist in determining the ecological attributes of both impact areas and offset sites. The review included the following databases, maps and reports:

- Aerial photography
- Department of Natural Resources and Mines (DNRM) Regional Ecosystem mapping under the *Vegetation Management Act 1999* and Regional Ecosystem Description Database
- Department of the Environment's Protected Matters Search Tool to review MNES species listed as potentially occurring MNES under the EPBC Act
- Wildnet Database
- Atlas of Australian Living
- Bruce Highway Upgrade (Cooroy to Curra) Section C - Review of Environmental Factors (Jacobs SKM, 2014). Habitat mapping and field survey work conducted to support the preparation of the Review of Environmental Factors (Jacobs SKM 2014) was specifically reviewed, which informed the initial definition of impact areas within the Project Area.

The results of the desktop assessment are provided in the Fauna Management Plan.

5.2.2 Field Survey of Potential Direct Offset Areas

5.2.2.1 Previous Field Surveys

A number of field surveys have been completed for the Project as outlined below:

- Fauna surveys were conducted by BAAM and Jacobs SKM to support the preparation of the Review of Environmental Factors (Jacobs SKM, 2014).
- A flora survey targeting Endangered, Vulnerable and Near-threatened (EVNT) flora species was undertaken by SMEC in October 2014, in accordance with the Flora Survey Guidelines – Protected Plants (DEHP, 2014).

The results of these surveys are provided in the Fauna Management Plan.

In addition a site specific survey of Lot 1382 on M371313 was undertaken in October 2014, as this land parcel was identified as a potential offset site at that time. An assessment of the

habitat value to threatened, migratory or otherwise significant fauna listed under the EPBC Act was undertaken based on their known habitat requirements and expert opinion. The result sof this assessment are provided in Appendix C.

Additional targeted field work was undertaken by SMEC between March and May 2015 to identify the habitat value of the impact areas and various land parcels within the area surrounding the Project to assist in identifying suitable offset areas. Results of the surveys are provided in Appendix D and Appendix E and are summarised in Sections 5.2.2.2 and 5.2.2.3 below.

5.2.2.2 Koala and Grey-headed Flying-fox Habitat Assessment, Impact Areas - March and April 2015

A field investigation was conducted by SMEC between 30th March and 2nd April 2015 to collate additional information for koala and grey-headed flying-fox, and verify suitable habitat present for both species within the Project area.

To identify koala activity levels, the investigation utilised the KSAT (Phillips and Callaghan, 2011) as this methodology is considered to be the most effective method of capturing presence/absence information on small populations. Koala spot assessment technique (KSAT) searches are also identified in the DoE Referral Guidelines for the koala as a suitable survey methodology when determining impact areas. As such, KSATs were conducted at intervals of approximately 200m where appropriate, noting that some were further apart due to lack of suitable habitat and prioritisation of sites.

A total of 21 KSATs were conducted at impact sites and potential offset sites. Where two adjacent KSATs had detected three or more trees with scats each, line transects were conducted between the two KSATs to search for direct observations of Koalas. Two line transects were therefore undertaken between Kybong Creek and Traveston State Forest. Figure 4 and Figure 5 show the location of the survey sites.

Of the 21 KSATs two of these identified scats beneath four of the 30 trees surveyed (13.3%), a third detected scats beneath three trees (10%), while a further three sites identified one tree of 30 with scats (3.3%). The three KSATS that detected the highest activity are located between Kybong Creek and Traveston State Forest. Two line transects were undertaken between these areas, in close proximity to KSATS where scats were identified. Neither transect recorded any direct observations of koalas. However this vegetation corridor is considered to be a significant movement corridor for koala within the Project area, as this area detected the highest level of koala activity within this study. Results of the KSATS are provided in Appendix D.

Throughout the survey, trees were searched for grey-headed flying-fox individuals while also searching for koalas. Species within each KSAT were recorded through the datasheets, indicating where suitable species for grey-headed flying-fox occur along the corridor, refer Appendix D.

5.2.2.3 Koala and Grey-headed Flying-fox Habitat Assessment - May 2015

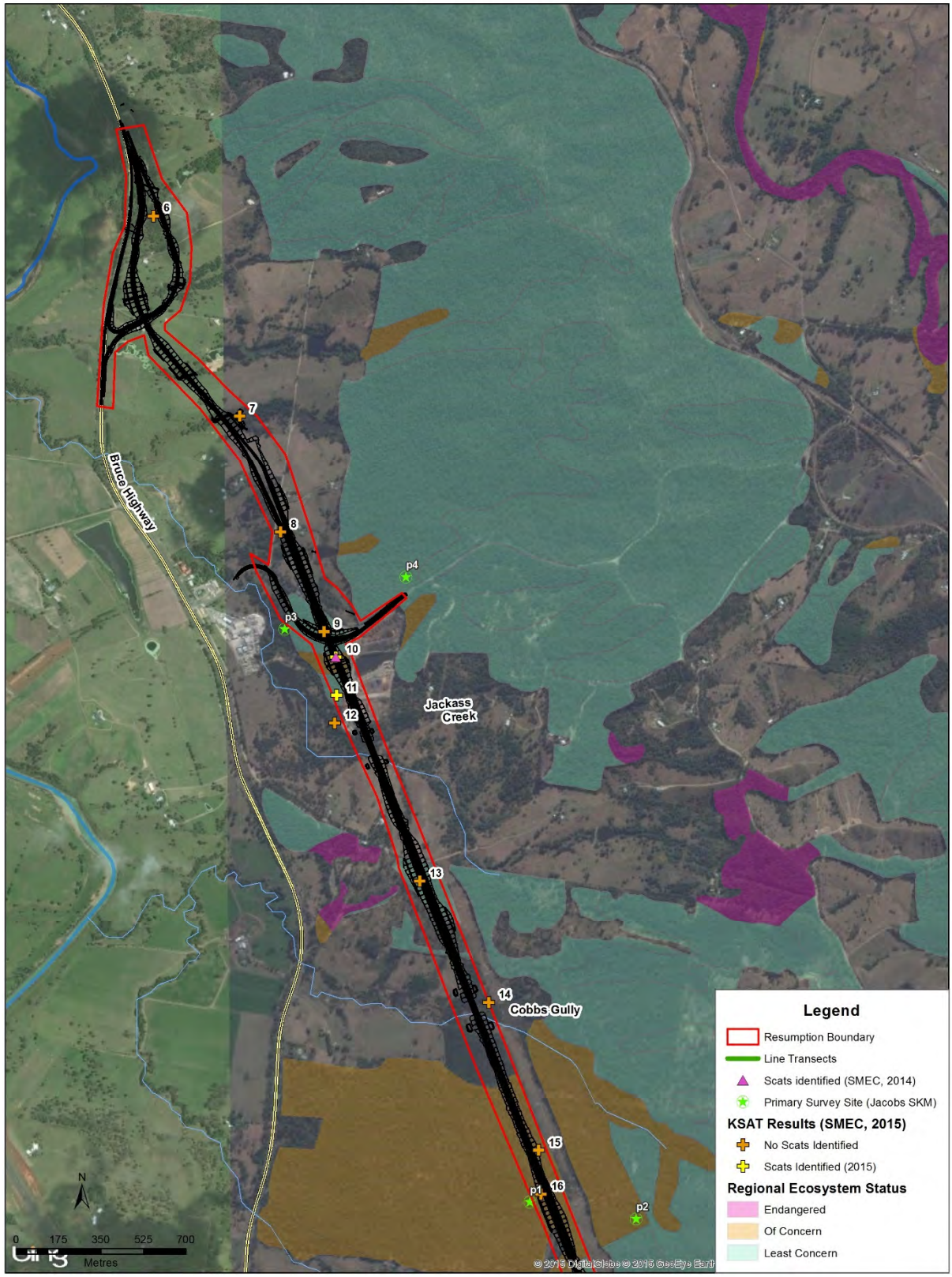
In May 2015, a field assessment was undertaken within the impact area. This survey approach adopted the relevant criteria from the Biocondition Assessment Tool, recording the characteristics of each vegetation strata, the level of disturbance, evidence of canopy species recruitment, GPS locations, opportunities for improvements to offset sites and taking photographs of each site.

A 100 x 20m plot was established at each site, following a north-south (or vice versa) direction. Within the plot, the number of each tree species above 10cm diameter at breast height (DBH) was recorded for both Eucalypt genera species and non-Eucalypt genera species. The DBH of all trees above 30cm was recorded to enable calculation of the density of large trees across the site. This provided sufficient data to extrapolate the tree density and composition to a ‘per hectare’ summary.

The level of disturbance for wildlife, logging, grazing and non-native plant cover was noted in accordance with the biocondition reference datasheet whereby the severity was ranked from 0 (nil) to 3 (severe) and time since last event was classified into the following categories:

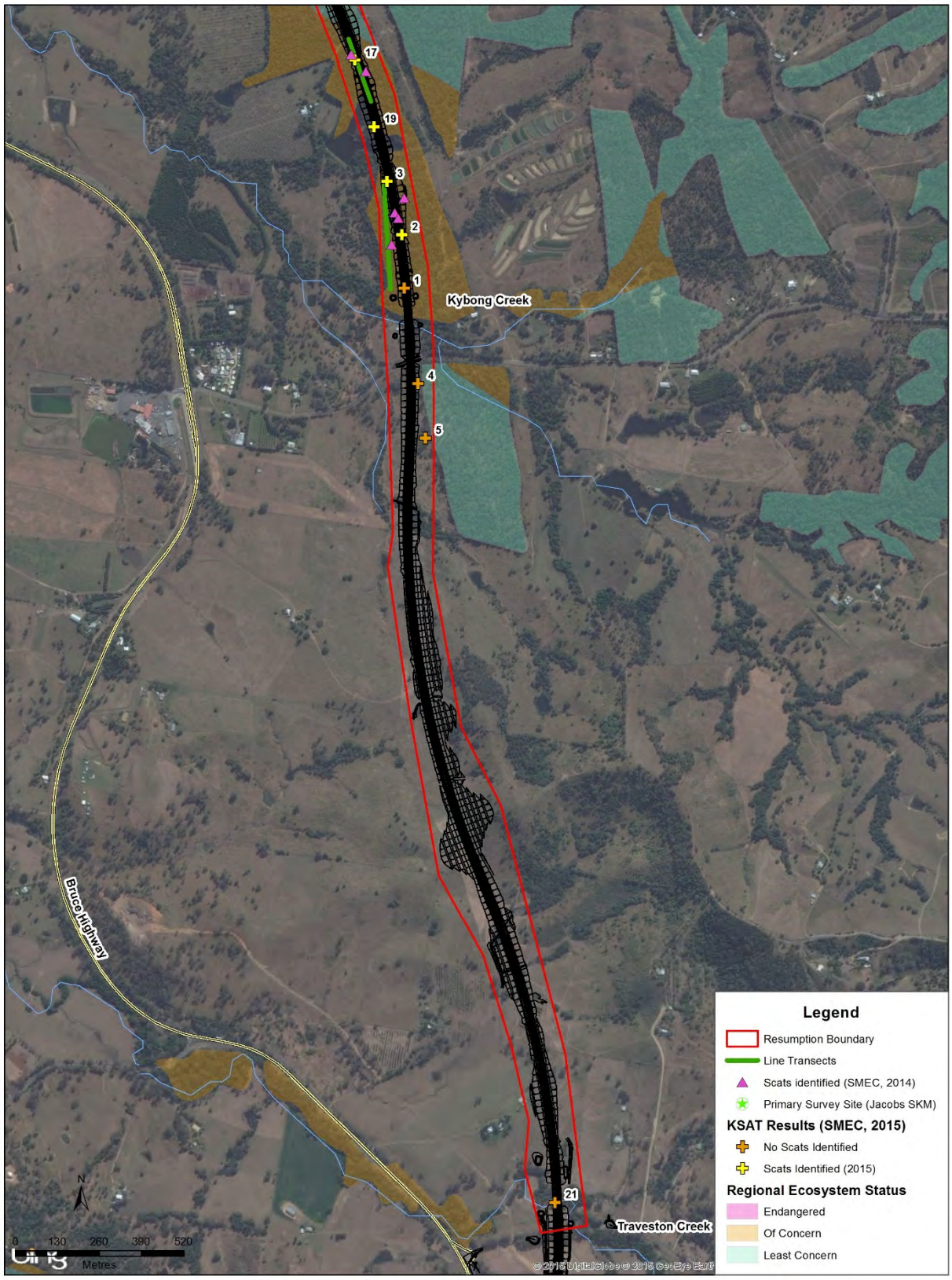
- A: <1 year
- B: 1-5 years
- C: 5-10 years
- D: 10-20 years
- E: >20 years.

Additionally, the characteristics of each vegetation strata (emergent, canopy, sub-canopy, shrub and groundcover) were documented. Characteristics recorded include the floristic composition, height (m), and cover (%). Layers of significant weed invasion such as Lantana (*Lantana camara*) were highlighted. Results of the surveys and a plan of the survey sites are provided in Appendix E.



PROJECT NO. 30031298 PROJECT TITLE Cooroy to Curra (Section C)	SKETCH SK-1298-0204 ISSUE 01 CREATED BY KM11809 DATE 10/06/2015 Time: 2:51:11 PM		
COORDINATE SYSTEM GDA 1994 MGA Zone 56 PAGE SIZE A3 SCALE	SOURCE QLD Govt, SKM, SMEC, BING	Copyright SMEC Australia Pty Ltd. All Rights Reserved. © State of Queensland (Department of Natural Resources and Mines) 2014. Updated data available at http://dds.information.qld.gov.au/dds/	Queensland Government CONSULTANT SMEC Australia

Figure 4: Field Survey Results



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COORDINATE SYSTEM GDA 1994 MGA Zone 56 PAGE SIZE A3 SCALE	SOURCE QLD Govt, SKM, SMEC, BING	Copyright SMEC Australia Pty Ltd. All Rights Reserved. © State of Queensland (Department of Natural Resources and Mines) 2014. Updated data available at http://dds.information.qld.gov.au/dds/	Queensland Government

Figure 5: Field Survey Results

5.3 Offsets Assessment Guide Assumptions

The Offsets Assessment Guide requires the proponent to establish a number of criteria to assess the impact and offset sites including site condition, site context and species stoking rate distribution. Details of each of these for the Project are outlined below.

5.3.1 Site Condition

A Project specific scale for assigning a score of 1 to 10 has been developed, with reference to presence or absence of primary and secondary food trees, winter flowering trees, and results from field investigations, as outlined in Table 5.

Table 5 Site Condition

Score	Site Condition
1	Little or no evidence of suitable habitat, no primary food trees, evidence of weeds, logging, grazing, cultivation or bushfire impacts
2	Little or no evidence of suitable habitat, no primary food trees, no evidence of weeds, logging, grazing, cultivation or bushfire impacts
3	No primary food trees, some suitable habitat, evidence of weeds, logging, grazing, cultivation or bushfire impacts
4	No primary food trees, some suitable habitat, no or minor evidence of weeds, logging, grazing, cultivation or bushfire impacts
5	Primary food trees present, suitable habitat present. No mapped RE.
6	Primary food trees present, suitable habitat present. Vegetation consistent with RE for which a Biocondition benchmark exists but does not achieve the Biocondition benchmark.
7	Primary food trees present, suitable habitat present. Vegetation consistent with RE for which a Biocondition benchmark exists.
8	Primary food trees present. Vegetation consistent with RE 12.11.3 or RE 12.3.11 but does not achieve the Biocondition benchmark. Evidence of weeds, logging, grazing, cultivation or bushfire impacts
9	Primary food trees present. Vegetation consistent with RE 12.11.3 or RE 12.3.11 but does not achieve the Biocondition benchmark. No evidence of weeds, logging, grazing, cultivation or bushfire impacts
10	Primary food trees present. Vegetation consistent with the Biocondition Benchmark for RE 12.11.3 or RE 12.3.11. No evidence of weeds, logging, grazing, cultivation or bushfire impacts

5.3.2 Site Context

Site context for each impact and offset site has been assessed in accordance with Chapter 6 of the *Guide to determining terrestrial habitat quality – A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (Version 1.1 December 2014).* This guide provides a robust and scientific method for assessment.

GIS mapping of the impact sites, offset site and resumption boundary was utilised, with reference to remnant vegetation mapping provided by Department of Natural Resources and Mines and the *Queensland biodiversity and vegetation offsets special features map* (displaying terrestrial and riparian corridors) to assess four key attributes of a 'fragmented landscape[1]', as described in Table

[1] The Project area is located within the Gympie Block (one of the sub-regions within the South East Queensland region)- which is recognised as a fragmented landscape in Section 11.6 of the *Guide to determining terrestrial habitat quality.*

6. The score of each attribute was calculated in accordance with the scoring guide provided in Table 7.

Table 6 Attribute Descriptions

Attribute	Description and Method of Calculation
Patch Size	The total area (ha) of the vegetation clearing patch, in addition to all other directly connected areas of mapped remnant vegetation.
Connectedness	The proportion (%) of the site boundary that is connected to remnant vegetation.
Context	The percentage of remnant vegetation mapped as occurring within a one kilometre buffer zone of the site.
Ecological Corridors	The proximity to terrestrial and riparian ecological corridors as shown on the *Queensland biodiversity and vegetation offsets special features map*

Note: for the offset site, vegetation within the resumption boundary was excluded from the calculations.

Table 7 Site Context Scoring Sheet Guide

Size of Patch	Score	0	2	5	7	10
	Description	<5ha	5-25ha	26-100ha	101-200ha	>200ha
Connectedness	Score	0	2	4	5	
	Description	0-10%	>10%-<50%	50%-75%	>75% or >500ha	
Context	Score	0	2	4	5	
	Description	<10% remnant	10-30% remnant	>30-75% remnant	>75%	
Ecological Corridors	Score	0	4	6		
	Description	Not within	Sharing a common boundary	Within (whole or part)		

The score for each site was then converted to a score out of 10 using the following equation which has been adapted from the guide to calculate site context individually:

(Site context score (measured) / site context score (max = 26)) x 10 = score/10

Each site was then weighted according to the size (hectares) and all weighted scores were added to determine the overall score for the impact site and offset site.

5.3.2.1 Species Stocking Rate Distribution

The calculation of species distribution, or species stocking rate was complicated by the extremely low documented occurrence of the koala and lack of evidence of grey-headed flying-fox within the Project area and surrounds. Therefore the application of the metrics from the KSAT Methodology was applied to score for koala, taking into consideration the regional representation of the koala, and the habitat preferences of the grey-headed flying-fox. The east coast (low) activity category from Phillips and Callaghan (2011) was applied to the koala population to provide an appropriate score from a regional perspective.

Habitat quality was calculated with and without the species stocking rate, as a sensitivity test. Species stocking rate was found to not be a key factor in the assessment of habitat quality, and therefore the potential for these species to utilise the offset sites is a more important metric than their presence or absence. The low presence noted during the KSAT investigations within the impact area confirmed that this approach was appropriate. A conservative approach was therefore adopted, applying a mid-range score to species stocking rate, on the basis that any proposed

offset sites have the potential to support koalas and grey-headed flying fox, though not documented in the area. The scores for species stocking rate are provided in Table 8.

Table 8 Species Stocking Rate/ Distribution

Score	Site Condition
1	No scats recorded
2	East coast low (low) less than 3.33%
3	East coast low (medium) 3.33% or greater but less than 5%
4	East coast low (medium) 5% or greater but less than 6.67%
5	East coast low (medium) 6.67% or greater but lower than 8%
6	East coast low (medium) 8% or greater but less than 9.5%
7	East coast low (medium) 9.5% or greater but less than 11%
8	East coast low (medium) 11% or greater but less than or equal to 12.59%
9	East coast low (high use) greater than 12.59% but less than or equal to 15%
10	East coast low (high use) greater than 15%

5.4 Impact Sites

The proposed habitat quality scores for the impact sites are outlined in Table 9. The habitat quality for the impact area, calculated as a combined score of all the impact sites, is 5.

Table 9 Impact Sites Habitat Quality

Patch	Impact Site	Condition	Context	Species Stocking Rate	Habitat Quality	Impact Site Area (ha)	Habitat Quality Score x Site Area
Patch 1	Traveston Creek, part of Lot 1RP176437 and Lot 20SP254364	5	0	1	2.0	1.09	2.2
Patch 2	South of Tandur Road, part of lot 3RP208996	8	2	1	3.7	1.18	4.3
Patch 3	North of Tandur Road, part of Lots 4RP139458, 3RP139458, 2RP124936 and local Road Reserve	8	6	9	7.7	7.30	56.0
Patch 4	North of Tandur Road, part of Lot 1281M37577 and Lot 1459M37678	8	7	7	7.3	6.80	49.9
Patch 5	Traveston State Forest, part of Lot 1459M37678, 950FTY1293, 416CP882034 and local Road Reserve	4	7	1	4.0	12.60	50.4
Patch 6	Cobbs Gully, part of Lot 416CP882034	5	4	1	3.3	2.00	6.7
Patch 7	North of Cobbs Gully, part of Lot 1382M371313 and 416CP882034	5	5	1	3.7	0.42	1.5
Patch 8	South of Jackass Creek, part of Lot 1382M371313 and local Road Reserve	4	6	1	3.7	2.29	8.4
Patch 9	Jackass Creek, part of Lot 2RP840266 and 1RP173216	2	4	1	2.3	1.66	3.9
Patch 10	South of Woondum Road, part of Lot 2RP138810 and 1RP173216	8	5	3	5.3	5.71	30.4
Patch 11	North of Woondum Road, part of Lot 2RP213686 and local Road Reserve (within PowerLink easement)	8	10	1	6.3	0.26	1.7
Patch12	South of Woondum Interchange, part of Lot 3RP165151	5	3	1	3.0	0.90	2.7
Patch13	North of Woondum Interchange, part of Lot 1RP35055 and existing Bruce Highway State-controlled Road Reserve	5	3	1	3.0	3.72	11.2
Combined						45.9	229.2
Habitat Quality							5

5.5 Offset Site

Based on the results of the desk-top and field investigations and using the assumptions in Section 5.3 a proposed offset site has been identified to the north east of Traveston State Forest, Kybong, as indicated on Figure 6. The site is 59. 1 ha in area and is formally described as Lot 1382 on M371313.

The offset site is comprised a mix several regional ecosystems (RE) and historically cleared vegetation, refer Plate 1. Field assessments have identified the presence of RE 12.11.3, RE 12.11.10 and RE 12.11.5e, refer to Figure 7. Dominant species recorded include *Corymbia intermedia*, *Eucalyptus acmenoides, Lophostemon confertus* and *Eucalyptus propinqua* (Small-fruited Grey-gum). *Eucalyptus moluccana* (Grey Box), a primary koala food tree was noted towards the eastern extent of the site in RE 12.11.5e and RE 12.11.3. Sites with Ironbarks (*Eucalyptus siderophlioa*, *E. fibrosa*), Pink Bloodwood (*Corymbia intermedia*) and/or White Mahoganies (*Eucalyptus acmeniodes*, *E. carnea*) would also be used by the grey-headed flying-fox, when nectar is seasonally available. Disturbance from weeds, grazing and logging were also observed

Plate 1: Offset Site

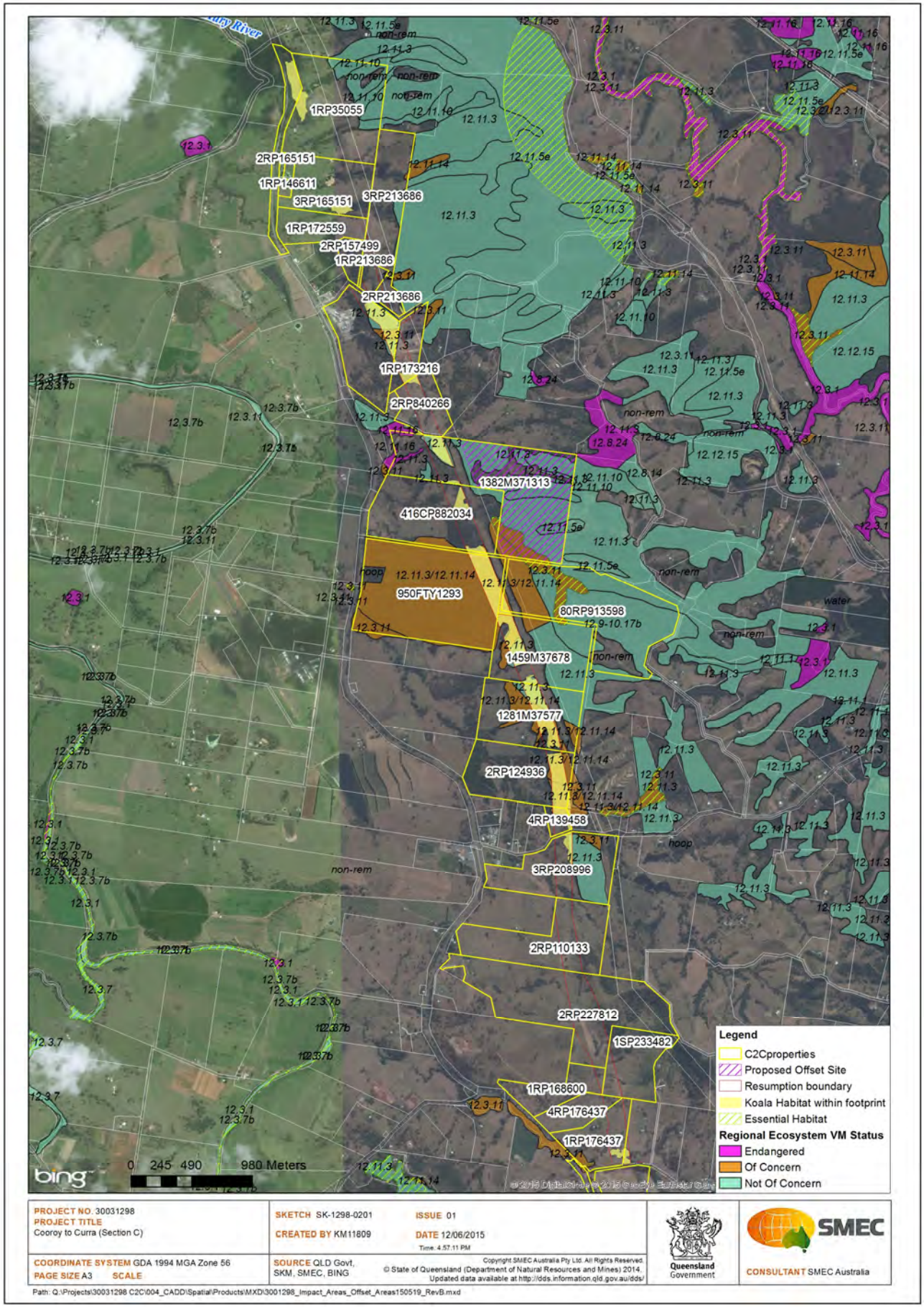

Figure 6: Location of Proposed Offset Site

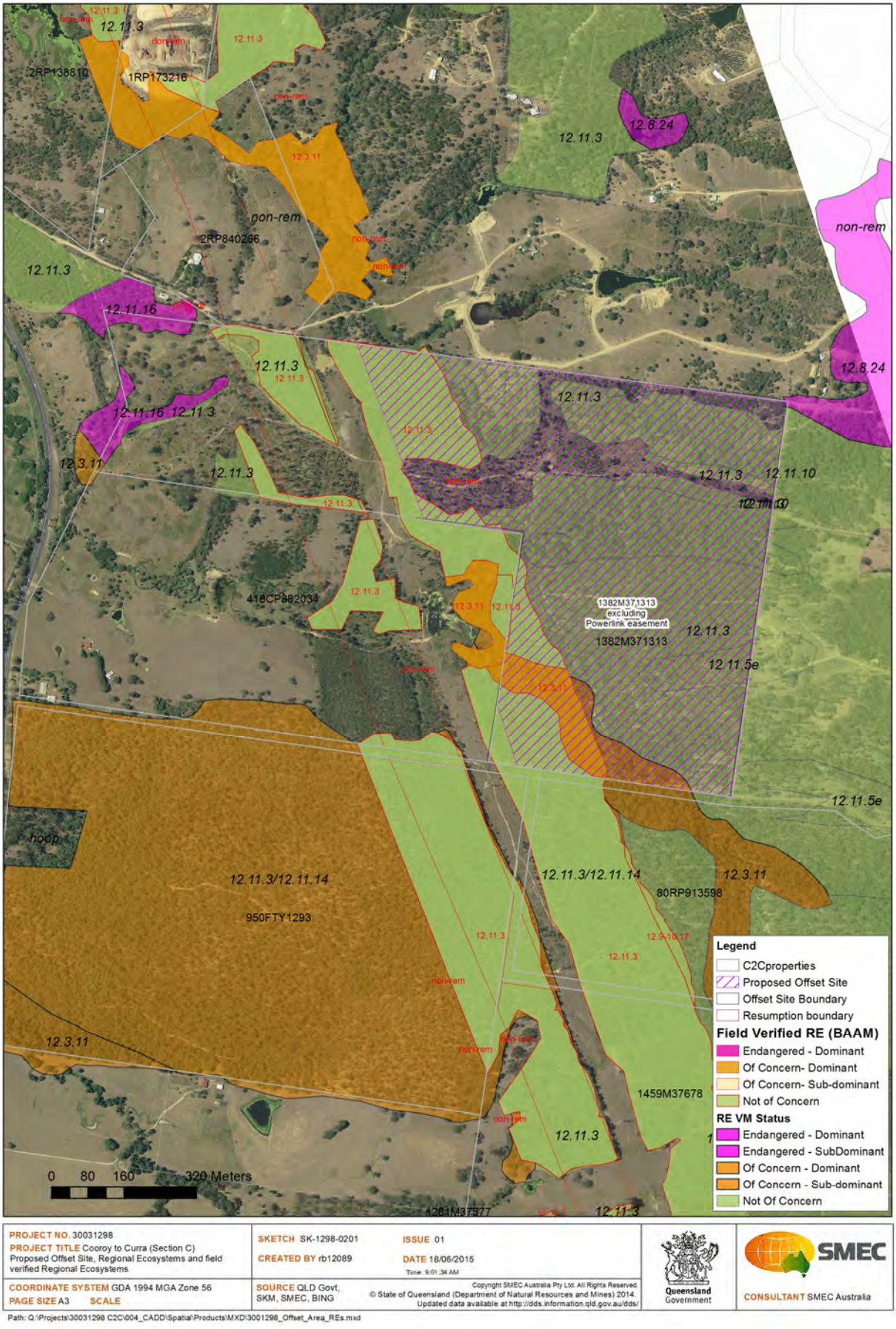

Figure 7: Regional Ecosystems in Proposed Offset Site

The offset site has been assessed in accordance with the criteria outlined in Section 5.2 to determine the direct offset requirements for the Project, refer to Table 10.

Table 10 Proposed Offset Site

Offset Site	Lot 1382 on M371313 North east of Traveston State Forest, Kybong	
Area suitable for offset	59.1ha, excluding the area under the Powerlink easement.	59.1ha
Total area of property	59.1ha (noting the residual property area on the western side of the Resumption boundary is not included in the offsets proposal).	
Habitat quality	Condition: Predominantly mapped as RE 12.11.3 RE 12.11.10. Evidence of lantana, historic logging and access tracks throughout the site.	6
	Context: located to the east of the Powerlink easement, provides for general habitat connectivity to the east.	9
	Species Stocking Rate: No evidence of Koalas or Grey-headed Flying-fox recorded. Conservative Score applied	5
	Habitat Quality Score:	**7**
Time over which loss is averted	A 20 year period has been applied as the land will be legally secured.	20 years
Time until Ecological benefit	A 0 year period has been applied as the habitat value at this site is already present.	0 years
Risk of loss without offset	If the site is not legally secured it is at risk of being sold and potentially cleared for cattle grazing or other agricultural activities consistent with the surrounding land uses. The site has been subject to grazing in the recent past and has had stock-grazing permitted within this lot.	50%
Future Quality without offset	Without protection and application the habitat quality is considered likely to reduce.	5
Risk of loss with offset	The site will be legally secured.	0%
Future Quality with offset	As the site will be legally secured the habitat integrity will remain and will not be at risk of future clearing for agricultural purposes.	7
Confidence in result	There is a high degree of confidence in this assessment due to the following factors: • Repeated survey efforts over a number of years resulted in consistent results (i.e. suitable habitat, low presence of Koala and Grey-headed Flying-fox) • Field work undertaken at representative locations • Project timeframes are clear and impact extents clearly defined	90%

5.6 Results of Offsets Assessment Guide

The Offsets Assessment Guide developed for the Project has been based on the outcome of the site assessment of the impact and offset sites in Table 7 and Table 10 respectively. The results are provided in Appendix F.

The result of the Offsets Assessment Guide indicates that:

- Based on a total impact area of 45.9ha with a habitat quality score of 5
- Based on a legally secured offset site of 59.1ha with a current and expected future habitat quality of 7, and
- Assuming that the offset site was not legally secured the risk of averting the loss of the site is 50% and the quality of the land will decrease to a habitat quality score of 5

the proposed offset site provides a 98.54% direct offset.

Based on current market land prices in the region the land in the proposed offset site has been valued at $150,000.

5.7 Management of Offset Site

An offsets area management plan (OAMP) will be prepared for this site and will detail will provide detail of the areas where management actions are to be implemented, with timeframes and performance objectives.

In order to maintain the proposed offset site at a habitat quality of 7 a number of short term management measures are required, including the following:

- Thinning of regrowth to allow canopy to regenerate in selected areas where historic logging has occurred and dense juvenile regrowth is apparent
- Moderating vehicle access
- Maintenance of Lantana and other weeds over a two year period where required.

The estimated cost of these measures is approximately $57,000.

5.8 Compliance with the EPBC Act Offset Policy

Option 2 has been developed in accordance with the principles and aims of the EPBC Act and EPBC Act Offsets Policy, as outlined in Table 11.

Table 11 Offset Proposal compliance with the EPBC Act Environmental Offsets Policy

Suitable offsets must:	Proposed offsets
1. Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	'Conservation gain' as defined in the EPBC Act Environmental Offsets Policy describes when an offset creates, improves, protects or manages habitat for a particular protected matter. This offset proposal provides a legally secured parcel of land with suitable habitat for the koala and grey-headed flying-fox.

2. Be built around direct offsets but may include other compensatory measures	A 98.54% direct offset is identified in this offset proposal. Funding of a wild dog abatement program is included as part of Option 2.
3. Be in proportion to the level of statutory protection that applies to the protected matter	The offset proposal has been defined based on the EPBC Act Offsets Assessment Guide, and therefore is considered consistent with the statutory protection afforded to the protected matters.
4. Be of a size and scale proportionate to the residual impacts on the protected matter	The offset proposal has been defined based on the EPBC Act Offsets Assessment Guide, and therefore is considered consistent with the statutory protection afforded to the protected matters.
5. Effectively account for and manage the risks of the offset not succeeding	The offset site is already owned by TMR and will be legally secured as part of this Offsets Proposal.
6. Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6)	There are no Queensland State approvals for the koala or grey-headed flying-fox for this Project.
7. Be efficient, effective, timely, transparent, scientifically robust and reasonable	The offset proposal includes clearly documented frameworks with an appropriate level of scientific rigour applied, relevant to the level of risk posed to the protected matters.
8. have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced	The offset proposal includes the commitment to develop a detailed OAMP for the Project, by TMR to be applied for a five year period.

6. Preferred Option

A comparison of Option 1 and 2 is provided in Table 12.

Table 12 Comparison of Option 1 and Option 2

Aspect	Option 1	Option2
Long-term conservation value and environmental outcome for the species	The research program seeks to measure the long-term effects of habitat fragmentation on koala health dynamics. The program shall measure the long-term recolonization patterns of koalas into rehabilitated landscape to assess whether rehabilitated landscapes can support sustainable populations of koalas. The results of the research program will provide robust scientific evidence to determine if viable koala populations can survive in fragmented habitat thereby assisting in the design of future projects, including any required offset proposal, thereby providing a long term environmental value to the species.	A parcel of land with potential habitat for the koala and grey-headed flying fox will be legally secured. It is unknown if the species will utilise the site nor if a viable population is currently present or will expand.
	The funding of the koala detection dog program will provide resources to assist in an improved identification of koala populations in the region, in particular in areas where low-densities of koala are known to occur.	
Research program	$550,000	N/A
Funding Koala Detection Dog Program	$88,000	N/A
Direct land offset	N/A	$150,000
Allocation of funding for maintenance of offset site	N/A	$57,000
Funding GRC wild dog detection program	$25,000	$25,000
Total funding	$663,000	$232,000

Option 1 is TMR's preferred option as it is considered to provide the most conservation value for the long term protection of the species due to the potential for improved detection of koala in field surveys and an improved understanding of the importance of offset habitat areas for the long term viability of populations of koala and grey-headed flying-fox. The findings of the research program will provide robust scientific evidence to inform offset proposals in areas were increasing urbanisation and clearing of land for infrastructure projects is resulting in the increased fragmentation of habitat. Furthermore, it is intended that the results of the research program will be used by TMR to assist in the design and construction of linear infrastructure and the preparation of offset proposals for future projects.

7. References

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Preece, H. 2007. Monitoring and modelling threats to koala populations in rapidly urbanising landscapes: Koala Coast, South East Queensland, Australia. The University of Queensland.

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8. Appendices

Appendix A - Option 1 Research Proposal

Proposal

University of the Sunshine Coast

Rise, and shine.

CRICOS Provider Number: 01595D

Non-invasive monitoring of fragmented and rehabilitated koala habitats using detection dogs: maximising koala conservation outcomes from mitigation strategies (e.g. offsets).

Authors: Dr Celine Frere & Dr Romane Cristescu (The University of the Sunshine Coast).

Significance & Aims

Koala numbers are declining across much of the remaining free-living populations in Queensland and are now listed as vulnerable. It is well known that koalas struggle alongside urban expansion and factors such as habitat destruction, habitat fragmentation, chlamydial disease and additional anthropogenic mediated threats (vehicle collision and canine attacks) are causing major population decline (Preece 2007, Cristescu R. 2011). To top this, climate change will further force koalas to contract their distribution toward cooler coastal areas where urbanisation is predicted to increase most significantly (Nations 2012). Minimising the impact of urbanisation on koalas will therefore require an understanding about how to best mitigate anthropogenic impacts on the fine scale population dynamics of koalas (e.g. genetics, survival, reproductive success and disease).

Development is inevitable to accommodate the current and projected human population growth. As such, the EPBC Act requires that when development occurs in koala habitat, it needs to be offset. Offset impacts are a hotly debated biodiversity conservation topic, with suggestions that offsets can produce perverse incentives and exacerbate biodiversity decline (Walker et al. 2009, Gordon et al. 2015). Conversely, others see offsets as a holistic approach incorporating loss and gain of habitat in an effort to provide the best conservation outcome (Madsen et al. 2010). All will agree that if offsets are to be undertaken, their design are critical to achieving the most efficient conservation outcomes (Quétier and Lavorel 2011). Surprisingly, no research, to date, has been undertaken about what factors should be considered when choosing koala offsets to ensure the best conservation outcomes for the long-term survival of koalas. This is despite evidence from other species that evaluating and comparing the benefit of different actions is the most effective strategy in a world of limited conservation investments (McDonald-Madden et al. 2009).

In the context of the koalas, offsetting land may not result in the best conservation outcomes. For instance, Cristescu et al. (2013) showed that flora rehabilitation did not correlate with koala recolonization of mine sites on Stradbroke Island. This highlights the urgent need to measure whether or not koalas do in fact recolonise rehabilitated offsets and if those provide long-lasting sustainable koala ecosystems. In addition, we need to investigate which offset design may be most cost-effective;

rehabilitating a larger area in lower koala habitat quality or smaller area in higher koala habitat quality more efficient? We do not even know whether offsets would in fact have better conservation outcomes for the koala than maintaining connectivity between existing fragmented koala habitats. For instance, no studies to date have investigated the extent to which koala habitat fragmentation impacts on the fine-scale population dynamics of koalas (genetics, disease and health). While councils and government bodies are trying their best to build corridors between fragmented koala habitats, no research to date has shown 1) whether these corridors are used and 2) whether the utilisation of these corridors do in fact help maintain genetic diversity. The World Conservation Union (IUCN) recognizes the need to conserve genetic diversity as one of three global conservation priorities (McNeely et al. 1990). This is because populations which can retain high levels of genetic diversity have increased potential for adaptation to changes in habitat, climate change or pathogens (Reed and Frankham 2003, Frankham 2005).

To ensure the future of koala conservation, it is therefore critical that we understand these trade-offs to maximise the benefit of the EPBC Offsets for koalas. Only when we increase our understanding of how fragmentation, connectivity and offset impact fine scale koala population dynamics over time can we ensure our strategies deliver an ecologically defensible mechanism to balance conservation and development (Gardner et al. 2013).

Studies on the fine-scale population dynamics of koalas have to date been limited by their behavioural ecology. Koalas are generally found at low density, low activity and cryptic, nocturnal habits (Cristescu et al 2012). Here, we will use new, innovative and non-invasive methodologies (detection dogs, (Cristescu et al. 2015)) to allow for the fine-scale population dynamic monitoring of fragmented and rehabilitated koala habitats across three a number of replicates within the Cooroy to Curra Project and surrounding area where appropriatereplicates (section A, B and C of the Cooroy to Curra project) to:

1. **Measure the long-term effects of habitat fragmentation on koala health dynamics and how these may be mitigated by the introduction of corridors (underground passages etc).**
2. **Measure the long-term recolonization patterns of koalas into rehabilitated landscape to assess whether rehabilitated landscapes can support sustainable populations of koalas.**
3. **Cost-effective analyses of 1 against 2.**

To do so, we will combine our expertise in koala ecology, genetics and disease to measure the following ecologically relevant traits (Table 1) from fresh faecal samples collected for the next five years across fragmented and rehabilitated habitats along the section A, B and C of the Cooroy to Curra project. Across the length of these three sections (~60 kms), we will select 6 fragmented non-connected sites, 6 fragmented connected by corridors sites, 6 rehabilitated and 6 control sites (n = 24). From these we will locate and collect fresh scats from a maximum of 20 koalas and measure the following individual/population traits:

Table 1. Traits that will be measured from fresh scats.

Population density	Sex ratio
Genetic diversity and connectivity	Reproductive hormones
Disease presence and load (intestinal infection of Chlamydia)	Parasitic load

To locate koalas, we will use two specially trained detection dogs, and walk transects across each site. Transects will be spaced to ensure the dogs can detect all koalas present within each study area in an accurate and cost-effective manner.

From this data, we will establish the distribution of koalas and monitor their trends (recolonization, extinction) based on a spot assessment method adapted to detection dogs (Cristescu et al. 2015). The sites for spot assessment will follow a grid pattern. At each site, 30 trees will be searched for the presence of koala scats, giving an indication of utilisation rate.

Habitat fragmentation monitoring. We will sample the 6 fragmented non-connected sites and the 6 fragmented connected by corridors sites in year 1, year 3 and year 5. We will aim to collect fresh scats from 20 koalas per site (n=240) per sampling year, totalling 720 koalas across the three sampling years.

Habitat rehabilitation monitoring. We would want to monitor the rehabilitated sites every year for five years for the distribution and trend component of the research. We will again aim to collect fresh scats from 200 koalas per site every year in year 1, year 3 and year 5 – and follow the same sampling methodology in the control sites.

Landscape context. All sites will go through a thorough landscape context analysis, with the objective to understand the larger scale influences on our sites. This analysis will include for example the amount and shape of high, medium and low value habitat as well as the length and speed of roads in the surroundings of our sites.

Expected outcomes.

1. Assess how quickly can rehabilitation and offset sustain a resident koala population.

2. Determine whether offset and rehabilitation can provide a safe habitat with a healthy koala population.

3. Identify whether there is a fragmentation threshold (tipping point) where koala health and population viability declines.

4. Assess whether corridors can maintain genetic connectivity and identify what attributes enhance connectivity (e.g. age, size, etc).

5. Optimisation and cost-benefit analysis of management strategies. Is it better to invest in maintaining adequate connectivity of fragmented landscape or rehabilitating habitats, etc.

References:

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Appendix B - Curriculum Vitae

DR CELINE FRERE

GeneCology Research Centre
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Maroochydore DC QLD 45

cfrere@usc.edu.au
www.celinefrerelab.com

OVERVIEW

I focus on genetic and non-genetic inheritance interactions in driving phenotypic evolution in natural populations, how genes evolve within social environments, fauna recolonisation of disturbed landscapes, and how animals adapt to urbanisation. I have developed new methods to test evolutionary theory using rare, long-term, empirical datasets on multiple taxa.

My research contributes to a growing appreciation that vertically transmitted sources of phenotypic variation can include more than the (additive) genetic processes that have dominated evolutionary models to date, and answers a growing call for a more inclusive and unified synthesis of evolution which would incorporate multiple mechanisms of inheritance, both genetic and non-genetic.

I have a total of 30 publications, including first authorships in top-tier journals including *Nature Communications*, *PNAS* and *Proc. R. Soc. B*. I have published an average of five articles per year since completing my PhD, and am either first, corresponding or senior author on more than 60 percent of my publications. To date, I have co-authored papers with over 100 researchers, from 6 government or non-government organisations, 7 industry partners and 22 universities.

EDUCATIONAL QUALIFICATIONS

- PhD (Evolutionary Biology), Dec 2009. University of New South Wales, Australia.
- First Class Honours, Bachelor of Science, Dec 2002. University of Queensland, Australia.
- Bachelor of Science Awarded Dec, 2001. University of Queensland, Australia.

APPOINTMENTS

ACADEMIC AND RESEARCH

University of the Sunshine Coast. Early Career Research Fellow. 2013 – current.
University of Exeter, UK. Lecturer. College of Life and Environmental Sciences, 2012 – 2013.
Maternity leave, Jan 2012 – August 2012.
University of Queensland. Postdoc Researcher. 2009 – 2012.
University of Queensland. Postdoc Researcher. 0.5 FTE 2009.

ADJUNCT APPOINTMENTS

Murdoch University. Adjunct Senior Lecturer Cetacean Research Unit, 2013 – 16 (current).
University of Queensland. Adjunct Research Fellow. School of Biological Sciences, 2013-16 (current).
University of New South Wales School. Adjunct Research Fellow. Biological, Earth and Environmental Sciences, 2009-2011.

AWARDS AND FELLOWSHIPS

- L'Oreal Women in Science Fellowship 2014 – Shortlisted 2014.
- UQ Postdoctoral Research Fellowship for Women 2013 (declined in favour of USC Fellowship).
- Prize - Best Presentation: Postgraduate Research Forum Awards (University of New South Wales) 2008.
- Post-graduate Scholarship Award (Sherwin Lab, University of New South Wales) 2006.

COMPETETIVE, INDUSTRY AND PARTNERSHIP FUNDING

2015 Sunshine Coast Regional Council **$AUD 20,000**
Project: Koala Health
2015 International Foundation for Animal Welfare. **$AUD $21,000**
Koala Detection Dogs
2014 University of the Sunshine Coast Research Grant. Co-PI Polkinghorne (USC). **$AUD 12,000**
2014 USC Research Grant. **$AUD 10,000**
2013 University of the Sunshine Coast Early Career Startup Award **$AUD 50,000**
Project: Eastern Water Dragons: genes and sociality.
2012 Australian Marine Mammal Centre Collaborative Grant (Australia): **$AUD 205,906**

Project: Population size, habitat use and genetic structure of Australian humpback dolphins (Sousa chinensis) around the North West Cape, Western Australia (ref: 2012/11). Co-PIs: Parra (Flinders), Bejder (Murdoch), Allen (Murdoch).

2011 Australian Marine Mammal Centre Collaborative Grant (Australia): **$AUD 127,000**
Project: Coastal dolphin abundance and genetic connectivity in the Kimberley. Co-PIs: Allen (Murdoch), Bejder (Murdoch).

2011 Sea World Research and Rescue Foundation: **$AUD 40,000**
Project: Genes associated with fitness. Co-PIs: Sherwin (UNSW), Mann (Georgetown USA), Krützen (Zurich), Bejder (Murdoch), Connor (Massachusetts, USA).

2009 Australian Marine Mammal Centre Collaborative Grant (Australia): **$AUD 125,000**
Project: Population genetics and phylogeography of Australian snubfin and humpback dolphins: defining appropriate management units for conservation. Co-PIs: Parra (Flinders), Seddon (UQ), Bejder (Murdoch) and Krützen (Zurich).

2009 National Science Foundation (United State of America): **$US 89,000**
Project: Blow-sampling: A new non-invasive tool for assessing cetacean diet, reproduction, health and kinship. PIs: Mann (Georgetown, USA), Mills (UQ). Collaborator: Dr CH Frère.

2008 International Collaborative Grant (Georgetown University): **$US 6,000**
Project: Non-invasive determination of female dolphin reproductive state using blow samples ($6000). PI: Mann (Georgetown, USA). Collaborator: CH Frère.

2007 Tangalooma Marine Education and Research Foundation: **$AUD 5,000**
Project: Genetic and cultural relationships in the Moreton Bay bottlenose dolphin population. Co-PIs: Neil (UQ), Noad (UQ), Parra (UQ).

CONFERENCES

ORAL PRESENTATIONS

- Oral presentation. Behaviour International conference. Cairns, Australia. *Forthcoming* - August 2015
- Keynote speaker. FoSHEE Research Week, University of Sunshine Coast May 2014.
- Invited speaker. ComBio International Conference, Cairns, Australia 2011.
- Oral presentation. International Society of Behavioural Ecology Conference. Perth, Australia 2010.
- Invited speaker. Department of Ecology and Evolution, University of Lausanne, Switzerland, 2010.
- Oral presentation. Evolution-The Experience. Melbourne Australia, 2009.
- Oral presentation. National Humpback & Snubfin Dolphin Research workshop. Brisbane, Australia, 2009.
- Invited speaker. School of Veterinary Sciences, University of Queensland. Brisbane Australia, 2006.
- Oral presentation. Anthropological Institute & Museum, University of Zurich. Switzerland, 2005.
- Oral presentation. Marine Biocomplexity: Brisbane, Queensland, 2003.

PUBLIC/COMMUNITY PRESENTATIONS

- *Forthcoming* Oct – Dec 2015. University of the Third Age. Nambour, Caloundra, Coolum and Maleny.
- *Forthcoming* - August 2015. Invited Speaker "Parks Alive Festival", Roma Street Parkland.
- May 2015. Invited Speaker "Diversity Week" University of the Sunshine Coast.
- Feb 2015.University of the Third Age.
- October 2014. Community Lecture Series.
- August 2014. Invited Speaker "Parks Alive Festival", Roma Street Parkland.
- Nov 2013. Invited presentation. Brisbane City Council Environment, Parks & Sustainability Committee.
- October 2012. Invited presentation: "Science in the Square" Kids Festival. Falmouth UK.

POPULAR SCIENCE MEDIA

- My research website (www.celinefrerelab.com) has received more than 6200 visits from people in 88 countries in two years.
- My publications have generated 184,000 twitter impressions (*Impactstory*).
- *Totally Wild* - Conservation of eastern water dragons. Channel 10, Australia 2012.
- *Totally Wild – S*ocial lives of eastern water dragons. Channel 10, Australia 2012.
- My research (as first author) has generated more than 80 national and international media articles including in *BBC News*, *Australian Geographic*, *USA Today*.

RESEARCH COLLABORATORS

- **Eastern Water Dragons**
  Associate Professor Martin Whiting (Macquarie University) - (genomics).
  Associate Professor Robbie Wilson (UQ) – Eastern water dragons (animal performance)
  Dr Daniel Ortiz-Barrientos (UQ) – Eastern water dragons and in-shore dolphins (genomics).
- **Giraffes**
  Associate Professor Anne Goldizen (UQ) – (sociality).
- **Shark Bay Research Project**
  Professor Janet Mann (Georgetown University, USA) - (Bottlenose dolphin behavior and genetics).
  Associate Professor Alastair Wilson, University of Exeter (Maternal Inheritance)

PROFESSIONAL ACTIVITIES

ACADEMIC COMMITTEES

- College of Experts (University of the Sunshine Coast)
- Faculty of Science, Health, Education and Engineering Research Committee (University of the Sunshine Coast).

FORMAL MENTORING

- Science Mentor: Secondary School enrichment program UNSW 2006.
- Academic Mentor (to 2 post-doctoral researchers): University of Exeter 2012-13.

PEER REVIEWER

- 2015: Invited Review Editor. *Frontiers in Marine Megafauna*. Open Access
- 2009-2015: I have peer-reviewed >20 articles for journals including: *Behavioural Ecology* (IF 3.157), *Animal Behaviour* (IF: 3.068), *Journal of Experimental Marine Biology and Ecology* (IF 2.475), and *Marine Mammal Science* (IF 1.820).

PUBLICATIONS

Scholarly Book Chapters

1. Prentis P, Gilding E, Pavasovic A, **Frere CH**, and Godwin I (2012) Molecular Markers in Plant Improvement. *Molecular Markers in Plants*, First Edition. Edited by Robert J. Henry.

Refereed Journal articles

2. **Frère CH**, Chandrasoma D, Whiting M. (2015) Polyandry in dragon lizards: inbred paternal genotypes sire fewer offspring. *Ecology and Evolution*; 5(8): 1686–1692.
3. Cristescu R, Foley E, Markula A, Jackson G, Jones D, **Frère CH** (2015) Accuracy and efficiency of detection dogs: a powerful new tool for koala conservation and management. *Scientific Reports 5.* Article number: 8349.
4. Strickland K; Gardiner R; Schultz AJ; **Frère CH** (2014). The social life of eastern water dragons: sex differences, spatial overlap and genetic relatedness. *Animal Behaviour* 97: 53-61.
5. Lin W, **Frère CH**, Karczmarski L, Xia J, Gui D, Wu Y (2014) Phylogeography of the finless porpoise (genus Neophocaena): testing the stepwise divergence hypothesis in the northwestern Pacific. *Scientific Reports*. 4: 6572.
6. Brown AM, Kopps AM, Allen SJ, Bejder L, Littleford-Colqhoun B, Parra GJ, Cagnazzi D, Thiele D, Palmer C, **Frère CH**. (2014). Population differentiation and hybridisation of Australian snubfin (*Orcaella heinsohni*) and Indo-Pacific humpback (*Sousa chinensis*) dolphins in north-western Australia. *PLoS ONE* 9(7): e101427.
7. Gardiner R, Doran E, Strickland K, **Frère CH** (2014) A face in the crowd: a non-invasive and cost effective photo-identification methodology to understand the fine scale movement of eastern water dragons. *PLoS One*. 9 (5), e96992.
8. Cristescu R, Carrick F, Banks P, **Frère CH** (2013) Potential 'Ecological Traps' of restored landscapes: koalas (*Phascolarctos cinereus*) re-occupy a rehabilitated mine site. *PLoS One* 8 (11), e80469.
9. Mace E, Tai S, Gilding E, Li Y, Prentis P, Bian L, Campbell B, Hu W, Innes D, Han X, Cruickshank A, Dai C, **Frère CH**, Zhang H, Hunt C, Wang X, Shatte T, Wang M, Su Z, Li J, Lin X, Godwin I, Jordan D, Wang J.

(2013) Whole genome sequencing reveals untapped genetic potential in Africa's indigenous cereal crop Sorghum. *Nature Communications* 4: 2320.

10. Cristescu R, Rhodes J, Banks P, **Frère CH** (2013) Is restoring flora the same as restoring fauna? Lessons learned from koalas and mining rehabilitation. *Journal of Applied Ecology*. 50 (2), 423-431.
11. Carter K, Seddon J, **Frère CH,** Carter J, Goldizen A (2013) Fission-fusion dynamics in wild giraffes may be driven by kinship, spatial overlap and individual preferences. *Animal Behaviour*. 85: 385–394.
12. Gilding E and **Frère CH** (equal first authors) Cruickshank A, Rada A, Prentis P, Mudge A, Mace E, Jordan D, Godwin I. (2013) Allelic variation at a single gene increases food value in a drought tolerant staple cereal? *Nature Communications* 4:1483.
13. Lambrides C, Zhou Y, Fukai S, Jewell M, Loch D, Godwin I, Holton T, Innes D, **Frere CH**, Hanna W, Ye C, Van Tran T, Le T, Cao N, Al Dabbagh H, O'Brien C, Roche M, Fullelove G, Ballard E, Kearns R, Pearce W, Hacker A, Puachuay M, Shelton M, Dalzell S, Anderson B, Harris-Shultz K, Cremer J (2013) Ecoturf-a case study on genetic variation and agronomic potential of bermudagrass (cynodon spp.) germplasm collected from Australian biodiversity. *International Turfgrass Society Research Journal.* 12: 263-266.
14. Jewell M, **Frère CH**, Harris-Shultz K, Anderson W, Godwin I, Lambrides C (2012) Phylogenetic analyses reveals multiple introductions of Cynodon species into Australia. *Molecular Phylogenetics and Evolution*. 65 (2), 390-396
15. Cristescu R, Goethals K, Banks P, Carrick F, **Frère CH** (2012) Experimental evaluation of koala scat persistence and detectability with implication for pellet-based fauna census. *International Journal of Zoology*. 2012: 1-12.
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Dr Romane CRISTESCU

BIOSKETCH

I am an early career scientist with interest ranging from conservation biology (new methodologies in conservation including detection dogs, remote surveys; applications of GIS technology to conservation biology) to landscape restoration, fauna responses to habitat loss and fragmentation, wildlife/human conflicts**,** interactions and synergies in threats to endangered species, and emerging infectious diseases in wildlife.

Three years out from my PhD, and with no research position, I have 14 publications, and I am first author on more than half of my publications. I have published in high-impact journals (average JIF of 3.99 - which is substantially above the median JIF of my ISI fields, including Biological Conservation (1.099) and Zoology (1.509)). My H index is 6, with a highest citations score per paper of 51.

ACADEMIC BACKGROUND

2007 - 2012 PhD (University of New South Wales, Sydney)
Thesis: Fauna recolonisation of mine rehabilitation through the example of arboreal marsupials, with a particular focus on the koala *Phascolarctos cinereus*

2005 - 2006 Research Masters in Biology 'Ecology, Evolution, Population Management' (University of Tours, France)
Literature review: The management of overabundant species through the examples of Australasian marsupials
Thesis: The importance of genetic issues in koala conservation

Sept 2005 Veterinary degree with highest honours
Thesis: A study of western lowland gorilla populations (*Gorilla gorilla gorilla)* following a demographic crash in the Odzala National Park, Republic of Congo

2004 – 2005 Wildlife specialisation (National Veterinary School of Nantes, France)

2000 - 2004 Veterinarian degree (National Veterinary School of Alfort, France)

AWARDS

- Endeavour International Postgraduate Research Scholarship
- Endeavour Europe Award
- Silver Medal (Veterinary Thesis Prize Competition)

WORK EXPERIENCE – Synopsis

2014 - Present Adjunct Researcher, GeneCology Research Centre, University of the Sunshine Coast.
Co-supervising one PhD student and two Honours students.

2011 - Present Mine closure and Fauna Advisor, responsibility include GIS, fauna and flora monitoring,
Sibelco, North Stradbroke Island, Australia

2008 - 2011 Research assistant for koalas in mine rehabilitation project on North Stradbroke Island
The University of Queensland, Brisbane, Australia

2006 - 2007 Consultant in charge of developing biodiversity indicators for French overseas territories,
Countdown 2010, Ecology and Sustainable Development Ministry of France, Paris

2005 Consultant in charge of training a research team for a gorilla study
Odzala National Park, Republic of Congo

PUBLICATIONS AND PUBLIC SPEAKING

Published

1. **Romane H. Cristescu**, Emily Foley, Anna Markula, Gary Jackson, Darryl Jones, Céline Frère, Accuracy and efficiency of detection dogs: a powerful new tool for koala conservation and management, 2015, *Scientific Reports,* 5 : 8349 | DOI: 10.1038/srep08349.
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Romane Cristescu, Maya the koala poo dog, Dunwich State School, May 2014, North Stradbroke Island

Romane Cristescu, Mining and rehabilitation on North Stradbroke Island, *Museum talk March 2013*, North Stradbroke Island

Romane Cristescu, Koala conservation on an Island paradise, *WPSQ Science in the Pub February 2013*, Cleveland

Romane Cristescu, Mining and Koalas: Fauna as a legal requirement on Stradbroke Island, *WDA Conference*, 26 September 2012, North Stradbroke Island

William Ellis, Sean FitzGibbon, Kristen Lee, Frank Carrick, **Romane Cristescu**, High benchmarks and complex assessment: rehabilitating mine sites for koala habitat, *Enviromine2011 – November 2011*, Santiago, Chile

Romane Cristescu, Frank Carrick, Paul Smith, Fauna criteria for mine closure, *MCA Sustainable Development Conference SD2011 – October 2011*, Mackay

Romane Cristescu, Minjerribah koalas: characteristics and relation with mine rehabilitation, *Moreton Bay Research Station Open Day 2009*, North Stradbroke Island

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Media

Articles in the press

Auf der Suche nach Koala-Häufchen, Neues Deutchland, January 2015

Oscar and Maya, canine pioneers in koala detection, Click Magazine, August 2014

Council enlists dog to sniff out koala habitats, ABC Science Online, April 2014

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OCD dog with a nose for poo helps koalas, Nine News, May 2014

OCD dog with a nose for poo helps koalas, The West Australian, May 2014

Koalas happy to hang out in rough, February 2013, Courier Mail

Koalas reject rehab field of dreams, February 2013, ABC Science Online

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Gliders live here too!, 2010, Sandtimes

Sugar gliders play possums, 2010, Stradbroke Island News

UNIMIN's koala research goes high-tech, 2010, Sandtimes

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Koalas research on NSI, 2009, Sandtimes

From Seuss to Science, December 2009, Stradbroke Island News

Radio Koala, December 2009, Stradbroke Island News

How much can a koala bear?, December 2008, Stradbroke Island News

TV

Totally Wild, Channel 10 (27th May 2014)

Maya the koala poop detector, Channel 9 11am news national, Channel 9 3pm news national, Channel 9 News State bulletin, Channel 10 News state bulletin, Channel 7 News state bulletin, Channel 10 Wake Up national breakfast, Albert and Logan News (2014)

Port Macquarie, koala's country, TF1 (2012)

Stradbroke Island Koalas, Stateline (2010)

Nature's guardian: Australia, Ushuaia TV (2009)

Radio
Interview, **ABC 612** ABC Brisbane (2014)
Interview, Breakfast with Ann Jones on **ABC 639**AM North and West (2013)

VOLUNTEERING - current

Wildcare Straddie: animal rescues
Creator / Editor at Wildhelpers, Wildlife Conservation Website http://www.wildhelpers.com/
Chairwoman "Clean Straddie" (plastic reduction and beach cleanup)
Founding member of the Feral Animal Management Working Group
National Bat Survey monthly count (Dunwich, North Stradbroke Island)
Glossy Black Cockatoos annual count (coordinator for North Stradbroke Island)
Urban koala annual survey – Koala tree survey with Redland City Council

Appendix C - Site specific survey of Lot 1382 on M371313

SMEC

Local People. Global Experience.

Ecological Findings Report
Lot 1382 M371313

Bruce Highway Upgrade

Cooroy to Curra – Section C

June 2015

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TABLE OF CONTENTS

LIST OF FIGURES

1. INTRODUCTION

1.1. Background

The Bruce Highway provides the principal corridor linking coastal Queensland cities and towns with Brisbane and interstate capitals, and represents a major component of the national land transport network in Queensland. The Bruce Highway services the long distance transport movements between the port facilities and major industrial areas as well as other major economic regions, both within and external to Queensland.

The section of the Bruce Highway between Cooroy to Curra serves as part of the national highway and an important link in the freight network for the state and local region. This section from Cooroy to Curra is generally comprised of a two-lane, two-way road in rolling and hilly terrain. At present, major deficiencies exist in the current highway such as at-grade intersections, direct property accesses onto the highway and limited safe overtaking opportunities. As a result, the existing highway suffers from significant safety risks, flood inundation and capacity constraints.

It has historically been one of Queensland's busiest and highest risk highways with disproportionally high crash rates and regular impact from flooding. It is identified as a High Priority 1 project in the Queensland Government's Bruce Highway Action Plan (2012). The Bruce Highway Upgrade (Cooroy to Curra) project was initiated with endorsement by state and federal governments, in order to address these issues and is being delivered by the Department of Transport and Main Roads (TMR).

The Bruce Highway Upgrade (Cooroy to Curra) project has been divided into four designated sections for construction purposes:

- Section A: Cooroy southern interchange to Sankeys Road;
- Section B: Sankeys Road to Traveston Road;
- Section C: Traveston Road to Keefton Road (Refer to **Figure 1**); and
- Section D Keefton Road to Curra, including the Gympie bypass.

Construction of Section B was completed in December 2012 and construction of Section A is currently underway and is expected to be completed late in 2016 and work on Section D Preliminary Evaluation stage has been initiated.

Section C has been divided into two components – North (Woondum to Keefton Road) and Mainline (Traveston Road to Keefton Road).

The aim of this project is to upgrade this section of the Bruce Highway to provide a safer and more reliable road network, which will in turn provide significant benefit to the State and local community.

1.2. Project Objectives

The performance objective for the project is to provide a safer and more efficient Bruce Highway that caters for increased travel demands within the Gympie Region and for the coastal population between Brisbane and Cairns. Providing this safer and more efficient Bruce Highway is to be done in a manner that is acceptable to the community and minimises any environmental impacts.

TMR has developed a number of overarching project objectives for the upgrade of the Bruce Highway which address existing constraints on the highway and contribute to whole of government priorities. These are outlined below:

- Provide a roadway of sufficient standard, capacity and flexibility to meet future road user requirements;
- Improve safety along the corridor for all roads users with provision of a national highway that complies with contemporary operational and design standards;

- Provide an efficient roadway that enhances road network function;
- Provide appropriate connectivity (free flowing) that in particular meets the needs of broader regional freight movements ;
- Minimise disruption through closures and delay by adhering to acceptable flood immunity standards to enhance network resilience;
- Enhance the amenity and liveability of local communities and adjacent land users through design and amelioration treatments and the removal of unwanted traffic intrusions into local urban areas;
- Encourage the use of alternate transport modes;
- Provide enhanced local connectivity and accessibility to support social inclusion within the local community;
- Provide improved capacity and efficiency of the road freight network to contribute to Queensland's continued economic growth (prosperity) in south east Queensland;
- Mitigate and/or manage any negative environmental impacts along the motorway corridor.

1.3. Scope

This report documents the findings of an ecological investigation conducted by SMEC in October 2014 of the potential offset values present in Lot 1382 M371313 (the potential offset site). Verification of mapped regional ecosystems adjacent to Six Mile Creek was also undertaken. The potential offset site occurs to the north-east of Traveston SF and shares a small section of common boundary. These two land parcels would become separated by the impending highway construction (**Figure 1**).

The potential offset site is part of a land parcel already owned by TMR and covers 59 ha (**Figure 1**), making it a suitable candidate for offset. The aim of the investigation was to determine the floristic and structural characteristics of the offset site. The biodiversity values of offset site were also documented to determine whether it (or a portion of it) would also be suitable for use for biodiversity offsets.

This investigation was completed prior to submission of the EPBC Act Referral.

Figure 1: Locality

FIGURE Locality	PROJECT NO. 30031298	0 300 600m	N	CONSULTANT SMEC Australia
CREATED BY AM11482	PROJECT TITLE Cooroy to Curra - Section C	Scale: 1:20,000 @ A4		SMEC Local People. Global Experience.
REVISION 0				
STATUS FINAL	COORDINATE SYSTEM GDA 1994 MGA Zone 56			CLIENT Department of Transport & Main Roads
DATE 11/11/2014	SOURCE The State of Queensland (DEHP), Copyright 2014, Microsoft Bing 2014			Queensland Government
ISSUED FOR INFORMATION	PATH A:\C2C\C2C Offset Site.wor			

2. SURVEY METHODOLOGY

2.1. Desktop Analysis

A desktop review was undertaken of Local, State and Federal Government planning instruments and databases to assist in determining the ecological attributes within the Study Area. The review included the following databases, maps and reports:

- Aerial photography imagery (API);
- Department of Natural Resources and Mines (DNRM) Regulated Vegetation Management Mapping under the *Vegetation Management Act 1999*;
- Department of Environment and Heritage Protection (EHP) Wildlife Online database to determine the records of EVNT and Special Least Concern species under the *NC Act 1992;*
- Department of Environment (Cmth) Protected Matters Search Tool to determine species listed as Matters of National Environmental Significance (MNES) under the *EPBC Act 1999* that are predicted to occur in the study area; and
- Bruce Highway Upgrade (Cooroy to Curra) Section C - Review of Environmental Factors (Jacobs SKM, 2014).

Maps of the Regional Ecosystems (RE) was obtained from Queensland Globe (Department of Natural Resources and Mines 2014). This was done to 1) compare the REs at survey sites and 2) to identify representative areas of the offset site to be targeted to describe its floristic and structural attributes. The RE maps were uploaded to an ipad to enable them to be located in the field.

2.2. Field Survey

At each location within the offset site the following information was recorded within a 50m radius of the points shown in **Figure 2**:

- Identification of the number of strata;
- Floristic composition of each strata;
- Height and cover (assuming tree and shrub crowns to be solid) of each strata;
- The diameter at breast height (DBH) of woody trees and shrubs (range and mean);
- The relative abundance of hollow-bearing trees and fallen logs; and
- The presence and cover of declared weeds.

An assessment of the habitat value to threatened, migratory or otherwise significant fauna listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Queensland *Nature Conservation Act 1992* (NC Act) was also made based on their known habitat requirements and expert opinion. Any observations or signs of significant flora and fauna were recorded. The presence and extent of any declared plants under the Queensland *Land Protection (Pest and Stock Route Management) Regulation 2003* was also documented.

3. RESULTS

Seven locations were used to describe the floristic, structural and habitat attributes of the offset site (**Figure 2; Appendix A and B**). Much of the offset site was mapped as the Least Concern RE 12.11.3, with smaller areas mapped as other REs: 12.3.11, 12.11.5e, 12.11.10, 12.11.14 (**Figure 2; Table 1**). A brief description of these REs is given in **Appendix C**. Two of these REs are Of Concern (12.3.11, 12.11.14), all others being Least Concern. Observed and possible threatened, migratory and significant fauna at the survey locations are summarised in **Appendix D**.

3.1. Site 1

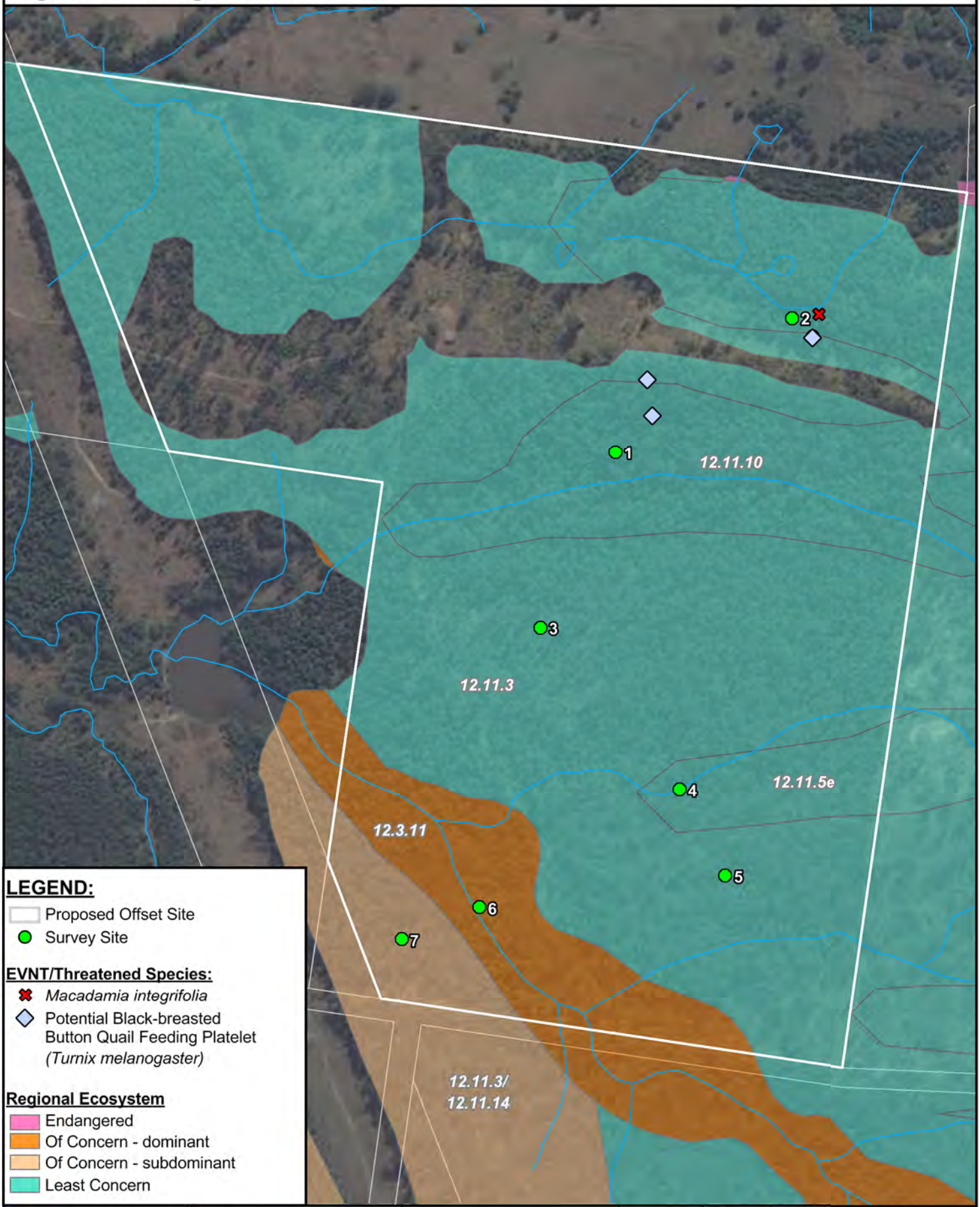
Site 1 (**Figure 2**) was mapped as RE 12.11.10, which was confirmed. The site had emergent Grey Gum (*Eucalyptus propinqua*), Grey Ironbark (*E. siderophloia*) and Hoop Pine (*Araucaria cunninghamii*) over a diverse sub-canopy of dry rainforest species. Many of the emergent Eucalypts were very large (up to 100 cm DBH) and contained multiple hollows, ranging from small to large. Such trees are potentially nest sites for the Powerful Owl (*Ninox strenua*) and Sooty Owl (*Tyto tenebricosa*). The Grey Goshawk (*Accipiter novaehollandiae*) is likely to forage in this area. Deep leaf litter was present and showed multiple plantlets that are consist with foraging by the Black-breasted Button Quail (*Turnix melanogaster*) (**Plate 1**)[1]. The Elf Skink (*Eroticoscincus graciloides*) also occupies scrubs with deep leaf litter and may also be present. EPBC-listed migratory birds included the Satin Flycatcher (*Myiagra cyanoleuca*), Rufous Fantail (*Rhipidura rufifrons*) and the Spectacled Monarch (*Symposiarchus trivirgatus*). The Satin Flycatcher was recorded at this site.

Logging was evident at this site as indicated by numerous small snig tracks through the scrub. These tracks were lined by the Class 3 declared plant Lantana (*Lantana camara*). In the absence of active management, Lantana is expected to infill these tracks and inhibit or delay to re-establishment of native species. The presence of Lantana also makes any nearby tree fall gaps prone to invasion. The Class 3 declared plant Cat's Claw Creeper (*Macfadyena unguis-cati*) had a minor presence at this site.

Plate 1: Potential Black-breasted Button-quail platelets found at Site 1.

[1] Note: the platelets could also be attributable to the Red-back Button-quail (*Turnix maculosus*) as this species sometimes occurs on the edges of rainforest where these abut grassy areas (as was the case).

Figure 2: Ecological Features



LEGEND:

- Proposed Offset Site
- Survey Site

EVNT/Threatened Species:

- *Macadamia integrifolia*
- Potential Black-breasted Button Quail Feeding Platelet *(Turnix melanogaster)*

Regional Ecosystem

- Endangered
- Of Concern - dominant
- Of Concern - subdominant
- Least Concern

FIGURE Ecological Features	PROJECT NO. 30031298	0 100 200m	N	CONSULTANT SMEC Australia
CREATED BY AM11482	PROJECT TITLE Cooroy to Curra - Section C	Scale: 1:5,000 @ A4		SMEC Local People. Global Experience.
REVISION 0				
STATUS FINAL	COORDINATE SYSTEM GDA 1994 MGA Zone 56			CLIENT Department of Transport & Main Roads
DATE 11/11/2014	SOURCE The State of Queensland (DEHP), Copyright 2014, Microsoft Bing 2014			Queensland Government
ISSUED FOR INFORMATION	PATH A:\C2C\C2C Offset Site.wor			

3.2. Site 2

Site 2 (**Figure 2**) was also mapped as RE 12.11.10. However, this Site lacked the large emergent Eucalyptus of Site 1. Instead, a canopy of Brush Box (*Lophostemon confertus*) and Brush Ironbark Wattle (*Acacia disparrima*) is present. Hollow-bearing trees are low in abundance. A midstorey of dry rainforest species is also present (**Appendix A**) where a single Macadamia Nut (*Macadamia integrifolia*) was recorded (**Figure 2**). The Macadamia Nut is listed as Vulnerable under both the NC Act and the EPBC Act.

At present, this community appears to be more consistent with RE 12.11.2. A 10% cover of Lantana is spread through the community and Cat's Claw Creeper was also present. Moreover, the leaf litter was not as deep as Site 1 and only a few Button-quail platelets were observed. The site is also likely to be suitable for the Grey Goshawk and the Elf Skink. The recovery potential of this site to RE 12.11.10 is good. Ultimately, it should develop similar biodiversity values to Site 1.

3.3. Site 3

Site 3 (**Figure 2**) was mapped as RE 12.11.3. While the floristic composition of this site is consistent with this RE it had been subject to recent logging (<10 years), which had reduced the canopy cover to only 25%. The groundcover consists of a mix of native grasses and herbs. The cover of Lantana was only 5%. Provided Lantana does not become further established, the recovery potential of this site is good. RE 12.11.3 is widespread in the Locality and has only low to moderate value for significant flora and fauna. There is a low likelihood of Koala (*Phascolarctos cinereus*) activity due to the lack of primary food trees.

3.4. Site 4

Site 4 (**Figure 2**) occurred along an ephemeral gully and was mapped as RE 12.11.5e, which has Spotted Gum (*Corymbia citriodora* var. *variegata*) as its main indicator species. Spotted Gum was absent from the site and the species present (**Appendix A**) suggest that a mixture of the REs 12.11.3/12.11.3a is appropriate. While this site has been previously logged (probably >30 years ago), it still retains large trees up to 75 cm DBH and a high density of fallen logs is present. Bandicoot or Rufous Bettong (*Aepyprymnus rufescen*) diggings were noted. There is a low likelihood of Koala (*Phascolarctos cinereus*) activity due to the lack of primary food trees. The Cicadabird (*Coracina tenuirostris*) and Satin Flycatcher were observed at this site. The abundance of Lantana was very low (~1% cover).

3.5. Site 5

Site 5 (**Figure 2**) was mapped as RE 12.11.3, which was confirmed. A moderate density of hollow-bearing trees and fallen logs is present. There is a low likelihood of Koala (*Phascolarctos cinereus*) activity due to the lack of primary food trees. Satin Flycatchers were observed at this site. The abundance of Lantana was very low (~1% cover).

3.6. Site 6

Site 6 (**Figure 2**) occurred along a sheltered ephemeral gully and was mapped as RE 12.3.11. However, the site is not consistent with this RE as 1) it is on metamorphics, not on alluvium and 2) the floristic composition is not sufficiently consistent (e.g. Forest Red Gum *Eucalyptus tereticornis* is absent). Thus, this site is more consistent with RE 12.11.3 (**Appendix A**). A moderate density of hollow-bearing trees and fallen logs is present. The Rufous Fantail and Satin Flycatcher were recorded at this site. There is a low likelihood of Koala (*Phascolarctos cinereus*) activity due to the lack of primary food trees. The cover of Lantana at Site 6 is ~5%.

3.7. Site 7

Site 7 (**Figure 2**) was mapped as RE 12.11.3/12.11.14. However, due to the absence of Narrow-leaved Red Ironbark (*Eucalyptus crebra*) and Forest Red Gum, only 12.11.3 is confirmed (**Appendix A**). A low density of hollow-bearing trees is present. There is a low likelihood of Koala (*Phascolarctos cinereus*) activity due to the lack of primary food trees. The cover of Lantana at Site 7 is only ~1%.

4. DISCUSSION

The seven sites investigated were chosen to be representative of the mapped REs on the offset site. Consideration of the land zones and floristic composition of the sites indicates that only three REs are actually present, all of which are Least Concern.

Two sites were mapped as 12.11.10 Notophyll and notophyll/microphyll vine forest +/- *Araucaria cunninghamii* on metamorphics. Although emergent Eucalypts were found on Site 1, it was considered to be consistent with this RE. Due to the presence of a canopy consisting of Brush Box and Brush Ironbark Wattle, Site 2 was considered to be more consistent with RE 12.11.2. However, over time it is expected, in the absence of disturbance such as logging or fire, to become 12.11.10 due to the presence of rainforest species in the midstorey. Both these sites are likely to support a number of significant species dependent on moist forest, such as the Macadamia Nut, Black-breasted Button-quail, Grey Goshawk, Sooty Owl, and migratory forest birds. Thus, the habitats these sites represent have high ecological value.

While there was some minor variation between them, the remainder of the sites were all assessed as open forest consistent with RE 12.11.3. Logging may have removed some of the indicator species (e.g. Grey Ironbark) locally at some sites. RE 12.11.3 is expected to have low to moderate biodiversity values. No evidence of the Koala was found at any of the sites and the probability of them occurring is low due to the lack of primary foods trees (e.g. Forest Red Gum, Tallowwood *Eucalyptus microcorys*). Sites with Ironbarks (*Eucalyptus siderophlioa*, *E. fibrosa*), Pink Bloodwood (*Corymbia intermedia*) and/or White Mahoganies (*Eucalyptus acmeniodes*, *E. carnea*) would be used by the Grey-headed Flying-fox (*Pteropus poliocephalus*), which is Vulnerable under the EPBC Act, when nectar is seasonally available. The more heavily treed areas would be used by the Grey Goshawk and EPBC-listed migratory species.

Most sites had trees in the 30-60 cm DBH range, indicating that stems suitable for logging are currently available or are approaching a suitable size in the next 10 years or so. The topography is undulating and numerous tracks already exist on the offset site.

Minor weed impacts were recorded at the survey sites. The Class 3 declared plant Lantana was present at low to moderate level at all sites. Cat's Claw Creeper was only detected at the moist habitat Sites 1 and 2. Landholders are not required to control a Class 3 declared pest plant on their land unless a pest control notice is issued by a local government because the pest is causing or has potential to cause an negative impact on an adjacent environmentally significant area. As both species can become very invasion, which is particularly likely at Sites 1 and 2, it is recommended that control actions are initiated.

5. REFERENCES

Department of Environment and Heritage Protection. 2014. Wildlife Online WildNet database.

Jacobs SKM (2014). Bruce Highway Upgrade (Cooroy to Curra) Section C (Traveston Road to Keefto Road) – Review of Environmental Factors

APPENDIX A VEGETATION STRUCTURE AT EACH SITE

					Canopy				Midstorey			Understorey			Groundcover					
Offset Site	Easting	Northing	Mapped RE	Disturbance History	Height (m)	Canopy Cover	Dominant Species	DBH range (cm)	Height (m)	Canopy Cover	Dominant Species	Height (m)	Canopy Cover	Dominant Species	Height (cm)	Cover	Dominant Species	Microhabitat Features	Potential Habitat for Threatened Species?	Notes
1	472600	7093418	12.11.10 (confirmed)	Logging	28	15%	*Eucalyptus propinqua* *Araucaria cunninghamii* *Eucalyptus siderophloia*	30-100	10	100%	*Lophostemon confertus* *Flindersia australis* *Alphitonia excelsa*	<2	5%	*Lantana camara*				Leaf litter 8cm deep Hollow logs: moderate abundance Many large trees with small hollows	Black-breasted Button-quail Grey Goshawk Powerful Owl Yellow-bellied Glider Elf Skink Echidna (SL)	* High feeding platelet count (potentially Black-breasted Button Quail) * Photos: 20141023_134835 - 20141023_135631 * Great potential as a habitat offset site
2	472790	7093514	12.11.10 (confimed)	Logging	20	70%	*Lophostemon confertus* *Acacia disparrima*	25-40, av. 35	12	20%	*Lophostemon confertus* *Flindersia australis* *Alphitonia excelsa*	<3	10%	*Lantana camara*				Leaf litter 5cm deep Very low hollow density		Photos 3169-3172
3	472563	7093238	12.11.3 (does not currently meet the RE description)	Logging	25	25%	*Lophostemon confertus* *Corymbia intermedia* *Eucalyptus acmenoides* *Eucalyptus propinqua* *Eucalyptus fibrosa*	25-40, av. 35	6-7	80%	*Acacia leiocalyx* *Lophostemon confertus* *Acacia disparrima*	*<3*	*5%*	*Lantana camara*	5-25		Grasses and herbs	Hollow trees very low Fallen log abundance high		
4	472684	7093047	12.11.5e (C. citriodora absent)	Logging	28	50%	*Eucalyptus propinqua* *Eucalyptus moluccana* *Lophostemon confertus* *Corymbia intermedia* *Eucalyptus carnea*	35-75, av 45	10	5%	*Lophostemon suaveolens*	*<5*	*80%* *1%*	*Acacia leiocalyx* *Acacia disparrima* *Alphitonia excelsa* *L. suaveolens* *Lantana camara*	5-25	5%	Native Grasses Herbs Lomandra spp.	High density fallen logs		Bandicoot/Rufous bettong diggings
5	472680	7092983	12.11.3	Logging (low impact)	25	50%	*Eucalyptus acmenoides* *Corymbia intermedia* *Eucalyptus moluccana*	30-60	6	50%	*Acacia leiocalyx* *Acacia concurrens* *Acacia disparrima* *Lophostemon confertus*	*<2*	*1%*	*Lantana camara*	5-35	35%	Native Grasses Lomandra spp.	Hollows trees and logs moderate abundance	Grey Goshawk	* Not likely Tusked Frog (*A. brevis*) habitat * Low Koala likelihood due to lack of primary food trees
6	472461	7092951	12.3.11		22	90%	*Eucalyptus propinqua* *Lophostemon confertus* *Eucalyptus acmenoides* *Eucalyptus siderophloia* *Corymbia intermedia* *Acacia disparrima*	20-50, av 35	12-18	8%	*Melaleuca salignus*	*5* *<3*	*10%* *5%*	*Acacia irrorata* *Alphitonia excelsa* *Acacia leiocalyx* *Dodonaea triquetra* *Lantana camara*	5-35	10% 1%	*Gahnia aspera* *Lomandra longifolia* *Ageratina riparia*	Hollow tree abundance Hollow logs moderate		Photos 3174-3175
7	472392	7092897	12.11.3/ 12.11.14		20	65%	*Eucalyptus carnea* *Corymbia intermedia* *Lophostemon confertus* *Eucalyptus propinqua*	25-40, av 30	6	5%	*Acacia disparrima* *Acacia leiocalyx* *Lophostemon confertus*		*1%*	*Lantana camara*		30%	*Grasses* *Lomandra spp.*	Hollow abundance low		Photos 3176-3179

APPENDIX B FLORA SPECIES LIST

Family	Species Name	Common Name	Q
Apocynacaeae	*Alyxia ruscifolia*	Prickly Alaxyia	
Apocynacaeae	*Parsonsia straminea*	Monkey Rope	
Araliaceae	*Polyscias elegans*	Celery wood	
Araucariaceae	*Araucaria cunninghamii*	Hoop Pine	
Bignoniaceae	*Macfadyena unguis-cati*	Cat's Claw Creeper	*3
Capparaceae	*Capparis arborea*	Brush Capper Berry	
Cyperaceae	*Gahnia aspera*	Rough saw-sedge	
Ericaceae	*Acrotriche aggregata*	Tall Groundberry	
Euphorbiaceae	*Alchornea ilicifolia*	Native Holly	
Euphorbiaceae	*Mallotus philippensis*	Red Kamala	
Fabaceae	*Acacia leiocalyx*	Black Wattle	
Fabaceae	*Jacksonia scoparia*	Dogwood	
Goodineaceae	*Goodenia rotundifolia*	Star Goodenia	
Hemerocallidaceae	*Dianella caeurlea*	Blue Flax-lily	
Lamiaceae	*Clerodendrum floribundum*	Smooth Clerodendrum	
Lauraceae	*Cryptocarya macdonaldii*	Cooloola Laurel	
Laxmanniaceae	*Cordyline rubra*	Red-fruited Palm Lily	
Laxmanniaceae	*Lomandra confertifolia*	Mat-Rush	
Laxmanniaceae	*Lomandra longifolia*	Spiny-Head Mat-Rush	
Mimosaceae	*Acacia concurrens*	Hickory Wattle	
Mimosaceae	*Acacia disparrima*	Hickory Wattle	
Mimosaceae	*Acacia fimbriata*	Fringed Wattle	
Mimosaceae	*Acacia irrorata*	Green Wattle	
Mimosaceae	*Acacia maidenii*	Maiden's Wattle	
Moraceae	*Maclura cochinchinensis*	Cockspur Thorn	
Myrtaceae	*Corymbia intermedia*	Pink Bloodwood	
Myrtaceae	*Eucalyptus acmenoides*	White Mahogany	
Myrtaceae	*Eucalyptus carnea*	Broad-leaved White Mahogany	
Myrtaceae	*Eucalyptus fibrosa*	Broad-leaved Red Ironbark	
Myrtaceae	*Eucalyptus moluccana*	Grey Box	
Myrtaceae	*Eucalyptus propinqua*	Small-fruited Grey Gum	
Myrtaceae	*Eucalyptus siderophloia*	Grey Ironbark	
Myrtaceae	*Lophostemon confertus*	Brushbox	
Myrtaceae	*Lophostemon suaveolens*	Swamp box	
Myrtaceae	*Melaleuca salignus*	White Bottlebrush	
Myrtaceae	*Syzygium australe*	Brush Cherry	
Myrtaceae	*Syzygium hemilamprum* subsp. *hemilamprum*	Broad-leaved Lilly Pilly	
Myrtaceae	*Syzygium smithii*	Lillypilly satinash	
Oleaceae	*Notelaea longifolia*	Large-leaved Mock Olive	
Passifloraceae	*Passiflora suberosa*	Corky Passionfruit	*

Family	Species Name	Common Name	Q
Pittosporaceae	*Pittosporum revolutum*	yellow pittosporum	
Poaceae	*Themeda triandra*	Kangaroo Grass	
Proteaceae	*Macadamia integrifolia*	Macadamia Nut	V (A,Q)^
Rhamnaceae	*Alphitona excelsa*	Red Ash	
Rutaceae	*Citrus australis*	Native Lime	
Rutaceae	*Flindersia australis*	Australian Teak	
Rutaceae	*Flindersia schottiana*	Bumpy Ash	
Rutaceae	*Zieria minutifolia*	Twiggy Zieria	
Sapindaceae	*Atalaya salicifolia*	Brush Whitewood	
Sapindaceae	*Cupaniopsis parviflora*	Small-leaved Tuckeroo	
Sapindaceae	*Cupaniopsis serrata*	Serrated Tuckeroo	
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush	
Sapindaceae	*Elattostachys xylocarpa*	White Tamarind	
Sapindaceae	*Jagera pseudorhus*	Foambark Tree	
Smilacaceae	*Smilax glyciphylla*	Native Sarsparilla	
Solanaceae	*Solanum jasminoides*	Potato Vine	*
Verbenaceae	*Lantana camara*	Lantana	*3
Vitaceae	*Cissus antarctica*	Kangaroo Vine	
Vitaceae	*Clematicissus poaca*	Small-leaved Water Vine	

APPENDIX C REGIONAL ECOSYSTEM DESCRIPTIONS

RE	Status	Description	Confirmation
12.3.11	Of Concern	*Eucalyptus siderophloia*, *E. tereticornis*, *Corymbia intermedia* open forest on alluvial plains. *Corymbia tessellaris*, *Lophostemon suaveolens* and *Melaleuca quinquenervia* usually present	Not present: lack of indicator species, not on alluvium
12.11.3	Least Concern	Open forest generally with *Eucalyptus siderophloia*, *E. propinqua* on metamorphics. Other species include *Eucalyptus microcorys*, *Lophostemon confertus*, *Corymbia intermedia*, E. *biturbinata*, *E. acmenoides*, *E. tereticornis*, *E. moluccana*, *Angophora leiocarpa*.	Confirmed
12.11.5e	Least Concern	Open-forest complex in which spotted gum is a relatively common species. Canopy trees include *Corymbia citriodora* subsp. *variegata*, *Eucalyptus siderophloia* or E. *crebra* (sub coastal ranges), *E. major* and/or *E. longirostrata* and E. *acmenoides* or *E. portuensis* or *E. helidonica* and/or *E. carnea* and/or *E. eugenioides*.	Not present: lack of *C. citriodora*, Grey Gum is *E. propinqua* rather than *E. major* (indicates better site quality
12.11.10	Least Concern	Notophyll and notophyll/microphyll vine forest +/- *Araucaria cunninghamii* on metamorphics. Characteristic species include *Argyrodendron trifoliolatum*, *Argyrodendron* sp. (Kin Kin W.D.Francis AQ81198), *Choricarpia subargentea*, *Dissiliaria baloghioides*, *Brachychiton discolor*, *Beilschmiedia obtusifolia*, *Diospyros pentamera*, *Grevillea robusta*, *Gmelina leichhardtii* and *Ficus macrophylla* forma *macrophylla*.	Confirmed in part.
12.11.14	Of Concern	*Eucalyptus crebra*, *E. tereticornis* grassy woodland on metamorphics. Other species including *Eucalyptus melanophloia*, *Corymbia clarksoniana*, *C. erythrophloia*, *C. tessellaris*, *Angophora* spp.	Not present: lack of indicator species

APPENDIX D FAUNA SPECIES LIST

Bird species observed on the offset site

Family	Species Name	Common Name	Status
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren	
Artamidae	*Cracticus torquatus*	Grey butcherbird	
Artamidae	*Strepera graculina*	Pied Currawong	
Campephagidae	***Coracina tenuirostris***	**Cicadabird**	**Mi (EPBC), SL (NCA)**
Cinclosomatidae	*Psophodes olivaceus*	Whipbird	
Cuculidae	*Chrysococcyx basalis*	Horsefield Bronze-cuckoo	
Meliphagidae	*Entomyzon cyanotis*	Blue-faced Honeyeater	
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater	
Monarchidae	***Myiagra cyanoleuca***	**Satin Flycatcher**	**Mi (EPBC), SL (NCA)**
Monarchidae	*Myiagra rubecula*	Leaden Flycatcher	
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush	
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler	
Pachycephalidae	*Pachycephala rufiventris*	Rufous Whistler	
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin	
Rhipiduridae	***Rhipidura rufifrons***	**Rufous Fantail**	**Mi (EPBC), SL (NCA)**
Turnicidae	***Turnix melanogaster #***	**Black-breasted Button-quail**	**V (NCA, EPBC)**

= feeding signs observed, EPBC = Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*; NCA = Queensland *Nature Conservation Act 1992*.

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Appendix D - KSAT Results

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
1	1	*Eucalyptus tereticornis*	18	40		30/03/2015
1	2	*Lophostemon suaveolens*	8	40		30/03/2015
1	3	*Lophostemon suaveolens*	12	30		30/03/2015
1	4	*Lophostemon suaveolens*	10	25		30/03/2015
1	5	*Eucalyptus tereticornis*	15	30		30/03/2015
1	6	*Corymbia intermedia*	14	25		30/03/2015
1	7	*Lophostemon suaveolens*	9	25		30/03/2015
1	8	*Eucalyptus tereticornis*	25	45		30/03/2015
1	9	*Lophostemon suaveolens*	10	20		30/03/2015
1	10	*Corymbia intermedia*	25	50		30/03/2015
1	11	*Eucalyptus siderophloia*	15	20		30/03/2015
1	12	*Corymbia intermedia*	16	30		30/03/2015
1	13	*Corymbia intermedia*	23	60		30/03/2015
1	14	*Corymbia intermedia*	22	40		30/03/2015
1	15	*Lophostemon suaveolens*	10	25		30/03/2015
1	16	*Lophostemon suaveolens*	10	25		30/03/2015
1	17	*Lophostemon suaveolens*	9	15		30/03/2015
1	18	*Lophostemon suaveolens*	8	20		30/03/2015
1	19	*Lophostemon suaveolens*	12	20		30/03/2015
1	20	*Eucalyptus tereticornis*	22	35		30/03/2015
1	21	*Lophostemon suaveolens*	10	30		30/03/2015
1	22	*Eucalyptus tereticornis*	20	40		30/03/2015
1	23	*Corymbia intermedia*	16	20		30/03/2015
1	24	*Lophostemon suaveolens*	8	25		30/03/2015
1	25	*Lophostemon suaveolens*	8	15		30/03/2015
1	26	*Lophostemon suaveolens*	6	10		30/03/2015
1	27	*Lophostemon suaveolens*	9	30		30/03/2015
1	28	*Lophostemon suaveolens*	10	25		30/03/2015
1	29	*Corymbia intermedia*	9	15		30/03/2015
1	30	*Corymbia intermedia*	28	65		30/03/2015
2	1	*Eucalyptus tereticornis*	26	45	Y	30/03/2015
2	2	*Lophostemon suaveolens*	12	20		30/03/2015
2	3	*Corymbia intermedia*	13	35		30/03/2015
2	4	*Lophostemon confertus*	15	20		30/03/2015
2	5	*Lophostemon confertus*	14	16		30/03/2015
2	6	*Lophostemon confertus*	13	20		30/03/2015
2	7	*Lophostemon suaveolens*	12	30		30/03/2015
2	8	*Lophostemon confertus*	15	20		30/03/2015
2	9	*Lophostemon suaveolens*	14	30		30/03/2015
2	10	*Lophostemon suaveolens*	9	30		30/03/2015
2	11	*Lophostemon suaveolens*	12	35		30/03/2015
2	12	*Corymbia intermedia*	16	30		30/03/2015
2	13	*Lophostemon suaveolens*	14	30		30/03/2015
2	14	*Eucalyptus tereticornis*	23	50		30/03/2015
2	15	*Corymbia intermedia*	15	25		30/03/2015
2	16	*Eucalyptus tereticornis*	18	40	Y	30/03/2015
2	17	*Corymbia intermedia*	17	35		30/03/2015
2	18	*Corymbia intermedia*	25	50		30/03/2015
2	19	*Corymbia intermedia*	17	40		30/03/2015
2	20	*Eucalyptus siderophloia*	14	25	Y	30/03/2015
2	21	*Corymbia intermedia*	18	45	Y	30/03/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
2	22	*Lophostemon suaveolens*	8	25		30/03/2015
2	23	*Corymbia intermedia*	18	55		30/03/2015
2	24	*Eucalyptus siderophloia*	18	35		30/03/2015
2	25	*Corymbia intermedia*	22	65		30/03/2015
2	26	*Eucalyptus siderophloia*	24	45		30/03/2015
2	27	*Lophostemon suaveolens*	11	25		30/03/2015
2	28	*Corymbia intermedia*	16	30		30/03/2015
2	29	*Lophostemon suaveolens*	7	15		30/03/2015
2	30	*Corymbia intermedia*	26	17		30/03/2015
3	1	*Corymbia intermedia*	17	25		30/03/2015
3	2	*Eucalyptus propinqua*	19	65		30/03/2015
3	3	*Corymbia intermedia*	9	25		30/03/2015
3	4	*Corymbia intermedia*	10	25		30/03/2015
3	5	*Corymbia intermedia*	16	30		30/03/2015
3	6	*Eucalyptus siderophloia*	18	35		30/03/2015
3	7	*Corymbia intermedia*	12	25		30/03/2015
3	8	*Eucalyptus propinqua*	14	30		30/03/2015
3	9	*Corymbia intermedia*	17	50		30/03/2015
3	10	*Eucalyptus siderophloia*	8	20		30/03/2015
3	11	*Eucalyptus propinqua*	17	45		30/03/2015
3	12	*Eucalyptus tereticornis*	15	45		30/03/2015
3	13	*Eucalyptus propinqua*	25	80		30/03/2015
3	14	*Corymbia intermedia*	16	40		30/03/2015
3	15	*Corymbia intermedia*	15	30		30/03/2015
3	16	*Eucalyptus propinqua*	8	25		30/03/2015
3	17	*Eucalyptus propinqua*	20	50		30/03/2015
3	18	*Eucalyptus microcorys*	23	80	Y	30/03/2015
3	19	*Corymbia intermedia*	18	45		30/03/2015
3	20	*Eucalyptus propinqua*	26	50		30/03/2015
3	21	*Corymbia intermedia*	17	30		30/03/2015
3	22	*Eucalyptus propinqua*	18	30		30/03/2015
3	23	*Eucalyptus propinqua*	22	50		30/03/2015
3	24	*Eucalyptus propinqua*	26	70		30/03/2015
3	25	*Eucalyptus propinqua*	27	50		30/03/2015
3	26	*Eucalyptus propinqua*	25	60	Y	30/03/2015
3	27	*Eucalyptus propinqua*	18	45	Y	30/03/2015
3	28	*Eucalyptus propinqua*	18	35	Y	30/03/2015
3	29	*Corymbia intermedia*	20	50		30/03/2015
3	30	*Eucalyptus siderophloia*	19	30		30/03/2015
4	1	*Lophostemon suaveolens*	7	30		30/03/2015
4	2	*Eucalyptus tereticornis*	26	70		30/03/2015
4	3	*Lophostemon suaveolens*	7	20		30/03/2015
4	4	*Corymbia intermedia*	18	45		30/03/2015
4	5	*Corymbia intermedia*	22	85		30/03/2015
4	6	*Eucalyptus tereticornis*	14	25		30/03/2015
4	7	*Eucalyptus tereticornis*	18	40		30/03/2015
4	8	*Lophostemon suaveolens*	12	30		30/03/2015
4	9	*Corymbia intermedia*	18	75		30/03/2015
4	10	*Eucalyptus tereticornis*	24	55		30/03/2015
4	11	*Eucalyptus tereticornis*	25	55		30/03/2015
4	12	*Eucalyptus tereticornis*	20	35		30/03/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
4	13	*Lophostemon suaveolens*	6	15		30/03/2015
4	14	*Eucalyptus tereticornis*	25	40		30/03/2015
4	15	*Lophostemon suaveolens*	8	30		30/03/2015
4	16	*Eucalyptus tereticornis*	25	35		30/03/2015
4	17	*Eucalyptus tereticornis*	25	45		30/03/2015
4	18	*Corymbia intermedia*	22	30		30/03/2015
4	19	*Eucalyptus tereticornis*	12	20		30/03/2015
4	20	*Corymbia intermedia*	16	35		30/03/2015
4	21	*Lophostemon suaveolens*	6	25		30/03/2015
4	22	*Corymbia intermedia*	12	25		30/03/2015
4	23	*Corymbia intermedia*	12	20		30/03/2015
4	24	*Corymbia intermedia*	15	40		30/03/2015
4	25	*Eucalyptus tereticornis*	20	30		30/03/2015
4	26	*Corymbia intermedia*	14	25		30/03/2015
4	27	*Eucalyptus tereticornis*	20	60		30/03/2015
4	28	*Corymbia intermedia*	12	35		30/03/2015
4	29	*Eucalyptus crebra*	12	20		30/03/2015
4	30	*Eucalyptus tereticornis*	26	60		30/03/2015
5	1	*Corymbia intermedia*	9	30		30/03/2015
5	2	*Eucalyptus propinqua*	16	55		30/03/2015
5	3	*Eucalyptus tereticornis*	16	30		30/03/2015
5	4	*Eucalyptus tereticornis*	20	45		30/03/2015
5	5	*Eucalyptus tereticornis*	20	55		30/03/2015
5	6	*Eucalyptus siderophloia*	9	30		30/03/2015
5	7	*Eucalyptus tereticornis*	16	40		30/03/2015
5	8	*Eucalyptus tereticornis*	24	55		30/03/2015
5	9	*Eucalyptus tereticornis*	24	60		30/03/2015
5	10	*Corymbia intermedia*	10	30		30/03/2015
5	11	*Eucalyptus tereticornis*	24	60		30/03/2015
5	12	*Lophostemon suaveolens*	9	20		30/03/2015
5	13	*Lophostemon suaveolens*	9	20		30/03/2015
5	14	*Lophostemon suaveolens*	8	15		30/03/2015
5	15	*Eucalyptus tereticornis*	20	40		30/03/2015
5	16	*Eucalyptus tereticornis*	16	40		30/03/2015
5	17	*Corymbia intermedia*	16	35		30/03/2015
5	18	*Eucalyptus tereticornis*	22	60		30/03/2015
5	19	*Lophostemon suaveolens*	6	20		30/03/2015
5	20	*Lophostemon suaveolens*	6	15		30/03/2015
5	21	*Eucalyptus tereticornis*	18	55		30/03/2015
5	22	*Eucalyptus tereticornis*	17	30		30/03/2015
5	23	*Eucalyptus siderophloia*	17	45		30/03/2015
5	24	*Eucalyptus siderophloia*	15	40		30/03/2015
5	25	*Eucalyptus siderophloia*	12	25		30/03/2015
5	26	*Corymbia intermedia*	16	45		30/03/2015
5	27	*Eucalyptus siderophloia*	15	35		30/03/2015
5	28	*Melaleuca salignus*	9	25		30/03/2015
5	29	*Eucalyptus tereticornis*	9	20		30/03/2015
5	30	*Eucalyptus tereticornis*	18	35		30/03/2015
6	1	*Lophostemon confertus*	15	35		31/03/2015
6	2	*Eucalyptus propinqua*	16	35		31/03/2015
6	3	*Eucalyptus tereticornis*	18	45		31/03/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
6	4	*Eucalyptus tereticornis*	20	50		31/03/2015
6	5	*Lophostemon confertus*	17	40		31/03/2015
6	6	*Eucalyptus propinqua*	7	25		31/03/2015
6	7	*Corymbia intermedia*	10	30		31/03/2015
6	8	*Eucalyptus propinqua*	15	25		31/03/2015
6	9	*Lophostemon confertus*	8	15		31/03/2015
6	10	*Lophostemon confertus*	9	20		31/03/2015
6	11	*Lophostemon confertus*	10	25		31/03/2015
6	12	*Eucalyptus propinqua*	18	40		31/03/2015
6	13	*Lophostemon confertus*	8	20		31/03/2015
6	14	*Lophostemon confertus*	12	35		31/03/2015
6	15	*Eucalyptus propinqua*	22	45		31/03/2015
6	16	*Eucalyptus siderophloia*	15	25		31/03/2015
6	17	*Lophostemon confertus*	18	40		31/03/2015
6	18	*Lophostemon confertus*	15	30		31/03/2015
6	19	*Lophostemon confertus*	14	25		31/03/2015
6	20	*Eucalyptus propinqua*	27	50		31/03/2015
6	21	*Lophostemon confertus*	8	20		31/03/2015
6	22	*Lophostemon confertus*	17	30		31/03/2015
6	23	*Eucalyptus propinqua*	24	45		31/03/2015
6	24	*Lophostemon confertus*	14	50		31/03/2015
6	25	*Eucalyptus siderophloia*	15	30		31/03/2015
6	26	*Lophostemon confertus*	9	30		31/03/2015
6	27	*Corymbia intermedia*	8	25		31/03/2015
6	28	*Lophostemon confertus*	9	25		31/03/2015
6	29	*Lophostemon confertus*	10	30		31/03/2015
6	30	*Corymbia intermedia*	10	30		31/03/2015
7	1	*Eucalyptus grandis*	24	45		31/03/2015
7	2	*Eucalyptus grandis*	25	60		31/03/2015
7	3	*Eucalyptus propinqua*	22	45		31/03/2015
7	4	*Eucalyptus grandis*	28	100		31/03/2015
7	5	*Eucalyptus grandis*	18	35		31/03/2015
7	6	*Eucalyptus grandis*	25	60		31/03/2015
7	7	*Eucalyptus grandis*	16	55		31/03/2015
7	8	*Eucalyptus grandis*	28	95		31/03/2015
7	9	*Eucalyptus grandis*	14	45		31/03/2015
7	10	*Eucalyptus tereticornis*	22	35		31/03/2015
7	11	*Eucalyptus tereticornis*	23	70		31/03/2015
7	12	*Eucalyptus grandis*	18	60		31/03/2015
7	13	*Eucalyptus propinqua*	24	60		31/03/2015
7	14	*Melaleuca salignus*	9	20		31/03/2015
7	15	*Melaleuca salignus*	8	25		31/03/2015
7	16	*Lophostemon confertus*	8	20		31/03/2015
7	17	*Lophostemon confertus*	15	45		31/03/2015
7	18	*Lophostemon confertus*	12	30		31/03/2015
7	19	*Eucalyptus tereticornis*	24	45		31/03/2015
7	20	*Eucalyptus grandis*	24	40		31/03/2015
7	21	*Eucalyptus tereticornis*	27	85		31/03/2015
7	22	*Eucalyptus tereticornis*	22	40		31/03/2015
7	23	*Eucalyptus grandis*	15	25		31/03/2015
7	24	*Eucalyptus grandis*	26	75		31/03/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
7	25	*Eucalyptus siderophloia*	18	40		31/03/2015
7	26	*Eucalyptus siderophloia*	12	20		31/03/2015
7	27	*Eucalyptus siderophloia*	14	25		31/03/2015
7	28	*Eucalyptus siderophloia*	15	30		31/03/2015
7	29	*Eucalyptus siderophloia*	24	110		31/03/2015
7	30	*Eucalyptus grandis*	26	100		31/03/2015
8	1	*Eucalyptus tereticornis*	12	35		31/03/2015
8	2	*Eucalyptus tereticornis*	12	30		31/03/2015
8	3	*Eucalyptus tereticornis*	9	20		31/03/2015
8	4	*Eucalyptus tereticornis*	12	30		31/03/2015
8	5	*Eucalyptus tereticornis*	16	35		31/03/2015
8	6	*Eucalyptus tereticornis*	15	30		31/03/2015
8	7	*Eucalyptus tereticornis*	18	40		31/03/2015
8	8	*Eucalyptus tereticornis*	7	15		31/03/2015
8	9	*Eucalyptus tereticornis*	9	20		31/03/2015
8	10	*Eucalyptus tereticornis*	8	20		31/03/2015
8	11	*Eucalyptus tereticornis*	8	15		31/03/2015
8	12	*Eucalyptus tereticornis*	15	30		31/03/2015
8	13	*Eucalyptus tereticornis*	15	25		31/03/2015
8	14	*Eucalyptus siderophloia*	8	20		31/03/2015
8	15	*Eucalyptus tereticornis*	17	20		31/03/2015
8	16	*Eucalyptus tereticornis*	12	25		31/03/2015
8	17	*Eucalyptus tereticornis*	9	15		31/03/2015
8	18	*Eucalyptus siderophloia*	25	50		31/03/2015
8	19	*Eucalyptus tereticornis*	8	20		31/03/2015
8	20	*Eucalyptus tereticornis*	6	12		31/03/2015
8	21	*Eucalyptus siderophloia*	18	30		31/03/2015
8	22	*Eucalyptus tereticornis*	8	15		31/03/2015
8	23	*Eucalyptus siderophloia*	15	25		31/03/2015
8	24	*Eucalyptus tereticornis*	10	20		31/03/2015
8	25	*Eucalyptus siderophloia*	15	25		31/03/2015
8	26	*Eucalyptus siderophloia*	12	20		31/03/2015
8	27	*Eucalyptus tereticornis*	12	20		31/03/2015
8	28	*Eucalyptus tereticornis*	18	30		31/03/2015
8	29	*Eucalyptus tereticornis*	18	35		31/03/2015
8	30	*Eucalyptus tereticornis*	20	40		31/03/2015
9	1	*Eucalyptus acmenoides*	20	40		31/03/2015
9	2	*Corymbia intermedia*	17	30		31/03/2015
9	3	*Corymbia intermedia*	17	35		31/03/2015
9	4	*Eucalyptus acmenoides*	20	45		31/03/2015
9	5	*Corymbia intermedia*	20	30		31/03/2015
9	6	*Eucalyptus acmenoides*	14	20		31/03/2015
9	7	*Eucalyptus acmenoides*	17	40		31/03/2015
9	8	*Eucalyptus acmenoides*	15	30		31/03/2015
9	9	*Corymbia intermedia*	15	20		31/03/2015
9	10	*Eucalyptus acmenoides*	18	45		31/03/2015
9	11	*Eucalyptus siderophloia*	12	15		31/03/2015
9	12	*Eucalyptus acmenoides*	15	40		31/03/2015
9	13	*Eucalyptus acmenoides*	14	20		31/03/2015
9	14	*Eucalyptus acmenoides*	15	40		31/03/2015
9	15	*Eucalyptus propinqua*	18	45		31/03/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
9	16	*Eucalyptus propinqua*	14	20		31/03/2015
9	17	*Eucalyptus acmenoides*	15	35		31/03/2015
9	18	*Eucalyptus acmenoides*	17	30		31/03/2015
9	19	*Corymbia intermedia*	14	20		31/03/2015
9	20	*Eucalyptus acmenoides*	22	50		31/03/2015
9	21	*Eucalyptus acmenoides*	18	35		31/03/2015
9	22	*Eucalyptus acmenoides*	18	40		31/03/2015
9	23	*Eucalyptus acmenoides*	18	40		31/03/2015
9	24	*Eucalyptus acmenoides*	15	20		31/03/2015
9	25	*Eucalyptus acmenoides*	21	40		31/03/2015
9	26	*Corymbia intermedia*	16	30		31/03/2015
9	27	*Eucalyptus siderophloia*	18	25		31/03/2015
9	28	*Eucalyptus acmenoides*	20	55		31/03/2015
9	29	*Eucalyptus siderophloia*	11	15		31/03/2015
9	30	*Corymbia intermedia*	16	25		31/03/2015
10	1	*Eucalyptus acmenoides*	18	60		31/03/2015
10	2	*Corymbia intermedia*	16	25		31/03/2015
10	3	*Corymbia intermedia*	22	75		31/03/2015
10	4	*Lophostemon confertus*	19	40		31/03/2015
10	5	*Corymbia intermedia*	19	30		31/03/2015
10	6	*Syncarpia glomulifera*	20	55		31/03/2015
10	7	*Corymbia intermedia*	24	45		31/03/2015
10	8	*Corymbia intermedia*	22	30		31/03/2015
10	9	*Eucalyptus acmenoides*	24	40		31/03/2015
10	10	*Syncarpia glomulifera*	18	40		31/03/2015
10	11	*Eucalyptus acmenoides*	18	35		31/03/2015
10	12	*Corymbia intermedia*	17	30		31/03/2015
10	13	*Syncarpia glomulifera*	20	70		31/03/2015
10	14	*Syncarpia glomulifera*	23	70		31/03/2015
10	15	*Corymbia intermedia*	20	45		31/03/2015
10	16	*Syncarpia glomulifera*	18	35		31/03/2015
10	17	*Syncarpia glomulifera*	20	50		31/03/2015
10	18	*Corymbia intermedia*	25	45		31/03/2015
10	19	*Syncarpia glomulifera*	20	50	Y	31/03/2015
10	20	*Eucalyptus microcorys*	25	50		31/03/2015
10	21	*Syncarpia glomulifera*	16	30		31/03/2015
10	22	*Syncarpia glomulifera*	20	55		31/03/2015
10	23	*Corymbia intermedia*	18	20		31/03/2015
10	24	*Eucalyptus microcorys*	22	40		31/03/2015
10	25	*Eucalyptus propinqua*	18	30		31/03/2015
10	26	*Syncarpia glomulifera*	18	40		31/03/2015
10	27	*Eucalyptus acmenoides*	16	30		31/03/2015
10	28	*Eucalyptus siderophloia*	18	25		31/03/2015
10	29	*Corymbia intermedia*	17	20		31/03/2015
10	30	*Eucalyptus acmenoides*	22	45		31/03/2015
11	1	*Eucalyptus propinqua*	16	35		31/03/2015
11	2	*Eucalyptus propinqua*	17	20		31/03/2015
11	3	*Eucalyptus acmenoides*	16	25		31/03/2015
11	4	*Eucalyptus siderophloia*	25	40		31/03/2015
11	5	*Eucalyptus acmenoides*	18	30		31/03/2015
11	6	*Eucalyptus acmenoides*	16	30		31/03/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
11	7	*Eucalyptus acmenoides*	15	30		31/03/2015
11	8	*Eucalyptus acmenoides*	14	20		31/03/2015
11	9	*Eucalyptus propinqua*	18	30		31/03/2015
11	10	*Eucalyptus acmenoides*	20	40		31/03/2015
11	11	*Corymbia intermedia*	18	40	Y	31/03/2015
11	12	*Eucalyptus acmenoides*	12	25		31/03/2015
11	13	*Eucalyptus acmenoides*	19	40		31/03/2015
11	14	*Eucalyptus acmenoides*	15	25		31/03/2015
11	15	*Eucalyptus acmenoides*	19	35		31/03/2015
11	16	*Eucalyptus acmenoides*	16	30		31/03/2015
11	17	*Eucalyptus acmenoides*	13	30		31/03/2015
11	18	*Eucalyptus acmenoides*	17	45		31/03/2015
11	19	*Eucalyptus acmenoides*	12	25		31/03/2015
11	20	*Eucalyptus acmenoides*	18	35		31/03/2015
11	21	*Eucalyptus acmenoides*	15	35		31/03/2015
11	22	*Eucalyptus acmenoides*	18	30		31/03/2015
11	23	*Eucalyptus acmenoides*	18	30		31/03/2015
11	24	*Eucalyptus acmenoides*	18	40		31/03/2015
11	25	*Eucalyptus acmenoides*	14	20		31/03/2015
11	26	*Eucalyptus acmenoides*	15	30		31/03/2015
11	27	*Eucalyptus propinqua*	25	50		31/03/2015
11	28	*Eucalyptus acmenoides*	24	55		31/03/2015
11	29	*Eucalyptus acmenoides*	25	60		31/03/2015
11	30	*Eucalyptus acmenoides*	24	35		31/03/2015
12	1	*Eucalyptus microcorys*	18	50		31/03/2015
12	2	*Eucalyptus microcorys*	16	35		31/03/2015
12	3	*Eucalyptus microcorys*	28	120		31/03/2015
12	4	*Eucalyptus microcorys*	25	75		31/03/2015
12	5	*Eucalyptus propinqua*	18	40		31/03/2015
12	6	*Eucalyptus propinqua*	12	40		31/03/2015
12	7	*Eucalyptus microcorys*	15	25		31/03/2015
12	8	*Corymbia intermedia*	18	40		31/03/2015
12	9	*Syncarpia glomulifera*	16	35		31/03/2015
12	10	*Syncarpia glomulifera*	18	50		31/03/2015
12	11	*Eucalyptus propinqua*	6	35		31/03/2015
12	12	*Corymbia intermedia*	18	40		31/03/2015
12	13	*Eucalyptus propinqua*	15	30		31/03/2015
12	14	*Syncarpia glomulifera*	6	15		31/03/2015
12	15	*Eucalyptus resinifera*	22	75		31/03/2015
12	16	*Corymbia intermedia*	15	30		31/03/2015
12	17	*Corymbia intermedia*	15	20		31/03/2015
12	18	*Eucalyptus resinifera*	18	40		31/03/2015
12	19	*Corymbia intermedia*	15	30		31/03/2015
12	20	*Eucalyptus chloryzema*	10	20		31/03/2015
12	21	*Corymbia intermedia*	18	45		31/03/2015
12	22	*Corymbia intermedia*	14	25		31/03/2015
12	23	*Corymbia intermedia*	15	30		31/03/2015
12	24	*Eucalyptus resinifera*	13	25		31/03/2015
12	25	*Eucalyptus propinqua*	18	30		31/03/2015
12	26	*Eucalyptus propinqua*	16	30		31/03/2015
12	27	*Corymbia intermedia*	18	45		31/03/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
12	28	*Lophostemon suaveolens*	8	20		31/03/2015
12	29	*Eucalyptus resinifera*	20	35		31/03/2015
12	30	*Corymbia intermedia*	14	20		31/03/2015
13	1	*Eucalyptus acmenoides*	12	25		1/04/2015
13	2	*Eucalyptus acmenoides*	15	30		1/04/2015
13	3	*Corymbia intermedia*	17	40		1/04/2015
13	4	*Corymbia intermedia*	18	20		1/04/2015
13	5	*Eucalyptus acmenoides*	15	35		1/04/2015
13	6	*Corymbia intermedia*	15	30		1/04/2015
13	7	*Eucalyptus acmenoides*	17	40		1/04/2015
13	8	*Eucalyptus acmenoides*	9	20		1/04/2015
13	9	*Eucalyptus acmenoides*	10	15		1/04/2015
13	10	*Eucalyptus acmenoides*	10	30		1/04/2015
13	11	*Corymbia intermedia*	16	30		1/04/2015
13	12	*Eucalyptus propinqua*	12	20		1/04/2015
13	13	*Corymbia intermedia*	17	40		1/04/2015
13	14	*Corymbia intermedia*	14	35		1/04/2015
13	15	*Eucalyptus acmenoides*	16	30		1/04/2015
13	16	*Eucalyptus acmenoides*	15	30		1/04/2015
13	17	*Eucalyptus acmenoides*	18	50		1/04/2015
13	18	*Eucalyptus acmenoides*	18	45		1/04/2015
13	19	*Eucalyptus acmenoides*	17	40		1/04/2015
13	20	*Corymbia intermedia*	16	45		1/04/2015
13	21	*Eucalyptus acmenoides*	8	15		1/04/2015
13	22	*Corymbia intermedia*	18	40		1/04/2015
13	23	*Eucalyptus acmenoides*	15	30		1/04/2015
13	24	*Eucalyptus acmenoides*	16	35		1/04/2015
13	25	*Eucalyptus siderophloia*	9	15		1/04/2015
13	26	*Lophostemon suaveolens*	8	25		1/04/2015
13	27	*Eucalyptus acmenoides*	14	25		1/04/2015
13	28	*Eucalyptus acmenoides*	17	40		1/04/2015
13	29	*Eucalyptus acmenoides*	13	25		1/04/2015
13	30	*Eucalyptus acmenoides*	12	20		1/04/2015
14	1	*Eucalyptus tereticornis*	28	90		1/04/2015
14	2	*Lophostemon suaveolens*	8	20		1/04/2015
14	3	*Eucalyptus tereticornis*	12	20		1/04/2015
14	4	*Lophostemon suaveolens*	6	12		1/04/2015
14	5	*Eucalyptus tereticornis*	10	20		1/04/2015
14	6	*Lophostemon suaveolens*	6	12		1/04/2015
14	7	*Lophostemon suaveolens*	9	20		1/04/2015
14	8	*Eucalyptus tereticornis*	15	30		1/04/2015
14	9	*Lophostemon suaveolens*	8	20		1/04/2015
14	10	*Eucalyptus tereticornis*	7	12		1/04/2015
14	11	*Lophostemon suaveolens*	7	12		1/04/2015
14	12	*Eucalyptus tereticornis*	8	10		1/04/2015
14	13	*Lophostemon suaveolens*	7	15		1/04/2015
14	14	*Eucalyptus tereticornis*	15	25		1/04/2015
14	15	*Lophostemon suaveolens*	7	15		1/04/2015
14	16	*Melaleuca salignus*	8	25		1/04/2015
14	17	*Melaleuca salignus*	7	20		1/04/2015
14	18	*Lophostemon confertus*	8	25		1/04/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
14	19	*Lophostemon confertus*	8	30		1/04/2015
14	20	*Lophostemon confertus*	10	25		1/04/2015
14	21	*Eucalyptus resinifera*	8	20		1/04/2015
14	22	*Eucalyptus resinifera*	9	25		1/04/2015
14	23	*Eucalyptus resinifera*	9	20		1/04/2015
14	24	*Corymbia intermedia*	10	20		1/04/2015
14	25	*Eucalyptus resinifera*	8	20		1/04/2015
14	26	*Eucalyptus siderophloia*	8	15		1/04/2015
14	27	*Corymbia intermedia*	12	30		1/04/2015
14	28	*Corymbia intermedia*	15	25		1/04/2015
14	29	*Lophostemon suaveolens*	8	15		1/04/2015
14	30	*Lophostemon confertus*	12	25		1/04/2015
15	1	*Eucalyptus acmenoides*	26	75		1/04/2015
15	2	*Eucalyptus acmenoides*	27	70		1/04/2015
15	3	*Lophostemon confertus*	8	30		1/04/2015
15	4	*Corymbia intermedia*	10	15		1/04/2015
15	5	*Eucalyptus acmenoides*	25	60		1/04/2015
15	6	*Lophostemon confertus*	15	45		1/04/2015
15	7	*Angophora leiocarpa*	12	25		1/04/2015
15	8	*Lophostemon confertus*	16	30		1/04/2015
15	9	*Eucalyptus acmenoides*	25	45		1/04/2015
15	10	*Lophostemon confertus*	14	35		1/04/2015
15	11	*Eucalyptus acmenoides*	26	50		1/04/2015
15	12	*Eucalyptus acmenoides*	26	60		1/04/2015
15	13	*Corymbia intermedia*	28	55		1/04/2015
15	14	*Lophostemon confertus*	16	55		1/04/2015
15	15	*Lophostemon confertus*	18	50		1/04/2015
15	16	*Syncarpia glomulifera*	8	25		1/04/2015
15	17	*Lophostemon suaveolens*	12	12		1/04/2015
15	18	*Melaleuca salignus*	17	40		1/04/2015
15	19	*Lophostemon suaveolens*	12	35		1/04/2015
15	20	*Melaleuca salignus*	9	20		1/04/2015
15	21	*Lophostemon confertus*	9	35		1/04/2015
15	22	*Eucalyptus acmenoides*	25	40		1/04/2015
15	23	*Corymbia intermedia*	24	45		1/04/2015
15	24	*Eucalyptus acmenoides*	22	40		1/04/2015
15	25	*Eucalyptus acmenoides*	20	35		1/04/2015
15	26	*Eucalyptus acmenoides*	9	25		1/04/2015
15	27	*Syncarpia glomulifera*	10	35		1/04/2015
15	28	*Corymbia intermedia*	26	55		1/04/2015
15	29	*Lophostemon suaveolens*	10	20		1/04/2015
15	30	*Eucalyptus propinqua*	26	35		1/04/2015
16	1	*Eucalyptus acmenoides*	21	50		1/04/2015
16	2	*Lophostemon confertus*	8	20		1/04/2015
16	3	*Eucalyptus acmenoides*	6	15		1/04/2015
16	4	*Eucalyptus acmenoides*	7	18		1/04/2015
16	5	*Eucalyptus siderophloia*	10	20		1/04/2015
16	6	*Lophostemon confertus*	9	15		1/04/2015
16	7	*Eucalyptus acmenoides*	18	45		1/04/2015
16	8	*Eucalyptus propinqua*	17	35		1/04/2015
16	9	*Eucalyptus acmenoides*	12	20		1/04/2015

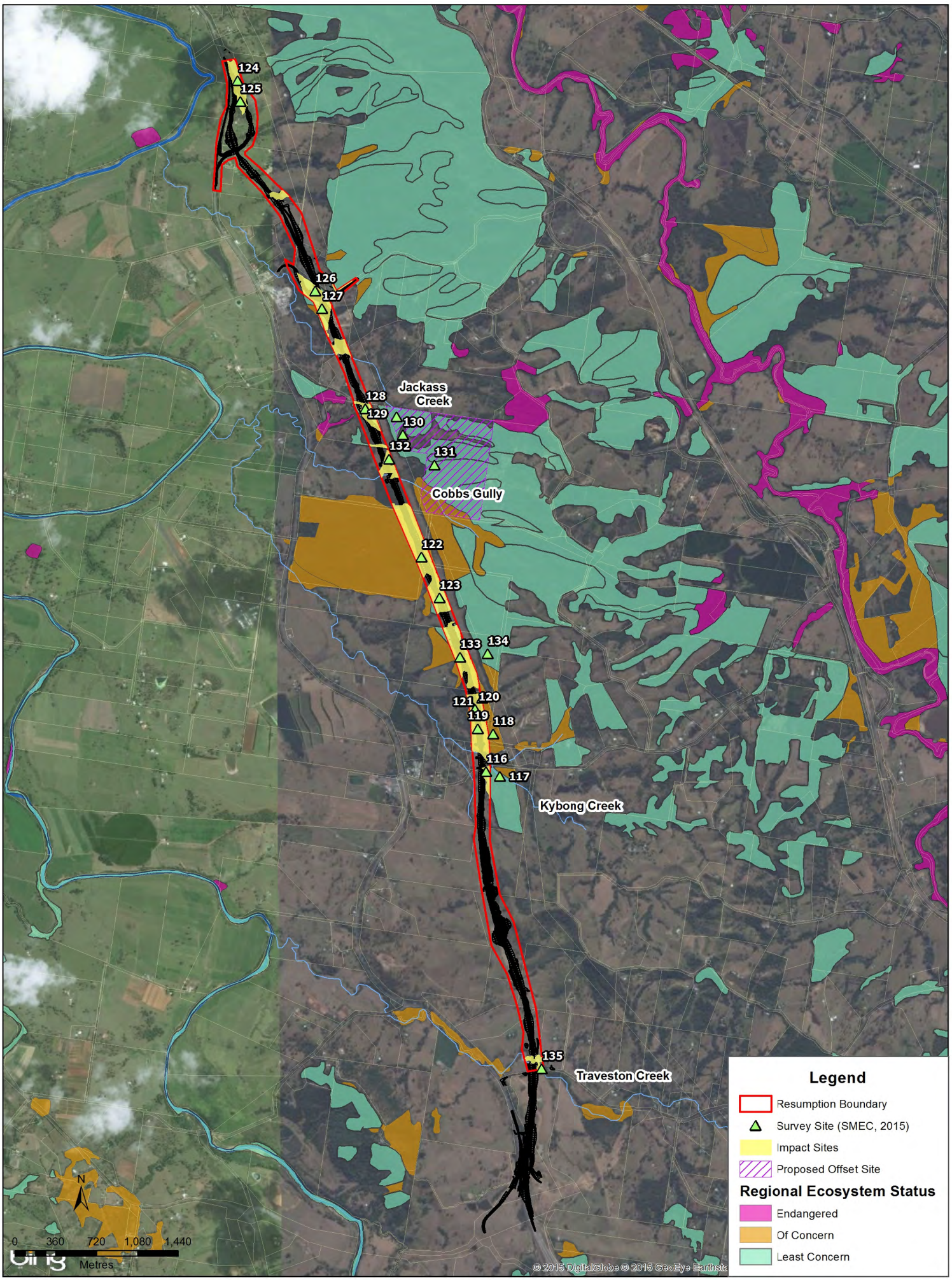
KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
16	10	*Lophostemon confertus*	8	15		1/04/2015
16	11	*Corymbia intermedia*	10	25		1/04/2015
16	12	*Eucalyptus propinqua*	20	45		1/04/2015
16	13	*Angophora leiocarpa*	12	25		1/04/2015
16	14	*Eucalyptus acmenoides*	7	15		1/04/2015
16	15	*Eucalyptus pilularis*	13	25		1/04/2015
16	16	*Eucalyptus propinqua*	20	45		1/04/2015
16	17	*Angophora leiocarpa*	7	15		1/04/2015
16	18	*Eucalyptus siderophloia*	11	20		1/04/2015
16	19	*Angophora leiocarpa*	10	20		1/04/2015
16	20	*Eucalyptus acmenoides*	23	50		1/04/2015
16	21	*Eucalyptus acmenoides*	19	45		1/04/2015
16	22	*Eucalyptus acmenoides*	17	35		1/04/2015
16	23	*Eucalyptus acmenoides*	16	35		1/04/2015
16	24	*Eucalyptus acmenoides*	17	45		1/04/2015
16	25	*Eucalyptus propinqua*	24	40		1/04/2015
16	26	*Eucalyptus siderophloia*	26	40		1/04/2015
16	27	*Eucalyptus acmenoides*	14	25		1/04/2015
16	28	*Eucalyptus acmenoides*	20	55		1/04/2015
16	29	*Eucalyptus propinqua*	17	30		1/04/2015
16	30	*Eucalyptus acmenoides*	18	40		1/04/2015
17	1	*Eucalyptus microcorys*	22	50		1/04/2015
17	2	*Lophostemon confertus*	18	30		1/04/2015
17	3	*Corymbia intermedia*	17	25		1/04/2015
17	4	*Lophostemon confertus*	15	30		1/04/2015
17	5	*Corymbia intermedia*	17	40		1/04/2015
17	6	*Eucalyptus microcorys*	14	25		1/04/2015
17	7	*Lophostemon confertus*	14	20		1/04/2015
17	8	*Corymbia intermedia*	12	20		1/04/2015
17	9	*Eucalyptus siderophloia*	15	30		1/04/2015
17	10	*Corymbia intermedia*	22	50		1/04/2015
17	11	*Eucalyptus acmenoides*	16	30		1/04/2015
17	12	*Corymbia intermedia*	24	110		1/04/2015
17	13	*Eucalyptus microcorys*	27	100	Y	1/04/2015
17	14	*Corymbia intermedia*	22	40		1/04/2015
17	15	*Eucalyptus microcorys*	25	50		1/04/2015
17	16	*Eucalyptus acmenoides*	15	35		1/04/2015
17	17	*Eucalyptus acmenoides*	16	45		1/04/2015
17	18	*Eucalyptus acmenoides*	16	30	Y	1/04/2015
17	19	*Eucalyptus microcorys*	19	45		1/04/2015
17	20	*Corymbia intermedia*	20	35		1/04/2015
17	21	*Eucalyptus acmenoides*	18	40		1/04/2015
17	22	*Syncarpia glomulifera*	10	25	Y	1/04/2015
17	23	*Eucalyptus microcorys*	16	30		1/04/2015
17	24	*Eucalyptus acmenoides*	17	35		1/04/2015
17	25	*Corymbia intermedia*	16	30		1/04/2015
17	26	*Eucalyptus acmenoides*	14	25		1/04/2015
17	27	*Eucalyptus microcorys*	24	80		1/04/2015
17	28	*Corymbia intermedia*	16	30		1/04/2015
17	29	*Eucalyptus acmenoides*	18	40		1/04/2015
17	30	*Corymbia intermedia*	17	30		1/04/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
18	1	*Eucalyptus siderophloia*	22	40		2/04/2015
18	2	*Eucalyptus siderophloia*	24	45		2/04/2015
18	3	*Corymbia intermedia*	10	20		2/04/2015
18	4	*Lophostemon suaveolens*	15	35		2/04/2015
18	5	*Lophostemon suaveolens*	14	30		2/04/2015
18	6	*Corymbia intermedia*	18	25		2/04/2015
18	7	*Lophostemon suaveolens*	8	15		2/04/2015
18	8	*Lophostemon suaveolens*	9	20		2/04/2015
18	9	*Corymbia intermedia*	18	50		2/04/2015
18	10	*Syncarpia glomulifera*	15	50		2/04/2015
18	11	*Lophostemon suaveolens*	16	20		2/04/2015
18	12	*Eucalyptus siderophloia*	22	50		2/04/2015
18	13	*Lophostemon suaveolens*	15	30		2/04/2015
18	14	*Corymbia intermedia*	20	40		2/04/2015
18	15	*Eucalyptus resinifera*	14	25		2/04/2015
18	16	*Corymbia intermedia*	16	35		2/04/2015
18	17	*Lophostemon suaveolens*	8	20		2/04/2015
18	18	*Lophostemon suaveolens*	10	25		2/04/2015
18	19	*Corymbia intermedia*	18	40		2/04/2015
18	20	*Lophostemon suaveolens*	7	25		2/04/2015
18	21	*Melaleuca salignus*	6	15		2/04/2015
18	22	*Lophostemon suaveolens*	11	35		2/04/2015
18	23	*Melaleuca salignus*	6	15		2/04/2015
18	24	*Lophostemon suaveolens*	10	20		2/04/2015
18	25	*Lophostemon suaveolens*	10	25		2/04/2015
18	26	*Melaleuca salignus*	9	40		2/04/2015
18	27	*Lophostemon suaveolens*	18	15		2/04/2015
18	28	*Corymbia intermedia*	16	35		2/04/2015
18	29	*Corymbia intermedia*	15	35		2/04/2015
18	30	*Eucalyptus acmenoides*	7	20		2/04/2015
19	1	*Eucalyptus propinqua*	18	55		2/04/2015
19	2	*Lophostemon confertus*	11	15		2/04/2015
19	3	*Lophostemon confertus*	15	15		2/04/2015
19	4	*Corymbia intermedia*	16	20		2/04/2015
19	5	*Corymbia intermedia*	18	45		2/04/2015
19	6	*Corymbia intermedia*	18	30		2/04/2015
19	7	*Eucalyptus siderophloia*	9	20		2/04/2015
19	8	*Corymbia intermedia*	18	40		2/04/2015
19	9	*Eucalyptus propinqua*	24	40		2/04/2015
19	10	*Eucalyptus siderophloia*	16	15		2/04/2015
19	11	*Lophostemon confertus*	9	15		2/04/2015
19	12	*Melaleuca salignus*	7	15		2/04/2015
19	13	*Corymbia intermedia*	20	40		2/04/2015
19	14	*Eucalyptus propinqua*	28	60		2/04/2015
19	15	*Eucalyptus propinqua*	18	30		2/04/2015
19	16	*Corymbia intermedia*	17	25		2/04/2015
19	17	*Syncarpia glomulifera*	8	20		2/04/2015
19	18	*Corymbia intermedia*	16	40		2/04/2015
19	19	*Syncarpia glomulifera*	15	25		2/04/2015
19	20	*Corymbia intermedia*	16	25		2/04/2015
19	21	*Corymbia intermedia*	18	15		2/04/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
19	22	*Corymbia intermedia*	17	30		2/04/2015
19	23	*Corymbia intermedia*	13	20		2/04/2015
19	24	*Eucalyptus siderophloia*	18	30		2/04/2015
19	25	*Lophostemon confertus*	10	20		2/04/2015
19	26	*Corymbia intermedia*	22	45		2/04/2015
19	27	*Lophostemon confertus*	12	20		2/04/2015
19	28	*Eucalyptus propinqua*	20	45	Y	2/04/2015
19	29	*Corymbia intermedia*	15	45		2/04/2015
19	30	*Eucalyptus propinqua*	23	50		2/04/2015
20	1	*Eucalyptus acmenoides*	24	75		2/04/2015
20	2	*Lophostemon suaveolens*	22	50		2/04/2015
20	3	*Corymbia intermedia*	18	35		2/04/2015
20	4	*Syncarpia glomulifera*	16	50		2/04/2015
20	5	*Lophostemon suaveolens*	8	25		2/04/2015
20	6	*Lophostemon suaveolens*	9	30		2/04/2015
20	7	*Eucalyptus acmenoides*	10	30		2/04/2015
20	8	*Corymbia intermedia*	18	65		2/04/2015
20	9	*Lophostemon confertus*	17	45		2/04/2015
20	10	*Lophostemon confertus*	6	15		2/04/2015
20	11	*Corymbia intermedia*	25	65		2/04/2015
20	12	*Lophostemon confertus*	16	30		2/04/2015
20	13	*Eucalyptus acmenoides*	22	80		2/04/2015
20	14	*Corymbia intermedia*	20	75		2/04/2015
20	15	*Eucalyptus acmenoides*	20	60		2/04/2015
20	16	*Lophostemon confertus*	15	60		2/04/2015
20	17	*Eucalyptus resinifera*	17	40		2/04/2015
20	18	*Lophostemon confertus*	15	35		2/04/2015
20	19	*Lophostemon suaveolens*	10	30		2/04/2015
20	20	*Lophostemon suaveolens*	10	20		2/04/2015
20	21	*Lophostemon suaveolens*	14	30		2/04/2015
20	22	*Corymbia intermedia*	18	40		2/04/2015
20	23	*Eucalyptus resinifera*	8	20		2/04/2015
20	24	*Eucalyptus propinqua*	27	85		2/04/2015
20	25	*Lophostemon suaveolens*	15	30		2/04/2015
20	26	*Lophostemon suaveolens*	16	30		2/04/2015
20	27	*Eucalyptus acmenoides*	24	40		2/04/2015
20	28	*Eucalyptus acmenoides*	22	50		2/04/2015
20	29	*Lophostemon suaveolens*	9	25		2/04/2015
20	30	*Lophostemon suaveolens*	8	30		2/04/2015
21	1	*Eucalyptus tereticornis*	16	35		2/04/2015
21	2	*Eucalyptus tereticornis*	15	30		2/04/2015
21	3	*Corymbia intermedia*	18	55		2/04/2015
21	4	*Eucalyptus tereticornis*	18	45		2/04/2015
21	5	*Eucalyptus tereticornis*	8	15		2/04/2015
21	6	*Eucalyptus tereticornis*	10	30		2/04/2015
21	7	*Corymbia intermedia*	25	90		2/04/2015
21	8	*Eucalyptus tereticornis*	27	60		2/04/2015
21	9	*Eucalyptus tereticornis*	18	45		2/04/2015
21	10	*Corymbia intermedia*	22	80		2/04/2015
21	11	*Eucalyptus tereticornis*	10	25		2/04/2015
21	12	*Eucalyptus tereticornis*	18	45		2/04/2015

KSAT no.	Tree no.	Species	Ht(m)	DBH(cm)	Scats (Y/N)	Date
21	13	*Eucalyptus tereticornis*	25	80		2/04/2015
21	14	*Eucalyptus siderophloia*	8	30		2/04/2015
21	15	*Eucalyptus tereticornis*	10	35		2/04/2015
21	16	*Eucalyptus tereticornis*	22	65		2/04/2015
21	17	*Eucalyptus tereticornis*	20	80		2/04/2015
21	18	*Eucalyptus tereticornis*	24	110		2/04/2015
21	19	*Eucalyptus tereticornis*	23	65		2/04/2015
21	20	*Eucalyptus tereticornis*	16	35		2/04/2015
21	21	*Eucalyptus tereticornis*	24	65		2/04/2015
21	22	*Eucalyptus tereticornis*	8	25		2/04/2015
21	23	*Eucalyptus tereticornis*	16	75		2/04/2015
21	24	*Eucalyptus tereticornis*	9	25		2/04/2015
21	25	*Eucalyptus tereticornis*	26	110		2/04/2015
21	26	*Lophostemon suaveolens*	8	20		2/04/2015
21	27	*Lophostemon suaveolens*	6	20		2/04/2015
21	28	*Eucalyptus tereticornis*	26	90		2/04/2015
21	29	*Eucalyptus tereticornis*	24	80		2/04/2015
21	30	*Corymbia intermedia*	14	15		2/04/2015

Appendix E - May 2015 Survey Results and Survey Locality Plan



PROJECT NO. 30031298 **PROJECT TITLE** Cooroy to Curra (Section C)	**SKETCH** SK-1298-0210 **CREATED BY** KM11809	**ISSUE** 01 **DATE** 12/06/2015 Time: 4:05:55 PM	Queensland Government **CONSULTANT** SMEC Australia
COORDINATE SYSTEM GDA 1994 MGA Zone 56 **PAGE SIZE** A3 **SCALE**	**SOURCE** QLD Govt, SKM, SMEC, BING	Copyright SMEC Australia Pty Ltd. All Rights Reserved. © State of Queensland (Department of Natural Resources and Mines) 2014. Updated data available at http://dds.information.qld.gov.au/dds/	

Path: Q:\Projects\30031298 C2C\004_CADD\Spatial\Products\MXD\3001298_Survey_Sites_SMEC2015_RevB.mxd

Site ID	116
Date	5/05/2015
Type	Impact
RE	border 12.11.3 but incorrecty mapped - should be 12.3.11
Recruitment	Recruitment of canopy species apparent

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	27	20	As per plot below
Sub-canopy	15	40	As per plot below
Shrub	5	20	*Acacia disparrima*
Lower Shrub	2	2	Lantana
Ground	0.5	75	Kangaroo Grass, Blady Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Eucalyptus tereticornis	15	30;35;40;35;55;35;45;60;50;45;30;35;50;60
Eucalyptus siderophloia	2	
Corymbia intermedia	9	
Lophostemon suaveolens	10	30
Acacia maidenii	1	

Disturbance

Type	severity (0-3)	Last Event
Fire	1	E
Logging	1	E
Grazing	1	C
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	117
Date	5/05/2015
Type	Offset
RE	12.11.3 - incorrectly mapped, should be 12.3.11
Recruitment	Recruitment of canopy species apparent

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	27	25	As per plot below
Sub-canopy	18	10	As per plot below
Shrub	10	55	*Acacia* and *Lophostemon*
Lower Shrub	2	60	Lantana
Ground	N/A	55	Kangaroo Grass and Blady Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Corymbia intermedia	11	40;30
Eucalyptus tereticornis	23	35;40;30;50;40;35;40;40
Eucalyptus siderophloia	4	30
Lophostemon suaveolens	47	30
Acacia disparrima	10	

Disturbance

Type	severity (0-3)	Last Event
Fire	1	E
Logging	1	E
Grazing	1	C
Weeds	2	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Offset comments: Lantana removal

Site ID	118
Date	5/05/2015
Type	Offset
RE	12.11.3/12.11.14
Recruitment	Not recorded

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	20	70	As per plot below
Sub-canopy	14	5	*Lophostemon suaveolens*
Shrub	8	20	Red Ash, *Allocasuarina littoralis, Acacia disparrima*
Shrub 1	4	5	*Breynia spp, Trema tomentosa*
Lower Shrub	2	2	Lantana
Ground	0.5	40	Kangaroo Grass and Blady Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Eucalyptus acmenoides	1	
Corymbia intermedia	29	30;35;40;35;30;40;30
Eucalyptus siderophloia	6	30;35;30
Lophostemon confertus	4	40;35
Acacia disparrima	3	
Eucalyptus propinqua	1	40
Lophostemon suaveolens	11	

Disturbance

Type	severity (0-3)	Last Event
Fire	1	D
Logging		
Grazing		
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Offset comments: minor lantana removal and minor gap planting

Site ID	119
Date	5/05/2015
Type	Impact
RE	12.3.11
Recruitment	No evidence of recruitment

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	28	5	*Eucalyptus tereticornis*
Canopy	22	10	*Corymbia intermedia*
Sub-canopy	16	90	*Lophostemon* and *Acacia*
Shrub	5	5	*Lophostemon, Acacia* , Red Kamala, Red Ash
Lower Shrub	1.5	4	Lantana and other native shrubs
Ground	0.45	5	*Lomandra spp.*
Ground 2	0.15	30	Native grasses

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Lophostemon suaveolens	54	30;35;35
Corymbia intermedia	12	45;45;35;30;45
Lophostemon confertus	8	
Acacia disparrima	24	30
Eucalyptus tereticornis	3	30;65;35
Allocasuarina littoralis	9	
Eucalyptus siderophloia	1	

Disturbance

Type	severity (0-3)	Last Event
Fire		
Logging		
Grazing		
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	120
Date	5/05/2015
Type	Impact
RE	12.11.3
Recruitment	No evidence of recruitment

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	18	50	As per plot below
Sub-canopy	10	40	*Lophostemon suaveolens, Acacia disparrima* and *Acacia leiocalyx*
Shrub	4	2	*Acacia disparrima*
Lantana	2	2	Lantana
Lower Shrub	0.6	20	*Lomandra longifolia*
Ground	0.08	45	*Lomandra confertus* and native grasses

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Corymbia intermedia	26	30;35;30;45;55;45;40;40;45
Lophostemon confertus	17	30;35
Eucalyptus propinqua	9	45;30;30;45;40;45;40
Eucalyptus siderophloia	5	30;30
Allocasuarina torulosa	2	
Acacia leiocalyx	1	
Acacia disparrima	2	

Disturbance

Type	severity (0-3)	Last Event
Fire		
Logging	1	E
Grazing	1	A
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	121
Date	5/05/2015
Type	Offset
RE	12.11.3
Recruitment	poor recruitment as a result of dense canopy cover

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	18	50	Eucalypts as below, including *Eucalyptus acmenoides*
Sub-canopy	15	40	As per plot below
Shrub	4	10	*Melaleuca salignus, Acacia disparrima, Lophostemon suaveolens*
Lower Shrub	2	20	Lantana
Ground	15-45	50	Grasses, including Blady grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Corymbia intermedia	13	45;30;30
Allocasuarina torulosa	5	
Eucalyptus siderophloia	2	30
Lophostemon suaveolens	49	
Lophostemon confertus	13	
Acacia disparrima	7	
Eucalyptus propinqua	2	30;45
Allocasuarina littoralis	2	
Eucalyptus crebra	2	30

Disturbance

Type	severity (0-3)	Last Event
Fire		
Logging		
Grazing	1	A
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	122
Date	5/05/2015
Type	Impact
RE	12.11.3
Recruitment	Recruitment mainly Lophostemon and Angophora

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	24	15	As per plot below
Sub-canopy	18	75	As per plot below
Shrub	9	10	*Lophostemon suaveolens* and *Acacia disparrima*
Lower Shrub	N/A	N/A	N/A
Ground	0.2	35	Kangaroo Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Lophostemon confertus	6	50
Lophostemon suaveolens	4	
Corymbia intermedia	2	
Eucalyptus acmenoides	16	30;35;45;40;40;40;40;35
Eucalyptus propinqua	4	35;35
Allocasuarina torulosa	1	
Acacia disparrima	1	
Eucalyptus siderophloia	5	
Angophora leiocarpa	4	30

Disturbance

Type	severity (0-3)	Last Event
Fire	1	C
Logging	2	C and D
Grazing	0	
Weeds	0	

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	123	
Date	5/05/2015	
Type	Impact	
RE	12.11.3	INCOMPLETE DUE TO TIME CONSTRAINTS
Recruitment		

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent			
Canopy			
Sub-canopy			
Shrub			
Lower Shrub			
Ground			

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Lophostemon suaveolens	39	
Corymbia intermedia	7	30;35;35
Acacia disparrima	1	30
Cheesetree	1	
Eucalyptus siderophloia	N/A	
Syncarpia glomulifera	N/A	
Eucalyptus resinifera	N/A	
Melaleuca salignus	N/A	

Disturbance

Type	severity (0-3)	Last Event
Fire		
Logging		
Grazing		
Weeds		

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	124
Date	6/05/2015
Type	Impact
RE	none
Recruitment	No recruitment as mostly rainforest and weeds

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	20	65	As per plot below
Sub-canopy	8	95	As per plot below
Shrub	4	15	Rainforest species and Chinese Celtis
Lower Shrub	2	12	Lantana (10%) and Prickly pear (2%)
Ground	0.7	45	Lovegrass, Coral Berry, Potato Vine

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Acacia disparrima	8	
Eucalyptus propinqua	7	45;30;30
Eucalyptus siderophloia	17	35;35;30;35;30;30
Red Ash	1	
Foambark	1	
Celtis sinensis	11	
Melaleuca stypheloides	10	
Red Bean	1	
Eucalyptus tereticornis	12	30;45;30;30;45;35
Lophostemon suaveolens	11	
Red Kamala	2	
Corymbia intermedia	1	35

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	0	
Grazing	0	
Weeds	3	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	125
Date	6/05/2015
Type	Impact
RE	N/A
Recruitment	No recruitment

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	18	80	As per plot below
Sub-canopy	6	5	As per plot below
Shrub	N/A	N/A	N/A
Lower Shrub	6	5	Lantana and Cats Claw Creeper
Ground	0.5	50	Grasses and herbacious weeds including Blue Billygoats Weed, Farmers Friend, Kangaroo Grass and Blady Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Lophostemon confertus	39	30
Eucalyptus siderophloia	1	
Eucalyptus propinqua	5	35;30;30
Corymbia intermedia	3	
Lophostemon suaveolens	2	
Celtis sinensis	2	
Red Ash	2	

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	0	
Grazing	1	A
Weeds	2	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	126
Date	6/05/2015
Type	Impact
RE	12.11.3
Recruitment	Minor recruitment of *Lophostemon confertus*

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	20	85	
Sub-canopy	9	25	*Syncarpia glomulifera* (Turpentine), *Lophostemon confertus* and *Acacia disparrima*
Shrub	N/A	N/A	N/A
Lower Shrub	2	5	Lantana
Ground	0.5	15	Blady Grass and Kangaroo Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Eucalyptus acmenoides	32	30;30;35;35;30;30;30;35;35;30;30
Corymbia intermedia	23	30;35;30;40;30
Lophostemon confertus	15	
Eucalyptus siderophloia	5	
Syncarpia glomulifera	8	
Acacia disparrima	2	
Eucalyptus propinqua	3	30
Allocasuarina littoralis	1	

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	0	
Grazing	0	
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	127
Date	6/05/2015
Type	Impact
RE	12.3.11
Recruitment	Recruitment is 1m shrub layer

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	26	30	As per plot below
Sub-canopy	20	60	As per plot below
Shrub	10	15	*Syncarpia glomulifera* (Turpentine), *Acacia disparrima, Celtis sinensis*
Lower Shrub	2	2	Lantana
Ground 1	1	5	*Lomandra longifolia* , rainforest species such as *Pittosporum spp* , Native Holly, Shield Fern and Foambark
Ground	0.1	30	Basket Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Lophostemon confertus	33	
Syncarpia glomulifera	27	30;30;40;35;30;30;30;30
Corymbia intermedia	16	30;35;40;35
Eucalyptus acmenoides	7	35;40;40;35;30;30;30
Eucalyptus propinqua	6	30;30
Eucalyptus microcorys	2	30;35
Allocasuarina torulosa	1	
Melaleuca salignus	2	
Lophostemon suaveolens	3	
Eucalyptus siderophloia	1	35
Celtis sinensis	2	
Beckea lagata	1	
Acacia disparrima	1	

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	0	
Grazing	1	A
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	128
Date	6/05/2015
Type	Impact
RE	12.11.3
Recruitment	*Acacia* and *Lophostemon* only

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	24	65	As per plot below
Sub-canopy	6	20	*Lophostemon confertus* and *L. suaveolens*
Shrub	4	25	*Acacia leiocalyx*
Lower Shrub	2	1	Lantana
Ground	0.5	20	Kangaroo Grass, Blady Grass, *Dianella caerulea* , Basket Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Lophostemon confertus	2	
Corymbia intermedia	9	30;30;30;40;35;30
Eucalyptus acmenoides	32	30;30;30;30;30;50;30;30;30;30;35
Eucalyptus propinqua	1	
Lophostemon suaveolens	8	30
Eucalyptus siderophloia	5	
Acacia leiocalyx	1	

Disturbance

Type	severity (0-3)	Last Event
Fire	1 and 2	C
Logging	1	C
Grazing	1	A
Weeds	1	

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	129
Date	6/05/2015
Type	Offset
RE	12.11.3
Recruitment	Recruitment evident

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	22	30	As per plot below
Sub-canopy	15	45	As per plot below
Shrub	9	35	*Acacia* , *Lophostemon* , *Eucalyptus acmenoides*
Lower Shrub	2	20	*Lophostemon* and *Acacia*
Ground 1	1.8	1	Lantana
Ground	0.2-0.6	20	*Xanthorrhea spp.* , Barbwire Grass, Kangaroo Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Corymbia intermedia	12	40;30;35;40
Eucalyptus propinqua	9	30;30;30
Acacia maidenii	1	
Eucalyptus acmenoides	25	30;30;30;30;30;30
Lophostemon confertus	20	
Lophostemon suaveolens	6	
Acacia disparrima	5	
Allocasuarina torulosa	1	

Disturbance

Type	severity (0-3)	Last Event
Fire	1	D
Logging	1	D
Grazing	0	
Weeds	<1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Offset recommendations: Very minor Lantana removal, heavier in the gully adjacent the site

Site ID	130
Date	6/05/2015
Type	Offset
RE	N/A
Recruitment	Recruitment evident

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	20	25	As per plot below
Sub-canopy	5	50	Regenerating Eucalypts
Shrub	1.2	10	*Acacia, Corymbia intermedia* , *Eucalyptus acmenoides*
Lower Shrub	N/A	N/A	N/A
Ground	0.25	75	Kangaroo Grass, Blady Grass, Barbed Wire Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Corymbia intermedia	3	
Acacia leiocalyx	1	
Eucalyptus propinqua	4	30;30;30
Eucalyptus acmenoides	12	30;35;30;30;90;30;30;30
Eucalyptus fibrosa	1	
Acacia disparrima	1	
Lophostemon confertus	1	

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	2	D
Grazing	2	
Weeds	1	B

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Offset recommendations: Gap planting with winter flowering Eucalypts such as *E. siderophloia*

Site ID 131
Date 6/05/2015
Type Offset
RE 12.11.3
Recruitment Lots of 5m tall recruitment evident

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	25	20	As per plot below
Sub-canopy	N/A	N/A	N/A
Shrub	5	85	*Acacia spp., Eucalyptus acmenoides, Lophostemon suaveolens* (stems 5-10cm)
Lower Shrub	1.5	1	Lantana
Ground	0.2-0.4	40	Kangaroo Grass, *Lomandra confertus*

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Eucalyptus propinqua	8	35;30;30;30;35;35;40
Acacia leiocalyx	1	
Eucalyptus acmenoides	11	30;30;30;30;30;30
Lophostemon suaveolens	2	

Disturbance

Type	severity (0-3)	Last Event
Fire	1	D
Logging	2	D
Grazing	1	A
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Erosion evident along tracks

Offset comments: Minor weed removal.
Close tracks.
Thinning of regeneration layer to allow canopy growth

Site ID	132
Date	6/05/2015
Type	Impact
RE	N/A
Recruitment	Minor recruitment of *Lophostemon suaveolens*

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	10	85	As per plot below
Sub-canopy	N/A	N/A	N/A
Shrub	1	<1	Lantana
Lower Shrub	0.6	1	*Lophostemon suaveolens*
Ground	0.1	45	Grasses

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Lophostemon suaveolens	94	30
Acacia disparrima	42	
Lophostemon confertus	10	30
Corymbia intermedia	8	
Allocasuarina torulosa	16	30
Syncarpia glomulifera	5	30
Corymbia torelliana	1	
Tristaniopsis laurina	2	
Acmena smithii	1	
Melaleuca salignus	1	
Foambark	1	

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	0	
Grazing	1	A
Weeds	<1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID	133
Date	6/05/2015
Type	Impact
RE	12.11.3/12.11.14
Recruitment	Recruitment evident

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	28	45	As per plot below
Sub-canopy	18	60	As per plot below
Shrub	10	25	Small eucalypts and *Allocasuarina torulosa*
Lower Shrub	2	25	Lantana
Ground 1	0.5	40	*Lomandra longifolia* and Blady Grass
Ground	0.2	30	Basket Grass

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Corymbia intermedia	42	95;35;35;30;30;30;30;30;30;30;30;30;30
Eucalyptus siderophloia	5	
Syncarpia glomulifera	11	
Lophostemon confertus	39	
Eucalyptus acmenoides	14	30;50;40;30
Allocasuarina torulosa	7	
Eucalyptus microcorys	2	85;35
Alphitonia excelsa	2	
Acacia disparrima	1	
Lophostemon suaveolens	3	

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	2	E
Grazing	1	A
Weeds	2	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Site ID 134
Date 6/05/2015
Type Offset
RE 12.11.3
Recruitment Recruitment evident

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	25	50	As per plot below
Sub-canopy	15	55	As per plot below
Shrub	8	25	As per plot below
Lower Shrub	2	1	*Hovea acutifolia*
Ground 1	1.5	1	Lantana
Ground	0.6	35	*Lomandra longifolia* and mixed grasses

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Eucalyptus acmenoides	11	30;35;35;30;40;30
Corymbia intermedia	32	30;55;60;35;30;40;30;30;30;35;30
Eucalyptus propinqua	3	
Syncarpia glomulifera	6	30
Lophostemon confertus	39	30;40;30
Acacia disparrima	5	
Eucalyptus microcorys	2	30
Allocasuarina torulosa	3	

Disturbance

Type	severity (0-3)	Last Event
Fire	1	D
Logging	0	
Grazing	1	A
Weeds	1	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Offset comments: Minor weed removal

Site ID	135
Date	6/05/2015
Type	Impact
RE	N/A
Recruitment	No evidence of recruitment

Strata Descriptions

Strata	Height (m)	Cover %	Floristic Description
Emergent	N/A	N/A	N/A
Canopy	18	80	As per plot below
Sub-canopy	10	20	As per plot below
Shrub	4	10	*Acacia* species
Lower Shrub	2	50	Lantana
Ground	0.5	10	Exotic grasses including Rhodes Grass, Basket Grass, Blady Grass, Groundsel Bush, Blue Billygoats Weed, Farmers Friend

100x20 Plot (trees 10-30cm DBH)

Species	Count	DBH above 30
Eucalyptus tereticornis	19	35;30;30;30
Acacia disparrima	17	30;60
Lophostemon suaveolens	18	
Syzygium floribundum	39	30;40;35;35;40;40
Acacia maidenii	8	30
Corymbia intermedia	1	35
Black Bean	2	30
Camphor Laurel	2	30
Red Kamala	1	
Creek Sandpaper Fig	2	

Disturbance

Type	severity (0-3)	Last Event
Fire	0	
Logging	0	
Grazing	1	A
Weeds	2.5	A

A:<1yr, B:1-5yrs, C:5-10yrs, D:10-20yrs, E:>20yrs

Note: linear riparian corridor so not in 100m straight transect

GPS Points for data

Waypoint	Easting	Northing	Date	Time
116	472888	7090533	5-May-15	10:38:03
117	472998	7090499	5-May-15	11:16:41
118	472953	7090867	5-May-15	12:06:31
119	472821	7090943	5-May-15	12:39:26
120	472797	7091108	5-May-15	13:11:16
121	472865	7091185	5-May-15	13:31:02
122	472324	7092446	5-May-15	15:04:09
123	472485	7092083	5-May-15	15:35:12
124	470689	7096665	6-May-15	10:49:38
125	470714	7096455	6-May-15	11:12:32
126	471377	7094783	6-May-15	11:36:44
127	471440	7094645	6-May-15	11:51:05
128	471823	7093742	6-May-15	12:27:42
129	472102	7093671	6-May-15	12:46:58
130	472159	7093509	6-May-15	13:07:08
131	472443	7093252	6-May-15	13:30:43
132	472035	7093293	6-May-15	13:50:58
133	472660	7091547	6-May-15	16:19:33
134	472901	7091581	6-May-15	16:35:23
135	473377	7087920	6-May-15	17:10:00

Appendix F - Offsets Assessment Guide

Impact Areas: habitat quality calculation

updated
1/6/15

Patch	area impacted (ha)	Description	mapped RE present	primary food trees present	other suitable habit present	evidence of koalas	weeds, threats	part of a larger landscape?	Site Condition (A)	Site Context (B)	Species stocking rate (C)	Combined Score	weighted score (by ha)
1	1.09	Waypoint 135 south side, KSAT 21. Koala habitat mapped at Traveston Creek	no.	yes, 17% within the 100x20m plot	yes	KSAT21- 0	Exotic grasses including Rhodes Grass, Basket Grass, Blady Grass, Groundsel Bush, Blue Billy goats weed, Farmers Friend.	no	5	0	1	2.0	2.2
2	1.18	waypoint 116 north end, also KSAT 4 and 5. Koala habitat mapped south of Tandur Road.	border 12.11.3 but incorrecty mapped - should be 12.3.11 Recruitment of canopy species apparent	yes, 40% within the plot	yes	KSAT 4- 0 KSAT 5- 0	minimal -Lantana Kangaroo grass, blady grass	although separated from habitat to the north by Tandur Road, considered to be part of a contiguous landscape	8	2	1	3.7	4.3
3	7.30	waypoint 119 north end (southern record), waypoint 120 south end (northern record), KSAT 1, 2 and 3. Koala habitat mapped north of Tandur Road, around Kybong Creek area.	12.3.11 at southern end, no evidence of recruitment. 12.11.3/12.11.14 at northern end	yes, 2% within the plot	yes	KSAT 1- 0 KSAT 2- 4 KSAT 3- 4 Evidence of koalas identified in the mid and northern section of the habitat patch, with evidence observed away from primary food trees at KSAT 3	minimal, some lantana	yes, though connectivity disrupted by powerlink easement and aquaculture farm	8	6	9	7.7	56.0
4	6.80	Waypoint 133, KSAT 19, 17 and 20.	RE12.11.3/12.11.14, with 12.3.11 and 12.11.3/12.11.14 at north	yes, 1.5% within the plot	yes	KSAT 19- 1 KSAT 27- 3 KSAT 20- 0. Evidence of koalas identified in the mid and southern part of the habitat patch	evidence of logging and weeds	yes, though connectivity disrupted by powerlink easement	8	7	7	7.3	49.9
5	12.60	Waypoint 123 and 122, within Traveston State Forest. KSAT 18, 16,15	small portion of 12.11.3 in the south, with Traveston State Forest mapped as 12.11.3/12.11.14	none within waypoint 122, which is the State Forest area (RE12.11.3/12.11.14), and none within waypoint 123 (south of the State Forest Boundary)	yes	KSAT18- 0 KSAT16- 0 KSAT15-0	evidence of logging in last 5-20 years, evidence of fire in last 5	yes, though connectivity disrupted by powerlink easement,	4	7	1	4.0	50.4
6	2.00	Waypoint 132, KSAT14. Vegetation around Cobb's Gully	not mapped as RE.	No primary food trees at waypoint (north end of the patch) but primary food trees documented in the KSAT survey	yes	KSAT14- 0	minimal, some lantana	small patch but connected in the wider context- disrupted by Powerlink	5	4	1	3.3	6.7
7	0.42	no waypoint, no KSAT, too small to survey	mapped as RE 12.11.3	use patch 6 trees as proxy	yes	NA	NA	very small patch contiguous with RE mapping	5	5	1	3.7	1.5
8	2.29	Waypoint 128, KSAT 13	mapped as RE 12.11.3	no primary food trees	Yes	KSAT13- 0	some evidence of weeds and logging	small patch but connected in the wider context- disrupted by Powerlink	4	6	1	3.7	8.4
9	1.66	Acacia regrowth - no KSAT. Habitat on Jackass Creek	not mapped as RE.	no primary food trees	no			Habitat on Jackass Creek	2	4	1	2.3	3.9
10	5.71	waypoint 126 and 127, KSAT 11, 10 and 9. Adjacent to landscape business and Woondum Road	Waypoint 126 RE 12.11.3, waypoint 127 RE 12.3.11	Primary food trees in waypoint 127 and KSAT 10 (consistent with RE12.3.11), not recorded at other points	yes	KSAT 9-0 KSAT 10- 1 KSAT 11-1	very minor evidence of weeds	small patch,with connectivity provided by Jackass Creek to the south.	8	5	3	5.3	30.4
11	0.26	no waypoint, no KSAT, too small to survey. RE consistent with patch 10. vegetation in road reserve outside Woondum State Forest Boundary	RE12.11.3	potentially yes, though area very small	yes	Record from KoalaTracker in adjoining area of Woondum State Forest	NA	adjacent Woondum State Forest, outside SF boundary	8	10	1	6.3	1.7
12	0.90	no waypoint, KSAT 7	not mapped as RE.	yes	yes	KSAT 7- 0	NA	associated with drainage line west of Woondum State Forest, surrounded by Grazing	5	3	1	3.0	2.7
13	3.72	waypoint 124 and 125, KSAT 6. Adjacent old Bruce Highway	not mapped as RE.	yes, at the northern waypoint, not at southern. Yes at KSAT 6	yes	KSAT 6- 0	weeds present	isolated habitat adjacent to Bruce Highway, but connected to east via vegetation along waterway	5	3	1	3.0	11.2
Total	45.92												229.2
												weighted score	5.0

method: site condition + site context _ species stocking rate / 3 = score
weighted score: sum (combined score x size of patch (ha) / 45.9 = weighted score

data sources: KSAT surveys (April 2015) and Habitat quality assessments (May 2015), RE mapping, Koalatracker and DEHP koala records.

Proposed Offsets: habitat quality calculation

updated 17/6/15

Lotplan	area available (ha)	Description	mapped RE present	primary food trees present	other suitable habit present	evidence of koalas	weeds, threats	part of a larger landscape?	Site Condition (A)	Site Context (B)	Species stocking rate (C)	Average	Actions to increase quality?	loss potential without offset?
1382M371313	59.155	waypoints 129, 130 and 131. Excludes portion of the property with the powerlink easement.	RE 12.11.3 RE 12.11.10	No	yes	NA	evidence of logging, some lantana	yes	6	9	5	6.7	close tracks. Minor gap planting with primary food trees. Weed management - lantana	30% property unlikely to be onsold, but if so vegetation may be cleared
totals	59.155													
Quality Score														

data sources: KSAT surveydata sources: KSAT surveys (April 2015) and Habitat quality assessments (May 2015), RE mapping, Koalatracker and DEHP koala records.

Site Condition score metrics

updated
1/6/15

	Site Condition
1	Little or no evidence of suitable habitat, no primary food trees, evidence of weeds, logging, grazing, cultivation or bushfire impacts
2	Little or no evidence of suitable habitat, no primary food trees, no evidence of weeds, logging, grazing, cultivation or bushfire impacts
3	No primary food trees, some suitable habitat, evidence of weeds, logging, grazing, cultivation or bushfire impacts
4	No primary food trees, some suitable habitat, no or minor evidence of weeds, logging, grazing, cultivation or bushfire impacts
5	Primary food trees present, suitable habitat present. No mapped RE.
6	Primary food trees present, suitable habitat present. Vegetation consistent with RE for which a biocondition benchmark exists but does not achieve the Biocondition benchmark.
7	Primary food trees present, suitable habitat present. Vegetation consistent with RE for which a biocondition benchmark exists.
8	Primary food trees present. Vegetation consistent with RE 12.11.3 or RE 12.3.11 but does not achieve the Biocondition benchmark. Evidence of weeds, logging, grazing, cultivation or bushfire impacts
9	Primary food trees present. Vegetation consistent with RE 12.11.3 or RE 12.3.11 but does not achieve the Biocondition benchmark. No evidence of weeds, logging, grazing cultivation or bushfire impacts
10	Primary food trees present. Vegetation consistent with the Biocondition Benchmark for RE 12.11.3 or RE 12.3.11. No evidence of weeds, logging, grazing, cultivation or bushfire impacts

Site Context scoring method

updated 1/6/15

Site context for each impact and offset site has been assessed in accordance with Chapter 6 Site context assessment of the Guide to determining terrestrial habitat quality – A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (Version 1.1 December 2014). This guide provides a robust and scientific method for assessment.

GIS mapping of the impact sites, offset sites and resumption boundary was utilised, with reference to remnant vegetation mapping provided by Department of Natural Resources and Mines and the Queensland biodiversity and vegetation offsets special features map (displaying terrestrial and riparian corridors) to assess four key attributes of a 'fragmented landscape ', as described in Table 1. The score of each attribute was calculated in accordance with the scoring guide provided in Table 2.

Table 1: Attribute Descriptions

Attribute	Description and Method of Calculation
Patch Size	The total area (ha) of the vegetation clearing patch, in addition to all other directly connected areas of mapped remnant vegetation.
Connectedness	The proportion (%) of the site boundary that is connected to remnant vegetation.
Context	The percentage of remnant vegetation mapped as occurring within a one kilometre buffer zone of the site.
Ecological Corridors	The proximity to terrestrial and riparian ecological corridors as shown on the *Queensland biodiversity and vegetation offsets special features map*

Table 2: Site Context Scoring sheet guide

Size of Patch	**Score**	**0**	**2**	**5**	**7**	**10**
	Description	<5ha	5-25ha	26-100ha	101-200ha	>200ha
Connectedness	Score	0	2	4		5
	Description	0-10%	>10%-<50%	50%-75%		>75% or >500ha
Context	Score	0	2	4		5
	Description	<10% remnant	10-30% remnant	>30-75% remnant		>75%
Ecological Corridors	Score	0	4		6	
	Description	Not within	Sharing a common boundary		Within (whole or part)	

The score of each site was then converted to a score out of 10 using the following equation which has been adapted from the guide to calculate site context individually:

(Site context score (measured) / site context score (max = 26)) x 10 = score/10

Each patch was then weighted according to the size (hectares) and all weighted patch scores were added to determine the overall score for the impact sites and offset sites. Note that the weighting was not included when considering the site context score with the site condition and species stocking rates scores, as the per hectare weighting is factored on the combined score for each site.

Source: Chapter 6 Site context assessment of the Guide to determining terrestrial habitat quality – A toolkit for assessing land based offsets under the Queensland Environmental Offsets Policy (Version 1.1 December 2014)

Refer site Context Calcs tab for working

Site Context scoring calculations

updated 1/6/15

Patch	size of patch only (ha)	size of patch and connecting RE (ha)	Size of patch score	Connectedness	Connectedness score	Context (% RE)	Context score	Ecological corridor	Ecological corridor score	Total	Score out of 10	Weighting	Final score
offset 1	13.1	13.1	2	no boundary to RE	0	9	0	none	0	2	1	0.171	0.13
offset 2	4.4	4.4	0	approx. 40%	2	24	2	within part of a terrestrial corridor	6	10	4	0.057	0.22
offset 3	59.1	>500	10	approx. 70%	4	47	4	within a terrestrial corridor	6	24	9	0.770	7.10
													7.45
Impact 1	1.09	1.09	0	no boundary to RE	0	3	0	none	0	0	0	0.024	0.00
Impact 2	1.18	14.28	2	approx. 40%	2	14	2	none	0	6	2.3	0.026	0.06
Impact 3	7.3	27.2	5	>50%	4	22	2	shares a common boundary	4	15	5.8	0.160	0.92
Impact 4	6.8	26.2	5	approx. 60%	4	53	4	within a terrestrial corridor	6	19	7.3	0.149	1.09
Impact 5	12.6	98	5	approx. 60%	4	53	4	within a terrestrial corridor	6	19	7.3	0.276	2.01
Impact 6	2	2	0	no boundary to RE	0	51	4	within a terrestrial corridor	6	10	3.8	0.044	0.17
Impact 7	0.4	1.6	0	>50%	4	39	4	within a terrestrial corridor	6	14	5.4	0.009	0.05
Impact 8	2.2	3.5	0	approx. 80%	5	33	4	within a terrestrial corridor	6	15	5.8	0.048	0.28
Impact 9	1.6	1.6	0	no boundary to RE	0	31	4	within a terrestrial corridor	6	10	3.8	0.035	0.13
Impact 10	5.7	7.1	2	approx. 30%	2	26	2	within a terrestrial corridor	6	12	4.6	0.125	0.58
Impact 11	0.2	>500	10	50% connected but >500ha	5	42	4	within a terrestrial corridor	6	25	9.6	0.004	0.04
Impact 12	0.9	0.9	0	no boundary to RE	0	27	2	within a terrestrial corridor	6	8	3.1	0.020	0.06
Impact 13	3.72	3.72	0	no boundary to RE	0	24	2	within a riparian corridor	6	8	3.1	0.081	0.25
													5.64

Context calculation	1km buffer area - polygon area (ha)	area of RE (ha)	Percent cover
offset 1	469.2	40.8	9
offset 2	463.1	113	24
offset 3	649.8	303.3	47
Impact 1	361.61	12.1	3
Impact 2	375.82	52.5	14
Impact 3	445.2	96.6	22
Impact 4	456.7	242.3	53
Impact 5	546.8	289.3	53
Impact 6	380.4	193.2	51
Impact 7	349.2	135.76	39
Impact 8	392.3	128	33
Impact 9	340.2	104.96	31
Impact 10	439.8	113.8	26
Impact 11	358.8	149.3	42
Impact 12	353	94	27
Impact 13	421.58	100	24

Species Stocking Rate score metrics

updated
1/6/15

	Species Stocking Rate
1	no scats recorded
2	east coast low (low) less than 3.33%
3	east coast low (medium) 3.33% or greater but less than 5%
4	east coast low (medium) 5% or greater but less than 6.67%
5	East coast low (medium) 6.67% or greater but lower than 8%
6	East coast low (medium) 8% or greater but less than 9.5%
7	East coast low (medium) 9.5% or greater but less than 11%
8	East coast low (medium) 11% or greater but less than or equal to 12.59%
9	East coast low (high use) greater than 12.59% but less than or equal to 15%
10	East coast low (high use) greater than 15%

source: Phillips and Callaghan, http://www.biolink.com.au/sites/www.biolink.com.au/files/publications/Phillips%20%26%20Callaghan.pdf

Note- this has changed since the initial offset proposal draft issue, now only includes East Coast (low) in the scoring as that is the relevant population

Offsets Assessment Guide

For use in determining offsets under the *Environment Protection and Biodiversity Conservation Act 1999*
2 October 2012

This guide relies on Macros being enabled in your browser.

Matter of National Environmental Significance	
Name	koala and Grey headed flying Fox
EPBC Act status	Vulnerable
Annual probability of extinction Based on IUCN category definitions	**0.2%**

Key to Cell Colours
User input required
Drop-down list
Calculated output
Not applicable to attribute

Impact calculator

Protected matter attributes	Attribute relevant to case?	Description	Quantum of impact		Units	Information source
Ecological communities						
Area of community	No		**Area**			
			Quality			
			Total quantum of impact	0.00		
Threatened species habitat						
Area of habitat	Yes	59.1 of koala and ghff habitat	**Area**	45.9	Hectares	
			Quality	**5**	Scale 0-10	
			Total quantum of impact	22.95	Adjusted hectares	
Protected matter attributes	**Attribute relevant to case?**	**Description**	**Quantum of impact**		**Units**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No					
Condition of habitat Change in habitat condition, but no change in extent	No					
Threatened species						
Birth rate e.g. Change in nest success	No					
Mortality rate e.g Change in number of road kills per year	No					
Number of individuals e.g. Individual plants/animals	No					

Offset calculator

Protected matter attributes	Attribute relevant to case?	Total quantum of impact	Units	Proposed offset	Time horizon (years)		Start area and quality		Future area and quality without offset		Future area and quality with offset		Raw gain	Confidence in result (%)	Adjusted gain	Net present value (adjusted hectares)	% of impact offset	Minimum (90%) direct offset requirement met?	Cost ($ total)	Information source
Ecological Communities																				
Area of community	No				**Risk-related time horizon (max. 20 years)**		**Start area (hectares)**		**Risk of loss (%) without offset**		**Risk of loss (%) with offset**									
									Future area without offset (adjusted hectares)	0.0	**Future area with offset (adjusted hectares)**	0.0								
					Time until ecological benefit		**Start quality (scale of 0-10)**		**Future quality without offset (scale of 0-10)**		**Future quality with offset (scale of 0-10)**									
Threatened species habitat																				
Area of habitat	Yes	22.95	Adjusted hectares	59.1	**Time over which loss is averted (max. 20 years)**	20	**Start area (hectares)**	59.1	**Risk of loss (%) without offset**	50%	**Risk of loss (%) with offset**	0%	29.55	90%	26.60	25.55	22.62	98.54%	Yes	$150,000.00	
									Future area without offset (adjusted hectares)	29.6	**Future area with offset (adjusted hectares)**	59.1								
					Time until ecological benefit	0	**Start quality (scale of 0-10)**	**7**	**Future quality without offset (scale of 0-10)**	**5**	**Future quality with offset (scale of 0-10)**	**7**	2.00	80%	1.60	1.60				
Protected matter attributes	**Attribute relevant to case?**	**Total quantum of impact**	**Units**	**Proposed offset**	**Time horizon (years)**		**Start value**		**Future value without offset**		**Future value with offset**		**Raw gain**	**Confidence in result (%)**	**Adjusted gain**	**Net present value**	**% of impact offset**	**Minimum (90%) direct offset requirement met?**	**Cost ($ total)**	**Information source**
Number of features e.g. Nest hollows, habitat trees	No																			
Condition of habitat Change in habitat condition, but no change in extent	No																			
Threatened species																				
Birth rate e.g. Change in nest success	No																			
Mortality rate e.g Change in number of road kills per year	No																			
Number of individuals e.g. Individual plants/animals	No																			

Summary

Protected matter attributes	Quantum of impact	Net present value of offset	% of impact offset	Direct offset adequate?	Cost ($)		
					Direct offset ($)	Other compensatory measures ($)	Total ($)
Birth rate	0				$0.00		$0.00
Mortality rate	0				$0.00		$0.00
Number of individuals	0				$0.00		$0.00
Number of features	0				$0.00		$0.00
Condition of habitat	0				$0.00		$0.00
Area of habitat	22.95	22.62	98.54%	**Yes**	$150,000.00	$6,759.94	$156,759.94
Area of community	0				$0.00		$0.00
					$150,000.00	**$6,759.94**	**$156,759.94**