An ORDINARY MEETING of LISMORE CITY COUNCIL will be held at the COUNCIL CHAMBERS, 43 Oliver Avenue, Goonellabah on Tuesday, 8 November 2011 at 6.00pm.

Attachments Excluded From Agenda

Gary Murphy
General Manager

1 November 2011

Attachments

12.3 Adoption of the Draft Comprehensive Koala Plan of Management for south-east Lismore for public exhibition

Draft Comprehensive Koala Plan of Management for south-east Lismore

lismore city council

Lismore: a great place to live and work

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Change Record

Date	Author	Version	Change Reference
01/02/2011	Damian Licari Stephen Phillips	0.1	Working draft.
01/04/2011	Damian Licari Stephen Phillips	0.2	Discussion draft. Approved by Manager, Integrated Planning.
25/10/2011	Damian Licari Stephen Phillips	1.0	Exhibition draft. Approved by Manager, Integrated Planning.

Acknowledgements

A working draft of this Plan was prepared with reference to a number of koala plans of management, including those prepared by Coffs Harbour City Council, Clarence Valley Council and Kempsey Shire Council. Of particular benefit was the draft plan prepared for Lismore City Council which was presented to Council in 2004 but was not adopted.

Then, the working draft of this Plan was presented to a panel of relevant koala and planning experts. These experts reviewed and provided comment on both the proposed regulatory provisions and management activities presented in the working draft. The following people from Lismore City Council and other organisations formed the panel: Steve Bennetts (Rural Works Engineer), Steve Jensen (Department of Planning), Matt Kelly (Compliance Coordinator), Rodney Mallam (Senior Development Assessment/ Heritage Planner), Joe Monks (Senior Ranger), Dr Steve Phillips (Biolink), Nick Stephens (Environmental Strategies Coordinator), John Turbill (Office of Environment and Heritage), Chris Watts (Development Assessment Coordinator), Greg Yopp (Strategic Planner).

Following review by the panel, a discussion draft of this Plan was prepared. This draft was presented to a stakeholder reference group of representatives from industry and environmental interest groups operating in Lismore. This reference group provided substantial comment on the contents of the Plan. The members of the group were: Steve Denize (Chairperson, Lismore City Council), Georgia Beyer (Nature Conservation Trust of NSW), Jolyon Burnett (Australian Macadamia Society), Kel Graham (Cooee Property Rights), Sandra Heuston (Northern Rivers Wildlife Carers Inc), Julie Reid (Envite Environment), Kath Robb (NSW Farmers Association), Malcolm Scott (Consultant Town Planner), Lorraine Vass (Friends of the Koala Inc), Tony Walker (Richmond Landcare Inc) and Jeffrey Zanette (Richmond Banana Growers).

Copyediting and plain English editing of the Plan was undertaken by Donella Andersen, Nature Edit.

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Definitions and Acronyms

In this Comprehensive Koala Plan of Management, the following definitions apply:

"building envelope" means an area of land designated for construction of a dwelling, buildings and ancillary infrastructure as well as any land required to be cleared for a bushfire asset protection zone, ancillary gardens and landscaping.

"Comprehensive Koala Plan of Management" means a plan of management prepared in accordance with *State Environmental Planning Policy 44 – Koala Habitat Protection*.

"core koala habitat" means an area of land with a resident koala population.

"development" has the same meaning as that defined by the *Environmental Planning & Assessment Act* 1979.

"development application" or **"DA"** has the same meaning as that defined by the *Environmental Planning & Assessment Act* 1979.

"development footprint" means the land that is likely to be impacted by any "small development", including any asset protection zone and ancillary infrastructure.

"diameter at breast height over bark" or **"dbhob"** is the diameter of a tree measured 1.4 metres above the ground, as detailed in *AS 4970-2009 Protection of trees on development sites*.

"EP&A Act" means the *Environmental Planning and Assessment Act* 1979.

"food tree" means "preferred koala food tree".

"ha" means hectares.

"infrastructure" means all structures associated with the construction of a single dwelling, dual occupancy and/or secondary dwelling and includes, gardens, landscaping, water tanks, on-site waste water management systems, any access route, road or driveway; but excludes farm dams.

"koala habitat" means "core koala habitat" and/or "preferred koala habitat".

"koala movement corridor" means an area or tract of land that is used, or could be used, by koalas when moving between different areas of their home range or habitat; these areas may include cleared land; these areas do not include "koala habitat".

"koala planning area" means the land to which this Plan applies as described and mapped in Figure 1.

"land" has the same meaning as that defined by the *Environmental Planning & Assessment Act* 1979*.*

"large development" means a subdivision creating more than four allotments or a permissible development that requires development consent and that is not of a scale of a "small development".

"Lismore DCP" means Lismore Development Control Plan 2006.

"Lismore LEP" means the Lismore Local Environment Plan 2000.

"LGA" means local government area.

"mm" means millimetre.

"NPW Act" means the *National Parks and Wildlife Act* 1974.

"NV Act" means the *Native Vegetation Act* 2003.

"PoM" means plan of management.

"preferred koala habitat" means any area identified as either Primary, Secondary A or Secondary B koala habitat as defined in the table below.

	Category	Definition
Preferred Koala Habitat	**Primary**	Vegetation associations and/or communities wherein "primary food tree species" comprise the dominant or co-dominant (i.e. ≥ 50%) overstorey tree species.
	Secondary A	Vegetation associations and/or communities wherein "primary food tree species" are sub-dominant components of the overstorey tree species and usually (but not always) growing in association with one or more "secondary food tree species".
	Secondary B	Vegetation associations and/or communities wherein "primary food tree species" are absent, habitat containing "secondary and/or supplementary food tree species" only.
Other Habitat	**Other**	Native vegetation associations and/or communities within which "preferred koala food trees" are absent.
	Unknown	Vegetation for which there is insufficient data available to enable classification. This includes both individual trees and clumps of trees which are unmapped owing to the resolution of the mapping. These trees may be verified as *koala habitat* by a Koala Habitat Assessment.

"preferred koala food tree" or **"food tree"** means any of the following tree species:

	Common Name	Scientific Name
Primary food tree species	Orange gum	*Eucalyptus bancroftii*
	Forest red gum*	*E. tereticornis*
	Tallowwood	*E. microcorys*
	Swamp mahogany	*E. robusta*
Secondary and/or supplementary food tree species	Grey gum	*E. punctata*
	Thin-leaved stringybark	*E. eugenoides*
	White stringybark	*E. globoidea*
	Small-fruited grey gum	*E. propinqua*
	Narrow-leaved red gum	*E. seeana*

* includes the naturally occurring *E. tereticornis* x *E. robusta* hybrid referred to as *E. patentinervis* by Bale (2003).

"receiving land" means the area of land receiving the benefit of habitat compensation works.

"RG-bSAT" means Regularised Grid-based Spot Assessment Technique.

"SEPP 44" means *State Environmental Planning Policy 44 – Koala Habitat Protection*.

"small development" means a subdivision creating no more than four allotments, a dwelling or buildings and structures ancillary to a dwelling. Also means development that is ancillary to extensive agriculture and/or intensive plant agriculture that requires development consent.

"stadia survey" means stadiametric survey, the recording of the precise location and taxonomic identity of all "preferred koala food trees" on a site, and is to be carried out by a registered surveyor and an appropriately qualified ecologist.

"study area" means the "subject site" and any additional areas that are likely to be directly and/or indirectly impacted by a large development, including any asset protection zone, ancillary and off-site works.

"subject site" means the allotment(s) to which a development application applies.

"suitably qualified person" means a person with a minimum undergraduate qualification from a recognised university in ecology, environmental management or similar and with experience in flora and fauna identification, survey and management, including experience in conducting koala surveys.

"the Plan" or **"this Plan"** means the "Comprehensive Koala Plan of Management for south-east Lismore".

"TSC Act" means the *Threatened Species Conservation Act* 1995.

"tree" has the same meaning as that defined in the Lismore Development Control Plan Part A, Chapter 14 – Tree Preservation Order.

"VMP" means vegetation management plan.

"VCA" means voluntary conservation agreement.

1

1 Aims and Objectives

1.1 Aims

The aims of the Comprehensive Koala Plan of Management for south-east Lismore are:

to ensure that the current extent of preferred koala habitat is maintained in the koala planning area, and to mitigate threatening processes which may limit and/or reduce koala occupancy rates and/or population size.

1.2 Objectives

The overall objectives of the Comprehensive Koala Plan of Management for south-east Lismore (this/the Plan), as it applies to the *koala planning area*[1], are to:

1. identify and list the *preferred koala food tree* species likely to found in the area;
2. map preferred *koala habitat* in the area;
3. ensure that there is no net loss of *preferred* or *core koala habitat* in the area;
4. minimise the effect of threatening processes acting on the koala population;
5. allow for safe koala movement across the landscape;
6. create, manage and/or restore koala habitat linkages and corridors;
7. provide a clear development application assessment pathway, assessment guidelines and performance criteria;
8. provide minimum standard guidelines for koala habitat assessments; and
9. provide guidelines on how to compensate for the loss of *preferred koala food trees* and *preferred koala habitat*.

These objectives will be realised through the regulatory provisions and management activities that are detailed in this Plan.

[1] Words and terms shown in italics are defined in the Definition and Acronyms section of the Plan.

2 Planning Context

2.1 Background

It is recognised that the statutory planning system in which Lismore City Council (Council) operates is complex and often difficult to understand. The purpose of this section is to provide an overview of the main legislation and planning instruments as they relate to the management and conservation of koalas and their habitats in the Lismore Local Government Area (LGA).

2.2 Legislative and planning context

2.2.1 Environmental Planning & Assessment Act 1979

The principal piece of planning legislation in NSW is the *Environmental Planning and Assessment Act* 1979 (EP&A Act). This Act provides a legislative framework for environmental planning, including the assessment of proposed developments. The Council's assessment of a proposed development is guided by this legislation and relevant environmental planning instruments. The EP&A Act provides for the preparation of environmental planning instruments, including State Environmental Planning Policies and local environmental plans. *State Environmental Planning Policy No. 44 – Koala Habitat Protection* is an environmental planning instrument which provides for the protection and conservation of koalas.

State Environmental Planning Policy No. 44 – Koala Habitat Protection

State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP 44) came into effect in 1995. Its objective is to halt the decline in koala populations and to provide for the recovery of koala populations. SEPP 44 applies to local government areas in NSW where koalas are found. The policy encourages the protection and management of natural vegetation that provides food and habitat for koalas. The policy applies to any development application (DA) on contiguous areas of land under the same ownership that are greater than 1 hectare in area, and where 'potential' and/or 'core' koala habitat (as defined in the SEPP) is found. In cases where such a DA proposes to disturb 'potential' or 'core' koala habitat, the DA assessment pathway identified in SEPP 44 must be followed.

Under SEPP 44, there is provision for the preparation of plans of management which aim to protect areas of koala habitat and mitigate the negative effects of a proposed development on resident koalas and their habitat. A Comprehensive Koala Plan of Management, such as this Plan, can be prepared for part of or the whole of an LGA. Individual Koala Plans of Management are prepared for specific land and developments. A DA on land that supports core or potential koala habitat cannot be approved by Council unless an approved Comprehensive or Individual Plan of Management is in place.

A Comprehensive Koala Plan of Management offers a number of significant advantages to both Council and applicants. For Council, a Comprehensive Plan:

- facilitates a strategic and coordinated approach to the management of koalas and their habitat
- reduces the resources required to process individual DAs
- facilitates further government, non-government and community involvement in koala conservation in the Lismore LGA.

For applicants, a Comprehensive Plan:

- removes the need to prepare an Individual Koala Plan of Management (if required)
- reduces the time taken to process a DA
- provides transparent procedures and guidelines for assessing a DA
- ensures that requirements to compensate the loss of *preferred koala food trees*, and *preferred* and *core koala habitat* are documented and transparent.

Lismore Local Environmental Plan 2000 / Draft Lismore Local Environmental Plan 2010 and Lismore Development Control Plan

The Lismore Local Environment Plan 2000 (Lismore LEP), Draft Lismore Local Environment Plan 2010[2] and the Lismore Development Control Plan 2006 (Lismore DCP) provide the planning framework for encouraging orderly development within Lismore LGA while protecting the natural and built environments. The Lismore LEP zones all land in the

[2] It is noted that the Draft Lismore Local Environmental Plan 2010 has not yet been gazetted by the Department of Planning.

LGA. For each zone, the LEP provides objectives and identifies land uses that are permitted either with or without development consent. The Lismore DCP supplements the LEP by providing more detailed information and planning standards and controls.

2.2.2 Threatened Species Conservation Act 1995

Council is required to consider a range of environmental matters, including the actual or likely impact of a proposed development on threatened species, populations, ecological communities or their habitats listed in the *Threatened Species Conservation Act* 1995 (TSC Act). The koala is listed as a 'vulnerable' threatened species in Schedule 2 of the TSC Act.

2.2.3 Native Vegetation Act 2003

In NSW, the *Native Vegetation Act* 2003 (NV Act) regulates the clearing of native vegetation on Rural and Rural Residential lands. Urban areas and lands in the conservation and forestry estates are not subject to the provisions of the NV Act. Clearing approvals under the NV Act are determined by the Northern Rivers Catchment Management Authority. Approvals for harvesting timber from native forests on private lands are also determined by the Authority. In addition, the Office of Environment and Heritage is responsible for monitoring compliance.

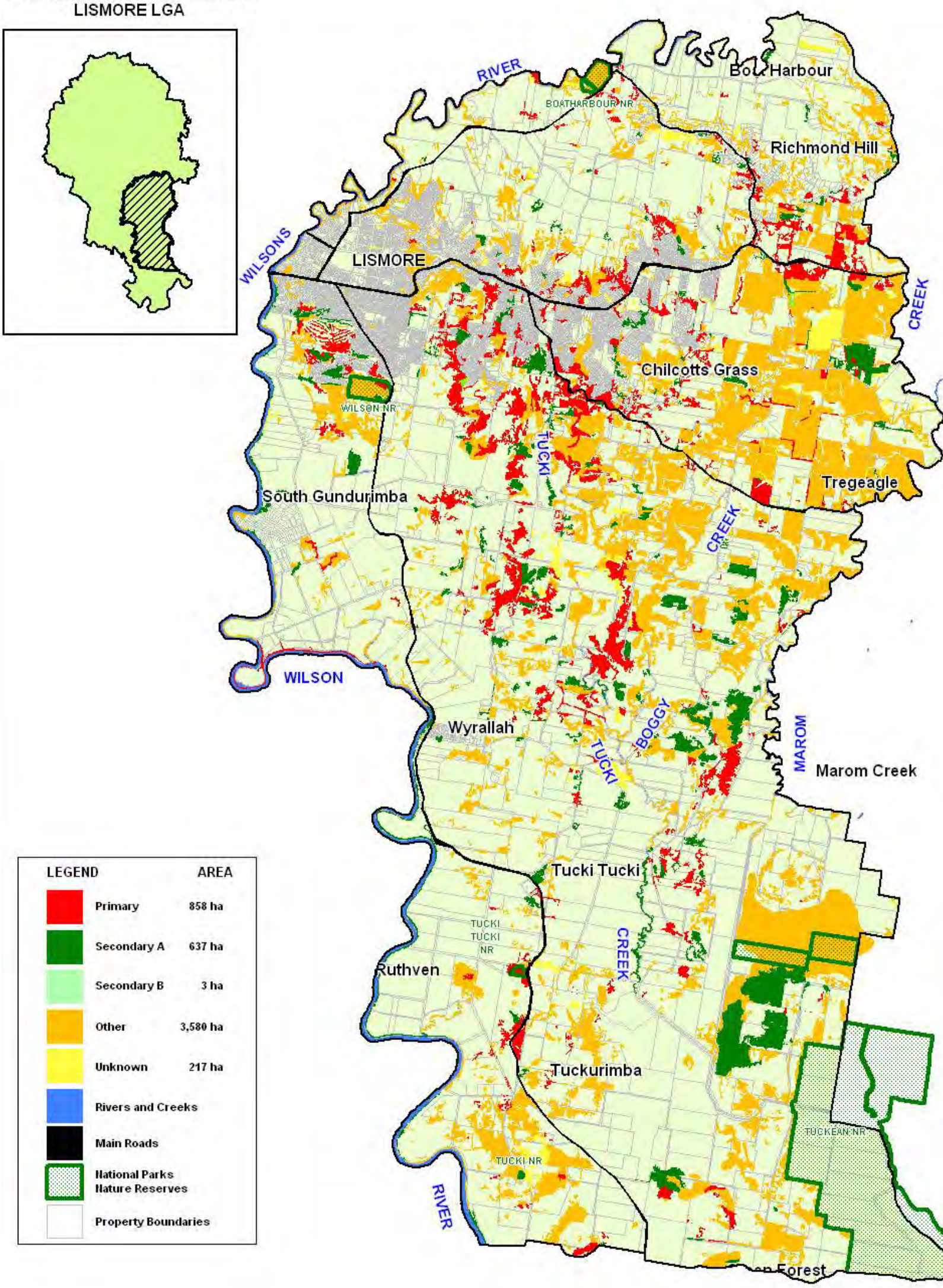
3 General Provisions

3.1 Land to which the Plan applies

Land to which the Comprehensive Koala Plan of Management for south-east Lismore applies is *land* in the *koala planning area* located in the south-east portion of Lismore LGA as shown on Figure 1.

The *koala planning area* is bounded by the Wilsons River in the north and west and the border with Ballina Shire in the east. In the south the boundary follows Delelvin Lane, Paff Lane, Maxwell Lane, Tuckean Island Road, then the drainage canal to the south of Tuckean Island Road and along the southern boundary of Tuckean Nature Reserve.

KOALA PLANNING AREA WITHIN LISMORE LGA



LEGEND	AREA
Primary	858 ha
Secondary A	637 ha
Secondary B	3 ha
Other	3,580 ha
Unknown	217 ha
Rivers and Creeks	
Main Roads	
National Parks Nature Reserves	
Property Boundaries	

Preferred Koala Habitat within the koala planning area

LISMORE CITY COUNCIL

0 1.5 3
kilometres
Original Map Reproducted in A3 Format

Printed: 21.10.2011
Scale: 1:70,000

Figure 1. Map of Preferred Koala Habitat within the koala planning area

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3.2 Land to which the Plan does not apply

The Plan does not apply to:

1. Crown lands within the *koala planning area* that are in the conservation or forestry estate
2. lands that are outside the *koala planning area* which are contiguous areas under the same ownership greater than 1 hectare and to which a DA proposes to disturb 'potential' and/or 'core' koala habitat – the provisions of SEPP 44 apply to these lands.

However, the provisions of this Plan should be used as a guide for lands outside the *koala planning area*, including the assessment pathway for DAs (Section 4.1), assessment of koala habitat (Section 4.2), preferred koala food tree and habitat retention guidelines (Section 4.3), preferred koala food tree and habitat compensation guidelines (Section 4.4), and performance criteria (Section 4.5).

3.3 Relationship to other Koala Plans of Management

The Plan does not supersede any approved Individual Koala Plans of Management that are currently in force in the *koala planning area*. Approved and conditional Individual Koala Plans of Management currently in force are detailed in Table 1. Should any of these Individual Koala Plans of Management have a requirement to be reviewed or updated, that review or update should be in accordance with this Plan.

3.4 Duration of the Plan

The Plan will take effect on <INSERT DATE> which is the date it was approved by the Department of Planning. The Plan is to remain in effect for a period of 15 years unless amended and/or superseded. The Plan must be reviewed five and ten years after taking effect. However, the Plan may be reviewed at any time at the discretion of Council.

Table 1. List of the approved Individual Koala Plans of Management currently enacted within the koala planning area

LCC DA No.	DoP File No.	Address	Lot(s)/DP(s)
96/271	G96/00236	Caroona Nursing Home 65 & 101 Rous Road, Goonellabah	Lot 291 DP 800777 Lot 23 DP 259391
01/297	G01/00168	6 Windsor Court, Goonellabah	Lot 3 DP 1031507
01/367	G01/00146	International Residential College Cynthia Wilson Dr & Rifle Range Road, Lismore	Lot 1 DP 625561
01/754	G02/00016	35 Greenwood Dr ,Goonellabah	Lot 45 DP 1031507
02/233	G02/00111	Communications Tower 49A John Street, Girards Hill	
02/516	G02/00127	Communications Tower Lismore Crematorium, Goonellabah	Lot 588 DP 728678
05/253	GRA6323753	29 Airforce Road East, Lismore	Lot 1 DP 715446
06/1	GRA6323917	Conner Road, Tregeagle	Lot 1 DP 731808 Lot 13 DP 734809
07/426	G07/00079	218A, 218B, 268B and 309A Henson Road, Wyrallah	Lot 105 DP 755705 Lot 111 DP 755705 Lot 5 DP 252788 Lot 10 DP 1092151
	11/02329	98 Ballina Road, Goonellabah	Lot 31 DP 1079954

4

Regulatory Provisions

4.1 Development Application Assessment Pathways

Lodging a DA with Council on *land* in the *koala planning area* (see 3.1) for a land use that requires development consent under the Lismore LEP, 'triggers' the provisions and guidelines of this Plan. Activities that are permitted without consent do not 'trigger' and do not need to comply with this Plan. The word 'development' in this Plan has the same meaning as that in the EP&A Act.

The assessment pathways detailed in Table 2 and Figure 2, 3 and 4 indicate the process to be followed in the assessment of all DAs on *land* in the *koala planning area*. Note that the detailed work instructions specified in columns A', B' and C' of the above figures take precedence over any summarised description provided in the flow charts in columns A, B and C.

Table 2. DA Assessment Pathways to be followed by Council in determination of DAs on land in the koala planning area

DA Assessment Pathway	Purpose
A: Preliminary Assessment (Figure 2)	The purpose of the preliminary assessment is to determine if either this Plan or SEPP 44 applies to the DA.
B: Habitat Assessment (Figure 3)	The purpose of the habitat assessment is to determine if the DA's *development footprint* or *study area* contains *preferred koala food trees* (*food trees*) or *koala habitat* and/or is part of a *koala movement corridor*.
C: Compliance (Figure 4)	The purpose of the compliance component of the assessment is to: • determine if all options to avoid, minimise and or mitigate the impact of the development on *food trees* and/or *koala habitat* have been exhausted, and to establish if clearing is proposed • determine that food trees or habitat compensation guidelines have been met • ensure that the proposal meets the performance criteria detailed in the Plan.

Pathway A: Preliminary Assessment

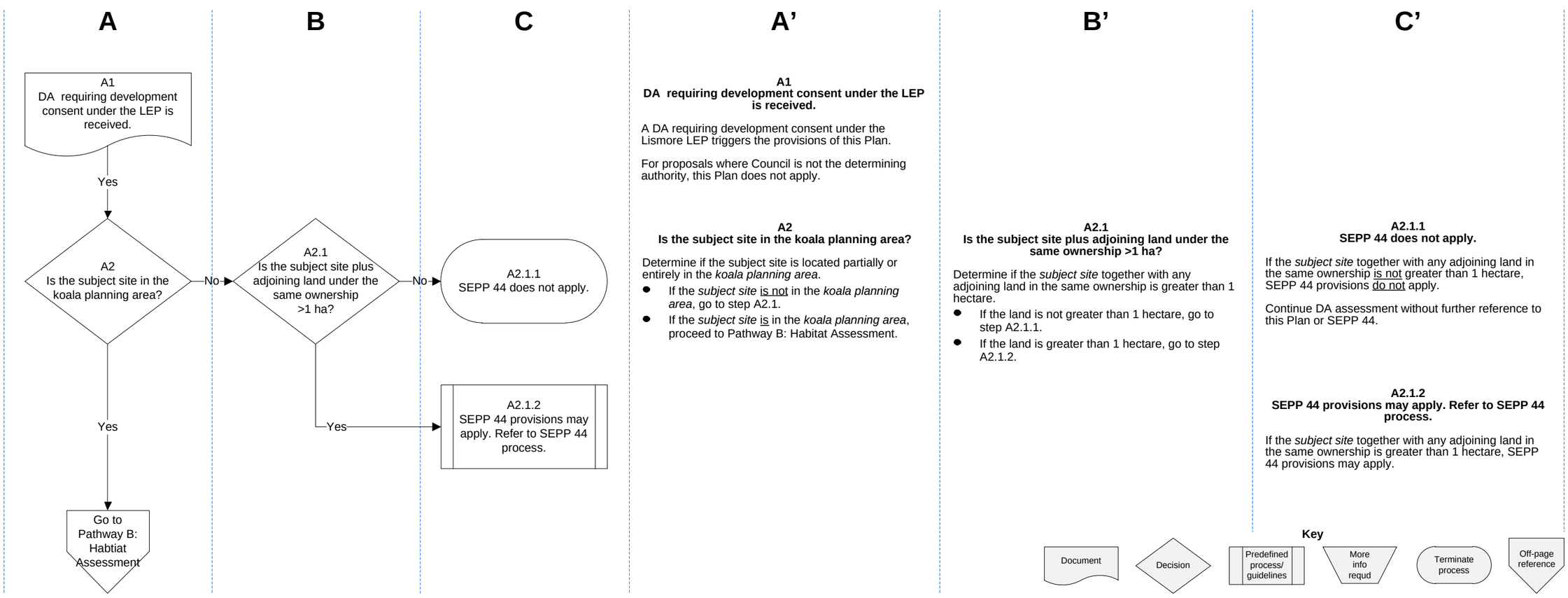

Figure 2. Development Application Assessment Pathway A: Preliminary Assessment

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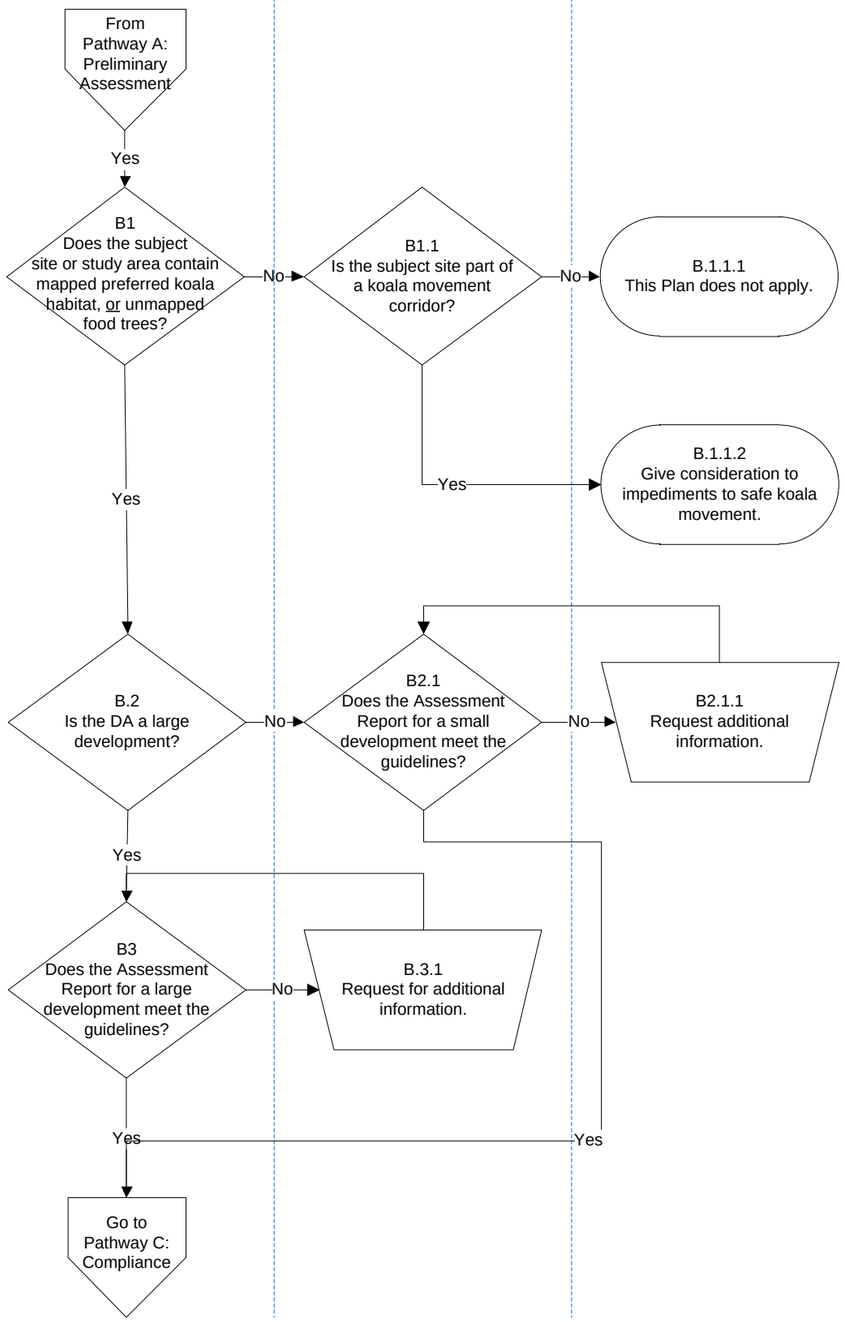
Pathway B: Habitat Assessment



A'

B1 Does the subject site or study area contain mapped preferred koala habitat, OR does it support unmapped food trees?

Determine if the *subject site* or *study area* contains either mapped *preferred koala habitat* (see Figure 1) or unmapped *preferred koala food trees* (*food trees*). Identification of *food trees* must be conducted by a *suitably qualified person*.

- If the *subject site* or *study area* contains neither mapped *preferred koala habitat* nor *food trees*, go to step B1.1.
- If the *subject site* or *study area* contain either mapped *preferred koala habitat* or *food trees*, a Koala Habitat Assessment Report (Assessment Report) is required, go to step B2.

B2 Is the DA for a large development?

Determine if the DA is for a *large development*.

- If the DA is not for a *large development*, go to step B2.1
- If the DA is for a *large development*, go to step B3

B3 Does the Assessment Report for a large development meet the guidelines?

A Koala Habitat Assessment Report (Assessment Report) must be provided if the *study area* contains either mapped *preferred koala habitat* or *food trees*. Determine whether or not the Assessment Report meets the requirements of the guidelines in Section 4.2.2 of the Plan.

- If the Assessment Report does not meet guidelines, go to step B3.1.
- If the Assessment Report does meet guidelines, proceed to Pathway C: Compliance.

B'

B1.1 Is the subject site part of a koala movement corridor?

Using Council koala habitat and vegetation mapping, consultant reports in the locality of the *subject site*, and koala records from the Atlas of NSW Wildlife, determine if the *subject site* is part of a *koala movement corridor*.

- If the *subject site* is not part of a *koala movement corridor* and does not contain *food trees*, go to step B1.1.1.
- If the *subject site* is part of a *koala movement corridor*, go to step B1.1.2.

B2.1 Does the Assessment Report for a small development meet the guidelines?

A Koala Habitat Assessment Report (Assessment Report) must be provided if the *development footprint* contains either mapped *preferred koala habitat* or *food trees*. Determine whether or not the Assessment Report meets the requirements of the guidelines in Section 4.2.1 of the Plan.

- If the Assessment Report does not meet the guidelines, go to step B2.1.1.
- If the Assessment Report does meet guidelines, proceed to Pathway C: Compliance.

B3.1 Request additional information.

If the Assessment Report does not meet the requirements of the guidelines in Section 4.2.2 of the Plan, ask the applicant to provide an Assessment Report that meets the requirements of those guidelines.

C'

B1.1.1 This Plan does not apply.

If the *subject site* is not part of a *koala movement corridor*, and does not contain food trees, then continue the DA assessment without further reference to this Plan.

B1.1.2 Give consideration to impediments to safe koala movement.

If the *subject site* is part of a *koala movement corridor*, consider whether the development activity will create any impediments to the safe movement of koalas across the landscape.

Apply the Performance Criteria identified in Sections 4.5.1 (2) and 4.5.2 (1) of the Plan. Then continue the DA assessment without further reference to this Plan.

B2.1.1 Request additional information.

If the Assessment Report does not meet the requirements of the guidelines in Section 4.2.1 of the Plan, then ask the applicant to provide an Assessment Report that meets those guidelines.

Key

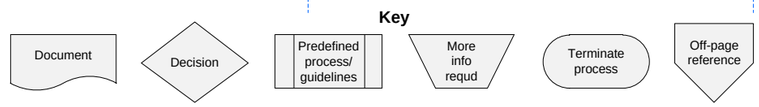


Figure 3. Development Application Assessment Pathway B: Habitat Assessment

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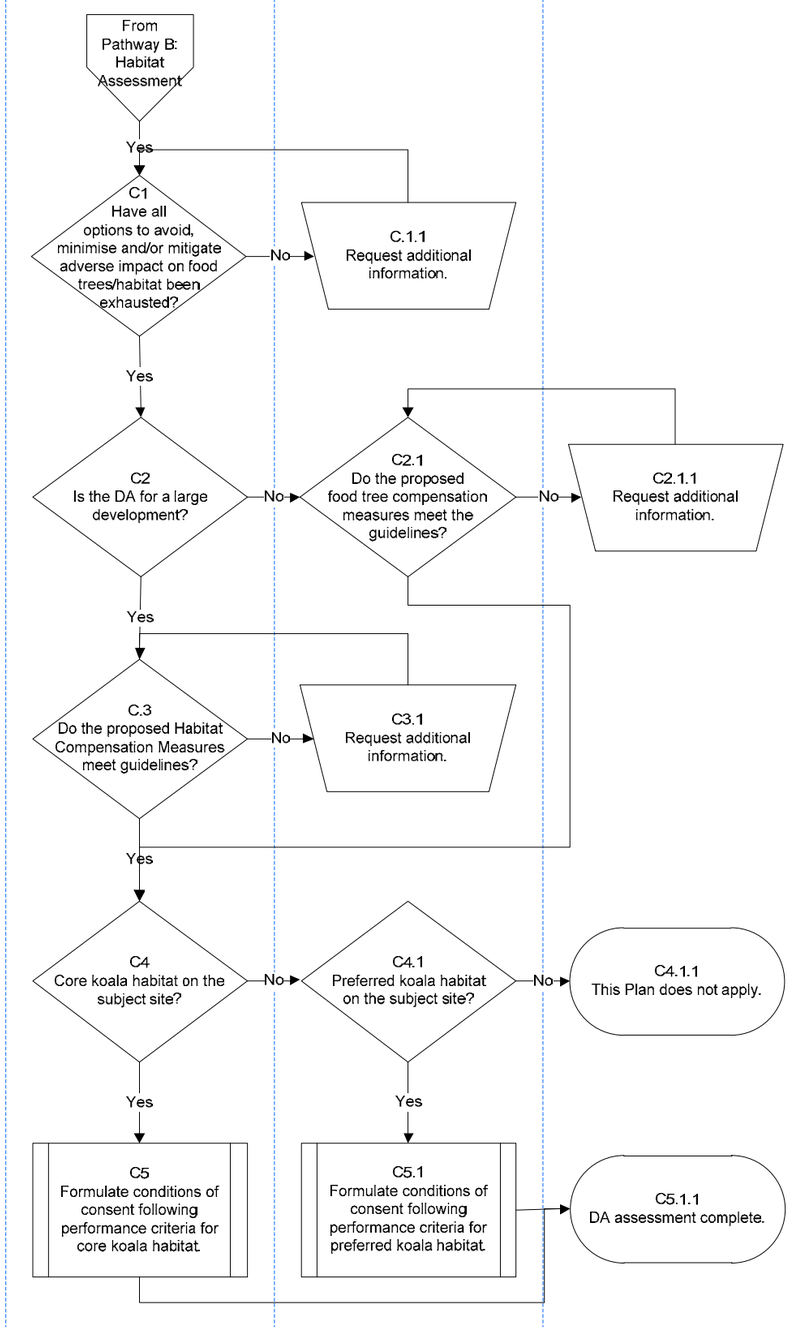
Pathway C: Compliance



A'

C1 Have all feasible options to avoid, minimise and/or mitigate adverse impact on food trees/koala habitat been exhausted?

Determine if the *preferred koala food trees* and habitat retention guidelines in Section 4.3 of the Plan have been followed.

- If all feasible options to avoid, minimise and/or mitigate impact on *food trees* and/or *koala habitat* have not been exhausted, go to step C1.1.
- If all feasible options to avoid, minimise and/or mitigate impact on *food trees* and/or *koala habitat* have been exhausted, go to step C2.

C2 Is the DA for a large development?

Determine if the DA is for a *large development*.

- If the DA is not for a *large development*, go to step C2.1.
- If the DA is for a *large development*, go to step C3.

C3 Do the proposed habitat compensation measures meet the guidelines?

For large developments, determine if the proposed habitat compensation measures meet the requirements of the guidelines in Section 4.4.2 of the Plan and/or do they comply with the Habitat Compensation Policy (Appendix 2).

- If the proposed habitat compensation measures do not meet the guidelines, go to step C3.1.
- If the proposed habitat compensation measures do meet the guidelines, go to step C4.

C4 Core koala habitat on the subject site?

Determine if the Assessment Report has verified whether any unmapped *food trees* and/or areas mapped as *preferred koala habitat* are *core koala habitat*.

- If unmapped *food trees* and/or areas mapped as *preferred koala habitat* are not verified as *core koala habitat* in the Assessment Report, go to step C4.1.
- If unmapped *food trees* and/or areas mapped as *preferred koala habitat* are verified as *core koala habitat* in the Assessment Report, go to step C5.

C5 Formulate conditions of consent following performance criteria for core koala habitat.

Pursuant to the performance criteria for *core koala habitat* detailed in Section 4.5.2 of the Plan, formulate conditions of consent for the DA.

B'

C1.1 Request additional information.

If the documentation supporting the DA does not provide a sound rationale or does not meet the requirements of the guidelines in Section 4.3 of the Plan, then ask the applicant to provide sufficient information to meet the requirements of those guidelines.

C2.1 Do the proposed food tree compensation measures meet the guidelines?

For small developments, determine whether or not the proposed food tree compensation measures meet the requirements of the guidelines in Section 4.4.1 of the Plan.

- If the proposed *food tree* compensation measures do not meet the guidelines, go to step C2.1.1.
- If the proposed *food tree* compensation measures do meet the guidelines, go to step C4.

C3.1 Request additional information.

If the documentation supporting the DA does not provide sound reasons or does not meet the requirements of the guidelines in Section 4.4.2 of the Plan, then ask the applicant to provide sufficient information to meet the requirements of those guidelines.

C4.1 Preferred koala habitat on the subject site?

Determine if the Assessment Report has verified whether any unmapped *food trees* and/or areas mapped as *preferred koala habitat* are *preferred koala habitat*.

- If unmapped *food trees* and/or areas mapped as *preferred koala habitat* are not verified as *preferred koala habitat* in the Assessment Report, go to step C4.1.1.
- If unmapped *food trees* and/or areas mapped as *preferred koala habitat* are verified as *preferred koala habitat* in the Assessment Report, go to step C5.1.

C5.1 Formulate conditions of consent following performance criteria for preferred koala habitat.

Pursuant to the performance criteria for *preferred koala habitat* detailed in Section 4.5.1 of the Plan, formulate conditions of consent for the DA.

C'

C2.1.1 Request additional information.

If the documentation supporting the DA does not meet the requirements of the guidelines in Section 4.4.1 of the Plan, then ask the applicant to provide sufficient information to meet the requirements of those guidelines.

C4.1.1 This Plan does not apply.

If the *subject site* does not contain unmapped *food trees* and the Assessment Report indicates that there is no *core koala habitat* (step C4) or *preferred koala habitat* (step C4.1) on the land, then continue the DA assessment without further reference to the Plan.

C5.1.1 DA assessment complete.

The Development Application Assessment Pathway has been completed. Terminate process.

Key

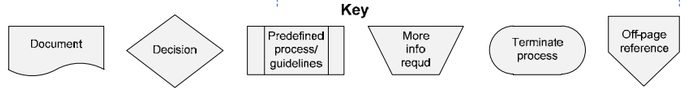


Figure 4. Development Application Assessment Pathway C: Compliance

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4.2 Koala Habitat Assessment Reports

4.2.1 Small developments

A Koala Habitat Assessment Report (Assessment Report) for *small developments* must be consistent with the following:

1. *Methodological guidelines*

   a. any *food tree* greater than or equal to 100 mm diameter at breast height over bark (dbhob) that occurs within the *development footprint* of *land* zoned Rural or the *subject site* of land use zones other than Rural must be assessed for evidence of use by koalas in accordance with the Spot Assessment Technique as described in Appendix 1 – Sampling and Assessment of Koala Habitat using the Spot Assessment Technique;

   b. the assessment must be undertaken by a Council officer or by a *suitably qualified person* who has been accredited in both the application and interpretation of Spot Assessment Technique data by an organisation and/or individual recognised by Council.

2. *Content guidelines*

   For *small developments*, the Assessment Report must include the following:

   a. an accurate map, plan and/or aerial photograph indicating the location of:

      i. the *subject site* and proposed *development footprint*;

      ii. all *food trees* including those that are proposed to be removed or lopped or isolated from koala use (e.g. fenced);

      iii. any trees that are being utilised by koalas at the time of the survey.

   b. a table detailing the species, size class (<100 mm dbhob, 100–300 mm dbhob and >300 mm dhob) and number of *food trees* that are proposed to be removed or lopped or isolated from koala use (e.g. permanently fenced).

4.2.2 Large developments

An Assessment Report for *large developments* must be consistent with the following guidelines.

1. *Survey guidelines*

   A *stadia survey* of all *food trees* greater than or equal to 100 mm dbhob on the *subject site* must be conducted.

1.

Table 3. Regularised Grid-based Spot Assessment Technique (RG-bSAT) grid cell sampling intensities for three categories of land area

Area of subject site	Initial RG-bSAT sampling intensity	Detailed RG-bSAT sampling intensity
<15 ha	150 m x 150 m	75 m x 75 m
15–50 ha	250 m x 250 m	125 m x 125 m
>50 ha	350 m x 350 m	175 m x 175 m

2. *Methodological guidelines*

   For *large developments*, the koala habitat assessment must:

   a. identify the spatial extent and type (i.e. structure and floristic composition) of all vegetation communities on the *subject site*;

   b. be undertaken in accordance with the approach described in Appendix 1 and at the sampling intensities specified in Table 3;

   c. be undertaken by a *suitably qualified person* who has been accredited in the application and interpretation of Spot Assessment Technique data by an organisation and/or individual recognised by Council.

3. *Structure and content guidelines*

   For *large developments*, the Assessment Report:

   a. must include the minimum structure and content requirements as detailed in Table 4. However, additional information may be required according to the nature of the proposed development and the requirements of Council;

   b. may be included in a Flora and Fauna Assessment if required under Parts 4 and 5 of the EP&A Act and Part 6 of the TSC Act, provided that the minimum structure and content requirements for the Assessment Report are addressed.

4.3 Preferred koala food trees and habitat retention guidelines

1. Strategies to retain and protect food trees and koala habitat

a. Avoiding, minimising and mitigating impacts are the three strategies employed to manage the adverse effects of development activities on koalas and their habitat,

and to reduce the scale and intensity of any adverse impact of development activity.

Table 4. Minimum structure and content requirements for a Koala Habitat Assessment Report

1.0 Background	
• Briefly describe the nature of the proposed development.	□
• Identify the Lismore LEP zoning(s) of the *subject site* and adjacent areas.	□
2.0 Links to legislation, other plans and documents	
• Demonstrate how the Assessment Report links to legislation, other plans and documents that relate to the proposed development.	□
3.0 Study Area	
• Identify the location and extent of the *study area* to be covered by the Assessment Report, including the *subject site* and any other areas that may be directly or indirectly impacted by the proposed development.	□
• Describe the type, extent and current condition of existing *koala habitat* in the *study area*.	□
• Describe the broader context of other vegetation in the *study area* and the landscape in general.	□
• Detail any environmental constraints and any significant or sensitive environmental features of the *subject site*.	□
4.0 Methods	
• Describe in detail the methodology used to sample the vegetation on the *subject site*.	□
• Include a map/plan with the overlain grid used to identify detailed and initial RG-bSAT sampling sites.	□
4.0 Results	
• Include a map/plan detailing the location of: o the proposed development and associated *infrastructure* and any requirement for an asset protection zone o all vegetation including *food trees*, and any areas of *core koala habitat* (as determined by the RG-bSAT assessment) o any *food trees* and/or *koala habitat* that are proposed to be directly and/or indirectly impacted, removed, regenerated and/or revegetated.	□
• Include a table detailing the: o area of all vegetation by vegetation type (including *koala habitat*), any area of vegetation proposed to be removed, regenerated and/or revegetated o species, size class (<100 mm dbhob, 100–300 mm dbhob and >300 mm dhob) and number of *food trees* that are proposed to be impacted.	□
5.0 Conclusion	
• Identify limitations to the assessment and further issues that might need to be addressed.	□
• Interpret and discuss the results of the koala habitat assessment.	□
• Include a proposal for a Habitat Compensation Plan that meets the habitat compensation guidelines in this Plan.	□
6.0 References	
• Include a list of all references cited in the report.	□
7.0 Appendices	
• Include any additional information or supplementary material pertinent to the DA proposal.	□

b. The three strategies identified in (1)(a) above must be applied for all development activities and at all stages of the proposed development;

c. Council must not grant approval for clearing of *food trees* or *koala habitat* unless:

i. the intended measures to avoid, minimise and mitigate likely and potential impacts of the development activity are documented and presented with the DA;

ii. sound and logical reasons are provided as to why the retention of *food trees* or *koala habitat* is not feasible.

2. <u>Avoidance and/or minimisation of adverse impacts on food trees and koala habitat</u>

a. Avoiding and/or minimising adverse impacts on *food trees* and *koala habitat* may be achieved through suitable site selection, sound development design and comprehensive planning:

i. for the purposes of this Plan, retaining *food trees* and/or *koala habitat* are seen as avoiding and minimising strategies, not mitigating/compensating measures;

ii. where site selection, development design and planning do not allow adverse impacts on *food trees* and/or *koala habitat* to be avoided, tree retention must be undertaken in a hierarchical manner as follows: firstly, *food trees* and native trees >300 mm dbhob are to be retained; secondly, *food trees* and native trees 100–300 mm dbhob; thirdly, *food trees* and native trees <100 mm dbhob; lastly, exotic trees, diseased and/or structurally unsound *food trees* and native trees that are unlikely to survive in the short term;

b. On lands to which the NV Act applies:

i. where clearing is for a single dwelling, any clearing must be the minimum extent necessary to carry out the development (in line with the *Native Vegetation Regulation* 2005 Clause 6);

ii. where development consent is required under the EP&A Act, pursuant to the provisions of the NV Act, the maximum clearing distances detailed in *Native vegetation management in NSW Info Sheet 7b* apply;

c. Examples of avoiding and/or minimising the impact of development activity include:

i. precluding development activity in verified *koala habitat*;

ii. changing the route of an access road or transmission line to avoid clearing *koala habitat*;

iii. changing the location and/or design of a dwelling to avoid clearing trees identified as *food trees*;

iv. retaining *food trees* on Council- and/or community-owned land in road reserves, parks or community allotments;

d. After all feasible ways to avoid and/or minimise impacts have been identified and/or implemented, mitigation of any residual impacts must be undertaken.

3. *Mitigation of residual impacts of development activity*

a. Mitigation measures must be implemented to ameliorate the residual impacts of development activities where the impacts are unavoidable through site selection, development design and planning;

b. Examples of mitigation of residual impacts of development activity include:

i. establishing a mature tree–sized protection zone (in accordance with *AS 4970-2009 Protection of trees on development sites*) for remnant *food trees* that are retained on private land, regardless of the size of the tree at the time of lodging the DA;

ii. erecting temporary fencing to protect retained *food trees* during construction works;

iii. lopping or pruning diseased tree limbs which may reduce the long-term structural integrity of a retained *food tree* (in accordance with *AS 4373-2007 Pruning of amenity trees*);

c. Only after all feasible mitigation measures have been identified and/or implemented will compensation for loss of trees identified as *food trees* or *koala habitat* be considered.

4.4 Preferred koala food tree and habitat compensation guidelines

4.4.1 Food tree compensation measures

Where removal of *preferred koala food trees* (*food trees*) is required, the following compensation measures apply:

1. *Food tree replacement ratio*

a. Any *food trees* removed must be replaced according to the ratio detailed in Table 5, or, at Council's discretion the applicant may conduct enhancement works which improve the integrity and viability of *food trees* or *koala habitat* on the *subject site*.

a.

Table 5. Replacement ratios for three size classes of food trees

Food tree size class (dbhob)	Replacement ratio (replacement:removed)
<100 mm	6:1
100–300 mm	8:1
>300 mm	10:1

b. Examples of enhancement works include:

   i. removal of woody weeds in an area of degraded vegetation containing *koala habitat* located on the *subject site*;

   ii. temporarily excluding stock from an area of regenerating *food trees* located on the *subject site*;

   iii. lopping or pruning diseased tree limbs which may reduce the long-term structural integrity of a large, retained *food tree*.

2. *Replacement food trees*

a. Any replacement *food trees* must be:

   i. of the same species as those removed from the *subject site*;

   ii. sourced from seed stock of local provenance;

   iii. planted in a cluster and, where feasible, in the vicinity of any retained *food trees*;

   iv. protected, nurtured and maintained until the trees have grown to a minimum height of 3 metres;

b. The planting of replacement *food trees* as well as their ongoing protection, nurture and maintenance is at the cost of the applicant.

3. *Location of plantings*

a. Where there is sufficient land on the *subject site* to support the establishment and growth of mature *food trees*, any *food trees* removed should be replaced on the *subject site*;

b. At Council's discretion and at the cost of the applicant, in cases where it is not feasible to plant replacement *food trees* on site, all or a proportion of the replacement trees may be planted off the *subject site* either:

i. on Council-owned land; or

ii. on some other land approved by Council for use as a compensation site.

4. *Ongoing protection, nurture and maintenance*

a. In cases where all or a proportion of replacement *food trees* are proposed to be planted on the *subject site*, the applicant is required to state how seedlings are to be protected, nurtured and maintained (e.g. tree guards, fencing, exclusion of stock, program for weed suppression and removal);

b. Any replacement trees that are planted on the *subject site* that die before they have grown to a height of 3 metres must be replaced by the applicant and at the cost of the applicant.

4.4.2 Habitat compensation measures

1. Application of the habitat compensation framework

a. An activity to compensate for adverse impacts of development activity (in particular, the clearing of native vegetation) should only be approved if Council considers that:

i. the requirements of all relevant legislation, planning instruments and policies have been applied;

ii. all feasible options to negotiate alternatives to avoid clearing, minimise clearing when clearing is unavoidable, and mitigate the adverse impacts of clearing have been exhausted and where appropriate undertaken;

iii. there are good prospects that proposed compensation works will lead to an improvement in the environmental values of *koala habitat*. In cases where compensation works are not feasible or there is a high risk that works may fail, application of this framework is not appropriate and should not be considered;

iv. application of compensation works has been conducted in accordance with the principles outlined in the Habitat Compensation Policy in Appendix 2;

v. The Habitat Compensation Plan identified in the Koala Habitat Assessment Report complies with this policy;

b. The minimum area required for compensation works for each class of koala habitat and for each category of compensation works defined in this Plan is to be calculated using the compensation multiplier formula detailed in the Habitat Compensation Policy in Appendix 2;

c. Where appropriate, compensation works may be undertaken concurrently with other activities that protect, enhance or create habitat (i.e. on the same *receiving land*). These works may include the creation of riparian corridors (as defined in the *Water Management Act* 2000) and revegetation of areas reserved for stormwater management and biological buffers;

d. With respect to Council *infrastructure* development and/or activities that fall under Part 5 of the EP&A Act, Council should ensure that the Habitat Compensation Policy is met.

2. *Receiving lands*

a. For compensation works to be applied under this Plan, Council must ensure that the habitat on the *receiving land* is the same or similar ecological community as the habitat that is lost to development activity;

b. Subject to compliance with clause (2)(a) above:

i. *receiving land*(s) should be on the *subject site* and/or adjacent to the *subject site*, or;

ii. in cases where it is not feasible to comply with clause (2)(b)(i) above, the *receiving land* should be anywhere within Lismore LGA where a relationship between the proposed development, the direct/indirect impacts of the proposed development, and the *receiving land* can be fairly and reasonably established;

c. For habitat creation to be applied as habitat compensation works, the *receiving land* must be determined to be a *koala movement corridor* or there must be some sound ecological reason to create habitat.

3. *Submission, implementation and monitoring of a vegetation management plan/plan of management*

a. For habitat compensation works to be applied under this Plan, Council must ensure that:

i. proposed compensation works are documented in a vegetation management plan (VMP) or, where appropriate, a plan of management (PoM);

ii. any VMP/PoM must be prepared in accordance with the structure and content of the most recently published Council guidelines for the preparation of VMP/PoMs;

iii. the VMP/PoM is to be prepared and implemented by *suitably qualified person*(s) with experience in current best practices for native vegetation rehabilitation, regeneration and revegetation;

iv. the VMP/PoM must include specific, measurable and time-bound performance criteria and a schedule of works by which to measure the success of the plan;

v. Council must approve the VMP/PoM prior to the commencement of any works associated with the DA;

b. In accordance with the performance criteria and the schedule of works referred to in clause 3a above, Council should be satisfied that:

i. there are adequate resources and funds to develop and implement the VMP/PoM for both the initial habitat compensation works and the associated management activities required for a minimum five-year maintenance period following the completion of the initial phase of habitat compensation works;

ii. the proponent will provide a monitoring report as evidence that implementation of the VMP/PoM has progressed to agreed performance criteria and schedule of works at the completion of initial habitat compensation works and then annually until the end of the term of the VMP/PoM;

iii. the initial habitat compensation works and associated ongoing management activities are secured with a bond to be held in trust by Council;

c. Where the proposed development involves:

i. the erection of a building or rural land-sharing community, initial habitat compensation works must be implemented prior to the release of the Occupation Certificate;

ii. a subdivision, initial habitat compensation works must be implemented prior to the release of the Subdivision Certificate.

4. <u>Secure protection for receiving land</u>

a. For compensation works under this plan, Council must not grant development consent unless Council is satisfied that compensation works on *receiving land* are, as a minimum, secured by all of the following mechanisms:

i. at least one of the primary protection mechanisms identified in Appendix 2; and

ii. a VMP/PoM approved by Council with a minimum five-year maintenance period to follow the completion of the initial phase of habitat compensation works; and

iii. positive covenants that impose a restriction on the use of the *receiving land* that bind the current and future owner of the *land* to manage the *receiving land* for conservation of its habitat values.

b. All *land* subject of the habitat compensation measures must be protected by a legally binding management agreement between Council, the proponent of the development, the lawful owner(s) of the *subject site* or other *receiving land* to which the habitat compensation measures apply.

c. The legal agreement must:

i. clearly identify and include as an attachment the approved VMP/PoM referred to in clause (3)(a)(i);

ii. identify the performance criteria and schedule of works detailed in the approved VMP/KPoM identified in clause (3)(a)(iv);

iii. identify a bond and a bond return schedule linked to the successful completion of works as evidenced by the meeting of agreed performance criteria according to the schedule of works identified in clause (3)(a)(iv);

iv. be enacted (i.e. signed and registered, or otherwise as per the legal requirements for the relevant agreement) prior to the issue of development consent and prior to the commencement of any works related to the DA on the *subject site*;

d. It is the responsibility of the proponent to:

i. secure all resources and funds to implement the VMP/PoM;

ii. pay all costs associated with enacting the legal management agreement referred to in clause (4)(b);

iii. pay all inspection and assessment fees associated with the VMP/PoM and subsequent monitoring reports at the time these are lodged with Council.

5. <u>Deferred commencement consent</u>

a. Pursuant to any requirement for habitat compensation works, Council may grant deferred commencement consent;

b. In granting deferred commencement consent, Council must identify the legal agreements that are to be enacted and works within any VMP/PoM that must be completed before the consent can operate.

4.5 Performance Criteria

4.5.1 Performance criteria for development applications for land verified as preferred koala habitat

Conditions of development consent appropriate to the impact of the proposed development may be imposed by Council where they meet the performance criteria detailed in this section of the Plan.

1. *Potential direct and indirect impacts on food trees and/or koala habitat*
   a. Council must not grant development consent unless it is satisfied that:
      i. the development does not result in any net loss of *food trees* and/or *koala habitat*;
      ii. the development is located, designed, constructed, and managed to avoid adverse impacts on *food trees* and/or *koala habitat*.
2. *Maintain habitat linkages and safe koala movement*
   a. Council must not grant development consent unless it is satisfied that the development:
      i. maintains any linkages between areas of *koala habitat* across the *subject site*;
      ii. maintains any *koala movement corridors* across the *subject site*;
      iii. does not result in development which would impede safe koala movement across the *subject site*;
   b. Measures which maintain habitat linkages and allow for safe koala movement may be incorporated into the design and construction of the development;
   c. Council must consider the need to revegetate cleared land within *koala movement corridors*.
3. *Buffer zones*
   a. Council must not grant development consent unless it is satisfied that, regardless of the size of the tree at the time of lodging the DA, a mature tree–sized tree protection zone is established in accordance with *AS 4970-2009 Protection of*

trees on development sites such that trees do not pose a future hazard to persons or property;

b. In assessing a DA for a residential subdivision or rural land-sharing community, Council must not grant development consent unless it is satisfied that:

i. a minimum buffer of 30 metres is established between the boundary of the development activity in the *study area* and areas containing *koala habitat* on or adjacent to the *subject site*;

ii. notwithstanding the provisions of the *Rural Fires Act* 1997, any requirement for bushfire asset protection zones may be incorporated within the buffer identified in (i) above.

4. *Location of asset protection zones*

a. Notwithstanding the provisions of the *Rural Fires Act* 1997 and the *Native Vegetation Act* 2003, development consent must not be granted unless Council is satisfied that any necessary bushfire asset protection zones are located within developable *lands* and not within adjoining *koala habitat*.

5. *Building envelopes*

a. In assessing a DA for a residential subdivision or rural land-sharing community, Council should give consideration to:

i. restricting development to an identified *building envelope*(s) that will contain all buildings and associated *infrastructure*;

ii. identifying the location of the above *building envelope*(s) on the Deposited Plan and registering them as a restriction on the land title.

6. *Retention of replacement trees and/or koala habitat*

a. Council must not grant development consent unless it is satisfied that:

i. where *food tree* replacement measures or habitat compensation measures (Section 4.4) are proposed, measures are in place to ensure the long-term retention of replacement *food trees* and/or *koala habitat*;

ii. such measures may include the erection of exclusion fencing and/or covenant restrictions on title.

7. Long-term protection and management of koala habitat

a. Council must consider the application of an environmental levy on the *subject site* of a *large development* for the long-term protection and management of *koala habitat* on the *subject site*.

b. Application of an environmental levy for *large developments* is subject to approval from the Department of Local Government.

8. *Protection of koalas, food trees and koala habitat during works*

a. Council must not grant development consent unless it is satisfied that appropriate measures in accordance with *AS 4970-2009 Protection of trees on development sites* are in place (e.g. erection of temporary exclusion fencing) to ensure *food trees* and/or *koala habitat* is/are protected during construction works on the site;

b. Before approved clearing of vegetation takes place, temporary fencing that excludes koalas may be erected around trees that are to be felled in order to minimise the risk of koalas occupying the trees on the day that felling takes place;

c. Where approved clearing of vegetation is proposed, development consent must not be granted unless Council is satisfied that measures are in place to ensure that:

i. on the day of clearing and prior to any felling taking place, all trees within 30 metres of those trees to be felled are inspected for the presence of koalas by an experienced koala spotter from at least two locations;

ii. the koala spotter will remain on site during any clearing of vegetation and will not be involved in the clearing of vegetation while they are responsible for identifying koalas present on the site;

iii. the koala spotter will continually look for koalas during clearing of vegetation to ensure against accidental felling or interference with a tree which is occupied by a koala;

d. Pursuant to the *National Parks and Wildlife Act* 1974 Clause 118A, should koalas be found on site during the clearing of native vegetation and/or earthworks, works:

i. must be temporarily suspended within a range of 30 metres from any tree which is occupied by a koala;

ii. must be avoided in any area between the koala and the nearest areas of habitat to allow the animal to move to adjacent undisturbed areas;

iii. must not resume until the koala has moved from the tree of its own volition.

4.5.2 Performance criteria for development applications for land verified as core koala habitat

1. *Lot boundary fencing*

   a. Pursuant to this clause, consent must not be granted unless Council is satisfied that any new lot boundary fencing on *land* containing *core koala habitat* does not impede safe koala movement across the *subject site*.

   b. Fences that do not impede safe koala movement may include:

      i. hedges or screens of trees and/or shrubs;

      ii. fences where the bottom of the fence is a minimum of 300 mm above the ground to allow koalas to freely move underneath;

      iii. fences that are easy for koalas to climb (e.g. sturdy chain mesh fences not topped by barbed wire, or solid style fences with a timber 'post and bridge' system over the fence at regular intervals of less than 20 metres);

      iv. open post and rail fences;

      v. post and 4 or 5 strands of plain wire, barbed wire or some combination of plain and barbed wire, where the bottom strand of wire is a minimum 300 mm above the ground at any in-line fence post and/or dropper;

   c. Pursuant to clause (b) above, for *land* where livestock agriculture is a permitted activity, the design of new lot boundary fencing is subject to the landholders' requirements to secure livestock.

2. *Swimming pools*

   a. Before granting development consent for the installation of swimming pools on *land* containing or adjacent to *core koala habitat*, Council must include measures to ensure that all new swimming pools:

      i. incorporate features that allow koalas to easily escape from the pool, namely, a shallow ramp and/or a stout rope (minimum 50 mm diameter) that trails in the pool at all times and is secured to a stable poolside fixture;

      ii. notwithstanding the provisions of the *Swimming Pools Act* 1992, swimming pool fencing must exclude koalas (i.e. not be constructed of timber or have timber posts);

      iii. shrubs and/or trees that koalas could use to climb over the pool fence must not be planted within 1 metre of the swimming pool fence.

b. This clause does not apply to the installation of farm dams.

3. <u>Keeping of domestic dogs</u>[3]

a. Council must not grant consent to residential subdivisions or rural land-sharing communities on *land* containing or immediately adjacent to *core koala habitat* unless:

i. the keeping of domestic dogs is prohibited by covenant restrictions on title; or

ii. the movement of domestic dogs is restricted to an enclosure or pen that would effectively contain dogs and exclude koalas.

b. Pursuant to clause (a)(ii) above:

i. any dog pens should covered and be located within the approved *building envelope*;

ii. any fences that are intended to contain dogs and exclude koalas should be located more than 2 metres away from any trees that koalas could use to cross the fence.

4. <u>Road design standards</u>

a. Council must not grant consent to residential subdivisions or rural land-sharing communities on *land* containing or adjacent to *core koala habitat* unless it is satisfied that the proposed development has made provision for:

i. appropriate road design standards, traffic calming devices, warning signage, and roadside lighting which restrict motor vehicles to a maximum speed of 40 kilometres per hour within the *subject site* where possible;

ii. for roads where the maximum speed of motor vehicles must be greater than 50 kilometres per hour in urban areas or greater than 60 kilometres per hour in rural areas, appropriate measures are required to exclude koalas from roads (e.g. koala exclusion fencing, underpasses) and minimise the likelihood of impediments to safe koala movement;

iii. Specifications for road design standards, signage, koala exclusion fencing and/or traffic calming devices and any other mitigation measures must be explicitly included with the DA.

[3] Author S. Phillips is not supportive of provisions (3)(a)(i) or (3)(b)(i, ii) in Section 4.5.2.

4.6 Planning Proposals to rezone land

The trigger that links the regulatory provisions of this Plan (Section 4) to the Lismore LEP is the receipt of a DA (under Part 4 of the EP&A Act) by Council for a permitted land use that requires development consent under the LEP. Under SEPP 44, the receipt of a Planning Proposal (under Part 3 of the EP&A Act) to rezone *land* does not trigger this Plan. Notwithstanding this key element of the SEPP, a Planning Proposal to rezone *land* may result in significant negative effects on *koala habitat*.

The regulatory provisions and assessment methodology detailed in this Plan (Section 4) consider the information required, the assessment process and performance criteria related to the determination a DA. The information required to support a DA under this Plan, as well as the assessment process and performance criteria for a DA under this Plan would also assist Council and the Department of Planning in determining whether a Planning Proposal to rezone *land* containing *koala habitat* should proceed.

5 Management Activities

The aim of this section of the Plan is to provide a non-regulatory framework for management activities that complement the regulatory provisions of the Plan. It is necessary to undertake these management activities to:

- minimise threats to koalas and their habitat that are not related to development activity
- increase the amount of *koala habitat* in the *koala planning area*
- maintain and where possible improve the quality of existing *koala habitat* in the koala planning area
- ensure smooth implementation and monitoring of the Plan by Council.

The management activities to be conducted as part of this Plan are detailed in Table 6 and have been classified into the following categories: implementation and monitoring; development application assessment; habitat conservation, restoration and management; communication and education; road and traffic management; dog management; koala health and welfare; bushfire management; funding; research and economic development and tourism.

Many of the management activities and actions outlined in Table 6 can be completed under existing Council service levels and recurrent budgets. However, it is noted that completion of activities and actions that require funding is subject to the allocation of budget via Council's Delivery Plan process and/or successful applications for external funding.

Table 6. Schedule of management activities and actions proposed to be conducted as part of this Plan.

Acronyms used in table: H = high; M = medium; L = low; N/A = not applicable; OEH = Office of Environment and Heritage

Activity / Action ID	Management Action	Priority H/M/L	Target Start	Indicative action Duration	Indicative budget	Funding Source
Implementation and monitoring						
1	Council to establish a Koala Advisory Group to oversee the implementation of management activities identified in this Plan	H	Within 3 months of Plan adoption	Quarterly, ongoing	$1000 annually	Council
2	The Koala Advisory Group is to produce a regular monitoring report on the effectiveness of this Plan to Council. This report is to include details of: a. progress of implementation of the management activities identified in this Plan b. any additional activities that may be required c. the amount of *food trees* and *koala habitat* retained, removed, restored and/or replaced	L	1 year following Plan adoption	Annually	N/A	Council (under existing recurrent budget)
3	Council is to develop an interim manual process and procedures to monitor: a. long-term compliance of DA conditions of consent b. the amount of *food trees* and *koala habitat* retained, removed, restored and/or replaced c. update GIS mapping to identify the location of koala habitat removed, restored and/or replaced	H	When Plan adopted	2 months	N/A	Council (under existing recurrent budget)
4	Council is to investigate development of an automated process and procedures to monitor the points in the items 2 and 3 above	L	Within 2 years of Plan adoption	3 months	TBC on investigation	Council
DA assessment						
5	Council is to include information regarding the presence of mapped *preferred koala habitat* on certificates issued under Section 149 (2) & (5) of the EP&A Act	M	When Plan adopted	1 month	N/A	Council (under existing recurrent budget)
6	In conjunction with OEH, Council is to develop and deliver a training program for staff/consultants on the requirements Koala Habitat Assessment Reports, the Spot Assessment Technique and its application for assessment purposes	H	Within first 6 months of Plan adoption	3 months	$20,000	External grant funding, OEH, Council
7	Council is to amend the Tree Preservation Order (Lismore DCP Chapter 16) to reflect the regulatory provisions detailed in section 4 of this Plan	M	When Plan adopted	1 month	N/A	Council (under existing recurrent budget)
Habitat conservation, restoration and management						
8	Council is to amend the Lismore LEP 2010 as indicated in Appendix 4 of the Plan, to activate the regulatory provisions identified in section 4 of the Plan	M	When Plan and LEP 2010 adopted	6 months	N/A	Council (under existing recurrent budget)

Activity / Action ID	Management Action	Priority H/M/L	Target Start	Indicative action Duration	Indicative budget	Funding Source
9	Council is to provide an extension service to support the implementation of voluntary *koala habitat* conservation, restoration and management by individuals and community groups by assisting with seeking grant funding and providing technical support	M	Within 12 months of Plan adoption	6 months	TBC	External grant funding and Council (under existing recurrent budget),
10	Council is to develop and implement a prioritised landscape-scale Koala Habitat Restoration Program to restore, revegetate and/or appropriately manage *koala habitat* within the *koala planning area*. Once developed, Council is to apply for external grant funding to implement the plan: a. on Council-owned land where appropriate b. on private lands in consultation with landholders who volunteer to participate	M	When external grant funding rounds advertised	Ongoing	Dependent on successful grant applications	External grant funding
11	Council is to develop a register of landholders who are willing to use their land for habitat restoration	M	When Plan adopted	Ongoing	N/A	Council (under existing recurrent budget)
12	Council is to ensure that seedlings used in restoration and/or revegetation works are propagated from seed that is of local provenance	M	When Plan adopted	Ongoing	N/A	Council (under existing recurrent budget)
13	Council is to develop a register of local nurseries that propagate seedlings from seed that is of local provenance	M	When Plan adopted	1 month, ongoing	N/A	Council (under existing recurrent budget)
Communication and education						
14	Council is to develop and implement an integrated communication program to inform and educate the community about threats to koalas and their habitats	H	Within 12 months of Plan adoption	3 months, ongoing	TBC on investigation	Council and external grant funding
15	Council is to make the Comprehensive Koala Plan of Management and associated maps available on the Council website and online GIS system	H	Within 1 month of Plan adoption	1 month	N/A	Council (under existing recurrent budget)
16	Council is to update Council guidelines for vegetation management plans to include guidelines for what is required for habitat compensation works	M	Within 12 months of Plan adoption	1 month	N/A	Council (under existing recurrent budget)
17	Council is to develop a fact sheet explaining Plan requirements for *small developments*	M	Within 12 months of Plan adoption	1 month	N/A	Council (under existing recurrent budget)
Road and traffic management						
18	For existing roads within the *koala planning area*, Council is to: a. audit existing koala road safety measures b. develop an integrated program of works for the implementation of a 'toolbox' of koala road safety measures (e.g. speed reduction, signage, lighting, road verge maintenance, exclusion fencing and underpasses) to	M	Within 12 months of Plan adoption	6 months, ongoing	TBC on investigation	Council and external grant funding

Activity / Action ID	Management Action	Priority H/M/L	Target Start	Indicative action Duration	Indicative budget	Funding Source
	target vehicle strike black spots identified in the Resource Document that accompanies this Plan as well as any other existing roads					
19	For any new roads proposed by Council within the *koala planning area*, Council is to apply the regulatory provisions identified in section 4 of this Plan.	M	When Plan adopted	Ongoing	N/A	Council (under existing recurrent budget)
20	For any RTA-funded road programs within the Lismore LGA, Council is to incorporate a 'toolbox' of koala road safety measures (e.g. speed reduction, signage, lighting, road verge maintenance, exclusion fencing and underpasses) in the design and construction of these roads	M	When Plan adopted	Ongoing	N/A	N/A
Dog management						
21	In relation to dog management within the *koala planning area*, Council is to: a. identify areas where koalas are at a high risk of contact with domestic dogs b. target monitoring of compliance in these areas in accordance with the provisions of the *Companion Animals Act* 1998 c. target the education on responsible pet ownership to new dog owners and dog owners in high risk areas d. review restrictions within existing dog exercise areas and ensure that use of these areas is compatible with the objectives of this Plan e. ensure any new leash-free areas are compatible with the objectives of the Plan	H	Within 12 months of Plan adoption	6 months, ongoing	TBC on investigation	Council and external grant funding
22	In consultation with the North Coast Livestock Health and Pest Authority, agricultural industry groups and landholders, Council is to: a. implement a wild dog control program on rural lands within the *koala planning area* b. seek external funding for implementation of the wild dog control program c. lobby the NSW Government to advocate suitable wild dog control methods on private land d. provide information to landholders for the management of wild dogs	H	Within 12 months of Plan adoption	6 months, ongoing	TBC on investigation	Council and external grant funding
Koala health and welfare						
23	Council is to conduct a study to estimate koala density and population size within the *koala planning area*	H	Within 12 months of Plan adoption	6 months	TBC on investigation	Council and external grant funding
24	Council is to identify and secure Council land appropriate for establishment of *food tree* plantations to supply leaf for koalas in the care of Friends of the Koala	M	Within 2 years of Plan adoption	12 months	N/A	Council (under existing recurrent budget)
25	Council is to consult with Friends of the Koala and other wildlife carer groups	L	Within 3 years of Plan	6 months	N/A	Council (under

Activity / Action ID	Management Action	Priority H/M/L	Target Start	Indicative action Duration	Indicative budget	Funding Source
	regarding: a. provision of records to the Atlas of NSW Wildlife b. standardising and improving the quality of data provided to the Atlas		adoption			existing recurrent budget)
Bushfire management						
26	Council is to: a. provide mapping of *preferred koala habitat* as a GIS layer to the Rural Fire Service and the Bushfire Risk Management Plan Committee b. develop best practice guidelines for fire management in *preferred koala habitat*	M	Within 2 years of Plan adoption	6 months	N/A	Council (under existing recurrent budget)
27	Council is to consult with the Rural Fire Service and the Bushfire Risk Management Plan Committee regarding: a. updating the Bushfire Risk Management Plan for Lismore LGA to take into account the location and significance of *preferred koala habitat* identified in Figure 1of this Plan b. providing a GIS layer that maps fire history within the Lismore LGA c. implementing best practice guidelines identified in 26 above by brigades located within the Lismore LGA	M	Within 12 months of Plan adoption	6 months	N/A	Council (under existing recurrent budget)
Funding						
28	Council is to investigate rate rebates for landholders who conduct *koala habitat* restoration works	M	Include for consideration in the community strategic planning process to be conducted in 2012	6 months	N/A	Council (under existing recurrent budget)
29	Council will consider the introduction of an Environmental Levy, in consultation with the community	M	Include for consideration in the community strategic planning process to be conducted in 2012	6 months	N/A	Council (under existing recurrent budget)
Research						
30	The Koala Advisory Group is to identify and prioritise potential koala research projects on the basis of their application to *koala habitat* and population management, as well as implementation and monitoring of the Plan	L	Within 2 years of Plan adoption	6 months	N/A	Council (under existing recurrent budget)
Economic development and tourism						
31	Council is to provide in-kind assistance to Friends of the Koala to investigate the feasibility of a self-funding business model to upgrade the existing koala care facilities and to cater for tourists	H	Within 12 months of Plan adoption	6 months	N/A	External grant funding
32	Council is to seek external funding to investigate the feasibility of koala-based	M	Within 2 years of Plan	6 months	N/A	External grant

Activity / Action ID	Management Action	Priority H/M/L	Target Start	Indicative action Duration	Indicative budget	Funding Source
	ecotourism opportunities within Lismore		adoption			funding

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Standards Australia (2007). *Australian Standard ® 4373-2007 Pruning of amenity trees*. Standards Australia, Sydney.

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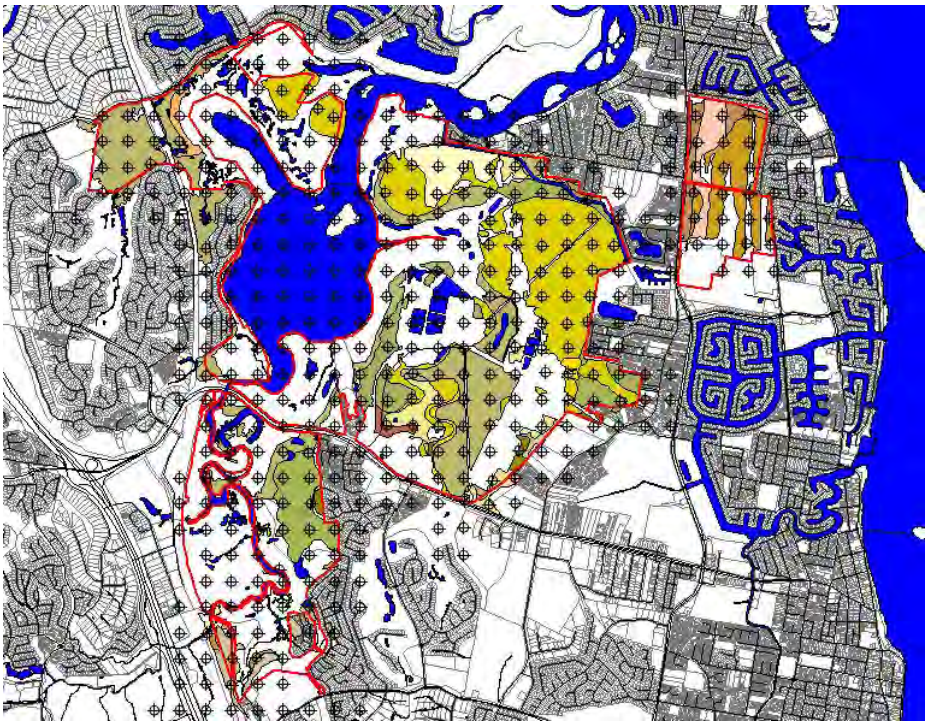
Appendix 1 – Sampling and Assessment of Koala Habitat using the Spot Assessment Technique

The Spot Assessment Technique of Phillips and Callaghan (2011) has been adopted by Council as a standardised sampling tool for koala habitat assessment in the *koala planning area*. For the purposes of this Plan, it is intended that only individuals who have been accredited in the application and interpretation of data obtained by this technique will be able to undertake koala habitat assessments referred to in Section 4.2 of the Plan.

Ongoing refinement in terms of how the Spot Assessment Technique methodology can be applied at the landscape scale has resulted in development of what is now known as Regularised Grid-based Spot Assessment Technique (RG-bSAT) sampling. The sampling principles of RG-bSAT, key elements of data analysis and modelling of associated koala activity data are currently the subject of a separate publication (Phillips et al. 2011 in review). Following is a step-by-step account of the application principles, herein illustrated using a 1500 hectare study site in south-east Queensland.

Working with RG-bSAT

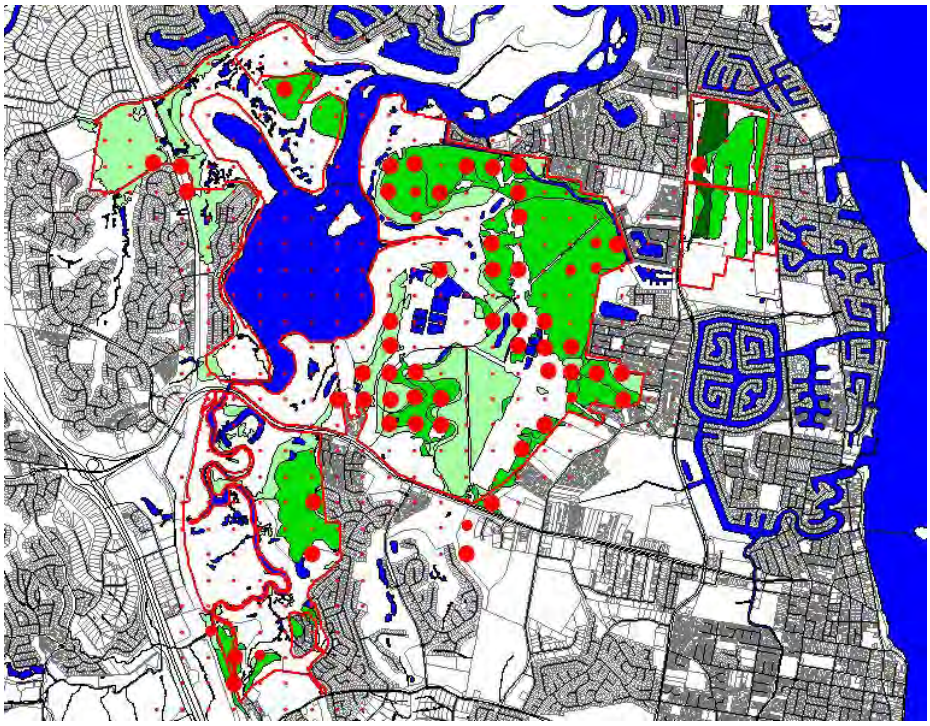
1. Determine the required sampling intensity for your site by referring to Table 3 in Section 4.2 (Koala Habitat Assessment Reports) of this Plan.
2. Overlay a map / aerial photo of your site with a regularised grid, the cell dimensions of which are as specified in the 'detailed RG-bSAT sampling intensity' column of Table 3. You can use either the grid cell intersections or the approximate centre of each grid cell as your proposed field sampling sites. Your study site map should look like this (⌖ indicate sampling site locations):



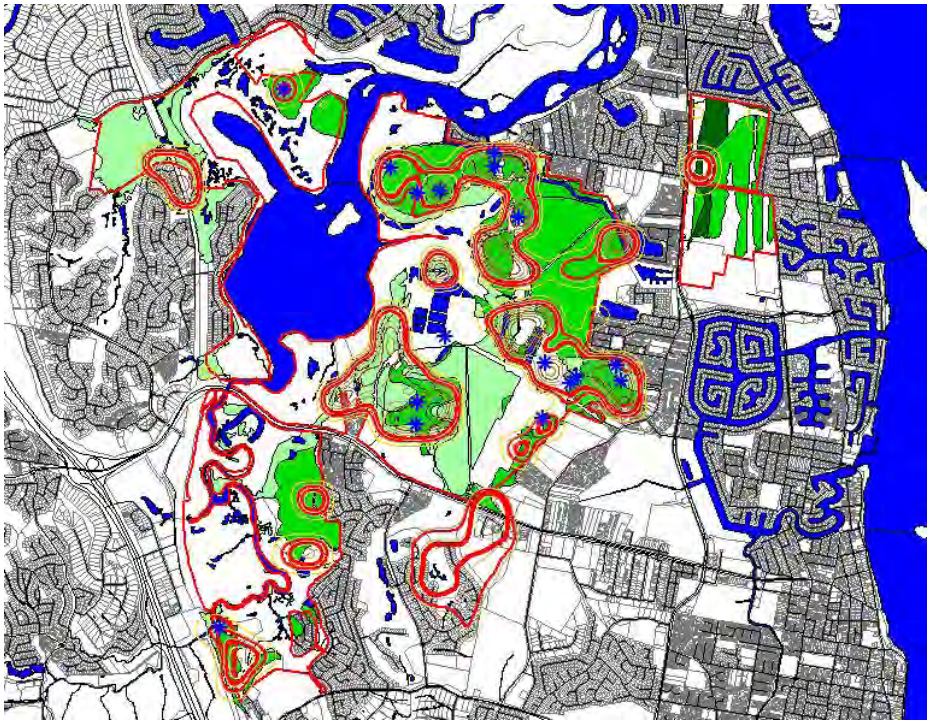
3. Disregard any potential field sites that fall within areas such as waterbodies or area that do not have measurable forest cover. For each of the remaining field sites, sample each one using the Spot Assessment Technique, commencing with the density specified for 'initial RG-bSAT sampling intensity' in Table 3.

   Resulting koala activity levels at each field site is then interpreted as either Low, Medium (normal) or High Use in line with the 'East Coast (med-high)' activity thresholds specified in Table 2 of Phillips and Callaghan (2011).

   For any sites that returned Medium (normal) or High Use activity levels, sample the 'detailed' sites around the edges of these sites, but not the 'detailed' sites between these sites. If no Medium (normal) or High Use sites are detected, no further assessment of the site is required. Your study site map could then start to look a bit like this (graduated red circles indicate Low, Medium (normal) and High Use sites):



4. Koala activity data should then be interpolated to cover the assessment area. There are a number of ways that this can be done. The model below was created using lightly weighted thin plate splining techniques to delineate the boundaries (red lines) of areas of *core koala habitat*.



Appendix 2 – Habitat Compensation Policy

Background

This policy is designed to provide a system for determining appropriate compensation for development activity that has the potential to adversely impact *koala habitat* and/or impede safe koala movement. A case-by-case based habitat compensation system is not considered appropriate. The standardised approach presented here is transparent, can be applied in a consistent manner, and is less resource-intensive for Council and development proponents.

The habitat compensation framework presented in this policy is based on a loss/gain multiplier based on: 1) the relative conservation value of the area of *koala habitat* lost due to the activity; and 2) a factor that takes into account the time lag before ecological benefits are realised and the risk of the compensation works failing[4].

The policy aims to:

- provide for ecologically sustainable development
- protect and enhance existing areas of *koala habitat*
- create *koala habitat*.

Guiding principles

The principles that underpin this policy are:

1. The primary objective of habitat compensation must be to protect, enhance or create ecologically viable *koala habitat*.
2. Compensation must only be considered once all options to avoid, minimise and mitigate any adverse impacts have been exhausted.
3. Clearing must not be permitted when the impact of clearing is so great that it cannot be satisfactorily compensated for by minimising, mitigating and compensating the impacts.

[4] This policy is based on the Habitat Offsets Policy Framework detailed in Liverpool City Council (2003).

4. Habitat compensation works should lead to a net gain in the area of *koala habitat*, and an improvement in the condition of *koala habitat*.
5. The *land* receiving compensation works ('*receiving land*') must be ecologically suitable and appropriate for protection, enhancement or creation of *koala habitat*.
6. An activity that leads to the loss of *koala habitat* (especially clearing) should only proceed once the management arrangements on the *receiving land* are legally secure.
7. Compensation works must not lead to permanent environmental impacts and should not be used as a justification for granting approval to a DA where the adverse environmental impacts of a development are greater than the benefit to be obtained from the compensation works.
8. Compensation works undertaken on rural lands should be conducted in a way which achieves best practice farm management.
9. Management and monitoring of habitat compensation activities should be undertaken over an ecologically meaningful timeframe (i.e. a minimum of five years).

Components of the Habitat Compensation Policy

If Council gives approval to clear an area of *koala habitat*, this policy requires the proponent to undertake compensation works to compensate for the loss of *koala habitat*. The compensation works must benefit another area of *koala habitat* or a *koala movement corridor*. This policy recognises two main components of the habitat compensation framework:

- the nature of the habitat compensation works
- a conservation multiplier.

Habitat compensation works

This policy recognises three classes of compensation works:

- habitat protection (with enhancement)
- habitat enhancement
- habitat creation.

Each class of compensation works must be applied in accordance with the guiding principles outlined above. The performance criteria associated with each category of compensation works are detailed in Section 4.4 of the Plan. Each of the three classes of compensation works are described below.

Five classes of koala habitat are recognised under this policy (see Table 7): endangered ecological communities (which may also be classified as *core* or *preferred koala habitat*), *core koala habitat*, *preferred koala habitat* (i.e. primary koala habitat and secondary koala habitat), and *koala movement corridors*.

Habitat Protection (with enhancement)

If Council gives development consent to clear an area of *koala habitat*, then the proponent may compensate for that loss of habitat by increasing the level of conservation security of the *receiving land* (i.e. Habitat Protection, or 'Protection'). If *core koala habitat* or *preferred koala habitat* (including primary or secondary koala habitat) is adversely impacted by development activity, the Protection compensation works may be applied to protect the *receiving land* containing *koala habitat* (Table 7). All classes of koala habitat, except *koala movement corridors*, can receive Protection under this policy (Table 7).

There are three acceptable primary Protection mechanisms:

1) transfer of land ownership to the Crown and/or Council for dedication as a conservation reserve;

2) dedication of *land* under a voluntary conservation agreement; and

3) positive covenants that impose a restriction on the use of the *receiving land* that bind the current and future owner of the *land* to manage the *receiving land* for conservation of its habitat values (Table 8).

In addition, *land* receiving Protection is to be appropriately managed with enhancement works to improve the integrity and viability of habitat over time. Appropriate management must include a fully funded vegetation management plan (VMP) or, where appropriate, a plan of management (PoM) approved by Council with a minimum five-year management period to follow the completion of the initial phase of habitat protection works. A VMP/PoM should include enhancement works to restore/regenerate degraded habitat and/or prevent/minimise threats to *koala habitat*.

Habitat Enhancement

In addition to increasing the conservation security of koala habitat within the *koala planning area*, improving the viability of habitat that has become degraded is also an imperative. Consequently, this policy requires that *receiving lands* have an appropriate level of protection and are appropriately managed to improve their integrity and viability

Table 7. Habitat compensation works that can be applied for each class of koala habitat impacted by development activity

		Habitat Compensation Works		
		Protection	Enhancement	Creation
Class of koala habitat impacted by development activity	Endangered ecological communities	Yes	Yes	Yes
	Core koala habitat	Yes	Yes	Yes
	Primary koala habitat	Yes	Yes	Yes
	Secondary koala habitat	Yes	Yes	Yes
	Koala movement corridor	No	Yes	Yes

Table 8. Acceptable protection mechanisms for each class of habitat compensation works

	Habitat Compensation Works		
	Protection	Enhancement	Creation
Primary protection mechanisms			
Donation of land to the Crown for dedication as a conservation reserve (NPW Act)	Yes	No	No
Transfer of land to council for dedication as a conservation reserve	Yes	No	No
Voluntary conservation agreement (NPW Act)	Yes	No	No
Incentive property vegetation plan (NV Act)	No	Yes	Yes
Voluntary planning agreement (EP&A Act)	No	Yes	Yes
Management and funding mechanisms			
VMP/PoM fully funded with a minimum five-year management period as a condition of development consent (EP&A Act)	No	Yes	Yes

Environmental levy (*Local Government Act* 1993)	Yes	Yes	Yes
Land use protection mechanism			
Positive covenants (Section 88E, *Conveyancing Act* 1919)	Yes	Yes	Yes
Rezoning within the LEP to E2 Environmental Conservation, E3 Environmental Management, RE1 Public Recreation or SP2 Infrastructure (EP&A Act)	Yes	Yes	Yes

over time (i.e. Habitat Enhancement, or 'Enhancement'). Enhancement works can be applied to each class of koala habitat under this policy (Table 7).

Given the level of investment of money and resources in Enhancement works, it is important to ensure that the benefits of Enhancement works are durable over time. The loss of *koala habitat* for which the Enhancement works are compensating will be long-lasting and there will be a lag between the time that the Enhancement work is undertaken and the time that the ecological benefit is obtained. Consequently, all *receiving lands* for which Enhancement works are undertaken must be afforded primary protection via a voluntary planning agreement or an incentive property vegetation plan and positive covenants that impose a restriction on the use of the *receiving land* that bind the current and future owner of the *land* to manage the *receiving land* for conservation of its habitat values (Table 8).

Appropriate management must include a fully funded VMP or, where appropriate, a PoM approved by Council with a minimum five-year management period to follow the completion of the initial phase of habitat protection works. Management actions could include works to restore/regenerate degraded habitat and/or prevent/minimise threats to koala habitat. Bush regeneration, restoration works, threat prevention and minimisation activities (e.g. exclusion fencing) all contribute to *koala habitat* Enhancement. Enhancement activities that improve the integrity and viability of *koala habitat* over time can be applied to any class of koala habitat that is adversely impacted by development activity and to any class of koala habitat located *receiving lands*.

Habitat Creation

This habitat compensation framework provides opportunities for proponents to undertake works to create new habitat (i.e. Habitat Creation, or 'Creation') in areas that are adjacent to existing habitat or in an area where there is a sound ecological reason to do so (e.g. create a *koala movement corridor* or vegetated riparian corridor). Creation can be applied to any class of koala habitat that is adversely impacted by development activity and to any class of koala habitat located on the *receiving land* (Table 7).

It is important to ensure that that the benefits of Creation works are resilient over time as the loss *koala habitat* for which they are compensating will be long lasting and there will be a lag between the time that the habitat Creation work is undertaken and the time that the ecological benefit is obtained. Consequently, all *receiving lands* for which Creation works are undertaken must receive the same minimum level of primary protection and ongoing management (Table 8) as detailed for Enhancement above.

Appropriate works for habitat creation will depend on the individual features of the *receiving land* and the type of ecological community to be created. Revegetation works, landscape planting, bush regeneration, threat prevention and minimisation activities (e.g. exclusion fencing, restrictions on domestic dogs) all contribute to the Creation of *koala habitat*.

Calculation of the size of the area required for habitat compensation works

To ensure that the loss of *koala habitat* caused by development activity does not lead to a net loss of habitat, the area to be secured by compensation works need to be larger than the area of habitat that is impacted by development activity. In this policy, a one-for-one habitat compensation offset is not considered suitable because this loss/gain ratio does not take account of a number of ecological factors. Therefore, a multiplier is required to take account of the following factors:

- risk of all or some of the compensation works failing
- conservation value of the habitat adversely impacted by development activity and consequently the net gain required for environmental improvement
- time lag before the positive environmental benefit of the compensation works is achieved

- area of clearing and the negative impact of the clearing
- area of the compensation works and the positive impact of the compensation works.

In this plan, the compensation multiplier is based on two components:

- conservation value
- time/risk factor.

The conservation value represents the ecological value of the area of *koala habitat* lost to development activity. A relative value has been given to each of the five classes of koala habitat identified in this policy. Each of these classes of koala habitat has been assigned a relative conservation value ranging from 1 (low) to 4 (high) (Table 9).

Table 9. Compensation multiplier values

		Compensation multiplier values			Conservation value
		Protection	Enhancement	Creation	
Class of koala habitat impacted by development activity	Endangered ecological communities	5	10	20	5
	Core koala habitat	4	8	16	4
	Primary koala habitat	4	8	16	4
	Secondary koala habitat	3	6	12	3
	Koala movement corridor	N/A	4	8	2
Time/risk factor		1 (low)	2 (medium)	4 (high)	

The time/risk factor recognises that for any compensation works there is an inherent risk in the works failing and/or a time lag before the ecological benefit of the activity is realised. Each of the three classes of compensation works (i.e. Protection, Enhancement and Creation) were ranked as having either low, medium or high time lag and/or risk of failure (i.e. time/risk factor). The three types of compensation works were then assigned a numerical value to represent time lag and/or risk of failure (Table 9).

The compensation multiplier can only be represented as a relative value as it is not possible to quantify the true value of *koala habitat* lost to development activity. The relative values identified above and detailed in Table 9 were chosen to ensure that this policy is workable and does not place an unreasonable or prohibitive cost burden on proponents. At the same time, the values need to be high enough to accommodate the inherent risks associated with compensation works.

The compensation multiplier used for each class of koala habitat and each type of compensation work identified in this policy are detailed in Table 9 and is calculated by the following formula:

Compensation Multiplier = Conservation Value x Time/Risk Factor

The calculation of the area of habitat that is to undergo compensation works is based on the area of habitat that is impacted by development activity and the compensation multiplier, and is calculated by the following formula:

Area of Habitat Compensation Works = Area Impacted x Compensation Multiplier

Example

Within a 50 hectare proposed subdivision, there are 20 hectares of degraded *primary koala habitat* located on undevelopable *land* on the *subject site*. After all efforts to avoid, minimise and mitigate the adverse impacts of the proposed subdivision on *koala habitat* have been exhausted, clearing of 1 hectare of *primary koala habitat* (conservation value = 4) is proposed to upgrade an existing road servicing the proposed development.

As a habitat compensation measure, Enhancement of the degraded *primary koala habitat* is proposed (time/risk factor = Medium = 2). As Table 9 shows, the compensation multiplier for Enhancement of *primary koala habitat* is 8.

Compensation multiplier = conservation value x time/risk factor
= 4 x 2
= 8

The area of habitat compensation works required can then be calculated as follows:

Area of habitat compensation works = area impacted x compensation multiplier
= 1 ha x 8
= 8 ha

Appendix 3 – Indicative LEP amendment clause

In accordance with management activity 8 of this Plan and subject to public consultation, Council is to amend the Lismore Local Environmental Plan 2010 in order to activate the regulatory provisions identified in section 4 of the Plan. An indicative LEP amendment clause is provided below.

Clause X – Koala habitat

1. The objective of this clause is to ensure that development is designed to retain preferred koala food trees and preferred koala habitat.
2. This clause applies to land on which there are unmapped preferred koala food trees and/or mapped "Primary", "Secondary A" and "Secondary B" koala habitat as detailed on the map titled "Preferred Koala Habitat within the koala planning area".
3. Development consent must not be granted for development on land to which clause (X)(2) applies unless the consent authority is satisfied that the development is consistent with the relevant provisions of any adopted plan of management prepared pursuant to *State Environmental Planning Policy No 44 – Koala Habitat Protection.*
4. Development consent must not be granted for a subdivision of land to which this clause applies unless the consent authority is satisfied that each lot that would be created by the subdivision will contain a sufficient *building envelope* to enable future development of the lot to comply with subclause (3).

Note. The land shown as "Primary", "Secondary A" and "Secondary B" does not identify all preferred koala habitat areas.

Aspects of the ecology, distribution and abundance of koalas in the Lismore LGA



Report to Lismore City Council

October 2011

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Koala ecology - a brief overview

The koala is an obligate marsupial folivore that feeds primarily on trees of the Genus *Eucalyptus*. The distribution of koalas in eastern Australia extends from far north-eastern Queensland to the Eyre Peninsula in South Australia (Strahan and Van Dyck 2008). Throughout this range, koalas have been reported as utilising a diverse range of *Eucalyptus* species (Hawkes 1978; Lee and Martin 1988; Hindell and Lee 1990; Phillips 1990; White and Kunst 1990; Melzer and Lamb 1996; Lunney *et al*. 1998). Within a given area however, only a few of the available *Eucalyptus* species will be preferentially browsed, while others, including some non-eucalypts, are generally incorporated into the diet as supplementary browse or utilised for other purposes (Lee and Martin 1988; Hindell and Lee 1990; Phillips 1990; Phillips 1999; Phillips *et al*. 2000, Phillips and Callaghan 2000).

Koalas are not a highly fecund species; females reach sexual maturity between eighteen months to two years of age and can theoretically produce one offspring each year. However, data indicates that on average most females in wild populations breed every second year over the term of their reproductive lives (McLean and Handasyde 2006). The longevity of individuals in the wild also varies but probably averages 8-10 years for most mainland populations; Phillips (2000a) estimated a generation time for the species of 6.02 ± 1.93 (SD) years.

While the socio-biology of koalas is a critical aspect of their management, it remains an issue that tends to be overlooked and/or ignored by most planning studies. Factors that influence the distribution of koalas at the population level are more complex than that simply represented by habitat considerations alone. Studies of free-ranging koalas have established that those in a stable breeding aggregation arrange themselves in a matrix of overlapping home range areas (Lee and Martin 1988; Mitchell 1990). Home range areas vary in size depending upon the quality of the habitat (measurable in terms of the abundance of preferentially utilised food trees) and the sex of the animal (males have larger home range areas than do females). Long-term fidelity to the home range area is generally maintained by adult koalas in a stable population (Mitchell 1990; Phillips 1999); the dissolution of such social structure has been identified as a possible contributing factor to earlier population decline in the Tucki area (Phillips 2000a). Hence the concept of compensating for actions that have the potential to degrade koala habitat by either moving

affected animals or providing alternative habitat elsewhere is delusive; maintenance of existing social structure is a primary consideration in terms of developing conservation and management strategies for free-ranging koala populations.

Habitat fragmentation can also be a contributing factor to population decline and/or dissolution. Recent research by McAlpine *et al*. (2005; 2006; 2007) into the landscape ecology requirements of koalas suggests that the chances of koalas being present declined rapidly as the percentage of koala habitat or overall forest cover fell below 60-70% of the landscape. There was also some evidence of critical patch size requirements for koalas, with koalas more likely to be absent from patches of primary and secondary habitat that were less than 50ha in size, while the probability of koala presence started to decline below a habitat patch size of around 150ha (McAlpine *et al*. 2007).

Threatening processes

The viability of free-ranging koala populations can be threatened by a variety of processes:

- Destruction of koala habitat by ill-advised clearing for urban development, roadwork, forestry, agricultural and mining activities.
- Fragmentation of koala habitat such that barriers to movement are created that isolate individuals and populations, hence altering population dynamics, impeding gene flow and the ability to maintain effective recruitment levels.
- Unsustainable mortalities caused by dog attacks and road fatalities.
- Mortalities caused by stochastic events such as fire (including high fire frequency for the purposes of fuel reduction).
- Degradation of habitat by logging of preferred food trees.

There are also indirect impacts that often arise as a consequence of the above, most notably elevated levels of disease.

Historical overview

In this section we describe the results of an analysis of historical koala records for the Lismore LGA and the proposed planning area with a view to examining the following issues:

(i) any indications of broad changes/trends in the geographic distribution of koalas within the LGA over time, and

(ii) determining the extent to which the historical record may be capable of assisting/informing decisions relating to koala conservation by way of identifying important source populations.

Methods

An inherent problem associated with survey data such as historical records is that they are essentially observer-biased and do not represent the results of a systematic survey effort. Hence, quantitative range parameters such as the *Extent of Occurrence (EoO)*, the related *Area of Occupancy (AoO)*, and concepts such as generational persistence can potentially miscalculate the full extent of change (positive or negative) and/or the locations of such things as source populations respectively if existing bias' cannot be accommodated; it is with these considerations and limitations in mind that the following methodological approach has been developed:

Koala records were obtained from the NSW Wildlife Atlas, Friends of the Koala (FoK) and Lismore City Council databases. Once collated, records were checked individually for replication prior to being sorted chronologically by koala generation, dating backwards from 2010. Undated records and multiple records for the same location within a given generation were disregarded for the purposes of further analysis. The resulting data set was then partitioned in order to facilitate comparisons *pre* and *post* 1992 (the timeframes 1993-1998, 1999-2004 and 2005-2010 approximating the time intervals for the most recent three koala generations) in order to place results in the context of International Union for Conservation of Nature (IUCN) criteria which place weight on the concept of population change over a time period of three (taxon-specific) generations (WCUSSC 1994).

As alluded to above, the range parameters *EoO* and *AoO* are two key measures pertaining to the spatial distribution of a species, the *EoO* being that area within the outermost limits of the area within which the species occurs, while the *AoO* is the actual area within the *EoO* over which the species can be found (Gaston 1997). The *AoO* is typically determined by enumerating the number of occupied grid cells and is thus sensitive to sampling parameters such as study area and grid cell size.

Extent of Occurrence

The *EoO* was determined as the total area enclosed by a Minimum Convex Polygon (MCP) derived by connecting the outer-most koala records over time for each koala generation for which sufficient data was available.

Area of Occupancy

Although more useful, changes in the *AoO* over time are harder to quantify. As a general trend, there is an increase in available records over the last two to three decades. This creates the potential for an increase in the probability of a record being present in any given grid cell over that time period. The following procedures were applied in order to minimise the influence of chronological bias.

A 2.5km x 2.5km (625ha) grid was created to provide a series of grid cells for sampling purposes. This grid cell size was considered the minimum necessary to accommodate spatial uncertainty in the data (use of different mapping datums, observer error etc), while the actual number of records themselves became academic, the primary scoring mechanism being whether a koala record is either present or absent. In order to deal with the disproportionately greater number of koala records in recent years, each sampling iteration for this time period (following sentence refers) was based on a suite of randomly selected records, the number of records selected equal to the total number of records for the preceding time period to which it was being compared. Fifty percent of the grid cells were then randomly selected through each of 10 iterations for each time period examined, with the number of cells within which koala records were present enumerated and converted to a proportion of the total area occupied. Differences between time periods were analysed using two-sample *t*-tests.

Generational persistence

Koala records were also examined for localized re-occurrence over time. The term "Generational Persistence Analysis" (GPA) has been coined to describe this process, analyzing the data for repeated records of koalas within a localised area for the purpose of identifying the presence of resident and/or source populations. "Localised" is considered to include that area defined by the 2.5km grid cell around each koala record, with generational persistence inferred by records occurring over the course of three or more consecutive koala generations.

Threatening Processes

Records with sufficient detail were also examined to ascertain their potential to inform knowledge regarding the influence of factors such as disease, road-strike and dog attack on considerations relating to longer-term koala population viability.

Results

Koala records

Four thousand, two hundred and seventy six (4,276) individual koala records were obtained for the Lismore LGA, of which 3,619 had a date reliably attributed to them; hereafter the results of our analyses utilise only dated records. The chronological distribution and associated number of koala records is presented in Figure 2.

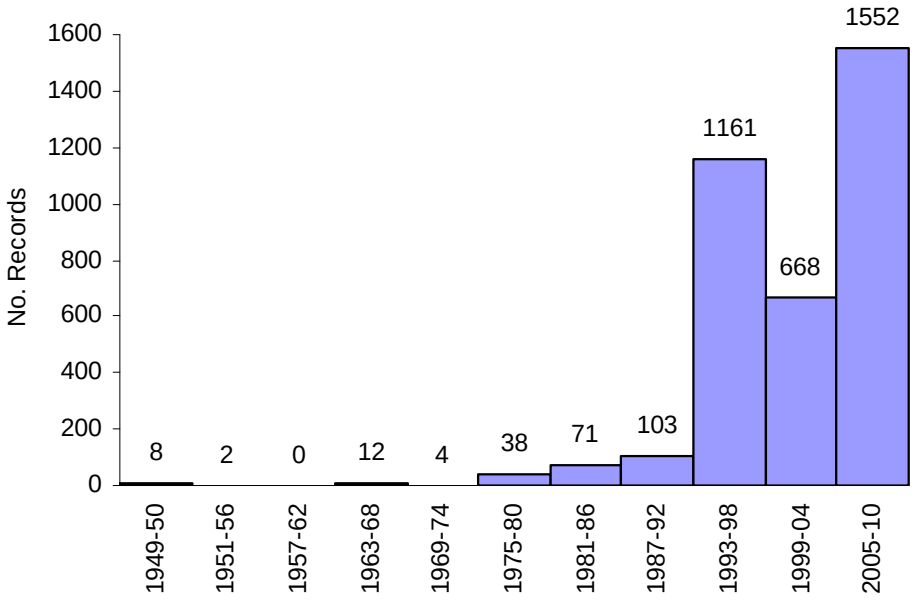


Figure 2. Chronological distribution of 3,619 koala records for the Lismore LGA over the period 1949 - 2010.

The earliest documented records of koalas in the Lismore LGA occur in 1949 – one in the Tuckurimba area, the other in what is now Nightcap National Park. Through the 1950s there are a further four records associated with the Tucki area, while the first records for Lismore – Goonellabah also appear. The first record for the Dunoon area does not appear until 1967. The frequency of reporting of koala records gathers momentum from the late 1970s, this time period coinciding with the first Statewide survey (Gall 1978), thereafter the National Koala Survey (Phillips 1990; Reed and Lunney 1990), and most recently Dan Lunney's 2006 community-based koala survey for NSW. Listing of the koala as a threatened species in NSW during the 1990s no doubt worked to elevate the species' profile and so increase the reporting rate throughout the LGA.

Extent of Occurrence

Available koala records reveal an *EoO* over time of approximately 151,226ha, this being that area captured by a MCP with vertices intersecting the outer-most koala records in the dataset for the time period 1949-2010 (Figure 3). The main clustering of records over time within the LGA generally coincides with two major areas, the first being the City of Lismore

and areas immediately to the south and east, the second to the northwest and encompassing areas of the former Big Scrub.

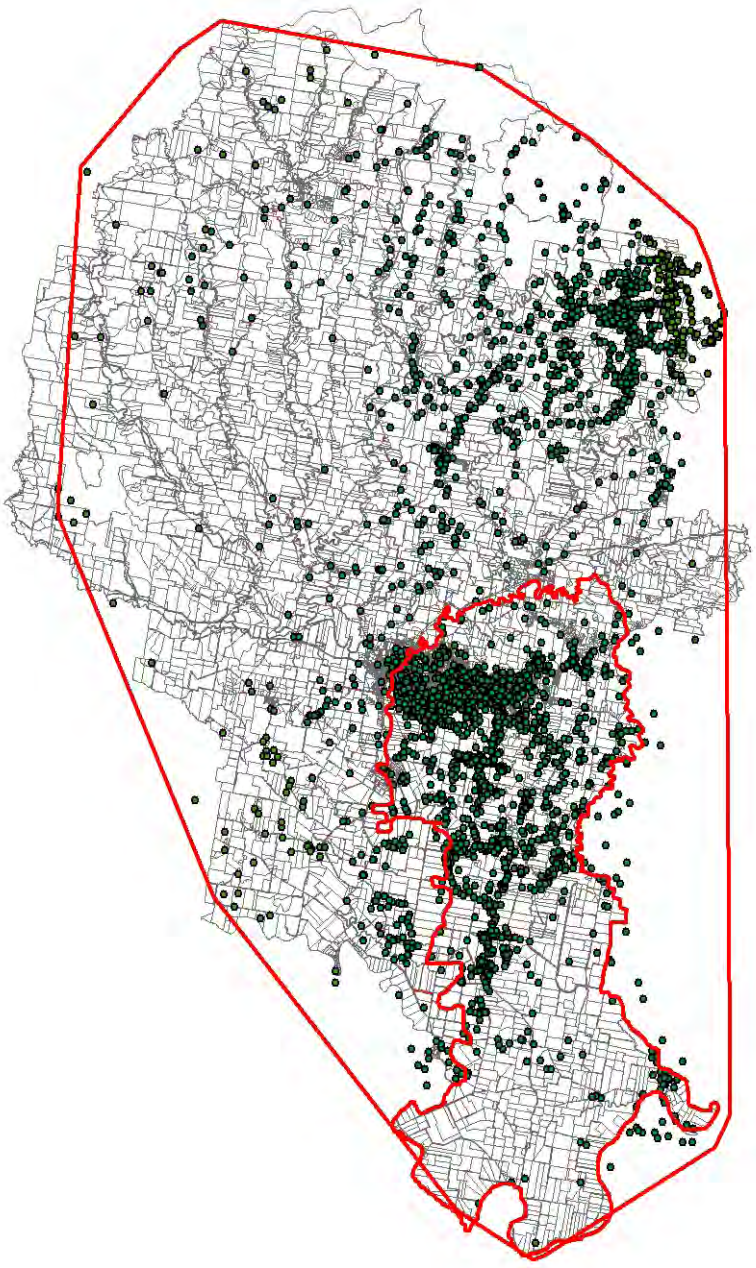


Figure 3. Extent of Occurrence of Koalas in the Lismore LGA over the period 1949-2010. Smaller area outlined in red in this and following figures incorrectly approximates area to be covered by proposed CKPoM.

This area exceeds that encompassed by the LGA's political boundaries, an outcome arising from the MCP process which by necessity captures areas from adjoining areas. Given that such areas are a constant in all subsequent analyses, their presence does not play a significant role in subsequent calculations. This issue aside, the records demonstrate that an *EoO* of this size has not always been the case - that for the time period 1949-1992 being substantively smaller at approximately 68% (102,183ha) of this area (Figure 4). As might be deduced from the difference between the two, the trend over the last six koala generations (1975-2010) appears to have been one of incremental range expansion (Table 1, Figure 5). The *EoO* for koalas across the LGA over the last three koala generations (1993-2010) is illustrated in Figure 6.

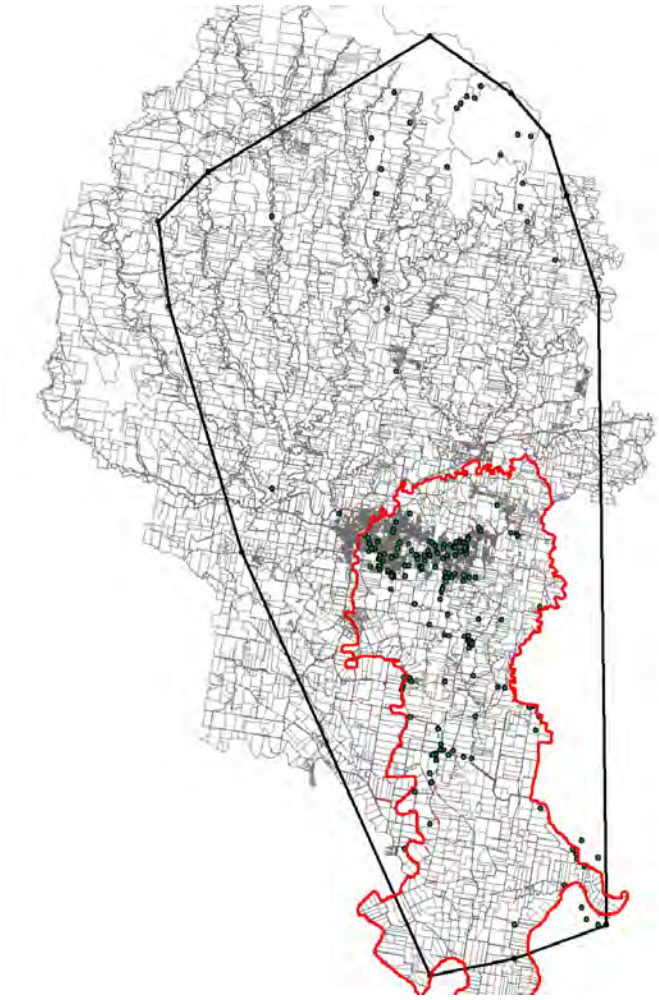


Figure 4. Koala *Extent of Occurrence* within the Lismore LGA over the period 1949-1992.

Table 1. Changes in the *Extent of Occurrence* of koalas in the Lismore LGA over the time period 1975-2010. Average change 1993-2010 represents the averaged generational trend when compared to the 102,183ha EoO for the time period 1949-1992.

Time Period	EoO (ha)

1975 - 1980	65,962	
1981 - 1985	78,778	
1986 - 1992	77,053	
1993 - 1998	126,445	
1999 - 2004	108,350	
2005 - 2010	146,554	
Average change 1993 - 2010	**+ 24,933**	**+ 24.40%**

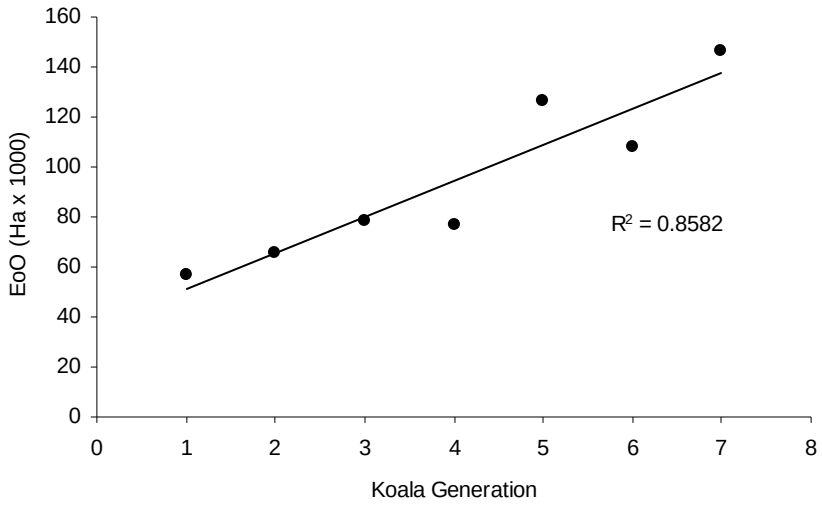


Figure 5. Changes in the Extent of Occurrence of koalas within the Lismore LGA over the time period 1949-2010. Numbers 2 – 7 on the x-axis indicate sequential koala generations (6 year cycles) commencing in 1975, while the value for "1" represents all records from 1949-74 inclusive.

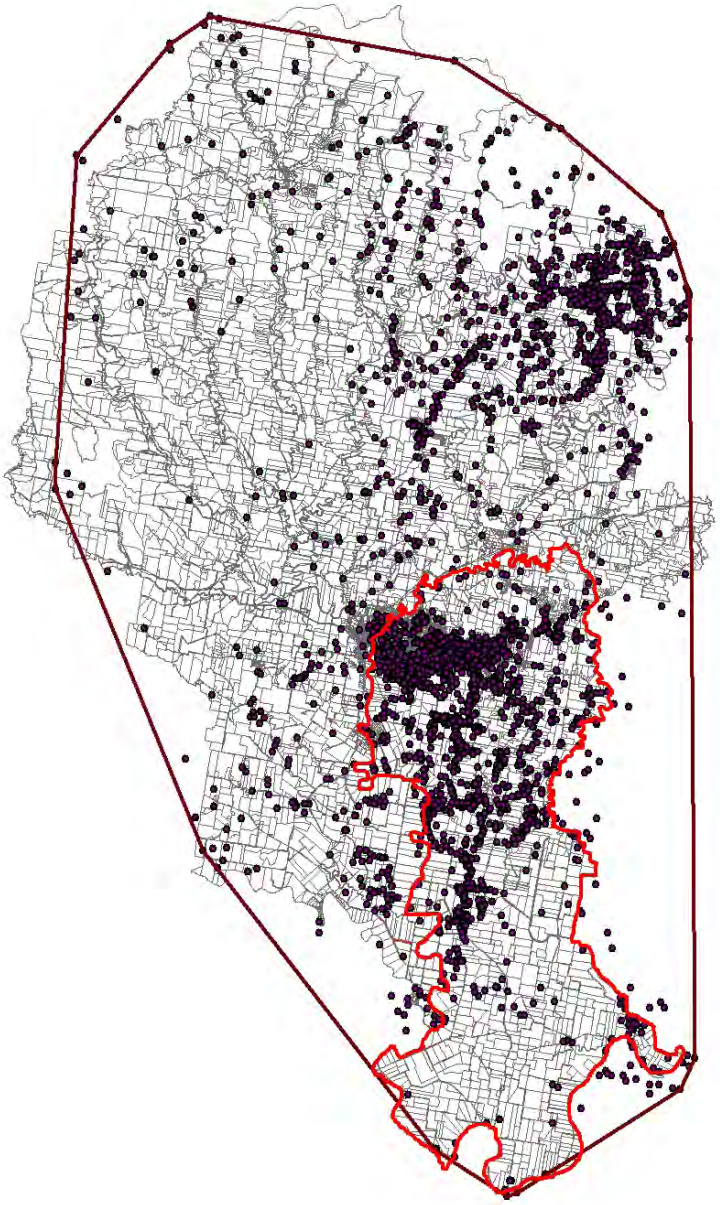


Figure 6. Koala *Extent of Occurrence* within the Lismore LGA over the period 1993-2010.

Area of Occupancy

The occupancy rate estimated from the 238 records that comprise the entire subset of data for the time period 1949 - 1992 was compared to that of 238 randomly selected records for the time period 1993 - 2010. Randomly sampling 50% of the LGA over 10 iterations returned the following results:

1949 – 1992

Mean *AoO* estimated at 24.51 ± 2.29% (25,045 ± 2,340ha; 95% CI).

1993 – 2010

Mean *AoO* estimated at 29.77 ± 1.65% (43,629 ± 2,418ha; 95% CI).

Analysis of the data associated with these two outcomes indicates that there has been a statistically significant increase in the extent of the study area being occupied by koalas over the last three koala generations (1949 - 1992 (n = 238) *vs* 1993 - 2010 (n=238): t = -4.21788, 18_{df}, P < 0.001, two-tailed test).

Generational persistence

Such is the number of records, it has been possible to undertake comparisons between two suites of three consecutive koala generations between 1975 and 2010 (Suite 1: 1975-1992; Suite 2: 1993-2010), thus illustrating shifts in the extent and location of areas of generational persistence. During the three koala generations from 1975 to 1992, available records for the LGA indicate three areas of generational persistence, coinciding with the areas of Lismore-Goonellabah, Wyrallah and Tucki-Tuckurimba. These data (Figure 7) suggest the presence of quite small and localised source populations. The subsequent three-generation subset (years 1993-2010) indicates a substantive increase in the area of generational persistence, with records from the aforementioned locations persisting through to 2010 (Figure 8); the most dramatic change when contrasted to that in Figure 7 is evident in the northeast of the LGA.

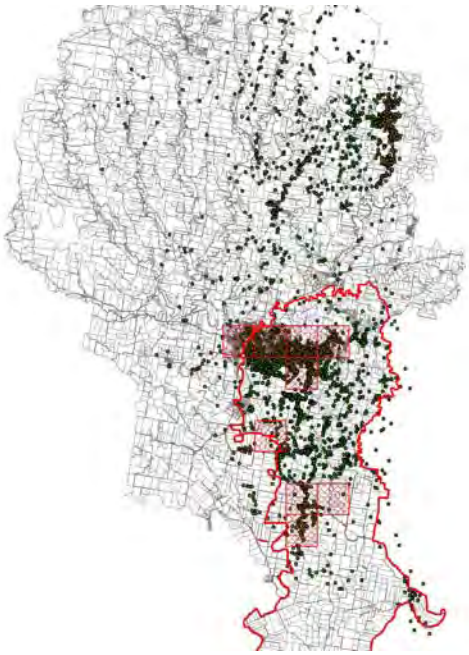


Figure 7. Areas of Generational Persistence: 1975 – 1992.

Figure 8. Areas of Generational Persistence: 1993 – 2010.

Disease

Disease is a fundamental element of wildlife population dynamics and a factor generally recognised as a density dependent mechanism enacting population regulation. This is also the case with koalas; reproductive output/population size is primarily affected by elevated levels of Chlamydiosis in response to reduced levels of metabolic/genetic fitness and/or immunological suppression brought about by stressors such as a reduction in the available food resource and/or elevated agonistic interactions. Unfortunately, at the urban-bushland interface such natural stressors are replaced by more anthropogenic catalysts such as habitat loss, dog attack and motor vehicle strike, the consequence of which tends to manifest itself in elevated levels of disease, reduced reproductive output and mortality. Disease levels are high within the Lismore – Goonellabah sub-population, an issue that – as detailed in section 1.2.4 - may well be exacerbated by the current genetic structure of the population, the high level of inbreeding having resulted in a suppressed immunological response.

Given the above, but also a notion indirectly supported by the strong recovery trend revealed by the records, we do not see disease *per se* as a direct or overriding threat to long-term koala population viability in the planning area. This aside, mortalities due to disease are widespread throughout the current range of koalas within the LGA, accounting for 7.4% (267/3619) of all dated records, Chlamydiosis being the most commonly attributed disease. Euthanasia (of diseased animals) also accounts for the majority of known mortalities since 2003, thus highlighting the importance of disease management as a local issue.

Road mortalities

There are 123 records of confirmed koala road kill in the database over the period 1992-2010. This should not be interpreted as the full extent of koala road-kill because the majority of records for this time period do not have relevant information associated with them, nor are all koala road-kills reported. However, if we use the available data as a proportional representation of the overall distribution of road-kill within the LGA and then further partition it in terms of locality the following outcomes emerge:

(i) the majority of koala road kill is associated with Wyrallah Road between the southern outskirts of Lismore and the locality of Tuckurimba. Eighteen percent (22/123) of all koala deaths directly attributable to motor vehicle strike occur along this road. We note that this road kill data includes double mortalities of mother and pouch or back young, but our analysis in this instance has been restricted to adult koalas only. Further analysis indicates that the number of koalas being killed has been increasing annually over the last decade (Figure 9).

(ii) That area of the Bruxner Highway between Lismore and the Alstonville Plateau within the Lismore LGA is the next highest contributor to road-kill, accounting for ~11% (13/123) of available records. Thereafter, the Alphadale to Wyrallah Roads, and the Bagotville Rd through to the village of Broadwater collectively account for a further 10% (12/123) of recorded mortalities, the remainder scattered elsewhere throughout the LGA.

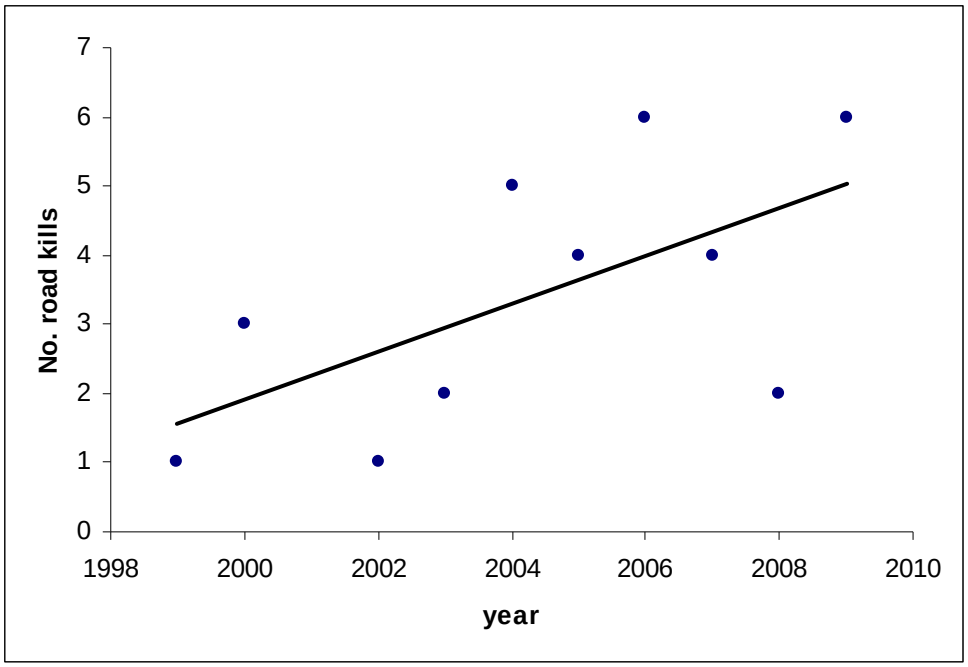


Figure 9. Changes in the rate of koala road-kill along Wyrallah Road in the Lismore LGA 1999-2009.

As has been demonstrated by the gradual upgrading of Skyline Road upgrade that has taken place since 2003, it is possible to effectively ameliorate the potential for koala road kill by effective use of exclusion fencing, strategically placed underpasses, and the use of specially designed cattle grids at fence ends and driveways. Monitoring of koala use of underpasses at this location has revealed 100 – 150 under-road traverses by koalas on an annual basis, with known mortalities limited to a single animal in December 2009, the locality of which was near to a gate that had been left open for several days preceding (Biolink 2010).

The overall efficacy of the measures applied at Skyline Road demonstrates what can be achieved, while the single mortality clearly attests to the consequences of lassitude and complacency. This latter consideration aside, the Skyline Road measures remain a benchmark that should set the minimum standard for all future road upgrades through areas of koala habitat, in addition to the obvious advantages of their application in terms of reducing existing road mortalities along the aforementioned black spots.

Dog attack

There are 98 mortalities directly attributable to dog attack, the majority of which (89%) occurred in the Lismore – Tucki area. Domestic dog attack continues to be recognised as a key threat to koala populations and a significant contributor to anthropogenically-originating koala mortality (Qld EPA 2006; DECC 2008). The impact of dog attack on koala populations increases with urbanisation and habitat fragmentation. Within the planning area the higher frequency of cleared areas and roads means individual koalas are required to travel greater distances in order to continue to access resources, increasing both the amount of time spent on the ground and susceptibility to dog attack.

Key Outcomes

- The historical record indicates that koalas have a long history of occupation in the Lismore LGA. The population was significantly reduced at some time in its past, but appears to have been on a recovery trajectory over the last three koala generations. The number of records available for analysis has also increased substantively over the last three koala generations, a fact attributable to both an

increase in reporting rate coupled with an increase in koala distribution and abundance.

- The recovery trend is well supported by analysis of changes in the range parameters *Extent of Occurrence* and *Area of Occupancy*. There have been progressive increases in the *EoO* over the time period 1949-2010, with that for the last 3 koala generations exceeding that of all generations before it. The current *EoO* for koalas in the Lismore LGA approximates an area of 146,000ha, or the entire LGA. There has also been a significant increase in the area being occupied by koalas, from approximately 25% of the LGA in the period 1949-1992, to 30% in the time period 1993-2010. Optimal occupancy rates for free ranging koala populations are estimated to be approximately 50% of available habitat (Phillips *et al*. submitted).

- Generational Persistence Analysis further evidences a much reduced population over the period up until 1992 with only three small source areas in the Lismore-Goonellabah, Wyrallah and Tucki-Tuckurimba areas. In contrast, the 1993-2010 GPA data alludes to both an expansion of these areas and the establishment of additional source populations in the area of the former Big Scrub to the northeast of Lismore.

- Disease, road-strike and dog attack feature prominently in the mortality data but do not appear to have significantly impeded the overall trends of positive population growth and gradual range expansion over the last 6 koala generations. This is not to say however that these issues can simply be discounted, because they have potential to significantly influence longer-term population viability.

- We consider that the recovery and associated range expansion of koalas in the Lismore LGA is arguably attributable to fire – or the lack thereof – throughout the two areas where the majority of the population(s) now reside, the first in a highly fragmented floodplain landscape with scattered food trees and little risk of wildfire, the second in a largely horticultural setting where koala food trees such as Tallowwood *Eucalyptus microcorys* have been planted as windbreaks.

- Recovery and range expansion detailed in this report accommodates neither complacency nor apathy in its outcomes. Results highlight a need for koala management measures beyond that area currently envisaged for the CKPoM. There are also interesting genetic issues to consider, along with the potential for rapid human population growth and urban expansion to turn this trend around within a single koala generation.

Genetics of Lismore koalas

Recent work by Lee (2009) has provided valuable insight into the genetic structure of koalas across the Lismore LGA. In brief, two significantly differentiated koala gene pools are present, the first of which occurs in the Lismore – Goonellabah area. This population is typified by a relatively low number of alleles and lower heterozygosity when compared to the other population in the north; Lee (2009) further surmising that the population has stemmed from a small number of founding individuals. Given that the preceding analysis of historical records also implies the presence of only a small population in the Lismore – Goonellabah area up until the late 80's – early 90's, there is support for the notion of a small founder population.

The other genetically differentiated population is located to the north of Lismore where it predominantly occupies – at this point in time – areas mostly associated with the former Big Scrub. This population is radiating southwards, assisted by use of tree species such as Tallowwood which have been planted as windbreaks by orchardists. In contrast to the Lismore – Goonellabah koalas, this population is genetically more diverse with strong affinities to known genomes in south eastern Queensland (Lee 2009). The southward radiation too is strongly supported by the historical record in terms of both the increasing number of records *post* 1992 when compared to the period 1949 – 1992, as well as the contemporary areas of generational persistence that have consolidated over the last three koala generations.

There is some evidence that genes from the two aforementioned populations are now starting to combine, but this has only happened in recent years; as it currently stands genetic equilibrium has not been reached, leading to what has been termed the Wahlund effect (Lee 2009). This effect can be expected to diminish over time as genes from the northern population continue to mix with those of the southern population.

Knowledge regarding genetic structure of the Lismore koalas provides for interesting speculation. In this context it is notable that the movement of genes is radiating in a southerly direction rather than expanding northwards. This indirectly implies that the northern population is the fitter of the two gene pools; it follows that we should expect to see an increase in fitness of the Lismore - Goonellabah koalas over time, perhaps manifested in lower levels of disease and increased reproductive output.

Food tree preferences & habitat mapping

In order to define the quality of koala habitat it is important to have an understanding as to what elements of the vegetated landscape most influence use by koalas and invariably these are the species' preferred food trees. It is widely recognised that koalas prefer a relatively small number of the *Eucalyptus* species in any given area (e.g. Hindell and Lee 1987; Ellis *et al*. 1999, 2002; Lunney *et al*. 1998, 2000; Martin and Handasyde 1999; Phillips *et al*. 2000; Phillips and Callaghan 2000; Smith 2004; Moore *et al*. 2004). The identification of preferred tree species across large and heterogenous landscapes can be a complex process, as it is now recognised that a number of factors influence the way koalas utilise their preferred suite of eucalypts, including the extent of habitat fragmentation, historical disturbance, stochastic events such as fire, and the nutrient status of the soil (Moore and Foley 2000; Phillips and Callaghan 2000; McAlpine *et al*. 2006). Knowledge regarding habitat use by koalas – and most importantly the issue of preferred food trees - has grown substantively over the last 10 – 15 years. Earlier studies by Phillips and Callaghan (1995), followed by Harris (1999) and independent observations by koala carers made important contributions to local knowledge, collectively isolating key food tree species such as Forest Red Gum *Eucalyptus tereticornis*, Tallowwood *E. microcorys*, and Swamp Mahogany *E. robusta*.

Largely as a component of broad-scale habitat sampling undertaken for purposes of the AKF's Koala Habitat Atlas, a review of koala food tree preferences across NSW was initiated by the NSW Koala Recovery Team in 2000. This work (Phillips 200b) presented an overview of koala food tree preferences throughout the species range in NSW, while also – for the first time – providing a mathematical basis for the classification of preferred koala food tree species as Primary, Secondary or Supplementary. Associated work by Phillips *et al* (2000) and Phillips and Callaghan (2000) further demonstrated that high levels of use of some tree species could be positively associated with their proximity to preferred food trees, and that underlying soil landscape could also influence food tree palatability such that even broadly accepted food tree species would be preferred on one soil landscape but avoided on another. Ongoing biochemical studies of this phenomenon (e.g. Moore and Foley 2005) have confirmed such volatility to be more widespread than previously known, and that it is particularly prominent in the Eucalyptus sub-genera *Symphomyrtus* (Gleadow *et al*. 2008).

For purposes of the approved NSW Koala Recovery Plan (DECCW 2008), the Lismore LGA is located in the North Coast Koala Management Area. Appendix 3 of the approved Recovery Plan lists 15 species of preferred koala food tree species for the North Coast Koala Management Area, four of which naturally occur within the planning area proposed to be covered by this plan:

<u>Primary Food Tree Species</u>:

Forest Red Gum* *Eucalyptus tereticornis*

Tallowwood *Eucalyptus microcorys*

Swamp Mahogany *Eucalyptus robusta*

<u>Secondary Food Tree Species</u>

Grey Gums *Eucalyptus propinqua* and *Eucalyptus punctata*

* includes the naturally occurring *E. tereticornis* x *E. robusta* hybrid referred to as *E. patentinervis* by Bale (2003).

A further four koala food tree species listed in Appendix 3 of the Approved Recovery Plan also occur within the broader boundaries of the Lismore LGA – Orange Gum *Eucalyptus bancroftii*, Narrow-leaved Red Gum *Eucalyptus seeana*, and the Stringybarks *Eucalyptus eugeniodes* and *Eucalyptus globoidea*. Some edaphic parameters associated with the local distribution of these four species do occur within the planning area proposed to be covered by this the CKPoM.

As previously reported by Phillips and Callaghan (1995) and Harris (1999), a wide variety of other tree species are known to be used by koalas in the study area. However, it is the aforementioned four species without which free-ranging koala populations cannot sustain themselves, and hence it must be these particular species that become the focus of habitat management. In this context there is widespread acknowledgment and support for the notion – even amongst preferred food trees – that bigger trees are more preferred than their smaller cohorts. Table 2 illustrates how this trend applies to food tree selection by koalas generally, but more so amongst secondary food tree species. For purposes of finding middle ground in the development – preservation argument however, the overriding rule is that retention of large trees must take precedent over smaller trees.

Table 2. Generalised model illustrating modes of preferential utilisation of food trees by koalas, based on size class. In this table, trees of the size class indicated by blocked out cells in Row 1 are a finite resource at the home-range level of individual animals, while those in Row 3 are least important. Row 2 represents the "grey area" within which retention should also be maximised.

1									
2									
3									
	<100	100 - 150	150-200	200-250	250-300	300-350	350-400	400-450	>450

Table 3. Approximate mapped areas (in hectares and % total veg cover) for each category of koala habitat identified within the planning area.

	Habitat Quality	Area (ha)	% of total
Potential koala habitat	Primary	858	16.2
	Secondary A	637	12.0
	Secondary B	3	0.1
Other habitat	Other	3,580	67.6
	Unknown	217	4.1
	Totals	**5,295**	**100.00**

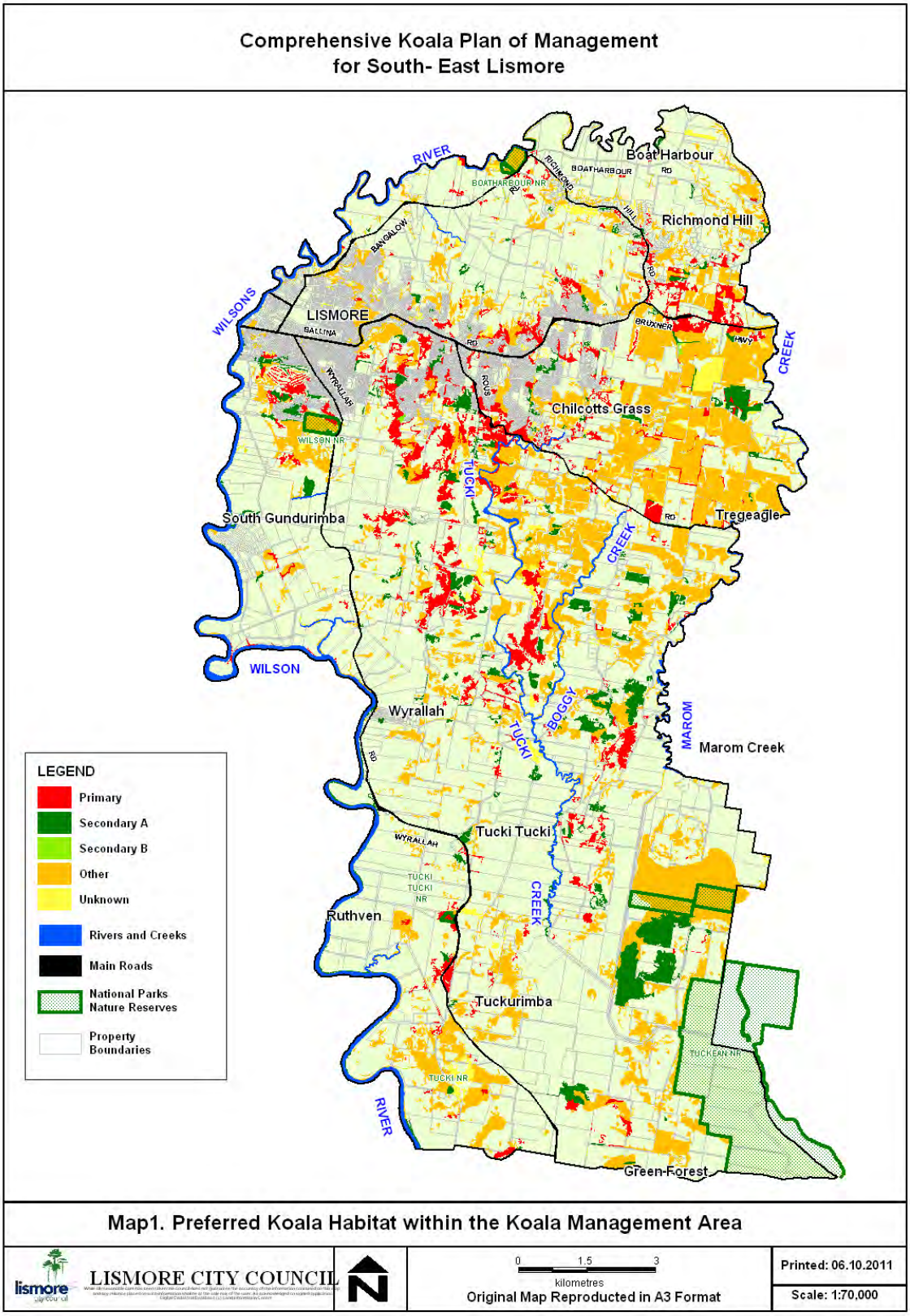
It is important to realise that the preceding table only accounts for those areas of remnant native vegetation capable of being mapped as structural attributes (i.e. polygons) of the landscape, the work of McKinley *et al*. (2011) focusing on polygons greater than 0.5ha in size. In reality however, a larger area of habitat additionally exists in the form of agricultural lands supporting scattered Forest Red Gums that typify so much of the Wilson and Richmond Rivers floodplains. It is also significant that the majority of mapped areas of Primary and Secondary A habitat, along with the aforementioned agricultural lands, are all located on high nutrient soil landscapes, thus creating a koala habitat landscape with high carrying capacity. Map 1 from the work of McKinley et al (2011) is reproduced on the following page. While extensively fragmented, remaining areas of both Primary and Secondary A habitat can be seen scattered throughout the northern half of the study area.

Key outcomes

- A suite of 4 eucalypt species comprising Swamp Mahogany *E. robusta,* Forest Red Gum *E. tereticornis,* Tallowwood *E. microcorys and* Grey Gum *E. propinqua* are the most preferred food tree species for koalas within the planning area.

- A total of 1,471ha of *potential koala habitat* can be identified based on available vegetation mapping. Primary Koala Habitat comprises the greater proportion of available habitat, representing approximately 16% of the total area of mapped vegetation.

- A large portion of lands not classified by McKinley *et al* (2011) comprise agricultural lands with scattered koala food trees, and in particular Forest Red Gum. Such lands similarly qualify as potential koala habitat and moreover, play a fundamental role in sustaining the local area's resident koalas.


Comprehensive Koala Plan of Management
for South- East Lismore
Boat Harbour
Richmond Hill
LISMORE
Chilcotts Grass
South Gundurimba
Tregeagle
Wyrallah
Marom Creek
Tucki Tucki
Ruthven
Tuckurimba
Green-Forest
WILSONS RIVER
WILSON
TUCKI CREEK
BOGGY CREEK
MAROM CREEK
CREEK
BRUXNER HWY
BOATHARBOUR NR
WILSON NR
TUCKI TUCKI NR
TUCKEAN NR
TUCKI NR
LEGEND
Primary
Secondary A
Secondary B
Other
Unknown
Rivers and Creeks
Main Roads
National Parks
Nature Reserves
Property
Boundaries
Map1. Preferred Koala Habitat within the Koala Management Area
LISMORE CITY COUNCIL
0 1.5 3
kilometres
Original Map Reproducted in A3 Format
Printed: 06.10.2011
Scale: 1:70,000

Other matters

An ability to move freely across the landscape allows for the effective dispersal of sub-adult koalas between breeding populations. On a broader scale such movements facilitate wider dispersal and so maintain genetic diversity, and can lead to re-establishment of populations where they may have died out. In the Lismore area local habitat links include riparian vegetation along Tucki Tucki and Marom Creeks and the Richmond and Wilsons Rivers, open space zones on the Northern Ridges, Goonellabah and East Lismore which connect larger remnants, and remnant vegetation between Invercauld and Rous Roads and between Military Road and Invercauld Road. Southern Cross University land, both the main campus area and the Technology Park site also form important habitat areas and linkages, as do Weston Park/Caroona Nursing Home/Goonellabah Primary School, across to the Northern Ridges area.

The influence of patch size, patch shape and level of connectivity are supposedly key factors determining the ability of a landscape to support viable koala populations. McAlpine *et al.* (2007) suggest that the probability of koalas being present falls as the percentage of the landscape containing forest cover decreases, while it has also been suggested that the chance of koalas being present starts to decline once patches become smaller than ~150ha. While this certainly does not appear to be the case in Lismore, the survival of meta-populations (a group of sub-populations connected by dispersal) relies on the ability of animals to recolonise habitat patches where a sub-population has become locally extinct. Whilst habitat patches that are further apart are often considered less connected than patches close together, connectivity also depends upon the nature of the matrix and the existence of barriers to movement.

The maintenance of habitat patches of sufficient size to support existing populations and provide for future population dynamics is fundamental to koala population and habitat management. To this end a three-faceted approach will be required, consisting of the following foci.

1. Retention of koala habitat *in-situ* in the first instance, with a focus on occupied habitat, and adjoining areas of potential koala habitat.
2. Protection of bushland areas that contain preferred food tree species is also necessary to preserve the habitat resource.

3. Maintenance and creation of vegetated linkages between habitat patches and source populations.
4. Strategic revegetation work with the aim of consolidation of existing habitat patches and habitat creation. Revegetation work should focus primarily on "gap-filling" in large habitat blocks within and adjacent to mapped source populations, edges of habitat blocks and within linkage areas.

Koala care and welfare

Given elements of the preceding information, there is clearly an ongoing requirement for an effective mechanism for managing koala casualties resulting from vehicle strike and dog attack, orphaned animals, and animals suffering from disease. In NSW wildlife welfare and carer groups are licensed to rescue, rehabilitate and release native fauna under Sections 120, 132C and 127 of the *National Parks and Wildlife Act 1974*. Friends of the Koala Inc. are the organisation responsible for koala care in the Lismore area.

Consultation with Friends of the Koala Inc has identified a number of issues that could be addressed in order to assist its ongoing operation and improve care for koalas in the planning area. These issues include increasing community awareness regarding how to recognise when koalas require assistance and what to do in this situation, the role of carers, and the need for ongoing recruitment of active carers. Sourcing of financial and in-kind assistance for equipment and training have also been identified as priorities.

Discussion

The preceding sections serve to provide an interesting overview of the ecology and other factors influencing and/or limiting the distribution and abundance of koalas in the planning area. This study is the first detailed assessment of koala distribution and abundance across the LGA and reflects application of a number of assessment techniques not previously available. Thus a framework for moving forward on an informed basis now exists. In the following pages we further discuss key outcomes arising from the study before proceeding to a general conclusion and associated prognosis for the study area's koalas. Recommendations intended to guide Council towards preparation of a CKPoM for the study area are also provided.

Despite a relatively recent history that has seen the Lismore – Goonellabah koalas arguably perched on the precipe of localised extinction, analysis of historical data supports a strong recovery trend over recent decades. Moreover, the presence of additional southwardly radiating genes from an additional population in the north now occupying much of the former Big Scrub, is also comforting given the potential of this northern population to enhance the overall well being of Lismore's koalas. The obvious question that arises is whether (or not) koalas have a secure future within the study area, to which our qualified response would be in the affirmative. However, it remains an unknown as to whether the incidental mortality rate attributable such things as motor vehicle strike and dog attacks is already exceeding that which is sustainable at the population level.

It is a novel situation indeed that the koala populations inhabiting the study area appear to bucking state and national trends of decline. Indeed, all available data points to a population that has been expanding over at least the last two decades, begging the question as to why this might be the case. We speculate that the absence of wildfire is a key consideration, as is the high carrying capacity landscape with correspondingly high numbers of palatable food trees. The extensive agricultural landscape on the floodplain is also likely to be a key factor, allowing large numbers of koalas to survive in areas that are relatively removed from threats such as domestic dogs.

Given the broad recovery trends inferred from analysis of the historical records some may argue that little, if anything needs to be done with the Lismore koalas, indeed, they appear to have not just survived, but also increased their population size despite everything that has thus far been thrown at them. While the recovery trend is both a positive outcome and encouraging in terms of the future, it is still a way from being secured. From a koala conservation perspective, an *optimal* occupancy rate is that which sees not all available habitat occupied, but in which there is allowance for population expansion (into currently unoccupied areas) and population contraction in response to stochastic events). As evidenced by situations in places such as French Is. (Vic) and Kangaroo Is. (SA), a population existing at high occupancy levels encounters stressors related to limited resource availability, a situation considered to be far from ideal. Results from our studies elsewhere of demographically stable koala populations consistently return occupancy

rates approximating 50% of the available habitat (Phillips *et al*. submitted). Conversely, for populations considered endangered such as those in Hawks Nest – Tea Gardens and the South-east Forests, occupancy rates have been determined to be as low as 16% and 8% respectively (Biolink 2005; Allen and Phillips 2008). While for many this variation in occupancy rate is a novel concept in terms of landscape-scale koala management, it makes ecological sense and thus underpins the need for conservation planning to both recognise *and* make allowance for koala metapopulation contraction and expansion over time in response to ongoing recruitment and/or attrition events.

Given the above, the currently estimated occupancy rate of ~30% of available habitat across the LGA is less than the notional benchmark of 50%, raising the question of whether or not the population is in a position to withstand the pressures of stochastic events, habitat loss and anthropogenic mortality rates. Population Viability Analysis recently carried out by Phillips *et al*. (2007) has determined that as little as a 2 – 3% increase above the naturally-occurring mortality rate (as a function of total population size) due to incidental factors such as road mortality, dog attack or the stressors associated with disturbance generally, is sufficient to precipitate decline. In short, there are no grounds for complacency and it will only be by effectively managing and continuing to assist the overall recovery process that the whole of the population will be preserved.

The preceding prognosis reinforces not just the need to remove and/or minimise known and potential threatening processes from those areas known to be currently occupied, but also to effectively buffer such areas from further adverse impact, facilitate recovery and accommodate the need for population expansion, as well as ensuring that effective habitat linkages are in place to facilitate ongoing recruitment processes. It would be a great tragedy should this population commence to decline. Hence the need for an appropriately informed and framed management response, the key purpose of which must be the identification of opportunities and/or actions to facilitate survival of the population in perpetuity.

Recommendations

It will be important that management actions for the planning area be prioritised so as to maximise the conservation benefit. With this in mind, the following recommendations are

provided in order to provide focus for issues to be addressed by Council as it moves towards integration of the outcomes of this study into an informed CKPoM.

1. Population size

- Current knowledge does not include key information such as an estimate of population size and the juxtaposition between occupied and unoccupied habitat areas; tools are available to provide such data. This baseline information is required in order to be able to inform on the efficacy of management actions that may be initiated by the CKPoM, and to enable effective monitoring of the population over time; it is also necessary to gauge the potential impacts arising from incidental mortalities in terms of whether they are currently sustainable or not.

3. Mitigation of threatening processes

- There is a need to develop effective habitat protection measures that can be enacted under the auspices of the CKPoM, in order to address any potential for further fragmentation and/or loss of koala habitat within the planning area. Measures that facilitate the protection of high-quality koala habitat and/or individual preferred koala food trees should be considered as a matter of priority.

- Available knowledge points to a need for development of effective measures such as vehicle calming devices and/or exclusion fencing and underpasses (such as those installed along Skyline Road) in key areas to effectively minimise the potential for road-strike at blackspots identified herein, with particular emphasis on the Wyrallah Road.

4. Planning considerations

- In the development of the CKPoM's planning provisions, there is a need to not only recognise and protect currently occupied areas to the maximum extent possible, but also areas of adjoining high quality (Primary/Secondary A) koala habitat.

- There will be a need for adoption of a standard measures to ensure that all future developments in areas of koala habitat consistently result in implementation of 'best-practice' koala-friendly planning measures.

- There is a need to support strategic bushland regeneration for areas of koala habitat with a view to infilling existing gaps in canopy cover so as to reduce the extent of habitat fragmentation and invasion by weeds that inhibit natural regeneration.

- There is a need to develop “minimum data set” assessment standards to ensure that a high standard of habitat assessment by ecological consultants is maintained and that it is this level of assessment that informs development and future planning within the study area.

- There is a need to develop long-term monitoring programs to form part of the CKPoM in order to enable the tracking of the success or otherwise of working provisions that may be promulgated for the planning area; again, data on population size and the extent and distribution of currently occupied areas will be fundamental to future planning and monitoring of the population.

- The planning area is already extensively fragmented and future koala management will benefit from development of an informed network of linkages and corridors, none of which necessarily need to compromise existing land uses. Given knowledge that koala population viability within the planning area does not appear compromised at this point in time, some time can be afforded this process as a task to be completed within the first few years of the plan.

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