



**ballina**  
shire council

# Koala Toolbox For Roadwork Activities

Ballina Shire Council 2019

**Take care** • **Be aware** • **Koalas are there**



**Take Care - Be Aware - Koalas are There**

**Ballina Shire Council 2019**

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# Background

## Koalas in Ballina Shire

The koala is listed as a vulnerable species under the NSW Biodiversity Conservation Act 2016 (BC Act). The combined population in Queensland, NSW and the Australian Capital Territory is listed as a vulnerable species under the Commonwealth Government's Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Ballina Shire's koala population within the Bagotville, Meerscham Vale and Wardell areas (the Southern Koala Management Precinct) meets the criteria for an 'Important Population' for the purposes of the Environment Planning and Biodiversity Conservation Act (1999). This means that the population in Ballina Shire is recognised as a nationally significant one.

## The Koala Management Toolbox for Roadwork Activities

Road and traffic management has been identified in the Ballina Shire Koala Management Strategy (KMS) as a key area for management action. The Road Works Koala Management Toolbox project aims to reduce adverse impact on koalas associated with Council road works (road construction, maintenance and roadside vegetation management) and support positive outcomes for koalas. The toolbox directly addresses actions listed in the Ballina Shire Koala Management Strategy 2017.

The key objectives of this Koala Management Toolkit are to:

- i. Provide information that improves the awareness of relevant Council staff about the importance of Ballina koalas and build an understanding of where they are more likely to encounter koalas when conducting roadwork activities.
- ii. Provide tools and procedures that assist relevant Council staff in minimising impacts to any koalas observed whilst carrying out work activities within road corridors.
- iii. Create a data capture procedure for Council staff to record koala sightings and assist in the ongoing conservation of the species in the Ballina Shire.
- iv. To provide staff training and induction processes as well as incentives that improve the awareness and understanding of the key objectives listed above.

**Section 1** outlines the tools and procedures established to minimise harm to koalas whilst working in the field. This section is supported by a staff induction for all relevant council staff carrying out construction, maintenance or roadside vegetation management activities in the road reserve.

**Section 2** provides information about koalas and how to spot them in the field. This component is supported by providing key staff with in-field training with an independent koala expert to learn the skills to spot koalas in the field. This includes not only spotting individual koalas but also recognising other signs that may indicate they are in the locality (such as scratches, scats, rubbing marks etc).

**Section 3** provides a decision framework and associated ameliorative / impact mitigation tools for new and existing road upgrade design and mitigation.

# 1. Koala Management Tools and Procedures

## 1.1 Priority Koala Areas - Roads Mapping

Mapping of all Council operated roads in Ballina Shire has been undertaken to identify areas that are important for koalas and hence where they are likely to occur. These areas are mapped as Priority Koala Areas (PKAs). Procedures have been developed in conjunction with Friends of the Koala (FoK) and Council staff that aim to minimise harm to koalas when Council staff are carrying out road work activities in these areas.

Council crews carrying out roadwork activities should have access to the koala toolbox information and mapping overlay to identify key koala areas as a means of planning their works program. Red (Koalas are there) and Orange (Be Aware) zoned roads indicate koalas use this area. This information is based on mapping and field studies undertaken by Biolink ecological consultants in 2018.

Figure 1 shows the shire roads and indicates those that are categorised as RED or ORANGE. Hardcopy location maps showing this information is available in Appendix 1 of this toolbox folder, together with an index of road names relevant to these zones.

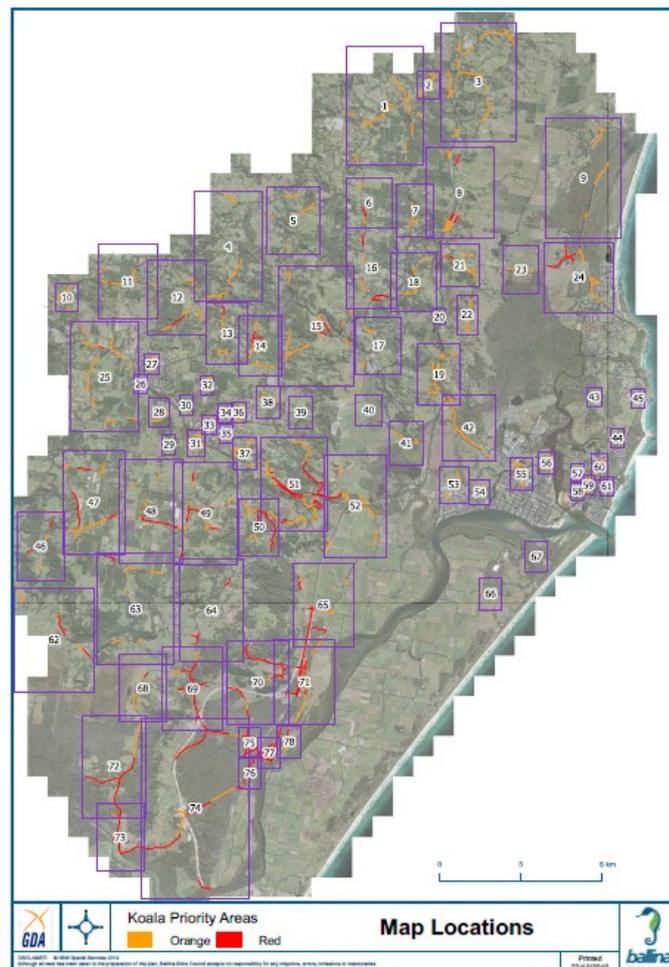


Figure 1: PKAs for roads in Ballina Shire (See Appendix 1)

Electronic maps are available on Council's Intra Map layer (PKA Intra maps layer can be found on Council's Intra Maps under the Environment Tab > Koala > zz Priority Koala Areas > PKA Roads) see Figure 2.

Figure 2: Intramaps PKA roads layer

The screenshot displays the Intramaps web application interface. At the top, there is a navigation bar with the following elements:
 

- Ballina > Environment
- File
- Edit
- View
- Favorites
- Tools
- Help

Below the navigation bar, there is a search and navigation area containing:
 

- Authority - Live
- Ballina Shire Website
- Ballina Shire Infonet
- Google Search
- ISSUU - Tactical Urbanism...
- Modify Survey
- Outlook Web App
- People Tracker
- OfficeMaps

The main map area shows a satellite view of a rural area with red lines representing roads. A legend on the right side of the map lists various layers, including:
 

- Text
- Boundaries
- Contours
- Parcel Boy
- Proposed Pacific Highway
- Imagery
- Imagery Archive
- Bionet - NSW Atlas.....(Click On Li...
- Koala
- Koala Management Strategy 2016
- Koala Habitat Study 2013
- zz Priority Koala Areas
- PKA Roads
- Code Red Road
- Code Orange Road
- Drainage/Underpass
- Koala Food Trees
- Potential Koala Corridor
- Wildfires
- Big Scrub Vegetation

The 'PKA Roads' layer is currently selected and visible on the map. The bottom of the screen features a footer with the text 'Take Care - Be Aware - Koalas are There' and '6 | Page'.

## 1.2 Koala Management Procedures for Roadwork Activities

These procedures refer to regular scheduled and planned maintenance and roadside vegetation management activities in Council operated road reserves such as:

- Roadside tree trimming pruning or removal
- Roadside sidearm and grass slashing
- Road resurfacing and patching
- Culvert maintenance and guidepost install and replacement

When undertaking the roadwork activities in Red or Orange Priority Koala Areas (PKAs) or when a koala is spotted during activities in other areas, work crews need to be aware of the following:

- AVOID working between dusk and dawn in red zones
- AVOID working in between dusk and dawn if a koala is observed during works in another zone
- Determine what roadwork activity needs to be undertaken and activate relevant procedures (see below)
- An expert koala spotter or a skilled koala spotter is required (dependent on roadwork activity - see procedures below)
- A pre-work assessment may be required (dependent on roadwork activity - see procedures below)

### **Expert Koala Spotters and Skilled Koala Spotters**

Expert koala spotters are those Ballina Shire Council staff and Friends of the Koala (FoK) members with training and expertise in ecological assessment, ecology and koalas. These expert koala spotters are required for road work activities that have a higher risk of harm to koalas (see procedures below). Contacts for expert koala spotters are:

- BSC Arborist –Bronson Branch Ph: 0436 018 267
- BSC Environmental Scientists – Elisha Taylor Ph: 66861231 or Ian Gaskell Ph: 66861286
- BSC Natural Resource Officer – James Brideson Ph: 66861412
- FoK - Maria Matthes, Mark Wilson, Bill Sheaff Ph: 66214664 Email: [info@friendsofthekoala.org](mailto:info@friendsofthekoala.org)

Expert koala spotters will need to be inducted on site before undertaking a pre-work site assessment.

Skilled koala spotters are those that have been trained in koala spotting. At least one member of the work crew is required to be a skilled koala spotter for all general roadwork activities in Red and Orange priority road areas. All koala spotters should be familiar with the koala toolkit and have this toolkit on site. The koala toolkit includes:

- PKA mapping for Council roads in the shire
- Binoculars
- Koala pre-work site assessment guide
- Koala procedures for roadwork activities
- Koala sighting and welfare reporting information

For a current list of Council staff trained as Expert Koala Spotters or Skilled Koala Spotters see CM 19/75983

### **1.2.1 Pre-work Site Assessment for Koalas in Work Area**

For RED and ORANGE priority koala areas (PKAs) or when a koala is observed in or near a work zone in any other area:

1. A trained koala spotter is required to undertake a pre-work site assessment of the work area before carrying out roadwork activities in Red or Orange PKAs (see mapping).
2. The type of koala spotter (expert or skilled BSC Koala spotter) will depend on the roadwork activity (see procedures listed below).
3. A pre-work site assessment of the work area involves checking the area carefully for koalas or signs of koala (koala scats, tree scratches, rubbing marks etc.) see Section 1.5 Koala Spotting Guide. This assessment **should be undertaken before the job commences and each morning prior to roadwork activities on the site progressing (usually during the morning toolbox meeting)**. If contractors are involved, the pre-work site assessment could be taken the afternoon before proposed works to allow time to delay contractor works if a koala is present in the work zone.
4. Any koala within or near the work zone must be recorded (see 1.3 Koala Data Capture Procedure and Welfare Check) and the appropriate procedure enacted.
5. The pre-work site assessment for koalas, procedure and sighting information is to be recorded in the Toolbox Talk notes.

## **Roadside Tree Trimming and Removal Procedure**

For RED and ORANGE priority koala areas (PKAs) **or** when a koala is observed in or near a work zone in any other area:

1. Avoid work between dusk and dawn.
2. A koala spotter is required to undertake a pre-work site assessment of the work area before carrying out roadside tree trimming and removal activities in Red or Orange PKAs (see mapping):
  - (i) An expert koala spotter is required for
    - The removal of trees (defined as greater than 3 m in height and/or greater than 100mm at breast height above bark) or,
    - Tree trimming/pruning activities using a cherry picker or climber.
  - (ii) A skilled koala spotter is required for
    - Tree trimming/pruning activities using a pole saw.
3. A pre-work site assessment and ongoing koala monitoring by the koala spotter of the work area is required when working in orange or red PKAs.
  - each morning prior to activities commencing in the work area
  - for the duration of tree trimming/removal activities

Note: If contractors are required it may suit work scheduling to conduct an additional pre-work site assessment the afternoon before tree trimming/ removal activity is proposed.

4. Koala actions
  - (i) If no koalas are observed during pre-work site assessment
    - Ongoing koala monitoring by a koala spotter during tree trimming/ removal activity
    - Trees should be trimmed/pruned/removed as carefully as possible
    - Work is to stop immediately if a koala is observed during activities
    - The koala spotter should have direct contact with operators to stop the activity as quickly as possible if required
  - (ii) **If a koala is observed within 50m of the work zone** during pre-work assessment or during roadwork activity
    - Stop work immediately
    - Notify the koala spotter and follow any additional instructions
    - Be quiet and do not approach within 10 m of the koala
    - Establish a 50m exclusion zone around the koala

- Machinery and associated noise (e.g. reversing beeps , vehicles parked or engines/machinery running, operation of radios and mobile phones, dragging of shovels etc.) should not occur within the 50 m buffer / exclusion zone
- Ensure traffic stop and go points are not located within 50m of the koala
- Maintain awareness of the koala's movements
- The koala should be allowed to move away from site on its own
- No interconnecting canopy tree that leads off site should be disturbed
- Once the koala has moved off site and providing no other koalas are observed during searches, works can proceed
- Report koala sighting (see 1.3 Koala Data Capture Procedure and Welfare Check)

*Where exclusion of machinery from the 50 metre buffer zone is not possible, these events should be recorded by the site supervisor in the Toolbox Talk notes. This information should include the type of machinery kept within buffer zone, the amount of time machinery was left in buffer zone and the reasons why this decision was made.*

### 1.2.2 Roadside Sidearm Slashing Procedure

For RED and ORANGE priority koala areas (PKAs) or when a koala is observed in or near a work zone in any other area:

1. Avoid work between dusk and dawn.
2. A skilled koala spotter is required. All sidearm slasher plant operators are to be skilled koala spotters when working in orange and red zones.
3. A pre-work site assessment for koalas of the work area is required, this should be an assessment of each slashing section (usually 300 metres) before the slashing of this section is to commence, and continued monitoring for koalas during works.
4. Koala action
  - (i) If no koalas are observed during pre-work site assessment:
    - Activity to proceed with caution, while being monitored by the koala spotter (for this activity, the plant operator)
    - Activity to stop immediately if a koala is observed during slashing
  - (ii) **If a koala is observed within 50m of the work area** during pre-work assessment or during roadwork activity:
    - Stop work immediately
    - Be quiet and do not approach within 10 m of the koala
    - Establish a 50m exclusion zone around the koala
    - Ensure traffic stop and go points are not located within 50m of the koala
    - The koala should be allowed to move away from site on its own
    - Maintain awareness of the koala's movements
    - No interconnecting canopy tree that leads off site should be disturbed
    - Once the koala has moved off site and providing no other koalas are observed during searches, works can return to zone
    - Report koala sighting (see 1.3 Koala Data capture Procedure and Welfare Check)

### 1.2.3 Roadside Grass Slashing Procedure

For RED and ORANGE priority koala areas (PKA) or when a koala is observed in or near a work zone in any other area:

1. Avoid work between dusk and dawn.
2. A skilled Koala spotter is required - all operators of roadside slashers in red and orange zones are to be skilled koala spotters.
3. No pre-work site assessment of work area is required however plant is to move through red and orange PKAs with caution with continued monitoring for koalas during works.
4. Koala action
  - (i) If no koalas are observed
    - Activity to proceed with caution, while being monitored by the koala spotter (for this activity, the plant operator)
    - Activity to stop immediately if a koala is observed during slashing activities
  - (i) **If a koala is observed**
    - Stop work immediately
    - Be quiet and do approach within 10 m of the koala
    - Establish a 50 m buffer/exclusion zone around the koala
    - The koala should be allowed to move away from site on its own
    - Maintain awareness of the koala's movements
    - Once the koala has moved off work site and providing no other koalas are observed during searches, works can return to zone
    - Report koala sighting (see 1.3 Koala Data Capture Procedure and Welfare Check)

### 1.2.4 General Roadworks Noise Procedure

For RED and ORANGE priority koala areas (PKAs) or when a koala is observed in or near a work zone in any other area:

1. Avoid work between dusk and dawn.
2. A skilled koala spotter is required for all road work activities.
3. A pre-work site assessment of the work area is required.
  - Pre-work site assessment is required each morning prior to activities commencing in the work area
  - Koalas can move into the work site following pre-work site assessment. Continued monitoring for koalas should occur during works.

Note: If contractors are required it may suit work scheduling to conduct a pre-work site assessment the afternoon before roadwork activity is proposed

4. Koala actions
  - (i) If no koalas are observed during pre-work assessment
    - Activity to proceed with caution, while being monitored by the koala spotter
    - Work to stop immediately if a koala is observed during activities
  - (ii) **If a koala is observed**
    - Stop work immediately
    - Be quiet and do not approach within 10 m of the koala
    - Establish a 50m exclusion zone around the koala
    - Machinery and associated noise (e.g. reversing beeps , vehicles parked or engines/machinery running, operation of radios and mobile phones, dragging of shovels etc.) should not occur within the 50 m buffer / exclusion zone.
    - Ensure traffic stop and go points are not located within 50m of the koala
    - Maintain awareness of the koala's movements
    - The koala should be allowed to move away from site on its own volition
    - Once the koala has moved off site and providing no other koalas are observed during searches, works can return to zone
    - Report koala sighting (see 1.3 Koala Data capture Procedure and Welfare Check)

*Note: Where exclusion from the buffer zone is not possible, these events should be recorded by the site supervisor in the Toolbox Talk e-form or notes. This information should include the type of machinery kept within buffer zone, the amount of time it was left in buffer zone and the reasons why this decision was made.*

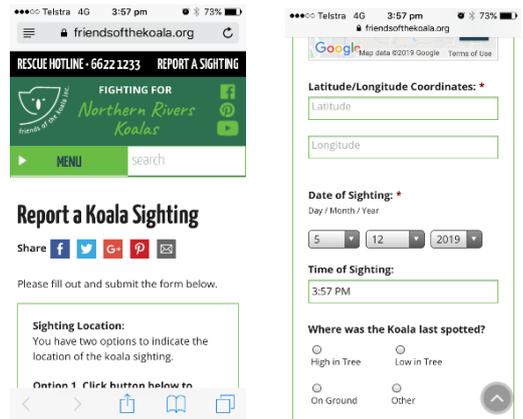
### 1.3 Koala Data Capture Procedure and Welfare Check

1. Report all koala sightings on a work site to the supervisor and log on to the 'Report a Koala Sighting' web page.

[www.friendsofthekoala.org/report-a-koala-sighting/](http://www.friendsofthekoala.org/report-a-koala-sighting/)

Sighting information requested will include:

- Sighting Location
- Date and Time of Sighting
- Where the Koala last spotted
- Condition of Koala
- Size of Koala
- Sex of Koala
- Are young Koalas
- Your contact details. FOK will only contact you if they need to find out more information about this koala.



2. If the koala is not healthy please call our 24 hour rescue hotline immediately (02) 6622 1233. Refer to the Koala Watch information (Appendix 2)
3. Relevant field staff are also required to capture data using the BSC e-form and provide this information to Elisha Taylor email [Elisha.Taylor@ballina.nsw.gov.au](mailto:Elisha.Taylor@ballina.nsw.gov.au)

### 1.4 Koala Spotter Award

## Win Koala Spotter of the Month

If you suspect a koala is ill or injured, please call the Friends of the Koala 24Hr Rescue Hotline on 02 6622 1233



## look up and look out

Complete the following for your chance to win a \$50 BCF voucher.

- 1 report all koala sightings on a worksite to a supervisor
- 2 log record on the 'Report a Koala Sighting' web page [friendsofthekoala.org/report-a-koala-sighting/](http://friendsofthekoala.org/report-a-koala-sighting/)
- 3 complete a BSC e-form

Winners announced each month.



Staff reporting sightings of koalas on a worksite anywhere in Ballina Shire are eligible to go in the draw for a \$50 BCF voucher (drawn every month) when they report a Koala Sighting through the FOK website.

Provide this information to Elisha Taylor via email: [Elisha.Taylor@ballina.nsw.gov.au](mailto:Elisha.Taylor@ballina.nsw.gov.au) within one week of your koala spotting to go in the monthly draw.

## 1.5 Koala Spotting Guide

- Koalas can sometimes be easy to see, but often they are difficult to see blending into the trunk or hiding in the foliage
- Signs of possible koala presence –scratches, scats, smell, noises
- Look carefully at all the branches and trunks – scanning up and down and across
- Look at the tree from different angles having 3 people – one on centre line and one on each side about 12m apart
- Look forward, look back, and look to each side
- If you think you see a koala stop and look carefully with the binoculars. It could be a knot in the tree or a termite mound or a clump of leaves, but it is important to check
- You may just see a dark lump, the glint of the ears as the light passes through, a flash of white on the underside of the arm chest or rump, or a black paw, or the top of the head or rump as a bump
- Koalas can be anywhere in a tree – low or high, on branches or against the trunk.
- Koalas can be found in non-food trees, often Acacias, Cheese trees, Camphor Laurel, vine thickets
- When a koala knows you are there, it will either stay where it is and keep an eye on you, or will move to the top of the tree or to the other side of the trunk where you can't see it
- On a hot day, a koala is likely to be low in a tree and often in a non-food tree
- There may be more than one koala in a tree – male and female, females, female and semi-independent/ independent joey.
- Look for koala scats at the base of those tree species that are preferred food trees for kolas (see Section 3.6 and FOK Koala Watch information in this Koala Toolkit).
- Look for scratches made may koalas on smooth barked trees (see FOK Koala Watch information in this Koala Toolkit).
- Report sightings of live healthy koalas on the FOK Report a Koala Sighting website [www.friendsofthekoala.org/report-a-koala-sighting](http://www.friendsofthekoala.org/report-a-koala-sighting) within 24 hours of the sighting as per 1.3 Koala Data Capture Procedure and Welfare Check
- If you suspect a koala is not healthy (see FOK Koala Watch information in this Koala Toolkit - physical signs of a distressed, sick or injured koala), report the sighting immediately to 24 hour FOK Koala Rescue Hotline 6622 1233.

- Individual koalas respond to noise and disturbance in different ways, and can be a result of age, experience, intensity, frequency and duration of the disturbance. Common responses include
  - opening eyes and looking down, closing them again and going back to alert resting
  - opening eyes and alert watching every move and noise but staying in position opening eyes, quickly moving to either top of tree or other side

**KOALAS CAN BE HARD TO SEE**



## 2. About Koalas

### 2.1 Why are they important?

The koala is listed as a vulnerable species under the NSW *Biodiversity Conservation Act 2016* (BC Act). The combined population in Queensland, NSW and the Australian Capital Territory is listed as a vulnerable species under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### 2.2 Why are Ballina koalas important?

Historical records for the BLGA date back as far as 1900. The most recent population estimate indicates somewhere between 285 – 380 koalas in the BLGA, with 70% of the population occurring along the Blackwall Range from Uralba/Lynwood through Coolgardie and into more lowland habitats around Bagotville, Meerschaum Vale and Wardell. This latter area has been identified as an important population supporting a nationally significant koala population for the purposes of the EPBC Act (Biolink 2013).

### 2.3 What is an important population of a species?

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

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

### 2.4 Threats to koala survival

The key threats to koala populations across the BLGA, include:

- Habitat loss by clearing for urban development, roadwork activities, private native forestry and agricultural activities;
- Habitat fragmentation that create barriers to movement, altering population dynamics, impeding gene flow and the ability to maintain effective recruitment levels;
- Unsustainable mortalities arising from vehicle-strike and domestic dog attack;
- Mortality caused by random events such as fire (including high fire frequency for the purposes of fuel reduction).

The impacts of these threatening processes can become exacerbated through the increased expression of stress related illnesses, which in turn lead to elevated disease incidence, reduced levels of fitness, increased morbidity and an associated decline in reproductive output.

Ultimately, the impacts of roads may be reduced by implementing appropriate mitigation measures (see Section 1.1 Koala Management Procedures for Roadwork Activities).

## 2.5 How and when they move

Koalas are an arboreal mammal, which means they predominately live in trees. However, koalas also move across the ground and will frequently do so between food trees. Koalas are at their most vulnerable to threats whilst on the ground and therefore, the more fragmented their habitat is (*e.g.* developed areas), the higher the risk of mortality because they must travel further over the ground.

Koala movements are more frequent and extensive during the breeding season (**September to February**) with the peak dispersal period (**July to August**) when juveniles move away from their mothers (Lassau *et al.* 2008). These periods will produce peaks in movement (particularly in males), resulting in a greater likelihood of road mortality and other impacts such as domestic dog attack and misadventure.

## 2.6 Where they live and what they eat

The koala is a leaf eating arboreal marsupial restricted to forests which contain their preferred food tree species (Lee and Martin 1988). They exhibit strong preferences between individual trees species, with species of the genus *Eucalyptus* consumed as a primary source of food, while other genera such as *Corymbia*, *Lophostemon* and *Melaleuca* may also be incorporated into the diet as supplementary browse and/or utilised for other purposes (Lee and Martin 1988; Hindell and Lee 1990; Phillips 1990; Phillips, Phillips and Callaghan 2000; Callaghan and Thompson 2000).

Specifically, for the BLGA, the following species are recognised as preferred koala food trees<sup>1</sup> (PKFTs) (Biolink 2013):

- Forest red gum (*Eucalyptus tereticornis*)
- Swamp mahogany (*E. robusta*)
- Tallowwood (*E. microcorys*)

Due to their highly specialised diet, food availability is thought to be a key determinant of high koala habitat quality (Moore and Foley 2000). High nutrient soils affecting palatability of the leaves (Reed *et al.* 1988), forest area and landscape configuration are also considered to be involved in the overall suitability of koala habitat (McAlpine *et al.* 2006).

## 2.7 Identifying PKFTs in the BLGA

PKFTs have been mapped alongside BSC managed roads (**Figure 1; Appendix 1**) and from this a mapping layer is provided to identify when workers enter a Priority Koala Area (PKA) and where PKFTs are located. The following descriptions and reference image should assist in identifying the PKFTs in the BLGA.

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<sup>1</sup> The *E. tereticornis* / *E. robusta* hybrid *E. patentinervis* is also a PKFT in the BLGA.

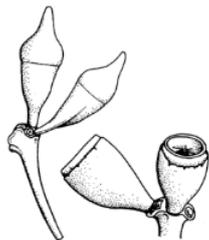
### Forest red gum

Forest red gum occurs in grassy, wet or dry forest, or woodland on soils of medium to high fertility. The species can grow up to 50 m high and is characterised by its smooth white or grey bark, shedding in large plates or flakes. The adult leaves are narrow, tapering to a point at each end, and are dull green in colour. The fruits are ovoid with exerted valves, whilst the buds are cylindrical and elongated tapering to a point.



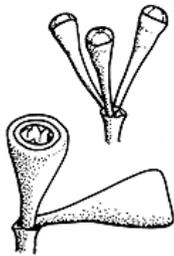
### Swamp mahogany

Swamp mahogany is locally abundant in low swampy areas on sandy and waterlogged soils, it is a tree up to 25 m high with thick persistent reddish brown spongy bark. The glossy dark green leaves are broad in shape which help form a dense canopy. Fruits are cylindrical and broad with rim-level or slightly exerted valves, whilst the buds are fusiform, meaning they are rounded and taper from the middle towards the end.



## Tallowwood

Tallowwood is a tree of up to 60 m high, native to New South Wales and Queensland. The species grows in forests near the coast on moderate to fertile soils and is covered with a persistent reddish brown, orange or brownish grey bark of stringy structure. Its narrow ovate shaped leaves are glossy green on the upper surface and dull green beneath, with fruits that are cone-shaped and have rim level or slightly exerted valves. The buds are small club-shaped with distinctive crosses on their caps.



## 2.8 Koala observational data capture

### Why this is important

Collecting robust and ‘useable’ data is essential to inform koala conservation and planning outcomes at the Local Government Area (LGA) level. Unfortunately, some of the data collected to date is poorly recorded (*e.g.* no spatial co-ordinates).

Records (historical and current) can allow range spatial distribution of koalas to be recorded. This can help monitor the persistence and/or decline of a species in a given area and identify the presence of long-standing source populations that may afford the greatest conservation benefit.

Another practical application of using historical records, can be to identify the types and locations of key threatening processes over time in a given area (*e.g.* vehicle-strike, domestic dog attacks). The latter can guide planning for mitigation to reduce the impacts of threats across the landscape.

### What data is required and how to collect it

Collecting informative data can be very simple, and all relevant field staff should be instructed to watch for koalas and required to capture data using the BSC e-form. As a minimum, data that is required for further assessment includes:

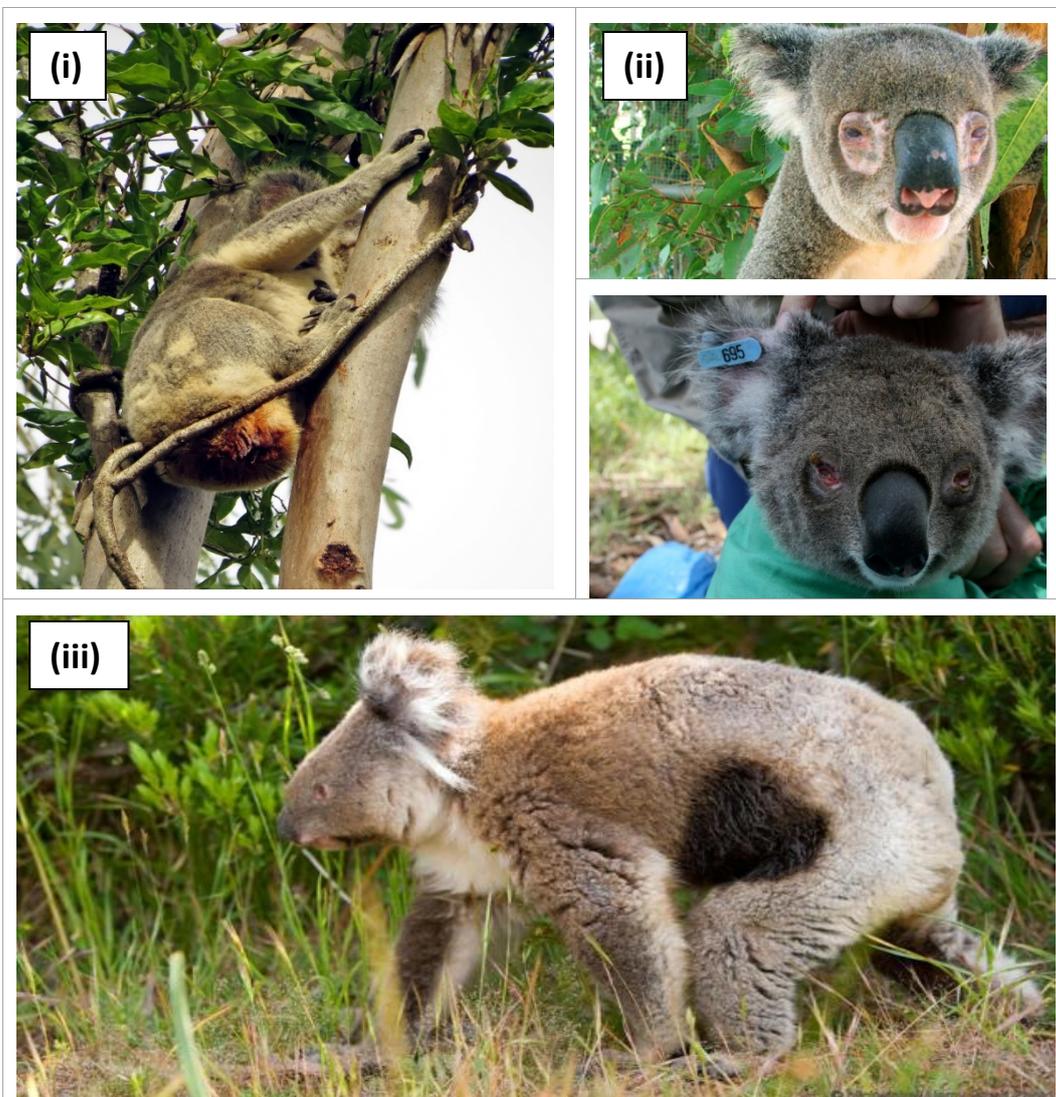
- Spatial (GPS) co-ordinates (*e.g.* latitude / longitude or easting / northing).
- Any other supporting information (*e.g.* is koala alive or deceased? What is it doing? Does it appear unhealthy).
- High-quality photograph (where possible).

These data can be collected within a matter of minutes using the FOK's **Report a Koala Sighting** webpage <https://www.friendsofthekoala.org/report-a-koala-sighting/>. Data should be passed on to a data manager at BSC within 24 hours and then uploaded to a centralised and secure database.

## 2.9 Identifying sick koalas

When collecting observational data for koalas, any obvious evidence of illness should be recorded. Signs of illness are not always obvious; however, if any of the following symptoms are clearly evident (see images that follow) or an animal is found on the ground and/or sitting at the base of a tree, Friends of the Koala (FoK) should be notified on the contact details provided below.

- (i) A notably wet rump and/or any obvious urinary incontinence,
- (ii) Partially or fully closed eyes with inflamed conjunctiva, or
- (iii) Any other discolouration or obvious distress that does not seem normal.



## 2.10 Koala rescue

In the event that a koala is injured, at risk of injury, or notably diseased or distressed, FoK should be contacted immediately for assistance. **FoK Hotline (24 hr rescue) (02) 6622 1233** FoK Website [www.friendsofthekoala.org](http://www.friendsofthekoala.org)

## 3 Decision Framework and Impact Mitigation Tools- Road Construction

### 3.1 Preface

The intent of this section is to provide a review of existing, new and envisaged mitigation and management measures likely to be applicable to koalas in relation to new or existing road infrastructure works in the BLGA.

For the purposes of **SECTION 3**, road infrastructure works are considered to be the construction of any new road and/or the widening of an existing road, as opposed to maintenance/upgrade works discussed in **SECTION - 1.1**

#### **Koala Procedures for Roadwork Activities**

This section will provide Ballina Shire Council (BSC) with a decision making framework for mitigation that considers factors such as (but not limited to) the following:

- Occurrence of koalas,
- Presence of Preferred Koala Food Tree species (PKFTs) and Preferred Koala Habitat (PKH),
- Most suitable mitigation measure(s),
- Road dimensions and other traffic data,
- Maintenance and monitoring requirements, and
- Cost-benefit.

The key objectives of **SECTION 3** of this Toolbox are to:

- i. Provide management actions and practical tools that guide new / existing road design to reduce adverse impacts to koalas.
- ii. Provide a summary of road mitigation measures and a recommended framework that reduce the number of koala mortalities attributed to vehicle-strike in the BLGA.

### 3.2 Vehicle-strike mitigation measures

The effect and subsequent mitigation of the impacts of roads on koala populations has been the focus of many studies, including the impacts of intersections, road size and dimensions, traffic volume and whether such things form barriers to dispersal (Lassau *et al.* 2008; Lunney *et al.* 2008; Phillips and Fitzgerald 2014). Habitat loss and poorly planned linear infrastructure such as roads are primary threats that amplify the vulnerability of koalas to anthropogenic-related mortality, particularly by vehicle-strike. Ongoing dispersal and connectivity between koala sub-populations are keys to the maintenance of existing populations and the establishment of new populations (Biolink 2017). Therefore, identifying blackspots where koala road mortalities are occurring and strategically implementing effective mitigation measures is an important component of effective koala conservation.

The application of mitigation measures for road infrastructure works in the BLGA can be guided by the following review and the relevant decision framework in **3.3** and **3.4**.

### 3.2.1 Static signage and pavement marking

Road signs offer an inexpensive and long-lasting approach to vehicle-strike mitigation. Their intended function is to alert drivers to the presence of wildlife and the potential risk of vehicle collision. Attached to an aluminium pole, they typically comprise a fluorescent background to enhance visibility at dawn and dusk when fauna are generally more active. Common koala signs portray an image of a koala and often a description below that highlights the length of road in which koalas are likely to be crossing (*i.e.* next 4 km). Static fauna signs are used across the east coast of Australia in known blackspot areas; however, there is no evidence to suggest they are successful in terms of changing driver behaviour enough to be an effective mitigation measure; indeed, and to the contrary, all available scientific evidence (e.g. Dique *et al.* 2003) indicates that static signage does not work. Pavement marking works in a similar way to static street signage, in that the road surface is marked to alert drivers to the presence of wildlife. Like signage, there is no evidence to suggest that pavement markings alter driver behaviour and subsequently reduce vehicle-strike.



**Advantage(s):** Inexpensive and long-lasting.

**Disadvantage(s):** Unlikely to change driver behaviour.

**Approximate cost:** \$100s

### 3.2.2 Speed limit signage

It might be presumed that a speed reduction to 40 kph would help decrease the reaction time of drivers to a potential collision. Biolink (2017) tested vehicle-strike data in the Lismore areas and found that any speed sign reduction below 60 kph did not support a measurable decrease in koala mortality. While a reduction to 40 kph may increase driver reaction time, the main issue is that speed limit signage rarely brings about changes in driver behaviour (Dique *et al.* 2003) and is thus of limited utility in terms of successfully mitigating the potential for vehicle-strike.



**Advantage(s):** Inexpensive, long-lasting and promotes driver safety.

**Disadvantage(s):** Unlikely to change driver behaviour.

**Approximate cost:** ~\$100s

### 3.2.3 Speed-activated signage / solar-activated signage

Speed-activated signs are intended to decrease a vehicle's speed by calculating the oncoming cars speed and displaying it on an activated sign, ideally creating increased awareness and a sense of responsibility. As with static signage, speed-activated has been shown to be ineffective at changing driver behaviour (Tierney 2017). This

implies that such signage is ineffective and that perhaps a more direct approach to reducing speed may be warranted (*e.g.* calming devices, speed cameras).

Solar-activated wildlife signs are another form of alert system that can be tailored to display a certain message or function during specific time periods or times of year, such as the breeding season when koalas are typically most active. These signs warn drivers that koalas may be in the area and facilitate an increased awareness via a flashing light, such as a revolving beacon, on top of a koala image. This is a non-intrusive measure that could be implemented over a short timeframe; however, it does not prevent koalas entering or crossing the road and is unlikely to change driver behaviour.

**Advantage(s):** Inexpensive, long-lasting and promotes driver safety; can target key timeframes.

**Disadvantage(s):** Unlikely to change driver behaviour. Subject to maintenance and malfunction.

**Approximate cost:** ~ \$1000s

### 3.2.4 Speed cameras

Fixed and average speed cameras have the potential to modify driver behaviour and speed. While, it will not completely solve the issue, drivers can be faced with consequences (*i.e.* fines) if they don't comply. Average speed cameras have the potential to alter speeds over extended lengths of road. To the best of our knowledge, speed cameras are yet to be used to directly assist in wildlife conservation; however, their potential use presents an opportunity and also a potential fund raiser for management actions.

**Advantage(s):** Long-lasting and can reduce vehicle speeds. Possibility of revenue raising for conservation (dependent of negotiations with other agencies).

**Disadvantage(s):** Not governed by Council so difficult to negotiate and install. Requires collaboration with other agencies (*e.g.* traffic, police etc.). Is not 100% effective in reducing driver behaviour and subsequent vehicle-strike.

**Approximate cost:** NA

### 3.2.5 Street lighting

Street lights enhance driver visibility at night when koalas are most active but will ultimately need to be used in conjunction with other mitigation measures.

**Advantage(s):** Enhances driver visibility at night.

**Disadvantage(s):** Does not prevent koala access to roads and therefore will not significantly reduce vehicle-strike on its own.

**Approximate cost:** ~\$1,000s

### 3.2.6 Exclusion fencing

Studies have found fencing to be an effective impediment to koala movement and as such it offers a useful and tested approach to mitigating the potential for koala vehicle-strikes. Exclusion fencing inhibits animals from entering the road and is an integral component to guide animals towards fauna crossing infra-structures. There are several types of koala exclusion fences, most of which are made from galvanised chain wire mesh with several modifications including narrow/wide gauge, tall/short upright, Anti-Climb Sheeting (ACS) and floppy-tops. ACS acts as a slippery surface to prevent koalas breaching the fence and gaining access to the road and when fixed at the bottom of the fence, also serves to reduce the visual stimulus for animals such as koalas by presenting as a solid barrier. Floppy-top fences (image shown) inhibit koalas climbing over the fence by increasingly folding downwards from the weight of the koala when they reach the top. There is some evidence that, regardless of the type, fencing *per se* successfully deters the movement of koalas and so the potential for koala vehicle collisions (Phillips and Fitzgerald 2014).



**Advantage(s):** Effectively prevents koala access to roads and subsequently eliminates vehicle-strike (if maintained).

**Disadvantage(s):** Expensive to install and maintain. Requires installation of crossing structures to maintain connectivity, and possibly koala grids to limit access to roads at intersections.

**Approximate cost:** ~\$100s per metre

### 3.2.7 Koala-grids

Phillips and Fitzgerald (2014) found a positive correlation between vehicle-strikes and entry nodes such as interchanges and intersections that allowed koalas access into fenced road corridors. Specially designed 'Koala grids' located at intersections has been shown to be very successful in preventing koalas from entering the road corridor (Biolink 2003 - 2009). The grid consists of a depression in the road covered by a grid of round pipes (designed based on 50 mm round pipe). The smooth surface of the pipes would become slippery during rainfall and so to increase the likelihood of human injury, a gate on the roadside verge that can be opened and closed to allow bicycle and pedestrian access is also likely to be required.



**Advantage(s):** Relatively inexpensive and maintains vehicle use of road, while preventing koala access to roads in areas unable to be fenced (e.g. intersections).

**Disadvantage(s):** Typically installed in conjunction with exclusion fencing. Potential hazard to humans when wet and when riding bicycles.

**Approximate cost:** ~\$10,000s

### 3.2.8 Crossing structures

Overpasses and underpasses work most efficiently when used in conjunction with exclusion fencing. An overpass is essentially a land bridge which extends over a road whereby the area above is available for revegetation and further enhancement to promote use. The most common overpass designs are wildlife bridges and cut-and-cover tunnels where the road passes below ground level through a tunnel (image shown above).



Overpasses can function to provide a more natural crossing for koalas as they appear as a continuation of the existing landscape, yet they are costly and require landscape rehabilitation and maintenance.

**Advantage(s):** Eliminates koala vehicle-strike by facilitating safe movement across roads.

**Disadvantage(s):** Expensive and must be installed in conjunction with exclusion fencing.

**Approximate cost:** \$1-3 million per overpass



Underpasses are typically in the form of bebo arches or reinforced concrete box culverts (RCBCs) (image shown). RCBCs of varying dimensions are suitable to accommodate a variety of fauna species including koalas; however, the further the transit under the road, the larger the culvert should be. The minimum dimension of RCBCs should be guided by the required distance of the under-road traverse, with a rough rule of thumb requiring 3 m x 3 m for a distance > 50 m, 2.4 m x 1.8 m for distances < 50 m but > 35 m, and 1.5 m x 1.5 m for distances < 35m.

Ideally, new roads requiring RCBCs to allow koala movement should be designed as split carriageways to avoid lengthy underpasses, which are likely to be less effective for koalas. RCBCs are often located at low points in the landscape and consequently serve a dual purpose in also accommodating drainage requirements. Because of this, retro-fitting of RCBCs with access ramps and internal ledges is also recommended so as to enable year-round, dry access and use by koalas.

Retro-fitting existing RCBCs can present opportunities on existing roads (e.g. Pacific Highway); however, its suitability will be determined based on the requirements discussed above.

**Advantage(s):** Eliminates koala vehicle-strike by facilitating safe movement under roads. Can be installed on existing roads where drainage lines are present and suitable. Existing RCBCs can be retrofit to facilitate use (where dimensions are applicable).

**Disadvantage(s):** Expensive and must be installed in conjunction with exclusion fencing.

**Approximate cost:** ~\$100,000 - \$700,000 per structure

### 3.2.9 Vehicle calming devices

Vehicle calming devices such as chicanes and speed bumps act as 'slow points' designed to slow traffic speeds. Unlike speed limit signs, vehicle calming devices can mitigate koala vehicle collisions through changing driver behaviour and achieving desired low speeds whereby driver response and awareness is maximised. Although some members of the community perceive such devices as a nuisance, they can be successful in preventing koala mortality.



Rumble bars are another form of vehicle calming device; however, these are unlikely to alter driver behaviour or speed enough to reduce koala vehicle-strike.

**Advantage(s):** Relatively inexpensive, and can be installed on new and existing roads. Modifies driver behaviour and speed.

**Disadvantage(s):** Does not eliminate koala access to roads, and in some instances may create a nuisance for humans.

**Approximate cost:** ~\$10,000s

### 3.2.10 Wildlife activated technology

#### Wireless Identification Device (WID) tags

WID tags (Wild Spy Pty Ltd) are an automated wildlife monitoring technology that notionally alerts drivers to the imminent possibility of a WID-tagged animal crossing the road. Signage linked to data loggers along the road light up when a WID-tagged animal is within a specified range of the roadside verge. This measure would require field work to capture and tag koalas and presents difficulties in terms of encompassing all new or dispersing individuals over time. While there is potential utility of WIDs in future mitigation projects; however, documented trials are limited and further refinement of the technology is required to differentiate between a koala that is moving towards the road or one that may be stationary in a tree within wireless range.

#### Virtual fencing

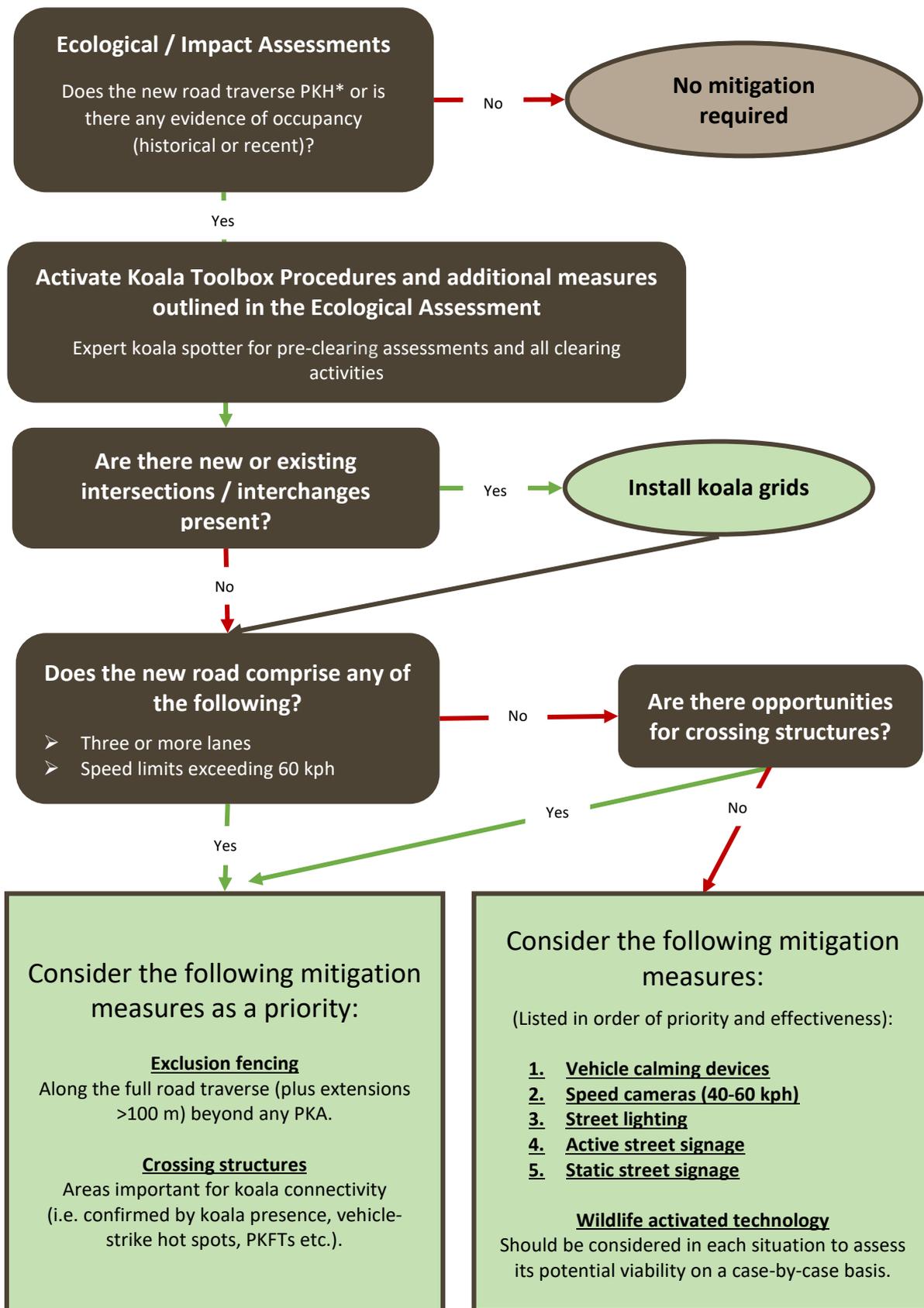
Virtual fencing is a recent electronic technology protection system that emits sound and light stimuli, activated by approaching headlights, to repel and prevent animals from entering the road corridor. The devices are placed at 25 m intervals along the road, in theory forming a 'virtual' fence. Despite its innovation, it is expensive to implement and further assessment is required to support it as a suitable and successful approach for koalas. Trials of this technology are currently underway in the Redlands Shire in South East Queensland but have yet to demonstrate any capacity to reduce the potential for koala vehicle-strike.

#### Beam-breaking technologies

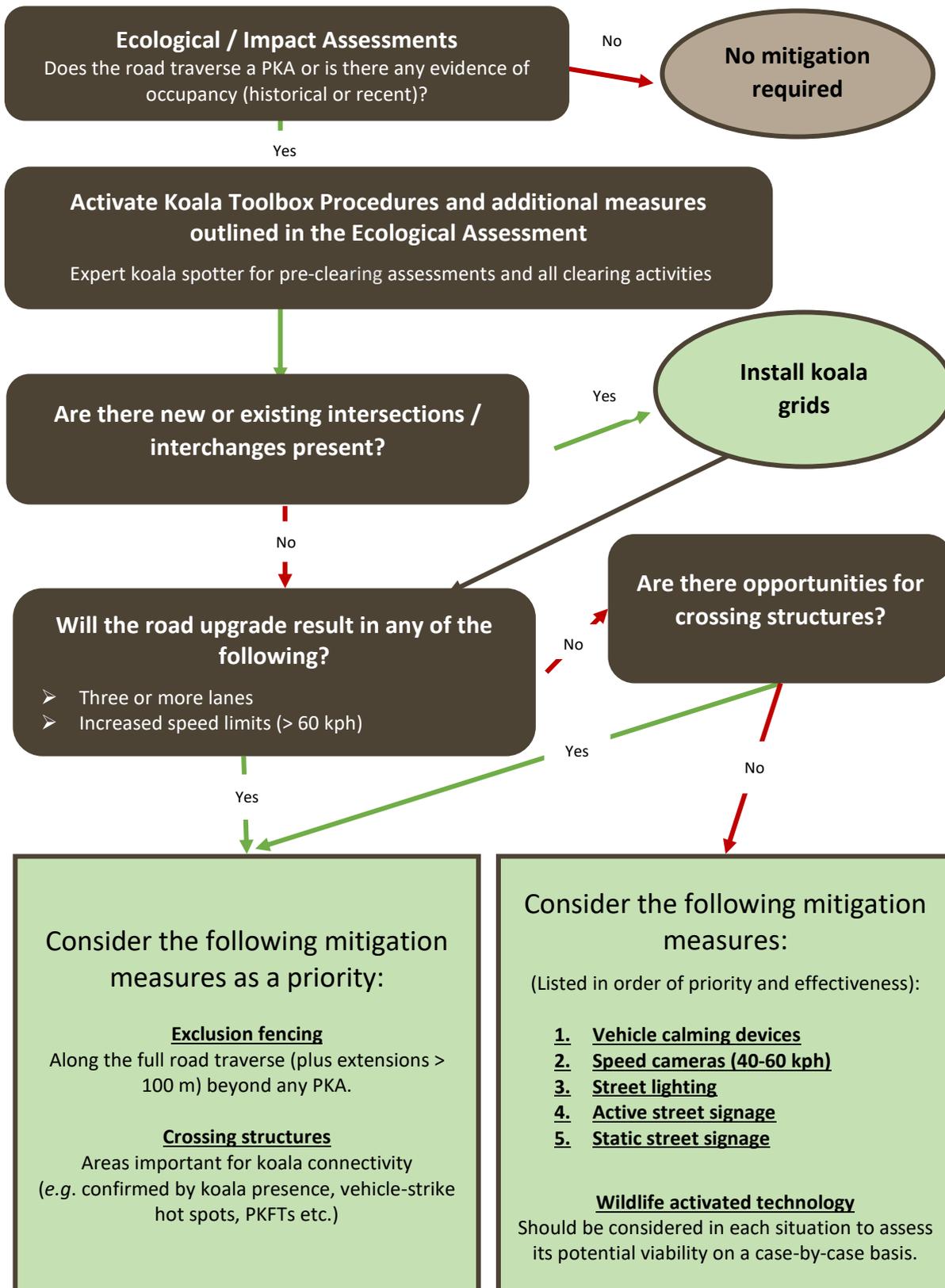
Beam-breaking technologies involve near-infrared and/or high-frequency laser beams and associated sensors that respond to motion along the road verge. They work by having an emitter side that sends out a beam of human-

invisible light to a receiver that is sensitive to the same light. When an animal or object passes between the two, the beam is broken, and a sign activated to warn drivers that a koala (or other target species) is on the road. A proof of concept has already been developed for this technology, the final design requiring further experimentation and testing.

### 3.3 Decision Framework - new road (Preferred Koala Habitat mapping and PKA's for roads mapping layers).



### 3.4 Decision Framework - existing road upgrade



# Appendix 1 Priority Koala Areas - Road Maps

## Appendix 2 Koala Watch Information