Port Macquarie-Hastings Koala Recovery Strategy

Acknowledgements

This strategy was prepared by Port Macquarie-Hastings Council with contributions from those listed below.

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Message from the Mayor

The koala is an iconic and important native Australian animal. We are very lucky to have a nationally significant population of koalas here in the Port Macquarie-Hastings as well as the internationally recognised Port Macquarie Koala Hospital, one of few such institutions in Australia.

The koala contributes to the character of the area, with many koalas visible within our urban areas. The koala is also important for our economy, attracting many visitors to the area each year.

In 2013, Biolink prepared a comprehensive report on the state of koala populations and habitat in our area. The report identified the need for council to take a proactive approach to identifying important habitat areas and setting out a management framework. Council is committed to providing habitat for our koalas to ensure a permanent free-living population over their present range.

The successful implementation of the Port Macquarie-Hastings Koala Recovery Strategy relies on Council working together with the New South Wales Government, landowners, environmental groups and the community over the next 10 years.

This is a strategy for all of us - Council, natural resource managers, residents, businesses and tourists - and will guide how we work together to manage and conserve our koala population and manage koala habitat into the future.

Cr Peta Pinson

Mayor, Port Macquarie-Hastings
1 Executive Summary

Koalas (*Phascolarctos cinereus*) are tree-dwelling, Folivore (leaf eating), medium-sized marsupials and are the most iconic of Australia’s wildlife species. Since the arrival of Europeans, the koala has suffered a dramatic decline in numbers and distribution and is currently listed as ‘vulnerable to extinction’ under Federal legislation.

The Port Macquarie-Hastings koala population has suffered decline largely due to habitat clearing, modification and fragmentation. Other threats to the local population include disease, fire, logging, road deaths and predation by dogs. These threats are unlikely to abate without action. An array of recovery focussed management actions are needed to ensure the long-term sustainable management of koalas across the region.

The Port Macquarie-Hastings Koala Recovery Strategy has been developed by Port Macquarie-Hastings Council (PMHC) to identify the key issues that are impacting the local koala population. It provides actions and guidelines to aid in the recovery of the local koala.

The Port Macquarie-Hastings Koala Recovery Strategy aims to:

- safeguard the welfare of koalas and reverse the current population decline;
- encourage management of areas of Koala habitat and increase habitat linkage opportunities;
- maintain the genetic diversity of koalas in the LGA;
- reduce Koala road strike;
- reduce domestic dog attacks;
- assist in the development of Fire Management Plans for the LGA;
- increase community and public awareness concerning Koala conservation and management; and
- increase our understanding of local threats to population by undertaking selective and localised research.
2 Introduction

Koalas (*Phascolarctos cinereus*) are tree-dwelling, Folivore (leaf eating), medium-sized marsupials that worldwide, are the most recognised of Australia’s wildlife species. The koala is found in Australia’s eastern and southern coastal regions, inhabiting Queensland, New South Wales, Victoria, and South Australia. Since the arrival of Europeans, the koala has suffered a dramatic decline in numbers and distribution and is currently listed as 'vulnerable to extinction' under the Biodiversity Conservation Act 2016. Such listing gives the species more protection and attention, and means proposals for development that will affect koala habitat are rigorously assessed.

The Port Macquarie-Hastings area is home to an estimated 2,000 koalas - a nationally significant population with most located in the coastal strip east of the Pacific Highway. The local koala population has suffered decline largely due to habitat clearing and fragmentation. Other threats to the local population include disease, fire, logging, road deaths and predation by dogs. These threats are unlikely to abate without action, and may be further exacerbated by climate change impacts. An array of recovery-focused management actions are needed to ensure the long-term sustainable management of koalas across the region.

The Port Macquarie-Hastings Recovery Koala Strategy (‘the Strategy’) has been developed by Port Macquarie-Hastings Council (PMHC) to identify the key issues that are impacting the koala population in the PMHC Local Government Area (LGA). It provides actions and guidelines to aid in the recovery of the local population and assistance in managing these impacts.

The Strategy is based on the scientific information and outcomes of the Port Macquarie-Hastings Koala Habitat Study (Phillips, 2013) and follows both the National and (Draft) New South Wales (NSW) Koala Management Strategies in aligning management and protection measures for koalas.

The Strategy aims to:

- Safeguard the welfare of koalas and reverse the current population decline
- Encourage management of areas of Koala habitat and increase habitat linkage opportunities
- Maintain the genetic diversity of koalas in the LGA
- Reduce Koala road strike
- Reduce domestic dog attacks
- Assist in development of Fire Management Plans for the LGA
- Increase community and public awareness concerning Koala conservation and management
Through this strategy, PMHC is committed to the health and welfare of koalas and their habitat and recognises the social, educational, and economic benefits of having a thriving population of koalas in Port Macquarie-Hastings LGA.
3 Koalas in New South Wales

In NSW, koalas mainly live on the central and north coasts, with some populations west of the Great Dividing Range, on the south coast and on the southern tablelands. Most populations live in isolated habitats and many areas in which koalas are most abundant are subject to intense pressures. Koalas are listed as ‘vulnerable’ under the Biodiversity Conservation Act 2016 as NSW populations have declined by an estimated 26% over the past 15 to 21 years. Development of areas of Core koala habitat is managed under State Environmental Planning Policy No. 44 – Koala Habitat Protection (SEPP44).

Protecting and managing koalas today is a complex task. Much of their habitat occurs on private land where there are many competing land uses and the range of management issues is varied. The need for a strategic approach across all land managers to the management of koalas to maximise the effectiveness of conservation efforts has been recognised by NSW Government who are developing a NSW Koala Strategy. The draft NSW Koala Strategy is scheduled for release in December 2017 (OEH, 2017).

Three coastal koala populations in NSW, previously supporting large populations have now been listed as ‘endangered populations’, including the area between the Tweed and Brunswick Rivers, the Hawks Nest and Tea Gardens populations, and, the Pittwater LGA. All of these populations, and many others that are not listed, have shown similar trajectories of decline in line with the Adams-Hosking et al. (2015) review of 26% with this decline expected to continue for the next three generations.

Coastal areas with their high levels of development are not the only regions where koala populations are under threat. Inland areas also show declining koala populations due to habitat loss and habitat degradation (attributable to increased drought events, hotter weather and extreme climatic events).

Koalas have also declined in the central west region, with the Pilliga Forests population (in the Narrabri Shire LGA) showing a decline of 80% since the 1990s. The NSW Chief Scientist and Engineer (2016) and Predavec (2016) suggest that the Liverpool Plains and Gunnedah koala populations have experienced similar declines.
4 Koalas in Port Macquarie-Hastings

Koalas have a long history in the Port Macquarie-Hastings area. Sighting records date back to 1949 with historical photographs showing evidence of a significant koala population well into the preceding century. Unfortunately during these early times koalas were hunted for their skins, depleting the number in this area considerably. Koalas feature in many Aboriginal dreaming and creation stories and are a totemic species of many tribes. Today, Port Macquarie-Hastings supports a nationally significant population of about 2,000 koalas. One of the largest populations of koalas remaining on the east coast of Australia (Phillips, 2013).

Koalas are found across most of the PHMC LGA with the highest concentration (66%) living east of the Pacific Highway in the urban areas. At present, more than 80,000 hectares (21%) of the LGA is classified as suitable koala habitat with about 24% of this habitat occupied by koalas (Phillips, 2013). This occupancy figure is low when compared to similar areas on the north coast of NSW. Notably, most koala habitat occurs outside formally protected areas such as National Parks, and is instead occurring across different land uses and tenures within the LGA.

Figure 1 Coastal Koala habitat and activity contours within the Local Government Area.
Survey data indicates approximately 1,200 koalas occur in the coastal strip east of the Pacific Highway between the Hastings and Camden Haven Rivers. This includes a nationally significant source population with an estimated population size of greater than 500 individuals located on public and freehold lands surrounding Lake Innes. Secondary geographically discrete populations occur around Telegraph Point-Red Hill, Bonny Hills and Camden Haven, Dunbogan and around Yarras-Debenham in the western reaches of the Hastings Valley (Figure 1).

Based on the current population configuration in the coastal strip and records in the higher elevated areas to the west, at least four genetically distinct koala populations are considered likely within the LGA. Preserving unique koala genomes and the genetic diversity they provide is of fundamental importance to koala population health, increasing their resilience to physical abnormalities, diseases and their ability to adapt to change.

Research in 2013 concluded that the Extent of Occupancy of Koalas within LGA hadn’t changes, which is synonymous with a stable population (Phillips, 2013). However, recent Port Macquarie Koala Hospital records and population modelling undertaken subsequently by Council points to a decline in the local coastal population (Figure 2). Without intervention and clear direction and action to mitigate or remove some of the threats currently impacting on the koala population in the PMHC LGA, it is likely that they will become extremely rare in most areas within 25 years and functionally extinct within the next 50 years.

**Figure 2**  
Koala Population Viability Assessment. - Projected population decline if current threat levels remain
5 The challenges faced by koalas

By 2036, the Port Macquarie-Hastings region is expected to be home to approximately 108,000 people, most living in the coastal region, east of the Pacific Highway. The need to accommodate this population growth, including new subdivision areas and new roads to connect them, will put pressure on existing areas of koala habitat on privately owned land. Without a strategic approach to managing development in or close to this koala habitat, vital areas may be lost entirely or become isolated or reduced in size so that their ability to maintain a healthy koala population is threatened. Barriers to recruitment and dispersal are created through fragmentation of koala habitat isolating individuals and sub-populations, altering population dynamics, impeding gene flow and the ability to maintain effective recruitment levels.

Urban development close to koala populations poses several significant threats to individual koalas including attack by domestic dogs and road strikes. While koalas spend the majority of their time in trees they also need to come to ground to move between trees within their home range. For koalas living in or near urban areas much of their habitat is dissected by roads placing them at greater risk of being struck by cars, particularly at night. Climbing over fences into backyards where dogs may be present can lead to confrontation and serious injuries or death to the koala.

Large landscape bushfire (wildfire) is a major threat to koalas in the PMHC LGA. Koalas become trapped at the top of trees and cannot escape. Koalas frequently therefore experience direct mortality or injuries, such as burnt paws, which effects their ability to forage and climb trees. Wildfire can also result in severe short-term shortages of food resources for local populations. The PMHC koala population has predominant concentrations in the Lake Innes and Yarras-Debenham areas. A severe wildfire in either of these areas could therefore greatly impact the LGA’s koala population. Conversely, a lack of fire, promotes rainforest colonisation in the coastal region of the LGA, which degrades koala habitat. Careful management of fire regimes, through prescribed or hazard reduction burning, in and around koala habitat is therefore important to protect local populations.

Forestry harvesting on both state forests estate and private lands (under Private Native Forest Code of Practice approvals) can significantly impact on koala habitat by selectively removing key food trees and degrading habitat quality. Lack of adequate pre-harvest surveys, particularly on private lands, often means that management prescriptions are not triggered or implemented.

Koalas are vulnerable to a wide range of diseases, including the highly infectious bacterial disease *Chlamydia*. Such diseases tend to become more prevalent when koalas are under stress which can be the case with decreased habitat opportunities and the increasing impacts of urbanisation (e.g. McAlpine *et al.*, 2017). These koala diseases not only result in increased
mortality of individuals, but can also render koalas infertile. This means that while koala populations might appear ‘stable’ while the current cohort of individuals are still alive, the future is bleak with low numbers of young being produced.

Overall, the current estimated average “area of occupancy” (% of occupied habitat) by free-ranging koala populations across the LGA is considered to be less than optimal, at 24% (Phillips, 2013)

Population modelling based on koala activity data has resulted in identification of key koala population hubs, the largest of which is located around the northern fringes of Lake Innes, Kooloonbung Creek and the Christmas Bell Plains, with smaller outliers in the Lake Cathie and Bonny Hills localities. Population cells in the Red Hill – Telegraph Point area and at Dunbogan likely represent extreme outliers of other koala genomes centred to the north (Kempsey) and south (Taree) respectively. West of the Pacific Highway, one or more population cells are also present in the Yarras–Debenham area. However more detailed surveys are required to fully document the population in the western areas of the LGA.

Knowledge of koalas in the western parts of the LGA is lacking, both in terms of habitat selection, home range size and distribution.

In summary, the Port Macquarie-Hastings koala population is under threat from a variety of processes (Figure 3):

- destruction of koala habitat by clearing for urban development, roadwork, forestry, and agricultural activities
- fragmentation of koala habitat such that barriers to recruitment and dispersal are created
- domestic dog attacks
- vehicular strikes
- wildfire and prescribed burns
- stress and associated illnesses and diseases.

The loss of habitat and or the fragmentation severely interrupts the home range, movement patterns, social structure and stress levels in koala populations, making them much more vulnerable to disease, road strike and dog attack. Thus taking in its totality, habitat loss and fragmentation is considered the principal cause of decline in koala populations.
Figure 3  
Total Koala Admissions to the Local Koala Hospital, Port Macquarie
6 Recommended Actions

6.1 Habitat Loss, Modification and Fragmentation

Koalas face many threats to an increasingly cleared, developed and fragmented landscape. The biggest threat to koalas is habitat loss, including impacts from clearing for development and selective logging. Much of the koala's habitat in Port Macquarie Hastings area overlaps with areas where significant clearing has occurred, and continues to occur, for urban, industrial and rural development.

Data found by Phillips (2013) supports an assertion that the long-term logging of tree species preferred by koalas is having an effect on koala carrying capacity. As of 2016 there was 3,413ha of approved Private Native Forest (PNF) operations located on land that has been identified as Core Koala Habitat in Council’s draft Comprehensive Coastal Koala Plan of Management. This represents 21% of all core Koala Habitat mapped east of the Pacific Highway and could be a significant threat to the long-term viability of the local koala population.

In order to meet NSW government logging quotas, Forest Corp are required to or are sourcing source timber from trees below 400mm DBH (Diameter at Breast Height) size. Phillips (2013) identified that on low fertility soils, koalas tend to preferentially select larger tree sizes. This implies that the ongoing practice of logging small trees on Forest Corp land may continue to suppress the ability for impacted koalas to recover, or that the removal of smaller trees sizes will over time degrade koala habitat quality, and limit their home ranges to protected gullies and exclusion zones containing remaining koala food trees.

Habitat loss associated with residential and industrial development has been historically poorly managed through piece-meal site-specific Koala Plans of Management. The major failings of site-specific KPoMs include the inability to adequately address a development within the landscape setting and to assess cumulative impacts over time and space. Such important issues of addressing home ranges, variations in seasonal occupation, and habitat corridors, are more often overlooked. On average, this has led to the net loss of koala habitat, and the increase of threats such as dog attacks and road strike in areas regulated by site-specific Koala Plans of Management.

Habitat fragmentation can also be a contributing factor to population decline. Research by McAlpine et al. (2005; 2006; 2007) suggests that the chances of koalas being present declines rapidly as the percentage of koala habitat or overall forest cover falls below 60-70% of the landscape.
HABITAT LOSS, MODIFICATION AND FRAGMENTATION

Recommended Actions: The loss and fragmentation of koala habitat is proposed to be managed by the following actions:

1. Completion and adoption of the Coastal Koala Plan of Management and review provisions in the Development Control Plan (DCP).

2. Request an update of the NSW Biodiversity Values Map pursuant to Biodiversity Conservation Act 2016 to include core koala habitat as per approved Coastal Koala Plan of Management.

3. In partnership with NSW OEH update the NSW koala likelihood model based on updated home range information and koala habitat mapping (see Research Initiatives) to improve koala habitat protection measures associated with private native forestry.

4. Expand Coastal Koala Plan of Management to include the entire LGA once home range study and fine scale habitat mapping is complete (see Research Initiatives).

5. Explore re-populating unoccupied koala habitat on rural lands with willing landholders.

6. Resolve, by way of Council internal procedure, that development approved under Part 5 of the Environmental Planning and Assessment Act 1979 be subject to the same provisions as those outlined in Council’s Coastal Koala Plan of Management.

7. Ensure land rezoning take into account koala habitat as per council’s CKPoM (once approved).
6.2 Koalas and Roads

Koalas spend most of their time in trees, but they do need to come to ground to move between trees within their home range. This on-ground movement mostly occurs at night but koalas can be active at any time. Between July and September, koalas will spend more time moving across the ground as adult males seek mates and juveniles disperse into new home ranges.

For a koala living in or near areas that have been developed and urbanised, much of their habitat is dissected by roads. On-ground movement across these roads places koalas at great risk of being hit by cars, particularly at dawn and dusk. This risk increases where traffic volume and speed are high and where road position and road design create ‘black spots’ where koalas are hard to see. Vehicle related koala mortality has the most significant impact on koalas after habitat clearing and fragmentation with many of the koalas that are killed being breeding-age animals. Figure 4 details koala roads strike occurrences since 2000. The road strike ‘black spots’, contributing to the majority of koala deaths, as of 2017, are identified as:

1. Ocean Drive between Port Macquarie and Lake Cathie
2. Pacific Highway between the Oxley Highway and Kew interchanges
3. Lake Road between Blackbutt Road and Hill Street
4. Oxley Highway between Morton Street and Widderson Street

Figure 4 Heat Map Analysis of Koala Road Strike post 2000. Areas of frequent road strike is represent by green to yellow (moderate) and orange to red (high) clustering
**ROAD STRIKE**

**Recommended Actions:** Reduction of koala road strike is to be achieved through the following actions:

1. Risk of road strike on future development regulated by provisions and road design measures detailed in Council’s Coastal Koala Plan of Management.

2. Design and trial an ‘urban-friendly’ koala road grid solution to be used on urban road intersections together with fit for purpose koala proof fencing to exclude koala from high risk roads.

3. Install koala proof fencing and koala grids at major intersections shown to be koala black spots.

4. Target and investigate solutions to reduce road strike on currently identified roads, as listed below, and future sites as identified:
   - Lake Road between Blackbutt Road and Hill Street
   - Oxley Highway between Morton Street and Widderson Street

5. Advocate for the installation of koala proof fencing on the Pacific Highway between the Oxley Highway and Kew interchanges.
6.3 Koalas and Dogs

As habitat patches become smaller and more fragmented, koalas are more likely to move through developed urban areas. Koalas have to cross roads in these urban areas and move through properties where they may be attacked by dogs. Koalas on the ground are particularly vulnerable to dog predation especially when they traverse a dogs ‘territory’ or backyard.

The high prevalence of domestic dogs in the Port Macquarie –Hastings established urban areas results in serious injuries and death to koalas. Domestic dog attacks are the second highest cause of admissions to the Port Macquarie Koala Hospital. Figures 5 and 6 detail areas subject to frequent dog attacks by way of heat map analysis. Areas of high incidents of dog attacks since 2000 include Oceanview Terrace, Swift Street, and McLaren Drive in Port Macquarie, and Ernest Street in Lake Cathie.

Many dogs are curious by nature. Even if they generally don’t chase wildlife, their investigation of a koala in their backyard may cause injuries to both the koala and the dog. A small quick bite is enough to kill a koala as they have thin skin and low resilience to injury.

Figure 5 Dog attack incidents in Port Macquarie post 2000. Areas of frequent dogs attacks represent by yellow (moderate) and red (high) clustering
Figure 6  Dog attack incidents in Lake Cathie post 2000. Area of frequent dog attacks represented by orange (moderate) clustering

**DOG PREDATION**

**Recommended Actions:** Reduction in domestic dog attack incidents are to be achieved by the following actions:

1. Risk of dog attack from future development be regulated by provisions / development design measures detailed within Council’s Coastal Koala Plan of Management.

2. Develop a dog desensitisation training mobile app and education material to be provided to all new registered dogs and to local dog clubs.

3. Where dog desensitisation is not an option, investigate measures with the home- or dog-owner to exclude koalas from entering the property in areas as per action 2.

4. Provide annual community education /awareness information at the start of each year’s breeding season and upon registration of new dogs in areas of koala habitat.
6.4 Wildfire and high intensity prescribed burning

Natural random events such as large-scale wildfires can have a massive impact on the local koala population. High intensity wildfires in koala habitat result in canopy scorching and can cause significant multiple mortalities leaving large tracts of unoccupied habitat and a collapse in the social structures of koala populations and loss of genetic diversity. Recovery from wildfires is often measured in decades.

High intensity prescribed burning, where canopy scorch is prevalent can also have a similar effect. Timely koala rescue efforts post-fire are problematic due to safety constraints associated with working on a fire ground. Two examples of recent wildfires within Port Macquarie Hastings Core Koala Habitat include the airport fire in 2002 and the wildfires on the Dunbogan Peninsular in 2005 and 2012 respectively (Figure 7).

Koalas have evolved with fire. Their habitat, being wet or dry sclerophyll forest, requires burning to maintain its ecological function and health. However, as land use and development has boxed and fragmented koalas into ever smaller habitats, and as fire regimes and climate change events continue to be larger and more intense, the ability for koala populations to recover from fire is greatly reduced.

![Figure 7](image_url)  Wildfires within Core Koala Habitat in the Port Macquarie Hastings LGA: Airport (left) and Dunbogan Peninsular (right)
The issue of managing fire and koala habitat is a complex problem and is currently being explored through the recently formed Hastings-Macleay Fire and Biodiversity Consortium (FABCON). This consortium, consisting of representatives from OEH, RFS, Fire and Rescue, the Port Macquarie Koala Hospital, Forest Corp, Kempsey Shire Council and Port Macquarie-Hastings Council, is progressing with the development of a Hastings-Macleay Koala Fire Plan for the coastal koala habitat areas in both LGAs. The plan seeks to improve koala conservation by:

- reducing the impact of catastrophic wildfires on koalas
- conducting ecological burning (where required) to prevent the modification of koala habitat and succession of key areas of koala habitat from eucalypt-dominated communities into rainforest
- ensuring that all hazard reductions are undertaken in a manner which is beneficial to koala conservation and does not harm individual animals
- improving knowledge on fire management and koala activity levels and health.

The Hastings-Macleay Koala Fire Plan will seek to achieve these aims by:

- identifying important koala habitat patches at risk from fire;
- identifying important koala habitat patches that may require a burn;
- examining site and landscape-scale management regimes that may be applied to benefit koala habitat on these sites (site by site basis)
- examining the impact of fire on koala persistence through examination of fire history (intervals and intensity), vegetation types and koala activity levels
- examining the impact of fire (intensity/weather conditions/type of burn) on koalas (fatalities/injuries data from the Port Macquarie Koala Hospital database)
- developing a Code of Practice for Hazard Reduction Burning in Koala Habitat
- developing a Code of Practice for Koala Rescue following Fire.

**FIRE MANAGEMENT**

**Recommended Actions:** The issue of managing fire and koala habitat is currently being explored through the Hastings-Macleay Fire and Biodiversity Consortium (FABCON) who will produce a Hastings-Macleay Koala Fire Plan for the coastal koala habitat areas in both LGAs.

This strategy seeks to enable FABCON to meet its stated objectives and aims.
7 Other Strategic Recovery Initiatives

A summary of the recommended koala recovery plan management actions are provided in Table 1. In addition to these recommendations, recovery initiatives to mitigate local threats and respond to recovery of koala population have also been explored.

7.1 Research

There are still some large knowledge gaps in understating of koalas in the Port Macquarie Hastings LGA. Research priorities include:

- Undertake fine scale detailed koala habitat mapping for land west of the Pacific Highway.
- Identify if large areas of unoccupied koala habitat are occurring within the LGA as a legacy of wildfires, habitat fragmentation, and the historic skin trade. This information would inform the establishment of a potential koala relocation programme with participating rural landholders and the Port Macquarie Koala Hospital, subject to licencing approvals.
- Undertake an analysis of home ranges of local koalas and their seasonal use of landscapes in the western areas of the LGA.

7.2 Community Education

- Develop a dog desensitisation training mobile app and education material to be provided to all new registered dogs and to local dog clubs.
- Explore availability of ‘Citizen Science’ koala location app and education materials for the community to register sightings of koalas.
- Partner with the Port Macquarie Koala Hospital to undertake annual school and community education to foster behavioural change in order to reduce threats to the koala population.
- Undertake koala friendly backyard assessment with participating community members to improve survivability of the remnant koala habitat in urban areas.
8 Measuring Success and Strategy Review

Measuring the success of the Koala Recovery Strategy is of utmost importance. Within the first three months of the Strategy’s adoption an expert panel will be formed to design a monitoring program in conjunction with the Comprehensive Koala Plan of Management. The monitoring plan will include but will not be limited to:

1. A comprehensive initial survey to examine likely population within the Coastal KPOM area (using genetics) delivered within the first 12 months;
2. Snapshot surveys using a stratified, replicated design at the 1, 3 and 5 year mark which can examine broad population trends; and
3. A follow-up survey using the genetic methods at the 5 year mark.

The Strategy will be reviewed in accordance with the findings of the monitoring.

Success should be measured by the following metrics:

1. Stable Koala Population by 2023, with a trend of increasing population by 2029
2. Stable or increasing Area of Occupation and Extent of Occupation by 2029
3. 50% reduction in road strike and dog attack admissions to the Port Macquarie Koala Hospital by 2023

Koala population assessment will be measured by the following indicators:

- Prevalence of factors affecting mortality (relative admissions for koala disease, road strike, dog attack, fate of release animals and number of euthanised koalas). This will be undertaken on an annual basis and results compared against previous years.
- Area of occupation and extent of occupation. This will be undertaken every four years using the results of The Great Koala Count, other citizen science initiatives and additional Council SAT survey work.
- Assessment of abundance trends in sub-populations, undertaken using Rapid SAT methodology and consideration of activity levels (Phillips and Wallis, 2016). A stratified sample of the different sub-populations will be undertaken every 2 years.

Review of this plan will be undertaken every 6 years.
### Table 1: Recovery Actions

<table>
<thead>
<tr>
<th>Recovery Initiative</th>
<th>Action</th>
<th>Priority</th>
<th>Timing</th>
<th>Cost</th>
<th>Key Performance Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit Degradation and Fragmentation</td>
<td>Completion and adoption of the Coastal Koala Plan of Management (CKPoM) and update provisions in the Development Control Plan (DCP).</td>
<td>High</td>
<td>September 2018</td>
<td>Council In kind</td>
<td>Plan is adopted by Council and approved by the NSW Department of Planning and Environment</td>
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<tr>
<td>Request for an update of the NSW Biodiversity Values Map to include core koala habitat as per approved Comprehensive Koala Plan of Management.</td>
<td>Medium</td>
<td>Upon approval of CKPoM</td>
<td>Council In kind</td>
<td>Biodiversity Values Map updated</td>
<td></td>
</tr>
<tr>
<td>Update the NSW Koala likelihood model based on updated data on home range information and koala habitat mapping*</td>
<td>Medium</td>
<td>Upon completion of data</td>
<td>Council in kind</td>
<td>NSW Koala likelihood model updated</td>
<td></td>
</tr>
<tr>
<td>Expand CCOMprehensive Koala Plan of Management to include the entire LGA*</td>
<td>High</td>
<td>2018-2020</td>
<td>Council In-kind</td>
<td>Plan is adopted by Council and approved by the NSW Department of Planning and Environment</td>
<td></td>
</tr>
<tr>
<td>Repopulate unoccupied koala habitat*</td>
<td>Medium</td>
<td>2020-2026</td>
<td>Council and Port Macquarie Koala Hospital in-kind + $20,000 p.a for 5 years</td>
<td>Suitable Port Macquarie Koala Hospital patients successfully relocated to unoccupied habitat with participating landholders.</td>
<td></td>
</tr>
<tr>
<td>Part 5 internal procedure for managing Koala Habitat</td>
<td>High</td>
<td>Upon approval of CKPoM</td>
<td>Council In kind</td>
<td>Procedure adopted and REF template updated.</td>
<td></td>
</tr>
</tbody>
</table>

- Contingent on completion of habitat mapping and home range analysis (see research initiative)
<table>
<thead>
<tr>
<th>Recovery Initiative</th>
<th>Action</th>
<th>Priority</th>
<th>Timing</th>
<th>Cost</th>
<th>Key Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Strike</td>
<td>Design and trial an ‘urban-friendly’ koala road grid solution to be used on urban road intersections together with fit for purpose koala proof fencing at high risk sites.</td>
<td>High</td>
<td>2017-2018</td>
<td>$10,000</td>
<td>Koala grid and fit for purpose fence trailed and approved for urban streets.</td>
</tr>
<tr>
<td></td>
<td>Install 28.8km of koala proof fencing and koala grids at major intersections on Ocean Drive, from Koala Street to the Lake Innes Fire trail</td>
<td>High</td>
<td>Upgrade of Ocean Drive or external funding</td>
<td>$1.32M (as part of RMS funded Ocean Drive upgrade)</td>
<td>Fence and grids installed. Road strike reduced by 90%</td>
</tr>
<tr>
<td></td>
<td>Investigate solutions to reduce road strike on:</td>
<td>High</td>
<td>2019-2021</td>
<td>In-kind</td>
<td>Road strike mitigation measures designed and with allocated budget</td>
</tr>
<tr>
<td></td>
<td>- Lake Road between Blackbutt Rd and Hill St</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Oxley Highway between Morton St and Widderson St</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Advocate for the installation on koala proof fencing on the Pacific Highway between the Oxley Highway and Kew interchanges</td>
<td>High</td>
<td>2019-2020</td>
<td>RMS funded</td>
<td>RMS commits to installing fence and allocates budget</td>
</tr>
<tr>
<td>Dog Attack</td>
<td>Council to work with willing landowners with problem dogs in areas supporting koalas. This would be achieved by Council paying to retrofit fences to ensure koala exclusion on properties</td>
<td>High</td>
<td>2018 onwards</td>
<td>$20,000 p.a</td>
<td>At least 3 properties retro-fitted each year.</td>
</tr>
<tr>
<td>Recovery Initiative</td>
<td>Action</td>
<td>Priority</td>
<td>Timing</td>
<td>Cost</td>
<td>Key Performance Measure</td>
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<tr>
<td>---------------------</td>
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<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fire</td>
<td>Complete Hastings- Macleay Koala Fire Plan</td>
<td>High</td>
<td>2017-2019</td>
<td>$41,000 (grant funded)</td>
<td>Plan completed and actions implemented by agencies</td>
</tr>
<tr>
<td>Research</td>
<td>Undertake fine scale detailed koala habitat mapping as required for land west of the Pacific Highway.</td>
<td>High</td>
<td>2018-2020</td>
<td>$80,000</td>
<td>Mapping completed to standard that is accepted by DPE and OEH</td>
</tr>
<tr>
<td></td>
<td>Koala home range analysis</td>
<td>High</td>
<td>2017-2019 (underway)</td>
<td>$8,000 (grant funded)</td>
<td>Home ranges defined for western division of LGA</td>
</tr>
<tr>
<td></td>
<td>Assessment of koala presence of habitat previously considered to be 'Unoccupied' habitat</td>
<td>Medium</td>
<td>2020 onwards</td>
<td>$20,000</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>Dog desensitisation training app and Brochures</td>
<td>Medium</td>
<td>2019-2020</td>
<td>$25,000</td>
<td>App and brochures developed and used by 50% of new dog owners.</td>
</tr>
<tr>
<td></td>
<td>Citizen science koala location app</td>
<td>Medium</td>
<td>2019-2020</td>
<td>$10,000</td>
<td>App developed and utilised by local community</td>
</tr>
<tr>
<td></td>
<td>Annual School education programme</td>
<td>Medium</td>
<td>2019-2020 onwards</td>
<td>Incorporated into existing council community education programs</td>
<td>100% of local primary schools engaged per annum.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Koala population assessment</td>
<td>Medium</td>
<td>2018 every 3 years there after</td>
<td>$90,000 every 3 years</td>
<td>Data is current and relevant to measure the success of the strategy.</td>
</tr>
</tbody>
</table>
9 References


Appendix 1: Tree preferences in the LGA

Data from 10,186 trees collected during the course of the field assessment were augmented by other local studies in order to more thoroughly investigate utilisation of potential koala food trees. Consistent with previous work, 11 species were identified as the most significant koala food trees utilised by Koalas within the LGA:

Tallowwood, *Eucalyptus microcorys*
Swamp Mahogany, *E. robusta*
Forest Red Gum, *E. tereticornis*
Small-fruited Grey Gum, *E. propinqua*
Bastard Tallowwood, *E. planchoniana*
Orange Red Gum, *E. bancroftii*
Scribbly Gum, *E. racemosa*
Tallowwood hybrid, *E. patentinervis*
Flooded Gum, *E. grandis*
Blue Gum, *E. saligna*
Red Mahogany, *E. resnifera*