SUTHERLANDSHIRE

Sutherland Shire Council Koala Management Plan

2026-2031

Acknowledgement of Country

Sutherland Shire Council acknowledges the Dharawal people as the Traditional Custodians of the land within Sutherland Shire.

We value and celebrate Dharawal culture and language and acknowledge the Dharawal people's continuing connection to the land, the sea, and the community.

We pay respect to the Elders and their families, past, present, and emerging, and through them, to all Aboriginal and/or Torres Strait Islander peoples.

Image: Nawi canoe on the Woronora River, Sunset Cultural Ceremony 2024.

Still here: Koalas in Sutherland Shire

"Koalas are still living, breeding and moving through the landscapes of Sutherland Shire - and their future depends on the choices we make today."

Few animals capture the hearts of Australians like the koala. Quietly moving through the canopy, calling across the bush at night and raising young high above the ground, koalas are a powerful symbol of our natural heritage. For many residents, the discovery that koalas are still living in the wild so close to metropolitan Sydney is both inspiring and unexpected.

Across New South Wales, koalas face ongoing pressure from habitat loss, fragmentation, vehicle strike, dog attack, disease and climate change. Their long-term survival depends on intact, connected landscapes that support feeding, breeding and movement over generations.

The confirmation of a healthy, breeding koala population within and around Heathcote National Park revealed Sutherland Shire as an area of regional importance for koala conservation. This Koala Management Plan responds to that opportunity and responsibility, guiding informed action to protect koalas and the habitat they rely on – now and into the future.

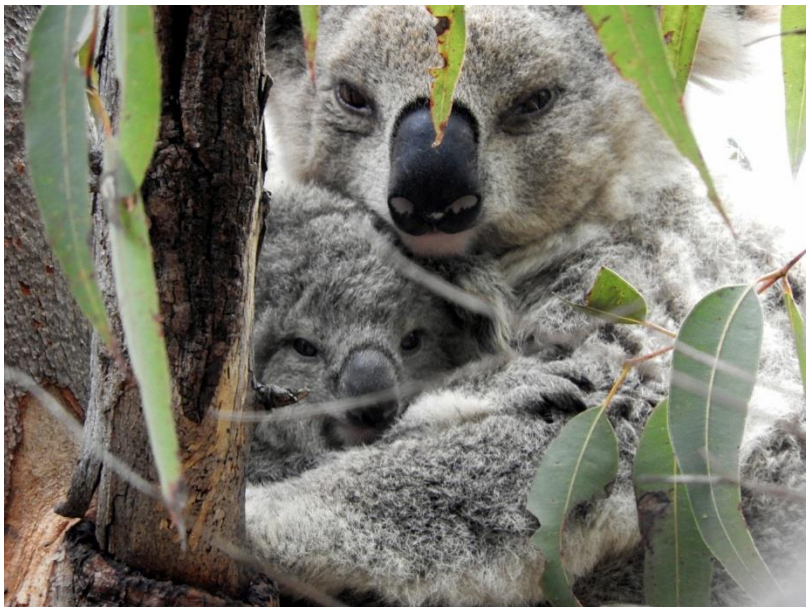
Koalas (*Phascolarctos cinereus*) are listed as Endangered under both the *Biodiversity Conservation Act 2016* (NSW) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). While broad patterns of koala decline are well documented across New South Wales, the presence, distribution and status of koalas within Sutherland Shire and the surrounding southern Sydney landscape were, until recently, poorly understood through formal survey programs.

'Elizabeth', image credit: Steve Anyon-Smith

Early understanding was substantially advanced through targeted field-based surveys undertaken between 2021 and 2022 within Heathcote National Park by local naturalists Steve Anyon-Smith and Tom Kristensen. Through systematic searches of preferred feed-tree communities and detailed on-ground observations, this work identified a large, healthy and breeding koala population within the park, including females with young. The presence of multiple age classes and the apparent absence of chlamydia indicated a viable population of regional significance located within protected bushland close to metropolitan Sydney.

The documentation of this population challenged earlier assumptions that koalas were rare or transient within the southern Sydney landscape. It also highlighted the critical role of intact vegetation, low-disturbance environments and landscape connectivity in supporting koalas beyond traditionally recognised strongholds. These findings provided important context for subsequent surveys within Sutherland Shire, informed early habitat mapping, and underscored the need for a coordinated, evidence-based approach to koala conservation across tenure and local government boundaries.

Building on this early work, Council expanded its evidence base through additional data collection and analysis, including fine-scale vegetation mapping, habitat modelling, drone and acoustic surveys, and occupancy modelling. This work was supported by funding through the NSW Koala Strategy, delivered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW), following the recognition of Sutherland Shire as an Area of Regional Koala Significance in 2023. These investigations strengthened understanding of local habitat condition, connectivity and threats, and provided a robust foundation for informed planning and management.



'Maryanne' and 'Ricki', image credit: Steve Anyon-Smith

Despite sustained advocacy, Sutherland Shire is not currently subject to Chapters 3 or 4 of the *State Environmental Planning Policy (Biodiversity and Conservation*) *2021* (Koala SEPP). As a result, Council cannot prepare a statutory Koala Plan of Management. In this context, the Koala Management Plan has been developed to provide a coordinated, locally appropriate and evidence-based framework to guide habitat identification, threat mitigation and planning decision-making for koalas within the Shire, while supporting adaptive management and continued collaboration with the community, government agencies and other stakeholders.

Background

Koalas are still living, breeding and moving through parts of the Sutherland Shire, and their long-term survival depends on protecting connected, functioning habitat across a shared landscape. The Sutherland Shire Council Koala Management Plan 2026 (the Plan) provides a coordinated, evidence-based framework to conserve and enhance the long-term viability of koalas and their habitat across Sutherland Shire. The Plan responds to the presence of a relatively small but regionally significant koala population, predominantly within the Woronora Valley and surrounding bushland, and recognises the cumulative pressures of urban growth, infrastructure, climate change and landscape fragmentation.

Koalas (*Phascolarctos cinereus*) are listed as Endangered under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the New South Wales *Biodiversity Conservation Act 2016*. Sutherland Shire lies within an Area of Regional Koala Significance as identified under the New South Wales Koala Strategy. While Sutherland Shire is not currently designated as a Koala Management Area under the Koala SEPP, this Policy applies to certain development proposals.

The Plan provides a clear, locally relevant framework to guide planning decisions, land management and conservation investment in alignment with State and Commonwealth policy intent.

'Hal', image credit: Steve Anyon-Smith

Purpose and objectives

The purpose of the Plan is to support the long-term conservation, recovery and expansion of koalas and koala habitat within Sutherland Shire. Key objectives are to:

1. Protect and conserve existing koala habitat on public and private land.
2. Restore and improve koala habitat and enhance connectivity.
3. Reduce and actively manage key threats affecting koalas and their habitat.
4. Foster community awareness, stewardship and shared responsibility.

5. Embed biodiversity values into decision-making by establishing and applying consistent criteria for development assessment. This should include clear guidelines for koala habitat assessment, identification and protection of feed trees, and prioritisation of habitat retention, with biodiversity offsets used only as a last resort for unavoidable impacts.
6. Support monitoring, research and adaptive management to meet objectives.
7. Embed koala conservation within Council biodiversity frameworks.
8. Regularly evaluate and report on implementation outcomes.

Strategic context and consultation

The Plan aligns with the National Recovery Plan for the Koala *Phascolarctos cinereus*, the New South Wales Koala Strategy, Koala Habitat Protection Guideline, relevant legislation, and Council's local planning and environmental strategies. The Plan sits beneath Council's Draft Biodiversity Strategy 2026-2036, delivering a species-specific approach that supports the Biodiversity Strategy's broader Protect-Connect-Celebrate directions. Development of the Plan was informed by ongoing collaboration through the Southern Sydney Koala Steering Committee, comprising Council, NSW agencies, Commonwealth land managers, Aboriginal representatives and infrastructure authorities.

Koala habitat and connectivity

The Plan identifies likely koala habitat and areas of known occupancy and recognises the importance of habitat buffers and movement corridors across the landscape. It also acknowledges the challenges koalas face moving between habitat areas and through a developed landscape. Protecting large, connected patches of habitat and maintaining east-west and north-south movement pathways are central to improving population resilience, genetic connectivity and climate adaptation capacity.

Key threats

The Plan identifies and addresses the primary threats to koalas in Sutherland Shire:

- Habitat loss, fragmentation and degradation, driven by development and vegetation clearing.
- Vehicle strike, particularly along major roads intersecting koala habitat.
- Disease, including the risk of chlamydia entering a small, genetically constrained population.
- Climate change, including heatwaves, drought, flooding and reduced habitat quality.
- High-intensity bushfire and altered fire regimes.
- Domestic dog attacks, particularly in fragmented urban landscapes.
- Pest species and invasive weeds, affecting habitat condition.
- Drowning, especially in residential swimming pools during heatwave events.

For each threat, the Plan outlines mitigation approaches consistent with best-practice koala conservation and adaptive management principles.

Development assessment and controls

A core function of the Plan is to support consistent, transparent assessment of development applications within, or affecting, koala habitat. It documents best practice planning principles

for koala conservation including requirements for koala habitat assessment, tree retention, mitigation, and, where unavoidable, offsetting consistent with a no net loss of koala habitat principle. The Plan promotes koala sensitive design for road and fence infrastructure and subdivision layout and best practice measures and controls for habitat protection, dog ownership and swimming pools.

While not a statutory Koala Plan of Management, the Plan aligns with the intent and application of the Koala SEPP 2021 and provides a strategic framework to inform Council decision-making.

Action plan, monitoring and evaluation

The Action Plan sets out priority actions linked to the Plan's objectives, identifying timeframes, partners, resources and implementation responsibilities. Actions span proposed amendments to Sutherland Shire's planning documents, habitat protection and restoration, threat mitigation, community education, development controls, research support and monitoring.

Implementation will follow an adaptive management framework, with regular monitoring of koala populations, habitat condition, threats and management effectiveness. The Plan will be reviewed at least every five years, or sooner if required, to respond to new information, changing conditions or legislative updates.

The Plan provides a comprehensive, long-term framework for koala conservation. It prioritises protecting high-value habitat, strengthening ecological connectivity and reducing key pressures such as fragmentation, invasive species and urban impacts. It commits to targeted species recovery, climate resilience and community stewardship, ensuring koala conservation is fully integrated within Council's broader biodiversity goals. Through coordinated planning, evidence-based controls, strong partnerships and community stewardship, the Plan aims to secure koalas as a valued and enduring part of Sutherland Shire's natural environment.

'Patsy' and 'Mel', image credit: Steve Anyon-Smith

Acknowledgement of Contributions

The Koala Management Plan has been informed by the collective efforts of community members, volunteers, researchers, consultants and government partners who have contributed to improving understanding of koalas and their habitat in Sutherland Shire.

In particular, Council acknowledges the significant field-based survey, monitoring and population identification work undertaken by Steve Anyon-Smith and Tom Kristensen (Figure 1). Their detailed and largely voluntary surveys have been central to establishing the presence, distribution and relative abundance of koalas within the Shire and have provided a critical foundation for habitat mapping, threat assessment and planning considerations included in this Plan.

Figure 1 Surveys in the field

Council also acknowledges the support of the NSW Koala Strategy, delivered by the Department of Climate Change, Energy, the Environment and Water (DCCEEW). Recognition of Sutherland Shire as an Area of Regional Koala Significance and associated funding enabled Council to undertake fine-scale vegetation mapping, commission drone and acoustic surveys, develop occupancy models and prepare this Koala Management Plan. This work aligns with the NSW Koala Strategy's focus on improving habitat mapping and supporting councils to strengthen local planning and conservation responses.

The preparation of the Plan was supported by specialist consultants Ecosure and EcoPlanning, who were engaged to synthesise existing data, technical studies and community knowledge into an evidence-based management framework tailored to local conditions. Their work drew on best-practice ecological assessment, modelling and planning principles to inform the structure and recommendations of the Plan.

Council further acknowledges the contributions of the Southern Sydney Koala Steering Committee (Figure 2), environmental reference groups, community organisations and individual residents who have shared local knowledge, raised issues, and provided feedback throughout the development of the Koala Management Plan. Early and ongoing input from stakeholders has helped shape the Plan's emphasis on habitat protection, connectivity, threat reduction and integration with land-use planning and development assessment processes.

Figure 2 Stakeholder Workshop during consultation of the Plan

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Definitions and acronyms

ARKS	Area of Regional Koala Significance (NSW Koala Strategy)
ANSTO	Australian Nuclear Science and Technology Organisation
AWC	Available water capacity
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016* (NSW)
Biodiversity Strategy	Sutherland Shire Draft Biodiversity Strategy 2026-2036
BOM	Bureau of Meteorology
BOS	Biodiversity Offset Scheme (NSW)
Council	Sutherland Shire Council
CLY	Clay content
DoD	Department of Defence (Commonwealth)
DPHI	Department of Planning, Housing and Infrastructure
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GLALC	Gandangara Local Aboriginal Land Council
Suitably qualified and experienced person	Has a tertiary qualification in ecology, environmental management, forestry or other equivalent qualification and experience in flora and fauna identification, survey and management, including experience in conducting koala surveys.
Koala SEPP	State Environmental Planning Policy (Biodiversity and Conservation) 2021
KPoM	Koala Plan of Management
KoRV	Koala Retrovirus
Likely koala habitat[1]	Areas of native vegetation where koala feed tree species (as outlined in Schedule 1 of the State Environment Planning Policy (Biodiversity and Conservation) 2021) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. It is important to note that 'likely koala habitat' is defined independent of koala record locations and predominantly based on food tree abundance.
LGA	Local Government Area
LKH	Likely koala habitat
LUT	Look up table
NPWS	National Parks and Wildlife Service (NSW)
NSW	New South Wales
NSW DCCEEW	Department of Climate Change, Energy, the Environment and Water (NSW)

[1]The term 'Likely koala habitat' is adapted from 'potential koala habitat' as defined in Chapter 3 of the Koala SEPP.

NVSMA	Native Vegetation of the Sydney Metropolitan Area
Occupied koala habitat	Land that is determined to contain koalas, supported by verified koala records within the last five years
PCT	Plant Community Type
PKFT	Preferred koala food tree
Plan	Koala Management Plan (this document)
RFS	Rural Fire Service (NSW)
SLGA	Soil and Landscape Grid of Australia
SOC	Soil organic carbon concentration
SSKSC	Southern Sydney Koala Steering Committee
Sutherland Shire	Sutherland Shire Local Government Area
SVTM	State Vegetation Type Map
TEC	Threatened Ecological Communities
TfNSW	Transport for New South Wales
WPA	Wildlife Protection Area

'Linda', image credit: Steve Anyon-Smith

Part 1 - Introduction

Sutherland Shire Local Government Area (Sutherland Shire) is located at the southern border of Sydney's metropolitan area (Figure 3) and is home to a significant and growing population of healthy koalas. To date, approximately 200 koalas have been recorded on Sutherland Shire Council (Council), State, and National Park land, predominantly in the tall, open sclerophyll forests of the Woronora Valley (K. Madden pers. comm. 2025).

Early confirmation of koala presence within Sutherland Shire was informed by targeted field-based surveys undertaken between 2021 and 2022 by local naturalists Steve Anyon-Smith and Tom Kristensen. This work documented multiple individual koalas through systematic on-ground observation and identification, providing some of the first consistent evidence of a resident, breeding population within the local and surrounding landscape (Anyon-Smith 2022). This early evidence informed subsequent habitat mapping, monitoring and Council engagement with State agencies regarding koala conservation.

Koalas are listed as Endangered under the New South Wales (NSW) *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Information on koala ecology is outlined in Appendix 1. Significant threats to koalas include land use change and habitat loss, climate change and intensifying extreme weather (including bushfire), disease, dogs, and vehicles (DAWE 2022a).

Council is committed to protecting koalas and their habitat and engaged Ecosure to develop this Koala Management Plan (the Plan). The Plan provides Council with a comprehensive, long-term framework for koala conservation. It sits beneath Council's Draft Biodiversity Strategy 2026-2036 (Biodiversity Strategy), delivering a species-specific approach that supports the Biodiversity Strategy's broader Protect-Connect-Celebrate directions. The Plan prioritises protecting high-value habitat, strengthening ecological connectivity and reducing key pressures such as fragmentation, invasive species and urban impacts. The Plan applies these principles directly to koalas by mapping occupied and likely habitat, enhancing movement corridors and guiding development decisions through the mitigation hierarchy. In doing so, it operationalises the Biodiversity Strategy's commitments to targeted species recovery, climate resilience and community stewardship, ensuring koala conservation is fully integrated within Councils broader biodiversity goals. It integrates ecological data, planning considerations and risk management principles to guide Council's actions across several strategic focus areas.

Figure 3 Sutherland Shire Local Government Area; map: Ecosure

1.1 Population recovery intent

This Plan is intended to support the stabilisation and long-term increase of the Sutherland Shire koala population, consistent with the objectives of the NSW Koala Strategy and the National Recovery Plan for the Koala.

While this Plan is a non-statutory policy document and does not replace planning legislation or regulatory processes, it represents Council's formal commitment to prioritising koala population recovery through coordinated habitat protection, threat reduction, connectivity enhancement and monitoring.

The effectiveness of the Plan will be assessed not only by implementation of actions, but by whether those actions demonstrably reduce anthropogenic mortality, improve habitat security and connectivity, and support persistence of koalas over time.

1.2 Purpose and objectives

This Plan is consistent with the National Koala Recovery Plan (DAWE 2022a), NSW Koala Strategy (DPE 2022c), and the principles of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Koala SEPP).

The purpose of the Plan is to support the long-term conservation, recovery, and expansion of Sutherland Shire's koala population and koala habitat. The objectives of this Plan are to:

1. Protect and conserve existing koala habitat on public and private land.
2. Restore and improve koala habitat and enhance connectivity.
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5. Embed biodiversity values into decision-making by establishing and applying consistent criteria for development assessment. This should include clear guidelines for koala habitat assessment, identification and protection of feed trees, and prioritisation of habitat retention, with biodiversity offsets used only as a last resort for unavoidable impacts.
6. Support monitoring, research and adaptive management to meet objectives.
7. Embed koala conservation within Council biodiversity frameworks.
8. Regularly evaluate and report on implementation outcomes.

1.3 Legislative and strategic context

Sutherland Shire is not currently subject to Chapters 3 or 4 of the Koala SEPP. Chapter 3 applies to rural local government areas identified under the policy, while Chapter 4 applies to nominated metropolitan and regional LGAs; Sutherland Shire is not included within either category. Consequently, koala habitat protection and development assessment within Sutherland Shire are undertaken through the *Biodiversity Conservation Act 2016*, the *Environmental Planning and Assessment Act 1979*, Council's Local Environmental Plan and Development Control Plan, and relevant Commonwealth legislation where applicable.

This Koala Management Plan has been prepared to provide a locally appropriate, evidence-based framework to guide koala habitat identification, threat management, and planning decision-making in the absence of formal coverage under the Koala SEPP.

A range of national and state legislation, policies, strategies, and plans are in place that directly and indirectly protect koalas and their habitat (Table 1). A summary of their relevance to koalas and the responsibilities of Sutherland Shire Council is provided in Appendix 2.

Table 1 Legislation, policy, guidelines, strategies and plans that help protect koalas and their habitat in Sutherland Shire

Level	Legislation	Policy or guideline	Strategy or plan
National	*Environment Protection and Biodiversity Conservation Act 1999*	Significant Impact Guidelines 1.1 - Matters of National Environmental Significance	National Recovery Plan for the Koala *Phascolarctos cinereus* (combined populations of Queensland, New South Wales and the Australian Capital Territory) (DAWE 2022b)
State	*Biodiversity Conservation Act 2016* *Environmental Planning and Assessment Act 1979* *Local Government Act 1993* *National Parks and Wildlife Act 1974* *Local Land Services Act 2013* *Rural Fires Act 1997* *Roads Act 1993* *Companion Animals Act 1998*	NSW Biodiversity Offsets Scheme (BOS) (NSW Government 2025) Biodiversity Assessment Method 2020 (BAM) (DPIE 2020a) Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide (DPE 2022b) State Environment Planning Policy (Biodiversity and Conservation) 2021 Design Guidelines for Koala-exclusion Fencing (draft for consultation) (DPIE 2025)	NSW Koala Strategy (DPE 2022c)

Level	Legislation	Policy or guideline	Strategy or plan
Local	Sutherland Shire Local Environmental Plan 2015		Sutherland Shire Draft Biodiversity Strategy 2026-2036 Sutherland Shire Development Control Plan 2015 (Sutherland Shire Council 2015) Greenweb, Sutherland Shire Environmental Specification 2020 (Sutherland Shire Council 2020) Sutherland Shire Environment and Sustainability Strategy (Sutherland Shire Council 2012) Climate Strategy 2050, Thrive. Design. Lead. (Sutherland Shire Council 2025a) Sutherland Shire Tree and Bushland Strategy 2025-2035 (Sutherland Shire Council 2025e) Sutherland Bush Fire Risk Management Plan (Sutherland Bushfire Management Committee 2025) Neighbouring Council Koala Plans and Strategies

1.4 Stakeholder consultation

Key stakeholders, including the Sutherland Shire community, have played a significant role in the development of this Plan. Initial engagement was facilitated through the Southern Sydney Koala Steering Committee (SSKSC) with specific opportunities for key stakeholders to provide input during the final stages of the Plan's development (Figure 2).

The SSKSC consists of members from:

- Council
- NSW Department of Climate Change, Energy, Environment and Water (NSW DCCEEW)
- NSW National Parks and Wildlife Service (NPWS)
- Commonwealth Department of Defence (DoD)
- Transport for NSW (TfNSW)
- Gandangara Local Aboriginal Land Council (GLALC)
- NSW Rural Fire Service (RFS)
- ANSTO
- WaterNSW.

Early, locally based ecological input also contributed to Plan development. This included field surveys and monitoring work that informed baseline understanding of koala presence and distribution (see Part 1 - Introduction).

The consultation process included the following:

- Ongoing consultation via the SSKSC.
- Targeted Plan development consultation to internal and external stakeholders within the SSKSC and adjoining Councils.

Council will publish a summary response to submissions received during public exhibition of this Plan. The response will outline key issues raised, matters incorporated into the final Plan, and matters not adopted, with reasons. This summary will be publicly available alongside the adopted Plan.

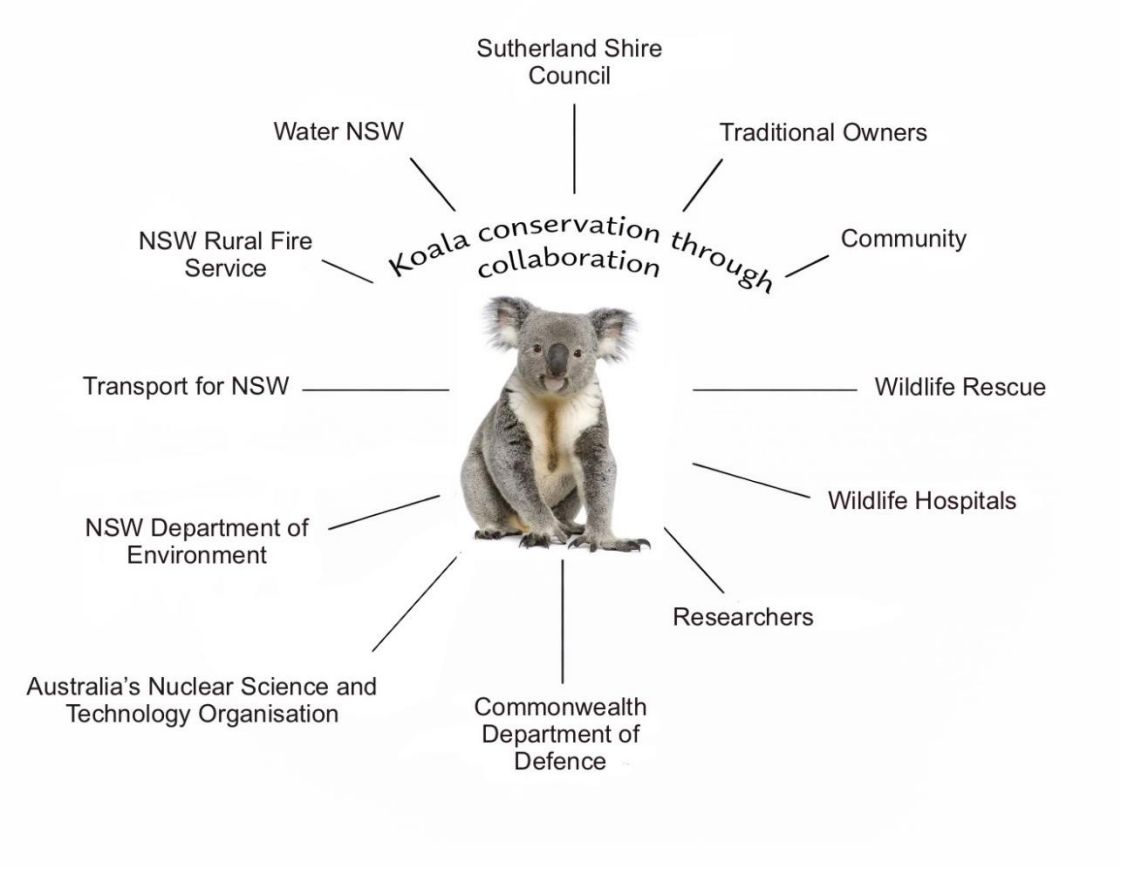


Figure 4 Sutherland Shire stakeholder consultation

1.5 Community engagement summary

Council undertook a broad and inclusive community engagement program to inform the development of the Koala Management Plan 2026. Engagement occurred during public exhibition of the draft Plan and included an online survey, written submissions, pop-up community engagement sessions and general correspondence received throughout the exhibition period. These mechanisms enabled participation from a wide range of interested parties, including residents, landholders, community groups, environmental organisations, Aboriginal stakeholders, wildlife carers and institutional landholders.

Feedback received during the exhibition period also reflected the views of established local advisory and land-management interests, including the SSKSC, and Cleanaway as a significant landholder with relevant koala habitat. Input from these sources complemented broader community feedback by providing local context and land-management perspectives within the overall consultation process.

Key insights

Community engagement demonstrated a strong awareness of, and support for, koala conservation within the Shire. Survey responses and submissions consistently identified

protection of existing habitat, reduction of koala mortality — particularly from vehicle strike — and maintenance of functional habitat connectivity as the highest priorities for Council action.

Many respondents expressed concern that ongoing pressures from development, road infrastructure and domestic animal interactions pose risks to the long-term viability of the local koala population. While there was broad support for the Plan's intent and overall direction, views differed on the strength and enforceability of proposed actions. Some respondents sought stronger controls, clearer prioritisation and greater accountability, while others acknowledged the Plan's non-statutory role and supported a pragmatic, evidence-based approach within existing legislative frameworks.

Community education, incorporation of local ecological knowledge, and transparent monitoring and reporting were widely identified as critical to achieving long-term conservation outcomes.

Key themes raised

Key themes emerging from consultation included:

- Protection of existing koala habitat and avoidance of development in key habitat and connectivity areas.
- Reduction of vehicle strike through targeted mitigation at known hotspots.
- Recognition and protection of functional habitat corridors and movement pathways.
- Management of risks at the urban–bushland interface, including domestic dogs, swimming pools and fencing.
- Community education, stewardship and improved reporting of koala sightings.
- Recognition of Aboriginal knowledge and ongoing cultural engagement.
- Requests for clearer implementation priorities, monitoring and public reporting.
- Clarification of the scope and limitations of a non-statutory management plan.

Response to feedback

The Koala Management Plan has been refined in response to community feedback while remaining within Council's statutory role and implementation capacity. The final Plan strengthens its focus on population-level threat reduction, particularly vehicle-strike mitigation, reinforces the importance of functional habitat connectivity, and enhances commitments to education, stewardship and transparent reporting.

Council acknowledges the diverse views expressed through consultation and thanks all contributors for their participation. Community feedback has directly informed the Plan's

priorities and approach, supporting a balanced, evidence-based framework for koala conservation and adaptive management across the Shire.

1.6 Roles and responsibilities

Council's roles and responsibilities in relation to this Plan are:

- To lead the development of the Plan and identify and map koala habitat in consultation with NSW DCCEEW.
- Use the Plan to guide decisions on development applications in koala habitat, and ensure any new projects follow the legislation to protect koalas and their habitats, including maintaining movement corridors.
- Manage Council land (e.g. parks, reserves, and road verges) in line with the Plan. This includes protecting trees, maintaining corridors, and controlling tree removal.
- Undertake community education campaigns and workshops and install signage to inform the community about koalas and how to protect them (e.g. responsible pet ownership, wildlife-safe pools, reporting sightings using the 'I Spy Koala' application/website).
- Work with residents and landowners to improve koala habitat on private land (e.g. education, advice, or provision of habitat trees).
- Support koala population monitoring and research.
- Review the Plan and the implementation of the Plan aiming to deliver long-term conservation of koalas and their habitat.

1.7 Koala habitat identification

Council has worked with NSW DCCEEW and Conservation Leaders, to identify likely koala habitat within Sutherland Shire (Figure 5). Likely koala habitat was identified as areas of native vegetation where primary koala food trees (PKFT) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component. Koala habitat maps required a fine scale and accurate vegetation map to underpin delineation of a 'Likely Koala Habitat' map, with the development of the koala habitat map involving extensive vegetation surveys across Sutherland Shire. Detailed methods for the production of fine scale, accurate vegetation mapping is described in Appendix 3, with detailed methods for identifying likely koala habitat, including PKFT, described in Appendix 4. Early field observations and verified local koala records were used to support interpretation and validation of habitat mapping outputs.

NPWS estate was not included as part of this Plan but has been included in maps, as important habitat in these areas connect to Sutherland Shire's managed areas. Additionally, koalas are likely to move between national park and Sutherland Shire's managed areas.

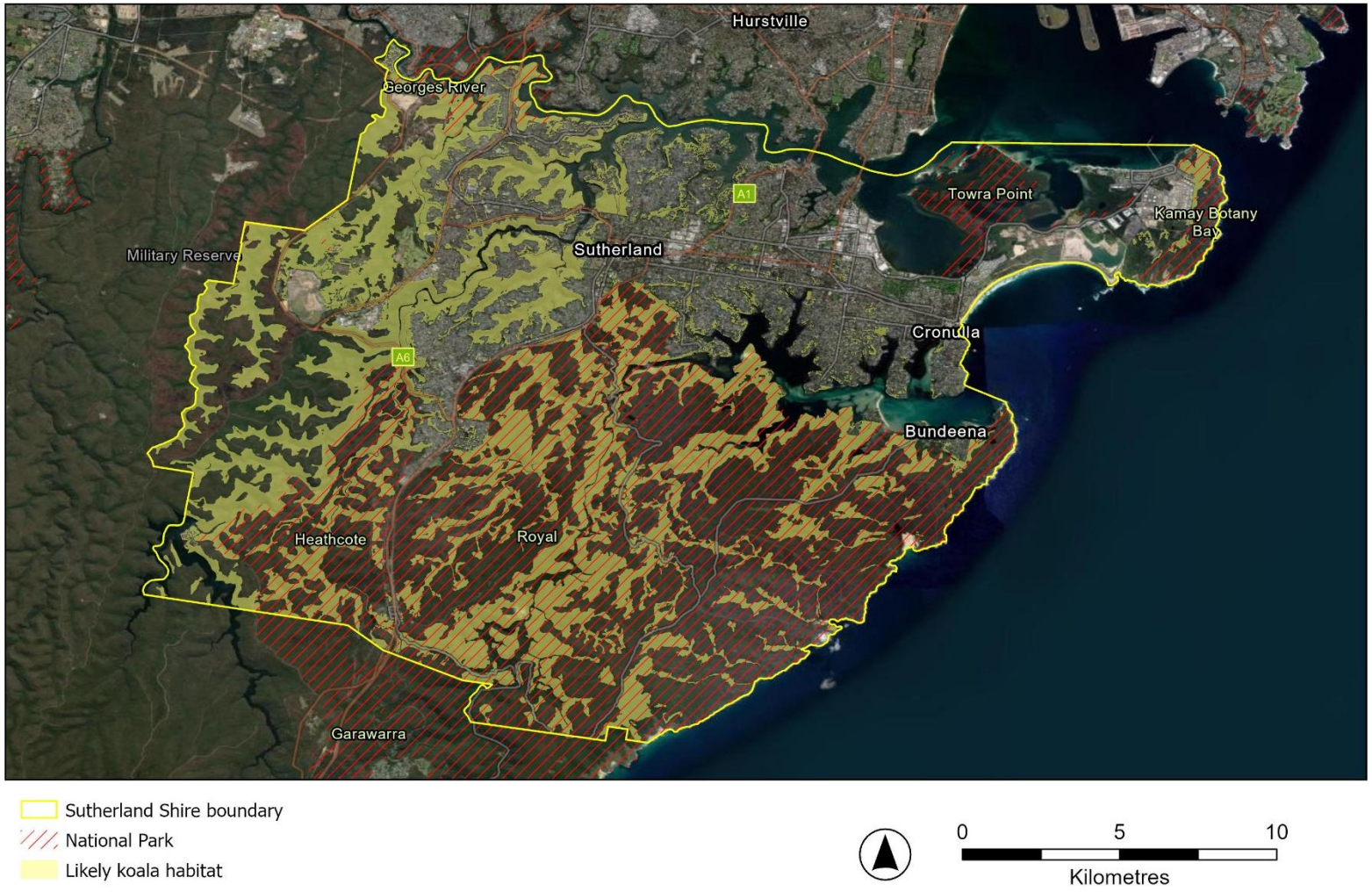


Figure 5 Likely koala habitat in Sutherland Shire (model: Conservation Leaders; map: Ecosure).

Occupied koala habitat is identified as land that is determined to contain koalas, supported by verified koala records within the last five years. The occupied koala habitat within Sutherland Shire was prepared by NSW DCCEEW and Conservation Leaders. The method included:

- overlaying the occupancy model on the likely koala habitat (LKH) map
- identifying patches of LKH modelled as occupied that meet one or more of the following criteria:
    - habitat patches larger than 100 ha, (which is the estimated minimum patch size to support at least one breeding female in south-west Sydney and Southern Highlands)
    - habitat patches smaller than 100 ha of LKH, modelled as occupied and either:
        - within 300 m of a 100 ha patch of occupied habitat (300 m readily traversed by koala in a night)
        - connected to a 100 ha patch of occupied habitat by intact bushland
        - contain a recent, verified koala record (within the past five years), indicating current occupancy.

Detailed methods for koala surveys and development of occupancy models are described in Appendix 5.

The koala occupancy model in Sutherland Shire is shown in Figure 6 (north) and Figure 7 (south) using natural breaks (Jenks) scaling. A map of the koala occupancy model encompassing the whole of Sutherland Shire is provided in Appendix 6. Koala records from BioNet between 2004 and 2025 (BioNet 2025) have been overlayed on the modelled occupied habitat (Figure 8).

In Sutherland Shire, koalas are present on the western side of the local government area (LGA) (Figure 6 to Figure 8). The BioNet records presented in Figure 8 have included koala vehicle incidents. Therefore, BioNet records are predominantly located on roads.

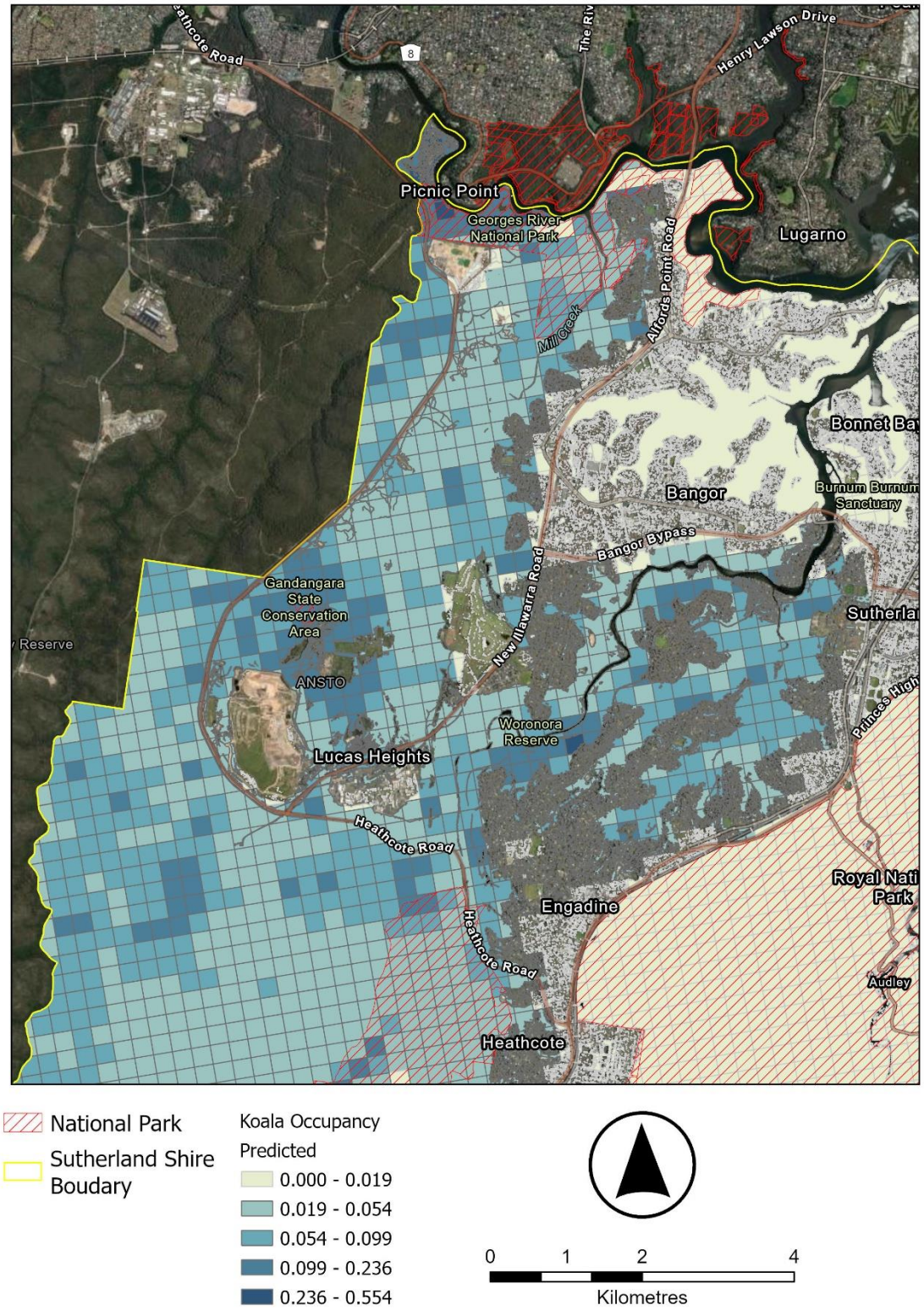


Figure 6 Koala occupancy model (natural breaks (Jenks) scaling) in Sutherland Shire (north) (model: Conservation Leaders; map: Ecosure).

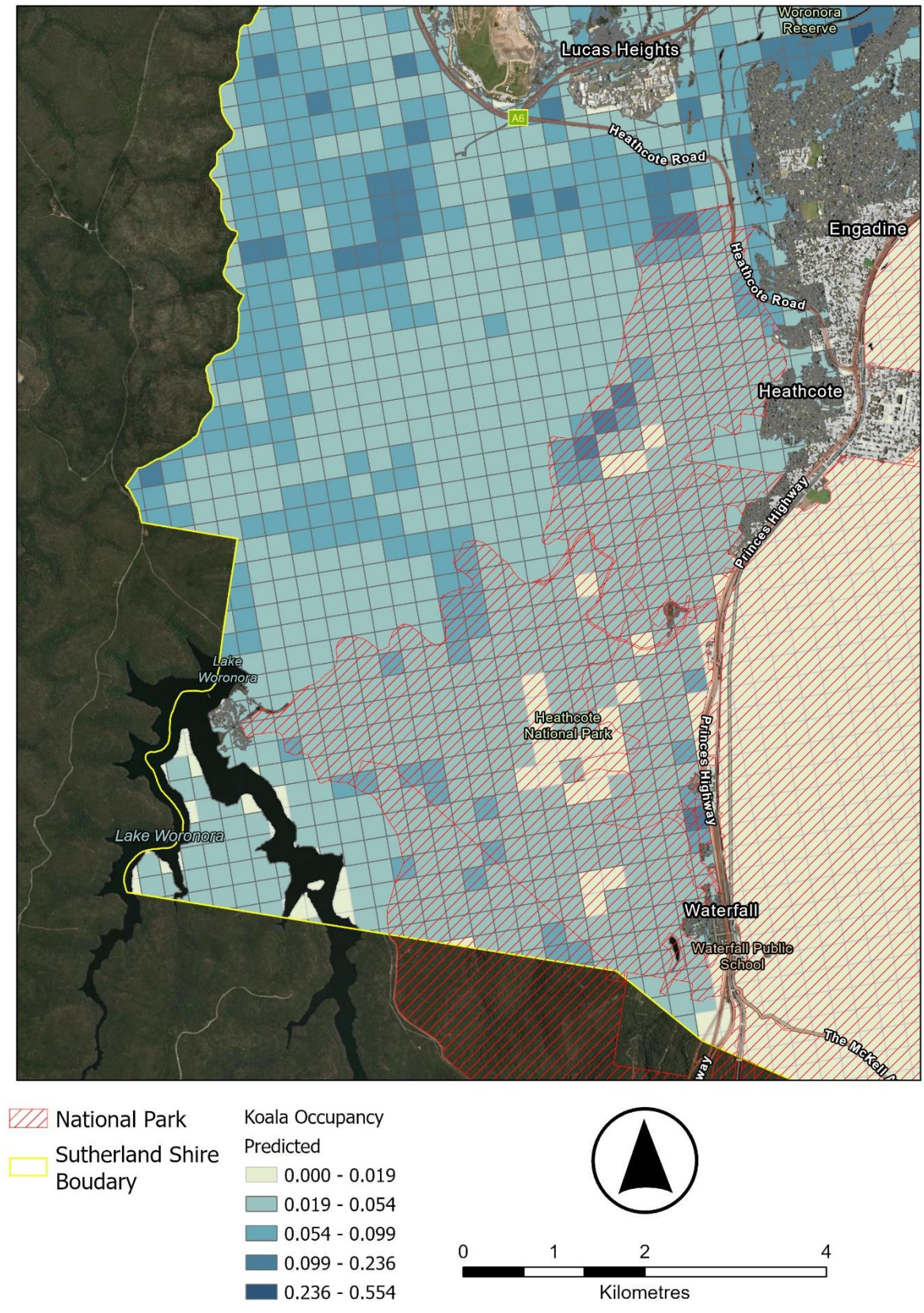


Figure 7 Koala occupancy model (natural breaks (Jenks) scaling) in Sutherland Shire (south) (model by Conservation Leaders

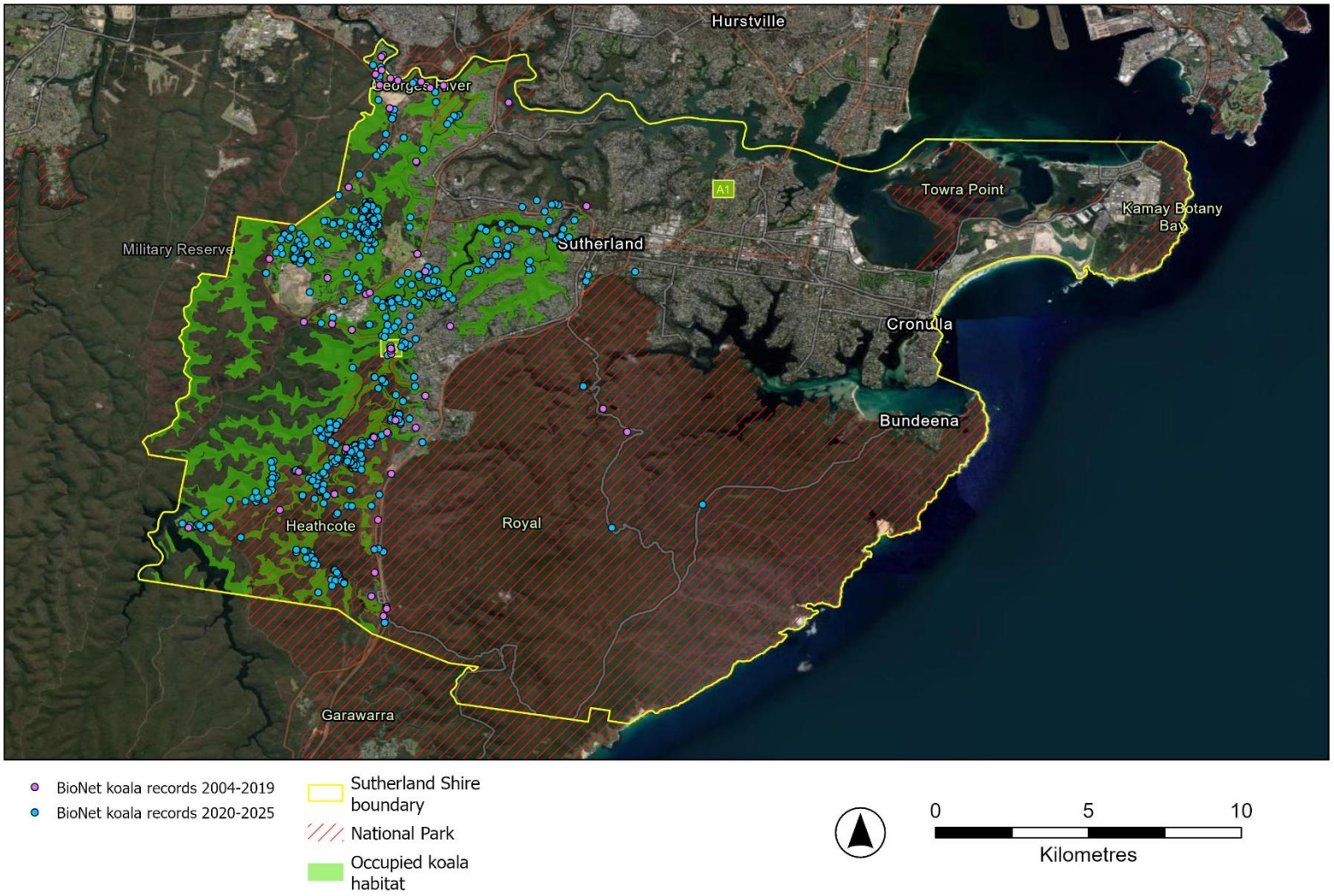


Figure 8 Occupied koala habitat in Sutherland Shire with BioNet records 2004-25 (model by Conservation Leaders; map: Ecosure).

1.8 Corridors and connectivity

Buffers and corridors between likely and occupied koala habitat are essential to enable safe movement of koalas across the landscape.

Council has identified key areas of bushland habitat and interconnecting linkages or corridors that can be established across Sutherland Shire. These selected areas have been identified on the Greenweb Map in Chapter 39 of the Sutherland Shire Development Control Plan 2015. Occupied and likely koala habitat was overlayed with the Greenweb Map to identify opportunities to enhance koala habitat connectivity. For clarity, the results are presented in three maps, in the northwest of Sutherland Shire in the vicinity of Menai and Barden Ridge (Figure 9) and in the vicinity of River Road, Woronora (Figure 10) and in the southwest of Sutherland Shire in the vicinity of Heathcote and Waterfall (Figure 11). A map showing areas identified for enhancing koala habitat connectivity in the entire Sutherland Shire is provided in Appendix 6.

Much of the occupied and likely koala habitat occurs within the Greenweb Map and is already connected through a network of:

- Greenweb Core areas - key habitat areas like national parks and Council reserves.
- Greenweb Restoration areas - long term restoration areas like bushcare sites.
- Greenweb Support areas - ancillary habitat or secondary linkages that can act like stepping stones including sports fields.

Key areas where measures are recommended to improve connectivity for koalas between occupied and likely koala habitats include:

- areas of Old Illawarra Road and Hall Drive in Menai (Figure 9)
- New Illawarra Road in Barden Ridge (Figure 9)
- River Road in Bangor and Woronora (Figure 10).

Improving connectivity between occupied koala habitat to the west of the Princes Highway at Heathcote, Engadine, and Waterfall (inclusive of Heathcote National Park) to Royal National Park in the east is also recommended as a priority (Figure 11). Achieving this will require collaboration between Sutherland Shire, TfNSW and the NSW DCCEEW.

Critically, the likely koala habitat map identifies opportunities to support the expansion of the koala population in Sutherland Shire. However, these areas are currently fragmented by major and suburban roads which are a barrier to safe passage. Efforts to enhance corridors need to ensure safe koala movement and, therefore, improving koala habitat near roads should be assessed in association with the risk of vehicle strike (refer Part 2.2). BioNet records indicate that koalas are crossing these roads, indicating that mitigation actions to support safe passage or prevent crossing require investigation.

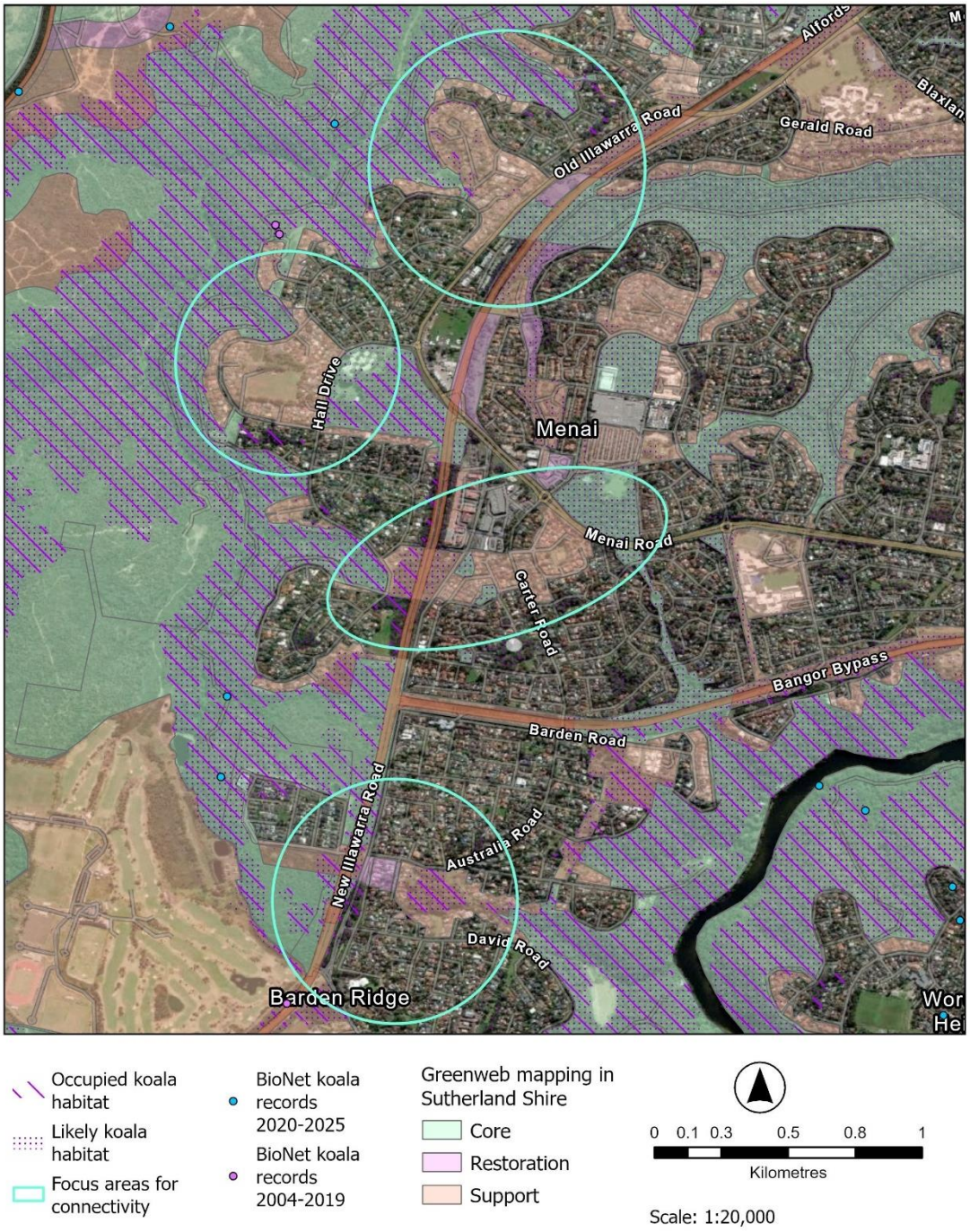


Figure 9 Opportunities to enhance koala habitat connectivity by linking occupied and likely koala habitat in Menai and Barden Ridge areas of Sutherland Shire (occupied and likely habitat was modelled by Conservation Leaders, Greenweb mapping provided by Council; map: Ecosure).

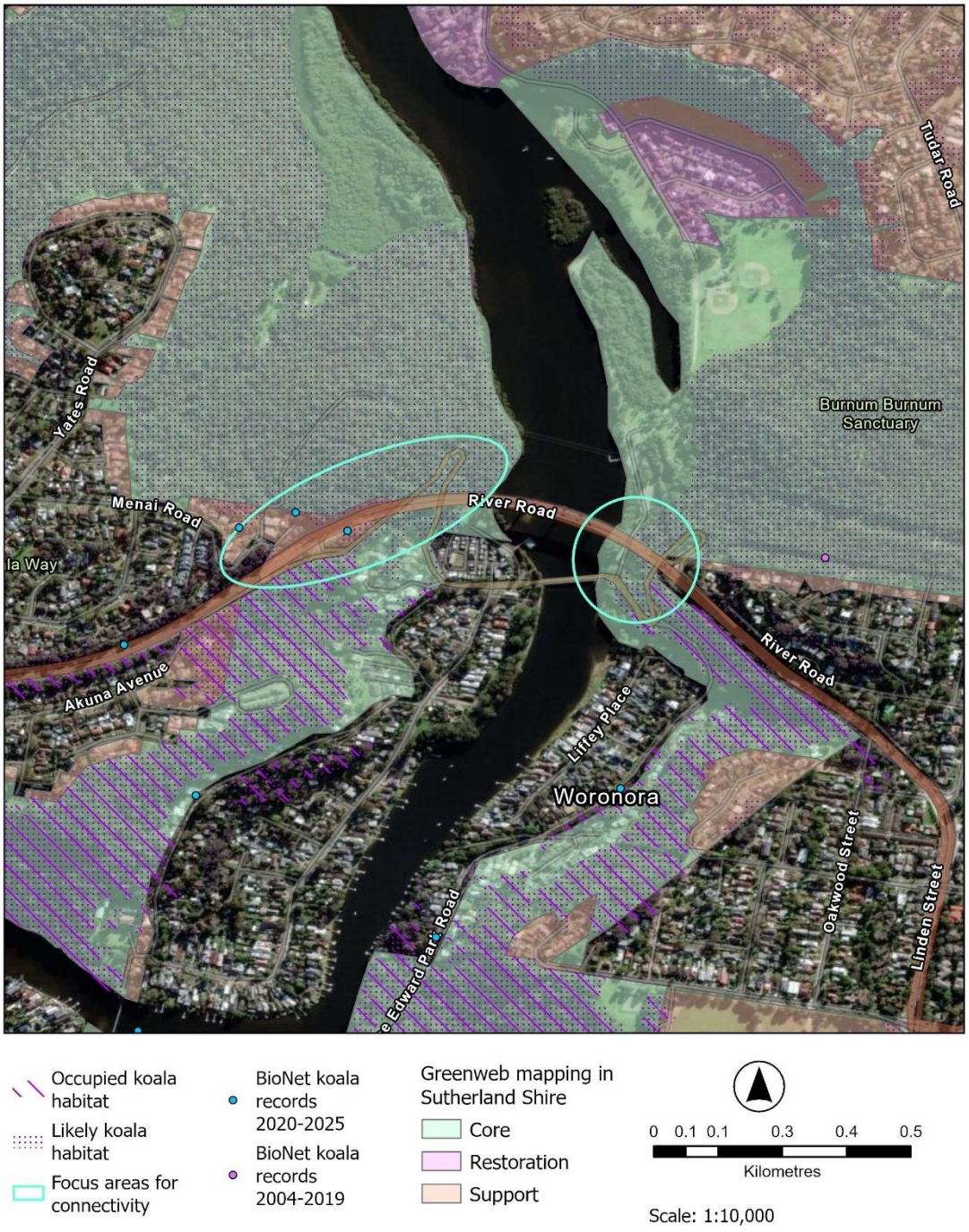


Figure 10 Opportunities to enhance koala habitat connectivity by linking occupied and likely koala habitat in the Bangor and Woronora areas of Sutherland Shire (occupied and likely habitat was modelled by Conservation Leaders, Greenweb mapping Council; map: Ecosure).

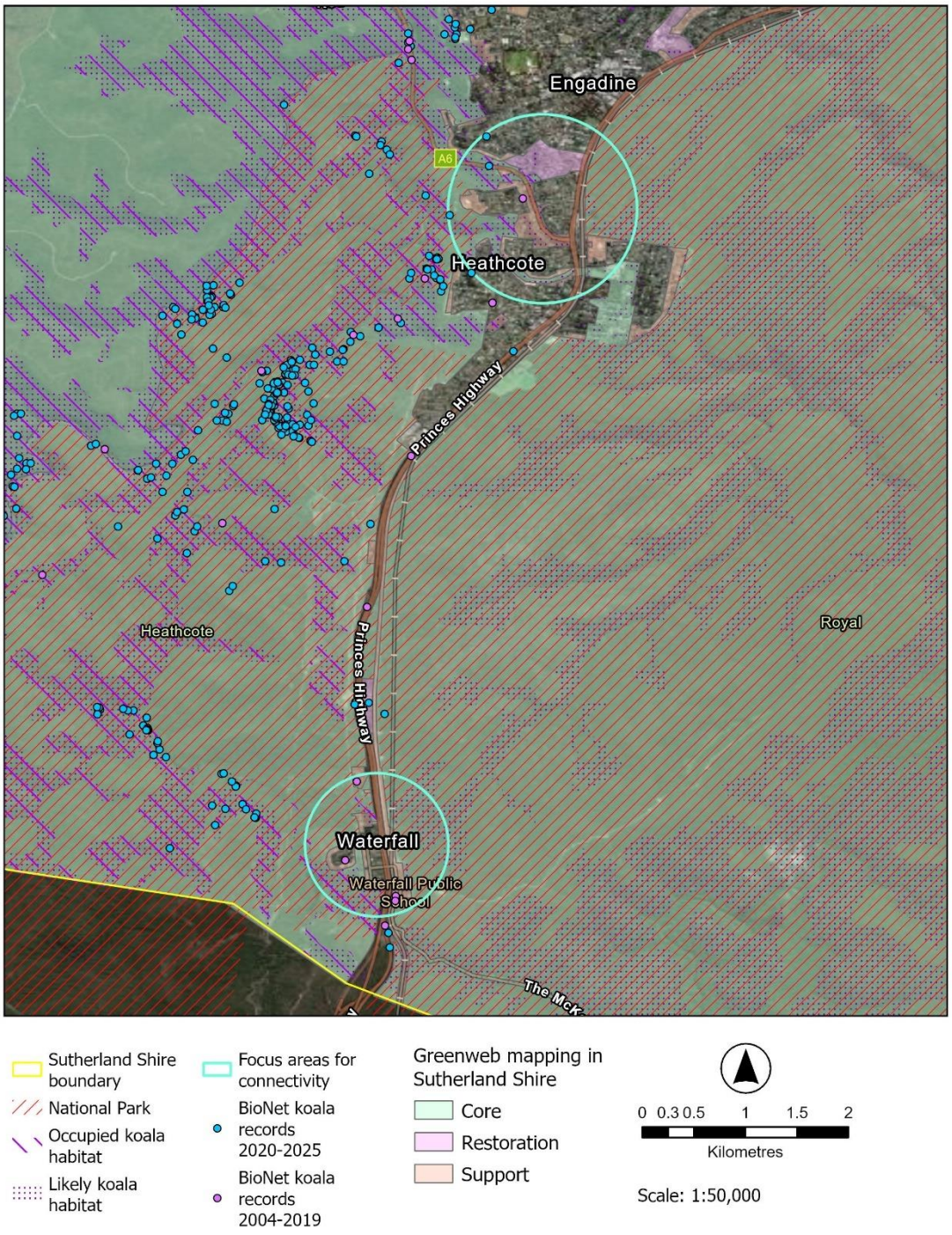


Figure 11 Opportunities to enhance koala habitat connectivity by linking occupied and likely koala habitat in the Engadine and Waterfall areas of Sutherland Shire; (occupied and likely habitat was modelled by Conservation Leaders, Greenweb mapping provided by Council; map: Ecosure).

Key actions to restore and improve koala habitat and enhance connectivity include:

- Deliver habitat improvement on Council reserves / public land including weed control, revegetation, canopy protection and koala food tree retention.
- Implement corridor restoration, including in climate refuges such as riparian zones. Ensure long-term maintenance, weed control and monitoring to avoid sink habitat.
- Establish a “Koala Web” private land stewardship program, aligned to Greenweb, offering koala habitat trees and advice in key connectivity areas.
- Work with TfNSW and NSW DCCEEW to identify connectivity and mitigation improvements in focus areas.
- Implement targeted road and construction management measures on Council managed roads in identified focus areas.
- Deliver a coordinated community education program, targeting hotspot and connectivity areas.

Further details are outlined in the Plan’s Action Plan, presented in Part 4 - Action plan. Cadastral-level mapping is not available at this stage. For any actions that may affect private land, Council will directly notify landowners before changes are made.

'Francis', image credit: Steve Anyon-Smith

Part 2 - Key threats and mitigation measures

2.1 Habitat loss, fragmentation, and degradation

The clearing, fragmentation, and degradation of koala habitat (here within referred to as 'habitat loss') is recognised as a primary threatening process affecting koalas. Since European settlement, the koala's distribution and population size has declined significantly (DAWE 2022a). Large scale clearing of native vegetation associated with development, farming, livestock grazing, and mining has greatly reduced the habitat available to koalas and contributed to ongoing population decline (Gonzalez 2018; DAWE 2022b). At present, the distribution of koalas occurs within landscapes modified for human land use including State Forest, rural land, and peri-residential areas.

Koalas are specialised arboreal folivores, that feed primarily on tree species in the genera *Eucalyptus*, *Corymbia*, and *Angophora* (Lunney and Hutchings 2012; DAWE 2022a; Speight 2022). Stable koala populations depend on the availability of sufficient primary food trees to support breeding and dispersal. This reliance makes them particularly vulnerable to the impacts of habitat loss (DAWE 2022b; Speight 2022).

The loss of habitat introduces a range of secondary stressors to koalas, including smaller and/or more geographically isolated populations, reduced genetic diversity, and crowding in the few remaining suitable areas (DAWE 2022a; McLennan et al. 2025). These conditions can lead to heightened disease transmission and can exacerbate population decline caused by illness (DAWE 2022a; Vitali et al. 2023). Koalas also face increased risks during dispersal, including drowning in suburban pools, attacks from domestic dogs, as well as collisions with vehicles (DAWE 2022a).

Furthermore, reduced access to food trees can result in over-browsing, starvation and greater competition for limited resources and territory (Whisson and Ashman 2020). This crowding can escalate the frequency of aggressive interactions between koalas, increasing the risk of injury, infection or death from fight-related wounds (Hanger et al. 2017).

Sutherland Shire's human population is projected to grow by seven percent to 252,000 by 2041 (DoP 2025), prompting proposals for the construction of thousands of new homes in alignment with the NSW Housing Strategy's South District Plan. Given this expected growth, it is essential that government policies and planning instruments are proactively implemented when assessing new developments. Doing so will help safeguard the remaining suitable foraging, resting and corridor habitat and support the conservation of this koala population. Detailed mitigation measures for koala habitat loss are provided in Part 3 - Development assessment and controls.

2.2 Vehicle strike

Vehicle strike is recognised as a key threat to koalas and has the potential to remove healthy breeding individuals from the population (Gonzalez 2018; DAWE 2022b). Strikes often occur in clusters, at specific locations, known as 'hotspots', which are typically found in areas where roads intersect with koala habitat (DAWE 2022b). Factors such as speed, traffic volume and the width of the road influence the likelihood of collisions (Dique et al. 2003; DPIE 2020f). In NSW, vehicle strikes are most common between July and November, aligning with the koala breeding season (August to February). During this period males are more active, and travel longer distances in search for mates and to defend their territories, and young male and female koalas are dispersing (Dique et al. 2003; Ryan et al. 2013; DAWE 2022b). Koalas are most active at dawn and dusk, increasing the risk of road crossings during low-light conditions (Ryan et al. 2013; DPIE 2020c).

Between 2020 and 2025 (a single koala generation[2]), a total of 40 koala vehicle strikes were reported, including 25 confirmed deaths, in Sutherland Shire (Appendix 7). Key hotspots in Sutherland Shire include Heathcote Road and the F6 (Princes Highway) bordering Heathcote and Royal National Parks (Figure 12). On Heathcote Road, 20 koala deaths from vehicle strike were recorded between 2020 and 2025 - approximately four per year (BioNet 2025). During this period, 80% of incidents (33 out of 40) occurred between July and February (BioNet 2025), identifying this period as the most common time of year for koala vehicle strikes, which coincides with the koala breeding season in NSW (DPIE 2020c). Six koala-vehicle incidents on suburban roads have been recorded during this period. However, in many cases only the suburb name was uploaded to the BioNet database. Koala vehicle strike records where the location is not clear have been excluded from Figure 12, though are included in the NSW BioNet vehicle strike data presented in Appendix 7. Although the BioNet vehicle strike data gives an indication of koala-vehicle strike hotspots, it is important to note that the data is limited to what is reported and it is likely that a portion of vehicle-related koala injuries, deaths and close collisions are not represented.

In the broader southwest Sydney area, a total of 158 koala deaths from vehicle strike have been recorded between 2022 and 2026 (unpublished data provided by DCCEEW; Appendix 7). This dataset includes 17 deaths within Sutherland Shire and also identifies Heathcote Road as a hotspot.

Koala vehicle-strike records occur across both Council-controlled roads and State-controlled roads within Sutherland Shire. While these records are used to inform understanding of risk locations, Council-led mitigation measures under this Plan are necessarily focused on roads for which Council has direct management responsibility. State-controlled roads are managed by Transport for NSW, and the design and implementation of mitigation measures on those roads sit outside Council's direct jurisdiction.

Accordingly, mitigation actions identified in this Plan may not align precisely with the spatial distribution of all recorded vehicle-strike incidents. Where vehicle-strike risk is identified on State-controlled roads, Council's role is to advocate for and work in partnership with relevant

[2]A koala generation is accepted to be 6 years by the Commonwealth Threatened Species Scientific Committee (2012).

transport authorities to support the investigation and implementation of appropriate mitigation measures.

The Sutherland Shire community have raised concerns and requested action from Council in relation to koala vehicle strikes. Locations where the community have raised concerns include Heathcote Road, Thomas Mitchell Drive, and St George Crescent and the suburbs of Engadine, Bardon Ridge, Sandy Point and Woronora Heights. A summary of community concerns, including those relating to koala vehicle strike, is presented in Appendix 8.

There are a range of mitigation strategies that Council has done previously in other locations and could implement to reduce collisions involving koalas and other wildlife. These include:

- reduced speed limits (in koala habitat areas)
- traffic calmers to reduce vehicle speed in hot spot areas
- koala grids (to exclude koala movement)
- jump outs
- fauna connectivity structures (e.g. over and underpasses)
- wildlife fencing to prevent access to roads (there are several egress options with variable suitability, such as escape poles and one-way valves) (TMR 2024; DPIE 2025).

Many community requests focus on installing signage or reducing speed limits. However, trials in south-east Queensland, targeting night-time speed-limit reductions (from 80 to 60 km per hour during the koala breeding season, when koala movement is highest) found no significant effect on either koala-vehicle collision rates or post-collision survival (Dique et al. 2003; TMR 2024). Additionally, most standard wildlife signage has been shown to be ineffective at changing driver behaviour or reducing wildlife-vehicle collisions (DES 2022). This is supported by other studies conducted around the world, that demonstrated signs alone do not appear to be effective at reducing driver speeds (Huijser et al. 2015).

'Fardia', image credit: Steve Anyon-Smith

Sutherland Shire received $130,000 in State funding to install vehicle-activated electronic signage. Signs featuring flashing lights, updated messaging, or

activation triggered by nearby vehicles or wildlife, may be more effective as they reduce driver habituation (Bond and Jones 2013; DPIE 2020b). Sutherland Shire Environment Centre installed electronic signage with rotating messaging along Heathcote Road, which was reported to raise driver awareness (C. Reynolds pers. comm. 2025).

Sutherland Shire has planned to install 12 sockets (sign support poles) to support six vehicle-activated signs, which will be rotated monthly during the koala breeding season (August to February) (Figure 13). At the time of publication, 12 sockets and five active signs have been installed (Table 2 and Figure 13). An example of a vehicle-activated sign is shown in Figure 14.

Council recognises that signage alone has limited effectiveness in reducing wildlife strike risk and will prioritise physical, behavioural, and enforcement-supported measures where feasible. These may include traffic calming, road-surface messaging, targeted enforcement partnerships, exclusion fencing, and safe crossing infrastructure, depending on road ownership, feasibility, and available resources.

Raising driver awareness may help reduce wildlife–vehicle collisions and should be considered in areas where fencing or crossing structures are not feasible (DPIE 2020c; TMR 2024).

Vehicle strike is a priority population-level threat to koalas in the Sutherland Shire, given the small population size and the concentration of incidents at specific locations. Council will prioritise mitigation measures on Council-managed roads where risk is highest.

For State-controlled roads, Council will advocate for mitigation in partnership with Transport for NSW and other relevant agencies and will report publicly on advocacy actions and outcomes.

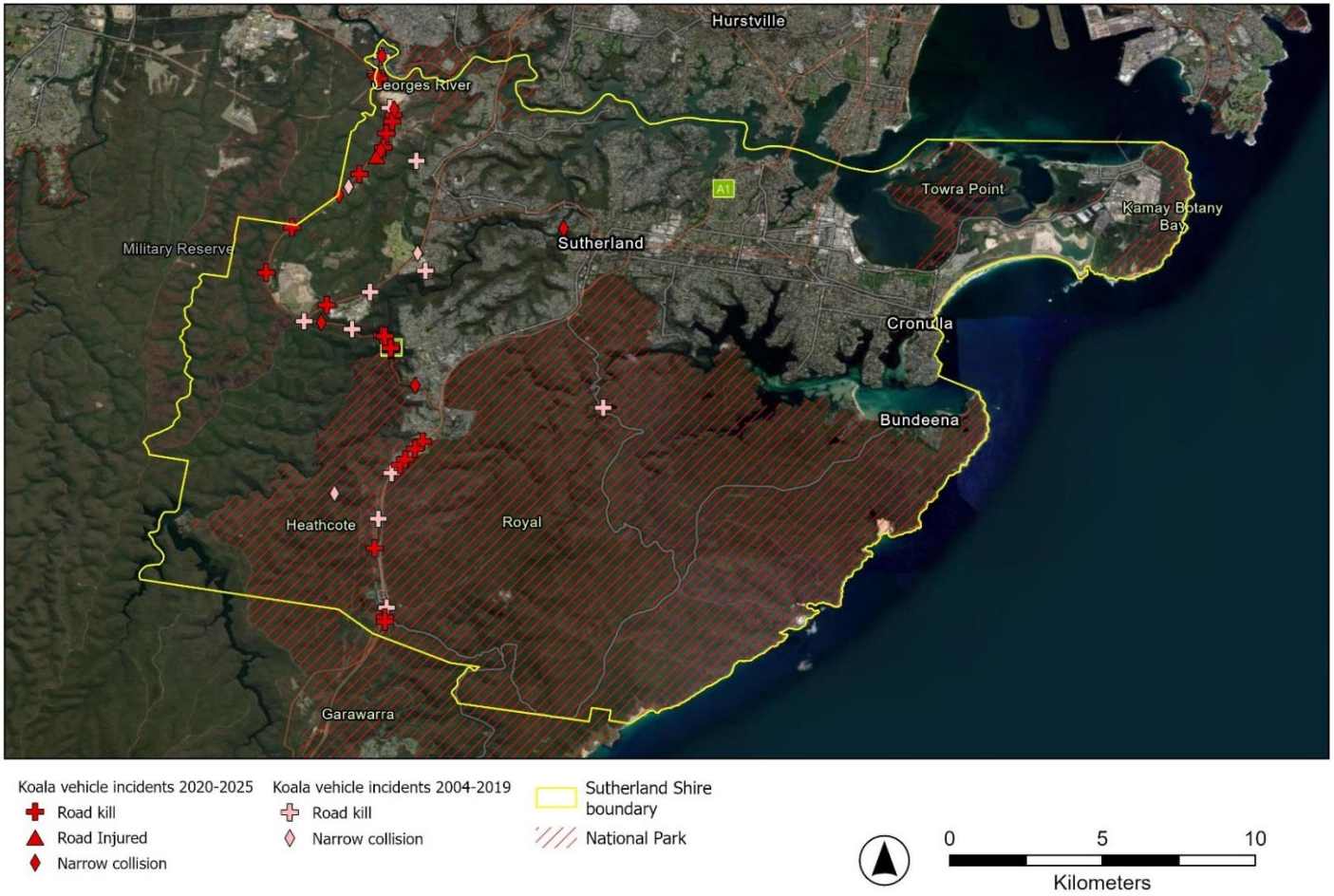


Figure 12 Koala vehicle incidents in Sutherland Shire between 2004-2025, (sourced from BioNet. No data available pre-2004; map: Ecosure

'Gwapo', image credit: Steve Anyon-Smith

Table 2 Location of sockets for vehicle-activated koala signs in Sutherland Shire

Address	Suburb	Socket installed	Sign installed
20 David Road	Barden Ridge	Yes	
1 Throsby Close	Barden Ridge	Yes	1st round installed for monthly rotation
125 Prince Edward Park Road	Woronora	Yes	
72 Prince Edward Park Road	Woronora	Yes	1st round installed for monthly rotation
26 Bundanoon Road	Woronora Heights	Yes	
14 Bundanoon Road	Engadine	Yes	
Sandy Point Entrance	Sandy Point	Yes	1st round installed for monthly rotation
58 St George Crescent	Sandy Point	Yes	
Little Forest Road	Lucus Heights	Yes	1st round installed for monthly rotation
1R Tudar Road	Sutherland	Yes	
26 Madison Place	Bonnet Bay	Yes	
26 Croston Road	Engadine	Yes	1st round installed for monthly rotation

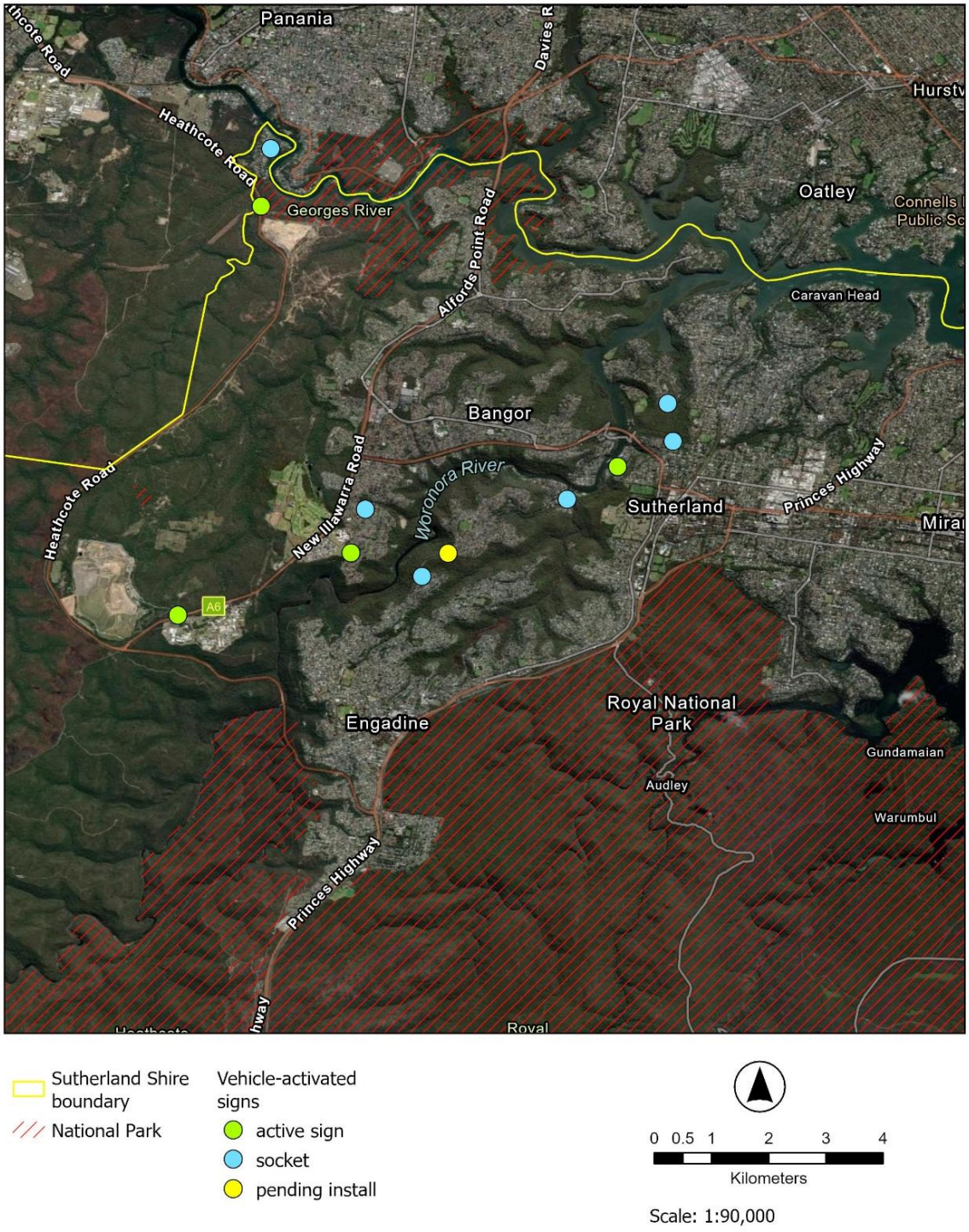


Figure 13 Vehicle-activated sign locations in Sutherland Shire (map: Ecosure).

Figure 14 Example of a vehicle activated sign installed by Sutherland Shire

2.3 Disease

The koalas in Sutherland Shire and neighbouring Campbelltown LGA have been documented as chlamydia-free, but they exhibit low genetic diversity and high relatedness - characterised by first cousin and half-sibling relationships - due to inbreeding (McLennon et al. 2025). However, there is emerging evidence of chlamydia spreading into the nearby Wollondilly LGA, which has high geneflow into the Campbelltown population (McLennan et al. 2025). This raises a significant concern that koalas infected with chlamydia may disperse into Sutherland Shire. The introduction of chlamydia into a genetically vulnerable population could trigger rapid declines, as low genetic diversity may limit individual koalas' potential to adapt and live with this disease (McLennon et al. 2025).

Chlamydial disease is the most frequently recorded illness in koalas, with infection rates ranging from 0 - 89% in wild populations (Robbins et al. 2019; Speight 2022; Vitali et al. 2023). The primary strain of infection is from *Chlamydia pecorum*, but *C. pneumonia* has been documented (Robbins et al. 2019; Vitali et al. 2023). If left untreated, chlamydia infection can have a significant effect on koala populations leading to reduced reproductive rates and increased mortality. In some populations, up to 57% of female koalas become infertile due to infection (Robbins et al. 2019), while in others chlamydial disease was found to be the leading cause of death (Rhodes et al. 2011). For instance, a four-year study of koalas in Moreton Bay, Queensland found that chlamydia accounted for 18% of recorded deaths - even though the population was receiving treatment at the time (Beyer et al. 2018). Similarly, a necropsy study of koalas across south-east Queensland found chlamydial infection in 58% (n = 304/519) of examined individuals (Gonzalez-Astudillo et al. 2019). Chlamydia can be treated with a course of antibiotics, often in combination with pain relief and gastrointestinal microflora support (Speight 2022; Vitali et al. 2023).

The koala population in Sutherland Shire is estimated to be small with approximately 200 individuals. If chlamydia enters the population, it poses a serious threat and may result in population decline (Augustine 1998; Craig et al. 2014).

Koala retrovirus (KoRV) is another significant virus affecting the health of koala populations. It has been detected in all tested koalas from Queensland and New South Wales (Hanger et al. 2017; Wildlife Health Australia 2023a). Although most KoRV-positive koalas tested showed no clinical signs of disease (Wildlife Health Australia 2023b), the virus is believed to increase susceptibility to diseases, worsen disease severity, and contribute to the development of cancers and severe immune system failure (Hanger et al. 2017; Wildlife Health Australia 2023b).

A range of diseases and health concerns can cause fatalities in koalas. Currently there is no consistent strategy for preventing and controlling disease in the wild. However, a ten-year study trialling five vaccines to protect koalas against *C. pecorum* found that vaccinated individuals had significantly lower incidence of disease and a 64% reduction in chlamydial morality (Phillips et al. 2024). Further research is essential to improve understanding of disease dynamics and risk factors, and to develop effective methods for disease prevention and control in wild koala populations (Rhodes et al. 2015; Beyer et al. 2018; Vitali et al. 2023).

Measures to mitigate the threat of disease to local koala populations are relatively limited for local government authorities. However, any actions that support resilient koala populations, including actions to protect and restore koala habitat, actions to improve safe movement between habitat areas, and creation, protection and restoration of climate refugia will assist. As will provision of support to koala care and rescue organisations and to koala disease research projects, including data collection and sharing.

2.4 Climate change including heat wave and drought

Climate change poses a growing threat to koala populations, particularly through increased drought and rising temperatures (Lunney et al. 2012; Herold et al. 2018; DAWE 2022a). As specialised folivores, koalas have limited ability to escape extreme weather conditions (DAWE 2022a).

Droughts and heat waves have significantly contributed to the decline and contraction of several koala populations. The remaining individuals are often restricted to areas that offer some refuge from extreme temperatures, such as riparian zones (Seabrook et al. 2011; Smith et al. 2013; Lunney et al. 2014). As temperatures rise, koalas favour trees at lower elevations, position themselves lower on the trunk and adopt tree hugging postures that enhance heat exchange with the cooler bark (Crowther et al. 2014; Briscoe et al. 2014; Mella et al. 2024). These trees are often non-feed species with denser foliage and provide greater shade, offering essential thermal refuge (Crowther et al. 2014).

During extreme heatwaves and drought, fatalities from heat stress, exposure, and dehydration are common, as leaf moisture (koala's main water source) substantially

'Don', image credit: Steve Anyon-Smith

decreases (Ellis et al. 2010). Compounding this issue, habitat loss and degradation have further reduced the availability of climatically suitable refuges (Seabrook et al. 2011; Smith et al. 2013; Lunney et al. 2014). The favouring of non-feed trees that provide some refuge to extreme heat highlights the importance of conserving and incorporating such tree species into habitat restoration and corridor planning, particularly considering the projected increases in heatwave frequency and intensity associated with climate change (Lunney et al. 2012; Lunney et al. 2014; DAWE 2022a).

Similarly, extreme rain events and flooding have caused mortality in two southeast Queensland koala populations. These deaths occurred through drowning and secondary infections caused by water-borne pathogens, leading to acute septicaemia (blood poisoning) (Vitali et al. 2023). These koalas had retreated to low-lying riparian areas after losing access to more suitable habitats (Vitali et al. 2023), highlighting the increased vulnerability of fragmentated populations.

Furthermore, climate change has altered the chemical composition of leaves, with rising carbon dioxide levels, reducing their nutritional value (Lunney et al. 2012; Gonzalez 2018). Drought conditions have also been linked to a decline in eucalypt flowering (Mac Nally et al. 2009), which lowers tree reproductive success and may further limit the availability of suitable habitat for koalas in the future. These factors may lead to lowered breeding success (Mac Nally et al. 2009) due to reduced food availability and quality, leading to population decline and exacerbating stressors of fragmentated populations in suitable habitats, such as over-crowding, low genetic diversity, and starvation (DAWE 2022a; McLennan et al. 2025).

The current climate models (CSIRO and BOM 2024) predict:

- declining average rainfall
- longer and more severe droughts
- more intense short-duration rainfall events leading to flooding
- an increase in dangerous fire weather days and extended fire seasons (see below)
- higher maximum temperatures.

Over the past decade, record-breaking extreme weather events have become increasingly frequent, often involving multiple hazards, such as heatwaves, droughts, and fires, occurring in close succession (CSIRO and BOM 2024). These compounding events intensify environmental stress and pose a serious threat to koala survival, particularly in areas affected by habitat destruction, fragmentation, and degradation (Mac Nally et al. 2009; Lunney et al. 2014; Gonzalez 2018; DAWE 2022a). Projections indicate that nationally, more than 20% of the listed koala habitat could be severely impacted by climate change under high-emission scenarios by 2030. It is predicted that in the foreseeable future, the rate at which koala habitat is lost due to climate change may soon exceed that lost to land use change (DAWE 2022a).

In Sutherland Shire, as with many parts of their distribution, the threat posed by bush fire associated with drought and heat waves is likely to be the greatest threat to the koala population. Retaining and planting large, dense canopy-trees that provide shade, alongside

koala food trees, can create important climate refuges for koalas and other wildlife during periods of extreme heat. This approach aligns with climate adaptation actions and biodiversity delivery mechanisms embedded within existing Council policies and strategies, including:

- Environment and Sustainability Strategy (Sutherland Shire Council 2012)
- Draft Biodiversity Strategy 2026-2036 (Sutherland Shire Council unpublished draft)
- Climate Strategy 2050 Thrive. Design. Lead (Sutherland Shire Council 2025)
- Urban Tree and Bushland Policy 2021 (Sutherland Shire Council 2021)
- Greenweb Sutherland Shire Environmental Specification 2020 (Sutherland Shire Council 2020).

Further details on Sutherland Shire Council's policies and strategies that address climate-related risks and support increased canopy cover are provided in Appendix 2.

2.5 High intensity bushfire and altered fire regimes

Fire has been a natural part of the Australian landscape since the late Cretaceous period (Crisp et al. 2011) and continues to play a key ecological role in shaping vegetation composition and biodiversity (Burrows 2008). Eucalyptus species are well adapted to fire, with many capable of resprouting within days or weeks after being burnt (Beale et al. 2022), resulting in only short-term loss of food for koalas (Matthews et al. 2007).

Local field observations within Sutherland Shire indicate that koala activity is generally higher in long-unburnt forests, with recent or frequent fire associated with reduced habitat use in some areas, even where preferred feed trees are present. This highlights the importance of considering fire frequency and patchiness, in addition to vegetation type, when managing koala habitat (Anyon-Smith 2022).

High-intensity fires that remove the tree canopy can cause more significant and immediate impacts, including loss of shelter, changes in microclimate, and a decline in the quality and availability of food (Beale et al. 2022). The recovery of eucalypt forests following fire depends on several factors, including the composition of the forest, seasonal conditions before and after the fire, and the fire's patchiness and intensity (Martin and Handasyde 1999). Altered fire regimes taken at inappropriate intervals can increase fuel loads, raising the risk of severe canopy fires. These intense fires can hinder the forest's ability to regenerate and may compromise long-term ecosystem resilience (Nolan et al. 2021).

High intensity bushfires can pose a significant threat to koalas, particularly in the context of climate change, where climate models project extended fire seasons and increased frequency of dangerous fire weather days (CSIRO and BOM 2024). Depending on the fire's severity and frequency, koalas may be affected in multiple ways, including habitat use, feeding behaviour, physiological stress, reduced growth rates, vulnerability to predation, injury and mortality (Beale et al. 2022).

Despite these risks, koalas can recolonise burnt areas, even following severe fires. Burnt habitats have also been recorded to support breeding (Law et al. 2022; Beale et al. 2022). However, research indicates that koala population densities can decline by 50-60% within a year after moderate to high severity fires. In contrast, areas that remained unburnt or experienced only low severity fires showed little or no changes in koala density (Law et al. 2022), highlighting the potential for more intense fires to contribute significantly to population declines.

The Black Summer bushfires of 2019-2020 impacted koala populations, particularly in regions containing key habitat (Speight 2022). In New South Wales, at least 5,000 koalas are estimated to have been killed as a result of these fires (NSW Parliament 2020).

Prescribed burning is a widely used management tool for reducing fuel loads and lowering the risk of uncontrolled, high severity bushfires. These burns are intended to be cooler and more controlled than wildfires, with most of the tree canopy left intact (Price et al. 2022). However, their effectiveness depends on various factors including, vegetation type, topography and climate conditions, all which require careful consideration when planning and implementing prescribed planning burns (Bradstock et al. 2009; Penman et al. 2020).

While prescribed burns can reduce fuel loads in the short term, they may also lead to unintended consequences. In some landscapes, rapid regrowth of dense understory vegetation following burns can increase fire risk over time (Zylstra 2018). Evidence suggests that in these areas, older, mature forests (those not recently subjected to prescribed burning) are less likely to experience high-severity fires compared to younger regrowth forests (Zylstra 2018; Zylstra et al. 2022). This highlights the importance of tailoring fire management strategies to specific ecological contexts.

Indigenous cultural burning practices are characterised by their low severity, minimal fuel consumption and reduced risk of triggering positive flammability loops, especially when compared to wildfires or conventional prescribed burns. These low-intensity burns may also support ecological regeneration by stimulating the seed bank through gentle heating (Price et al. 2022; Zylstra et al. 2022). Well-managed burns can activate seed germination in the soil, supporting regeneration of native plant species, including in eucalypt dominated communities (koala food trees). In addition, well-managed prescribed burns maintain suitable soil conditions for germination and growth of koala feed trees, reduce competition from mid-story vegetation and maintain the health of sclerophyll communities (DPE and NSW Rural Fire Service 2022).

While there is currently no published research specifically examining koala responses to prescribed or cultural burns, it is suggested that the impacts are likely comparable to those of low-severity wildfires, particularly when the canopy remains intact (Beale et al. 2022). This implies that cultural burning may present a more koala-sensitive fire management option in suitable landscapes.

'Slothy', image credit: Steve Anyon-Smith

In response to the impacts of fire on koalas and their habitat, the NSW Koala Strategy explicitly identifies improved fire management as a key action area. The Strategy states that the NSW Government will develop bushfire management approaches that better protect koalas and koala habitat while continuing to protect people and property, including by incorporating traditional ecological knowledge and Indigenous cultural burning practices (DPE 2022c). It also commits to improving understanding of the impacts of hazard reduction burns on koalas to inform future burn planning and implementation.

The NSW Koala Strategy further states that the NSW Government will strengthen emergency response actions for koalas and other wildlife through improved coordination with wildlife rehabilitators, veterinarians and partner organisations, and recognises community education as an important component of bushfire risk management (DPE 2022c).

The Sutherland Bushfire Risk Management Plan 2025, developed by the local Bush Fire Management Committee of which Council as a land manager is a member, identifies assets, which include residential, economic, cultural and environmental assets. It defines risk from bushfire and defines strategic treatments to mitigate bush fire risk to assets. Under this Plan, Council is the responsible authority for delivering hazard reduction treatments on land it owns or manages, including managing asset protection zones and completing prescribed burns. Together with other land management agencies and the RFS, Council can deliver strategic hazard reduction to minimise risk of wildfire through the Sutherland Shire, including protection of koala habitats. Council can also apply prescribed burns to promote healthy forests and the regeneration of koala habitats.

Ensuring appropriate measures are incorporated into pre, during and post burn planning and implementation in occupied koala habitat areas will support protection of koalas and their habitat. Measures Council can employ include:

- Pre-burn surveys to identify location of individual koalas and support their protection during burns.
- Removal of excessive fuels (ground and ladder fuels) wherever possible around PKFT, particularly any occupied trees.
- Use of ignition tactics to protect any occupied koala habitat.
- Ensure suitable burn conditions on the day to manage flame height and minimise any canopy scorch.
- Post-burn weed control and if required, invasive animal control.

Together, these actions support a more coordinated and koala-sensitive approach to mitigating fire as a threat to koala populations.

2.6 Domestic dogs

Domestic dogs are known to attack and predate on koalas, often resulting in serious injury or death (Gentle et al. 2019). Koalas can sustain life threatening injuries from dogs, even if there are a lack of puncture wounds or the injuries appear small (Gonzalez-Astudillo et al. 2019). Many koalas that survive the initial attack later die from infection from the injuries, internal injuries, or are euthanised due to the severity of their injuries and poor recovery prospects (Hanger et al. 2017; Charalambous et al. 2024).

Koalas travel on the ground when searching for mates, moving between feeding and resting trees, or dispersing to new habitat. This makes them especially vulnerable to dog attacks - an issue that is amplified in fragmentated landscapes (DPIE 2020d). When koala habitat is broken up by urban development and intense burns, koalas are often forced to travel greater distances across open ground or through suburban backyards to reach suitable trees, increasing their exposure to domestic and wild dogs (Whisson et al. 2020; DAWE 2022a; Bista et al. 2024).

Most koala attacks by domestic dogs occur in residential or rural-residential yards, especially at night, and attacks are more likely in households with larger dogs or multiple dogs (EPA 2006; Dissanayake et al. 2023). Uncontrolled or free-roaming dogs may attack koalas in public or rural bushland areas; the risk of dog attack is recognised through NSW conservation planning and local council awareness programs (Gentle et al. 2019; DPIE 2020d; DPIE 2022).

Under the *Companion Animals Act 1998* (CA Act) dog owners are legally responsible for ensuring that their pets do not harm native wildlife, which includes koalas. Owners are required to keep dogs under effective control and securely contained. It is a serious offence for a dog to attack, rush at, harass, or chase wildlife (even if no physical injury occurs). Significant fines may apply to the owner or person in charge of the dog in such incidents.

While Council has the authority to fine dog owners when a dog attacks a koala, it is not Council's intention to prosecute individuals in the event of an unforeseen, one-off incident. Instead, the emphasis is on education and prevention (see Part 4 - Action plan).

The aim is not to stigmatise or assign blame, but to ensure that any koala involved in a dog attack receives immediate veterinary care, and that steps are taken to prevent a reoccurrence. Although there are no records of dog attacks on koalas in Sutherland Shire (BioNet 2025), it is likely that not all incidents are reported or the data is not publicly available.

Encouraging responsible pet ownership will remain a key strategy in Sutherland Shire. Key measures include promoting the confinement of dogs within properties at night, particularly during koala breeding season and within the koala habitat areas and key focus areas of connectivity identified in Part 1.6.

Other mitigation measures available to local government authorities include:

- Designating Wildlife Protection Areas (WPA) under the CA Act on Council owned or managed lands where occupied koala habitat occurs, and the risk of dog attack is considered moderate to high. Council can prohibit dogs in WPAs that have been dedicated under the CA Act. Community education and enforcement should accompany designation of WPAs.
- Provide well-planned and suitably located fenced dog off-leash areas on Council owned or managed lands, particularly where suitable open space areas occur within the proximity of known or likely koala habitat. Community education should accompany any new dog off-leash parks to encourage their use in preference to Council natural area, thereby minimising the risk of dog-koala interactions. Fenced dog off-leash areas should have controlled access points and exclude koala food trees to discourage koalas from accessing the area.

2.7 Invasive species

A range of invasive species may indirectly or directly impact koala populations. Predation by invasive species such as feral cats and red foxes is known to pose a threat to young koalas (joeys), particularly during the vulnerable period when they have emerged from the pouch but remain dependent on their mother (DAWE 2022a). There are no known records of predation from cats and red foxes on joeys in Sutherland Shire.

Emerging invasive species, such as fire ants, may also pose a risk, with stings capable of causing injury or death if koalas encounter nests while moving between trees (Invasive Species Council 2024). However, this risk is currently considered low, as fire ants have only been detected in northern NSW (National Fire Ant Eradication Program 2025).

Invasive weeds can significantly degrade koala habitat by outcompeting native vegetation that provides essential food and shelter (DPE 2022a). Species such as lantana (*Lantana camara*) can form dense thickets that obstruct koala movement, reduce the

availability of preferred browse species, and inhibit the regeneration of key eucalyptus species (DPE 2022a). In addition, many invasive weeds contribute to increased fuel loads, acting as to elevate bushfire intensity and pose a greater risk to wildlife, including koalas (WWF 2025).

While there is currently limited direct evidence linking invasive weed presence to koala population decline (Beale et al. 2022), the indirect impacts through habitat degradation and increased fire severity are well-documented. Consequently, an ongoing prioritised and targeted weed management and koala habitat restoration program is an essential component of maintaining and enhancing suitable koala habitat across the landscape.

2.8 Drowning

Drowning in pools is a recognised risk to koalas, particularly during heat waves when they seek supplementary water sources due to limited moisture content in leaves (Kinsella and Young 2019). While koalas are capable swimmers, they struggle to exit pools due to the smooth, slippery edges (DEWNR 2016). There are no known records of koalas drowning in pools in the Sutherland Shire.

Although most child-proof pool fencing is generally effective at preventing koalas access to pools, entry is still possible where there are overhanging branches or gaps large enough for koalas to pass through. Management measures to reduce the risk of koala drownings in residential pools are outlined in Part 3.

'Gomez', image credit: Steve Anyon-Smith

Part 3 - Development assessment and controls

This Plan provides a policy framework to guide development assessment and land-management decisions affecting koalas and their habitat. While the Plan does not itself create statutory prohibitions, it establishes Council's expectations regarding avoidance and minimisation of impacts on confirmed and likely koala habitat and key movement corridors. Where impacts cannot be avoided, decisions will be informed by the mitigation hierarchy and the objectives of this Plan, with reasons documented where departures from Plan guidance occur.

Planning decisions and development proposals within Sutherland Shire have the potential to influence the long-term viability of the local koala population and the condition of their habitat. For this reason, it is critical that planning decisions are informed by clear and reliable information about koala habitat, habitat use, connectivity, and sensitivity. A consistent assessment framework will ensure that development applications affecting koalas and their habitat consider koala conservation values, identify risks early in the planning process, and embed effective avoidance and mitigation responses. By applying evidence-based standards and best-practice habitat management measures, Sutherland Shire can prevent unnecessary impacts, strengthen habitat protection, and support the ongoing health and conservation of the koala population across the Sutherland Shire.

Development in koala habitat may be subject to the following legislative provisions:

- Under the Commonwealth EPBC Act, the koala is listed as a threatened species and is therefore a matter of national environmental significance. To determine if a significant impact on koalas is likely from a proposed action, a self-assessment is required against the significant impact assessment criteria. If the assessment determines a significant impact is likely a referral to the Commonwealth Department of the Environment is required.
- Under the EP&A Act 1979, a development application must be accompanied by an assessment of the possible impacts on threatened flora and fauna, including the koala. Subject to the level of impact, and whether thresholds are triggered under the Biodiversity Offset Scheme (BOS) of the BC Act, furthermore detailed assessment may be required. This includes the preparation of a Biodiversity Development Assessment Report (BDAR) by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM).

It is recommended that Council considers best practice planning principles and development controls for koala conservation as detailed in Section 3.3 of this Plan, applying them to development proposals that have the potential to impact koala habitat or koala movement corridors. Section 3.2 of this Plan provides guidance to Council and development proponents in determining the koala habitat assessment requirements for development applications in Sutherland Shire.

3.1 Inclusion of development controls in Council's strategic planning instruments

This Plan is not a legislative document and does not provide specific detail on development requirements under Commonwealth, State or Local planning and environmental legislation. It does however provide guidance on best practice development control measures that may be applied to development applications that have the potential to impact koalas and their habitat.

As this Plan is not a statutory document like a Koala Plan of Management (KPoM) approved under the Koala SEPP, actions are incorporated into Part 4 - Action plan to embed koala habitat mapping and koala habitat protections into Council's planning instruments and ensure consistent and evidence based application of development controls. This could include:

- Inclusion of koala habitat mapping into the local provisions of the Sutherland Shire Local Environment Plan 2015, including incorporation of known and likely koala habitat mapping into Environmentally Sensitive Land provisions and mapping.
- Incorporation of koala habitat protection and development control provisions into Chapter 39 Natural Resource Management of Sutherland Shire Development Control Plan 2015.

3.2 Koala habitat assessment requirements for development applications

Proponents of development applications made to Council should identify and document if there is any potential koala habitat on the development site by conducting a formal habitat assessment.

Recommended assessment requirements include:

- be carried out by a suitably qualified and experienced person
- identify vegetation types, preferred feed trees, and key habitat areas
- map vegetation removal areas and proposed infrastructure locations
- measure and document tree location for any koala feed trees and shelter trees
- assess direct impacts (e.g. vegetation clearing) and indirect impacts (e.g. increased disturbance and risks to koalas i.e. reduced habitat corridor, vehicle strike, dog attacks, drowning in swimming pools) on koalas
- koala activity survey results where relevant (using approved methodologies[3])
- proposed restoration / mitigation measures of any likely / potential impacts.

It is intended that data derived from the implementation of this Plan, including a koala habitat map, key connectivity areas and recent koala records, would be used to inform the habitat assessment.

[3] Approved methodologies as per the Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide include Spot Assessment Technique, conservation detection dogs, spotlighting, passive acoustic and drones (DPE 2022b).

To assist Council and development proponents in determining the koala habitat assessment requirements for development applications in Sutherland Shire, a decision tree is provided (Figure 15).

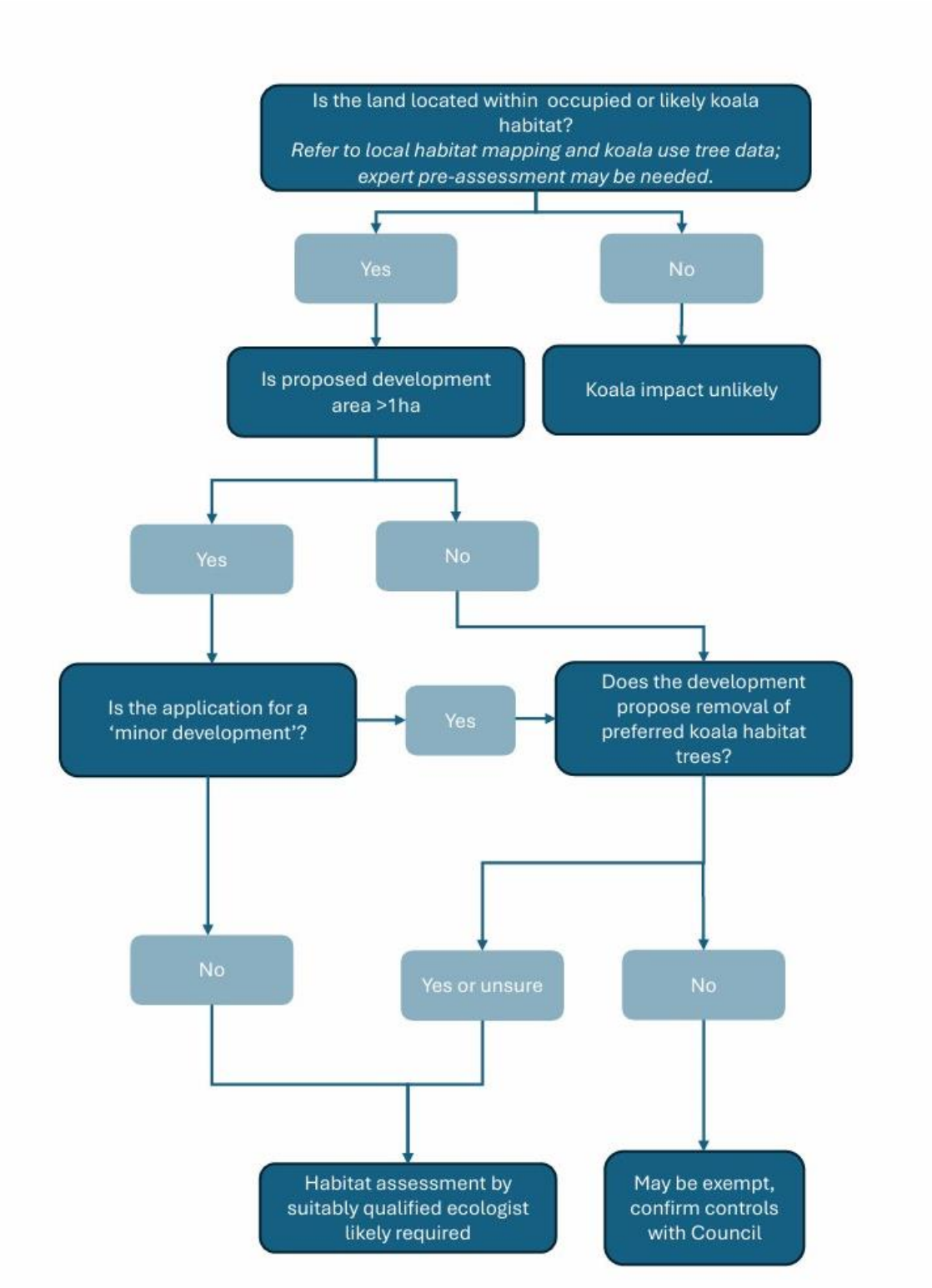


Figure 15 Likely development application requirements with regards to koala habitat in Sutherland Shire.

3.3 Best practice planning principles and controls

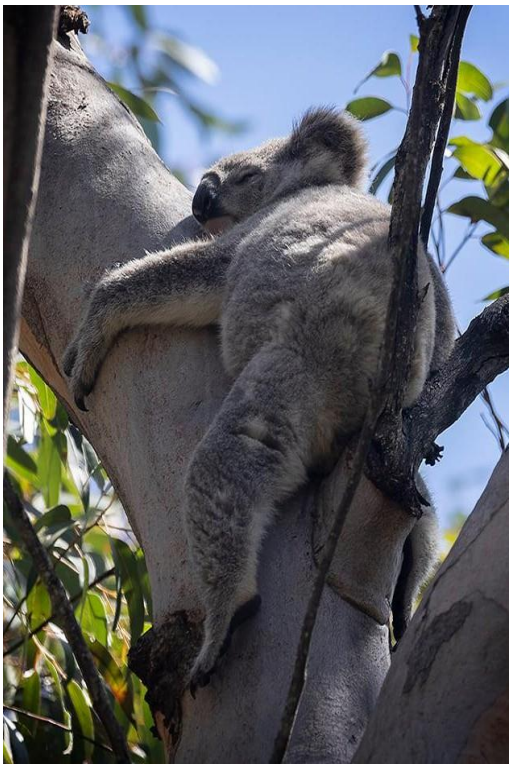
Where development is proposed in koala habitat, it is recommended that development controls be guided by best practice planning principles for koala conservation (McAlpine et al. 2007; DPE 2022a) including:

- Prioritise protection and maintenance of connected koala habitat networks and movement corridors to maintain ecological connectivity.
- Avoid development that fragments habitat, increases threats (such as traffic or dogs), or isolates koala populations.
- Locate development away from key koala habitats where feasible.
- Support habitat restoration and design approvals to avoid loss of trees or the imposition of barriers to movement.

Controls in koala habitat

Development in known and likely koala habitat should be avoided. Maintaining high quality habitat requires protecting large patches with high tree density and structure, as large patches and wider corridors reduce edge effects and associated risks such as predation and bushfire.

Development proposals should prioritise retention of key koala feed trees and trees with potential shelter value. Where removal is unavoidable, offsets and restoration should apply that achieve equivalent or improved habitat function. Offsets will comprise a mixture of on-site and off-site measures that are aimed at protection, restoring/enhancing koala habitat to achieve a 'no net loss' outcome of koala habitat and may include planting of koala food trees in proposed corridor areas, linking habitat areas, and restoring degraded habitat in priority areas.



'Maganda' image credit: Steve Anyon-Smith

For larger developments that trigger development assessment and approval under the EPBC Act and / or BC Act, then offset strategies under these legislative instruments will apply. For development that does not trigger these Commonwealth or State legislative requirements, suggested koala habitat compensation measures are provided in Appendix 10.

Road design

New roads and road upgrades in or near koala habitat should be designed to minimise vehicle-koala collisions and maintain safe koala movement across the landscape (DPIE 2025). Roads are one of the most significant causes of koala mortality nationally and within

the Sutherland Shire, and can create a substantial barrier that reduces movement, gene flow, and long-term population viability (TMR 2024).

Wherever possible, roads within or adjacent to occupied koala habitat or identified movement corridors should be avoided or realigned. Where avoidance is not feasible, road design should prioritise a hierarchy of measures that reduce mortality risk and maintain landscape connectivity, including speed management, physical exclusion from traffic lanes, and provision of safe crossing opportunities (DES 2019; TMR 2024; TfNSW 2024).

A combination of hard infrastructure, complementary design features and emerging technologies should be incorporated, particularly during new road construction or major upgrades, when koala-sensitive design can be integrated most effectively (TMR 2024).

Key design measures include:

- Speed management and traffic calming:
    - Reduced operating speeds are critical in areas of known koala activity, with localised speed environments typically 40 km/h or lower, supported by physical traffic-calming measures (e.g. road narrowing, chicanes, raised thresholds) and enforcement. Evidence shows that signage alone is generally insufficient to reduce wildlife-vehicle collisions unless supported by road design and enforcement measures (TMR 2024).
- Wildlife exclusion fencing with connectivity structures:
    - Koala-specific exclusion fencing to prevent access to the road corridor and to funnel koalas towards safe crossing points. Fencing should be continuous, well-maintained, and integrated with crossing structures to avoid exacerbating barrier effects (DES 2019; TMR 2024).
    - Where fencing is installed, fauna crossing structures should also be provided to maintain movement and genetic connectivity.

Fauna connectivity structures

Wildlife connectivity is a priority for maintaining healthy koala populations. A range of connectivity structures may be appropriate depending on site context (Soanes et al. 2024), with evidence that culverts are commonly used by koalas (TfNSW 2025b). Preferred design features include adequate height and openness, dry substrates or ledges, and incorporation of log rails and refuge poles to reduce predation risk (TMR 2024).

Vegetated land bridges may be effective where space allows, while canopy rope bridges and gantries have not demonstrated reliable use by koalas (TMR 2024).

Retrofit opportunities

Existing roads account for a substantial proportion of koala mortality. Retrofitting existing infrastructure - such as adding dry ledges to culverts, installing log rails or refuge poles, and improving fencing continuity - can be a highly cost-effective means of reducing impacts and improving permeability of the road network (TMR 2024).

Emerging detection and deterrent technologies

Emerging technologies, including AI-enabled wildlife detection systems that trigger real-time driver warnings, enhanced dynamic signage, and roadside reflectors, may be trialled as supplementary measures. These technologies should complement, not replace, proven structural solutions such as fencing and crossings (Huijser et al. 2015; TMR 2024; TfNSW 2025a).

Road surface and lighting treatments

Design measures that improve driver visibility of koalas at night—such as lighter-coloured pavement materials and targeted lighting—may assist in reducing collision risk. Lighting design requires careful consideration to avoid creating additional disturbance or barrier effects for koalas and other fauna (TMR 2024).

All road design within or adjacent to koala habitat should be developed in consultation with suitably qualified ecological specialists. Where possible, best practice road design will be informed by local koala habitat mapping, movement data, and collision hotspot mapping and assessment. Measures should be integrated early in the planning and design process and implemented using an adaptive management approach, with monitoring and maintenance to ensure long-term effectiveness (DES 2019; TMR 2024).

Domestic dogs

To reduce the risk domestic dogs pose to koalas, it is recommended that development controls are used for new subdivision and multi-unit development to prohibit dog ownership (excluding assistance dogs) in areas of known koala activity or strictly control dog ownership through covenants. Where dogs are permitted, dwellings should include secure, purpose-built dog-proof yards that exclude preferred koala feed and shelter trees, with fencing of appropriate height and structure with trees, shrubs and other climbable structures located at least three metres away. Avenues for Council to implement development controls could be through Section 88b instruments under the *Conveyancing Act 1919*, to the benefit of Council, as defined by development consent conditions. Covenants should be formally registered prior to the issue of construction certificates, ensuring koala-safe conditions are embedded from the outset of residential development.

Fencing

Fencing associated with subdivision and residential development should be designed to either facilitate safe koala movement or, where necessary, exclude koalas from high-risk areas, depending on context. In areas where koala movement across properties is required, koala-friendly fencing should be used. Appropriate designs include:

- Open post-and-rail, post-and-wire or chainmesh fencing that allows koalas to pass beneath or climb over.
- Solid fences fitted with timber posts or climbing structures on both sides at regular intervals (approximately every 20 metres) to allow koalas to safely traverse barriers.
- Ground clearances of approximately 300 mm to allow koalas to move underneath where climbing is not appropriate (DES 2022; DPIE 2025).

In contrast, where fencing is required to exclude koalas from roads, dog enclosures or other hazards, fencing should be purpose-designed for koalas. Koala-exclusion fencing should (DES 2022; DPIE 2025):

- Be of sufficient height and construction to prevent climbing (e.g. include 600 mm of slip-panel).
- Be free of gaps at ground level and maintained to prevent degradation over time.
- Include escape mechanisms such as poles or one-way exits, allowing koalas to safely exit if they breach the fenced area.

Fencing design should be site-specific and informed by ecological advice to ensure it does not inadvertently increase barrier effects or predation risk.

Swimming pools

Swimming pools associated with new development in key koala areas should be designed to restrict their access to the pool area and prevent koalas from becoming trapped in pools. All pools should incorporate a koala-escape feature, such as a shallow ramp or a stout rope of at least 50 mm diameter securely fixed to the pool edge and trailing into the water at all times. This will allow any koala that enters the pool to climb out safely. In addition, pool fencing should be constructed so that koalas cannot gain access, avoiding materials or nearby vegetation that would allow climbing, and ensuring trees or shrubs are not positioned close enough to provide a route into the pool enclosure. Together, these measures ensure both safe egress and effective exclusion in accordance with koala-friendly design principles.

Protection during clearing of koala habitat

Any clearing of vegetation should not commence until a suitably qualified and experienced person has inspected the area for koalas and provided written approval.

The written approval from a suitably qualified and experienced person is only valid for the day in which the inspection occurred. Clearing should be paused at a minimum of 25 metre buffer zone of any tree occupied by a koala until the koala moves away on its own. The buffer zone may be increased by the discretion of suitably qualified and experienced person at any time during the clearing process based on the level of disturbance that may occur to an individual koala. A suitably qualified and experienced person should remain on site throughout the clearing process to ensure these requirements are met.

No net loss of koala habitat

The principle of 'no net loss' of koala habitat seeks to ensure that, over time, the overall extent and functional value of koala habitat within the landscape is maintained at a minimum and not diminished. While this principle allows for the identification and enhancement of additional koala habitat in the future, its core objective is to prevent an overall reduction in the availability or quality of habitat required to support viable koala populations.

No net loss may be achieved where:

- impacts to koala habitat are entirely avoided through appropriate site selection, design and layout; or
- where complete avoidance is not feasible, impacts are avoided and minimised to the greatest extent practicable, with remaining impacts mitigated on site, and any significant residual impacts fully offset to counterbalance habitat loss, noting that offsets are only appropriate and achievable in limited circumstances.

'Deborah', image credit: Steve Anyon-Smith

Refer to Appendix 10 for suggested compensatory habitat measures. Developments may be captured under the EPBC Act or BC Act offset requirements.

Non-conforming developments

Non-conforming developments that do not meet these criteria should be subject to rigorous assessment and potential amendment to ensure compliance with habitat protections. Decisions should reflect the long-term conservation outcomes for koalas, consistent with relevant state policy.

Part 4 - Action plan

Actions under this Plan are prioritised based on their expected contribution to reducing koala mortality and supporting long-term population persistence. Where actions relate to identified vehicle-strike hotspots on Council-managed roads, Council will establish internal delivery milestones and report progress annually. Actions requiring external agency approval or funding will be clearly identified and reported against, including constraints where delivery is outside Council's direct control.

This plan provides actions linked to the Plan objectives (Section 1.1) including timeframe, partners and funding (Table 3). Many of the actions contribute to meeting multiple objectives, for clarity they are listed under the primary objective. In its implementation of the action plan, Council is committed to undertaking targeted stakeholder and community engagement and consultation as required, consistent with Council's Community Engagement Strategy 2022-2026.

Actions identified as funded represent commitments Council intends to deliver within existing resources. Actions identified as unfunded are dependent on future budget allocation, grant funding or partnerships. Progress on all actions, including funding constraints and delivery challenges, will be reported through annual outcomes reporting.

Table 3 Koala Management Plan action plan.

Objective	Action	Responsible	Delivery area / team	Funded (Yes/No)[4]	Measure of success	Timeline
1 - Conserve existing koala habitat on public and private land	Maintain and publish up-to-date mapping of koala occupied/likely habitat and key movement areas in Council GIS (Seed/Geocortex) to guide planning and investment.	Council (IM&T, Environment); NSW DCCEEW	Environment & Regulation; Information Management and Technology	Yes	GIS layers updated at least annually; mapping referenced in DA/planning reports and conservation prioritisation.	Immediate and ongoing
	Advocate for State acquisition/dedication opportunities for critical koala habitat/corridors where planning controls are insufficient.	Council (Urban Futures + Environment & Regulation)	Urban Futures; Environment & Regulation	Yes	Priority acquisition list maintained; opportunities assessed; acquisitions/voluntary dedications progressed when available.	Medium–long term

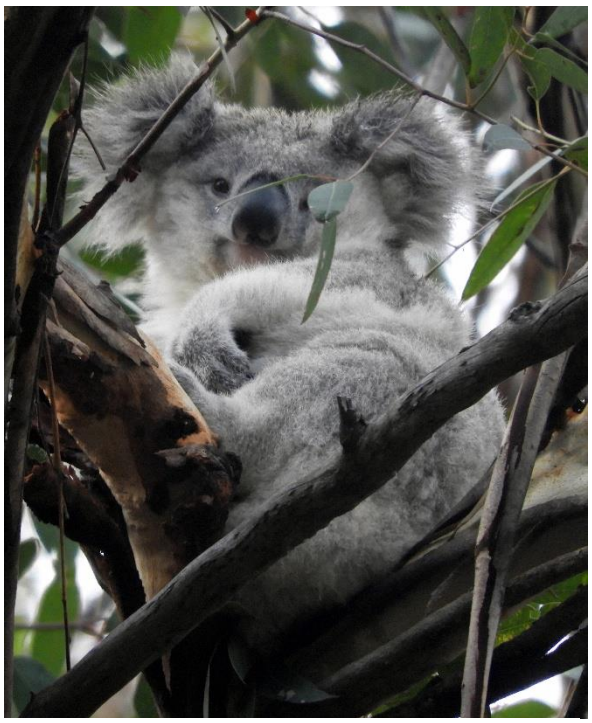
[4] 'Yes': Current funding secured; 'No': Council will seek funding to implement.

Objective	Action	Responsible	Delivery area / team	Funded (Yes/No)[4]	Measure of success	Timeline
	Deliver habitat improvement on Council reserves/public land (weed control, canopy protection, feed tree retention) and pursue grants for larger works.	Council; Bushcare groups	Parks and Natural Areas	Yes	Hectares treated; priority feed/shade trees retained; restoration survival/maintenance targets met.	Ongoing
2 - Restore and improve koala habitat and enhance connectivity	Implement corridor restoration (including climate refuges such as riparian zones/shaded gullies) and ensure long-term maintenance, weed control and monitoring to avoid sink habitat.	Council; Bushcare; ecologists	Parks and Natural Areas; Environment and Regulation	No	Corridor restoration sites delivered with 3-5 year maintenance plans; habitat condition scores improve at monitoring points.	Medium term and ongoing
	Maintain corridor mapping to guide restoration priorities, development assessment and landholder engagement (update and keep current).	Council; Greenweb	Environment and Regulation	Yes	Corridor layer maintained and version-controlled; used in restoration work programs and DA referral checklists.	Immediate and ongoing
	Establish a “Koala Web” private land stewardship program (aligned to Greenweb) offering koala habitat trees and advice in key connectivity areas.	Council; community; nurseries; Greenweb partners	Environment and Regulation	No	Participation numbers; trees supplied and survival after 12–24 months; connectivity plantings completed in priority suburbs.	Medium term
	Work with TfNSW and NSW DCCEEW to identify connectivity and mitigation improvements in focus areas (e.g., Princes Highway) and pursue grant opportunities.	Council; TfNSW; NSW DCCEEW	Urban Futures; Environment & Regulation	No	Joint mitigation plan agreed; at least one priority intervention designed/implemented (e.g., crossings/fencing/signage) within plan period.	Medium term and ongoing
3 - Threat management	Reduce vehicle strike risk: implement speed reduction, traffic calming and other physical or behavioural mitigation measures at agreed hotspots on local roads.	Council	Assets Strategy & Delivery	No	Treatments installed at priority sites	Medium term & ongoing
	Include koala requirements in construction traffic management plans.	Council; TfNSW; developers	Assets Strategy & Delivery; Civil Works and Presentation; Facilities and Fleet	No	Koala provisions included in CTMPs; trend decrease in reported incidents where data are available.	Short term-ongoing

Objective	Action	Responsible	Delivery area / team	Funded (Yes/No)[4]	Measure of success	Timeline
	Koala-safe fire management: coordinate hazard reduction burns in mapped koala habitat with fire agencies; ensure burn plans include pre/during/post-burn koala measures and ecological advice; incorporate TEK/cultural burning partnerships; align with NSW Koala Strategy fire actions.	RFS; Council; GLALC/Aboriginal organisations; NPWS	Parks and Natural Areas; Environment and Regulation	Yes	Burn plans and environmental approvals include koala actions and notifications; koala checks/monitoring completed for burns on Council estate; lessons learned captured.	Ongoing
	Strengthen post-fire wildlife response by maintaining contact lists, roles and recovery arrangements with wildlife carers and veterinarians.	Council; wildlife carers; veterinarians	Environment and Regulation	Yes	Response protocol and contacts current; after-action review completed following any activation.	Ongoing
	Reduce dog-koala risk through an integrated approach: guidance for property separation, DA conditions for fencing/yard design, off-leash areas located away from habitat with exclusion fencing, clear signage, ranger enforcement, and consider Wildlife Protection Areas. Any new Wildlife Protection Areas will consider community engagement before implemented.	Council (Rangers, Planning, Assets); residents	Public Safety & Lifeguards; Assets Strategy & Delivery; Development Assessment; Environment and Regulation	Yes	Wildlife Protection Areas/design controls applied where needed; compliance activity recorded; reduction in dog-related incidents in priority areas.	Immediate-medium term
	Plan and implement annual invasive-species works (identification, control, and monitoring) at priority sites with LLS, aligned to koala habitat protection objectives.	Council; Local Land Services (LLS)	Parks and Natural Areas	Yes	Annual priority invasive species program delivered; measurable reduction in target pest pressure at priority sites.	Ongoing
4 - Foster continued community awareness and stewardship	Deliver a coordinated community education program (target hotspot/connectivity areas; include schools, workshops, web/social content, signage/public art, responsible pet ownership and promotion of habitat gardening/tree planting).	Council; schools; community groups; wildlife carers	Urban Futures: Environment and Regulation; Community Impact & Innovation; Parks and Natural Areas	Yes	Annual education plan delivered; engagement metrics tracked; participant surveys show increased awareness/actions.	Ongoing
	Introduce a citizen-science koala monitoring program to expand data collection, support early-warning observations, and build community stewardship.	Council; community groups; schools; wildlife carers; local residents	Environment and Regulation; Parks and Natural Areas	Yes	Volunteer participation increases; geographic coverage of observations expands; validated community data incorporated into monitoring reports.	Immediate and ongoing

Objective	Action	Responsible	Delivery area / team	Funded (Yes/No)[4]	Measure of success	Timeline
5 - Develop and apply consistent criteria for development applications	Update the LEP/DCP to explicitly recognise 'status'-based protections.	Council (Planning/DA)	Urban Futures	Yes	LEP/DCP recognises vulnerable, endangered, critically endangered statuses and applies protections accordingly.	Immediate and ongoing
	Embed koala mapping and koala protection requirements in LEP/DCP and DA processes (avoid/minimise impacts; fencing, pool safety, construction traffic plans, offsets).	Council (Planning/Strategic Planning); DPHI; developers	Urban Futures; Development Assessment; Environment & Regulation	Yes	Updated planning controls adopted; koala-specific DA conditions applied consistently; compliance checks completed.	Immediate and ongoing
6 - Monitor, support research and adaptive management	Subject to grant funding, implement a bi-annual drone monitoring program aligned with NSW Tier 2/national frameworks, and contribute to shared morbidity–mortality datasets	Council; NSW DCCEEW; universities; carers/vets	Environment and Regulation; Corporate Governance	No	Monitoring program running; datasets updated; at least annual public summary report published and informs program adjustments.	Immediate and ongoing
	Integrate disease observation into monitoring and formalise referral pathways with koala hospitals/vets	Council; NSW DCCEEW; koala hospitals/vets	Environment and Regulation	No	Field protocol adopted.	Ongoing
7 - Embed koala conservation within Council biodiversity frameworks	Implement the Sutherland Shire Biodiversity Strategy 2036 as the primary framework for koala conservation.	Council; NSW DCCEEW	Environment & Regulation; Urban Futures; Parks and Natural Areas	Yes	KMP actions aligned to Biodiversity Strategy themes; annual reporting demonstrates integration.	Immediate-ongoing
	Advocate for inclusion of the Sutherland Shire in the Koala SEPP (or equivalent legislation).	Council	Urban Futures; Environment & Regulation	Yes	Submissions lodged; Sutherland Shire included in the Koala SEPP; strengthened provisions adopted.	Immediate-medium term
	Use Biodiversity Strategy, Climate Strategy and Greenweb as integrated delivery system for koala outcomes.	Council	Environment & Regulation; Urban Futures	Yes	Greenweb corridors adopted as KMP priority areas; integration into restoration programs.	Short term-ongoing

Part 5 - Plan evaluation



'Marlie', image credit: Steve Anyon-Smith

Success under this Plan is reflected not by the absence of threats, but by increased habitat security, safer movement pathways, improved knowledge, and informed decision-making over time.

To ensure the ongoing effectiveness of the Plan, identified threats and associated management actions will be subject to regular monitoring, review and refinement. Koala conservation within Sutherland Shire occurs in a dynamic social, ecological and planning context, requiring an adaptive approach that responds to emerging pressures, improved knowledge and changing circumstances.

Threat mitigation under this Plan follows an adaptive management framework in which key threats to koalas and their habitat are clearly identified, targeted actions are implemented to reduce impacts, and outcomes are monitored over time. Monitoring results will inform periodic evaluation of action effectiveness, allowing management approaches to be adjusted where necessary to improve conservation outcomes for koalas.

Council will prepare and publish an Annual Koala Outcomes Report, made publicly available on Council's website. The report will provide a transparent account of Plan implementation and outcomes and will include, where data are available:

- changes in mapped koala habitat extent and condition.
- habitat restoration and corridor enhancement progress.
- recorded koala mortality incidents and trends.
- progress on priority threat mitigation actions; and
- key implementation constraints or delays.

Reporting will focus on measurable outcomes and will inform ongoing adaptive management and review of priorities. Council will also provide guidance on appropriate pathways for reporting koala sightings to support data quality, verification and appropriate use in planning, fire and land-management decision-making, including clarification of how community reporting tools interface with State databases such as BioNet.

Council will ensure ongoing resourcing is available to drive Plan implementation, noting that the Plan will require effective and ongoing collaboration with multiple stakeholders and partners. Actions may be refined, expanded or reprioritised in response to monitoring results, stakeholder feedback, advances in scientific understanding, and changes to legislative or policy settings. A comprehensive review of the Plan will be undertaken at least every five years, informed by updated threat assessments, habitat condition, koala population data (where available), and implementation performance. Council will provide regular status updates to the community on the Plan's implementation.

The prioritisation of actions will consider conservation benefit, risk reduction, resource availability and alignment with Sutherland Shire's broader strategic and statutory obligations. Stakeholder engagement, including with state agencies, land managers, community groups and Traditional Custodians, will be an integral part of the review and prioritisation processes to support coordinated and efficient delivery of koala conservation outcomes (Figure 16).

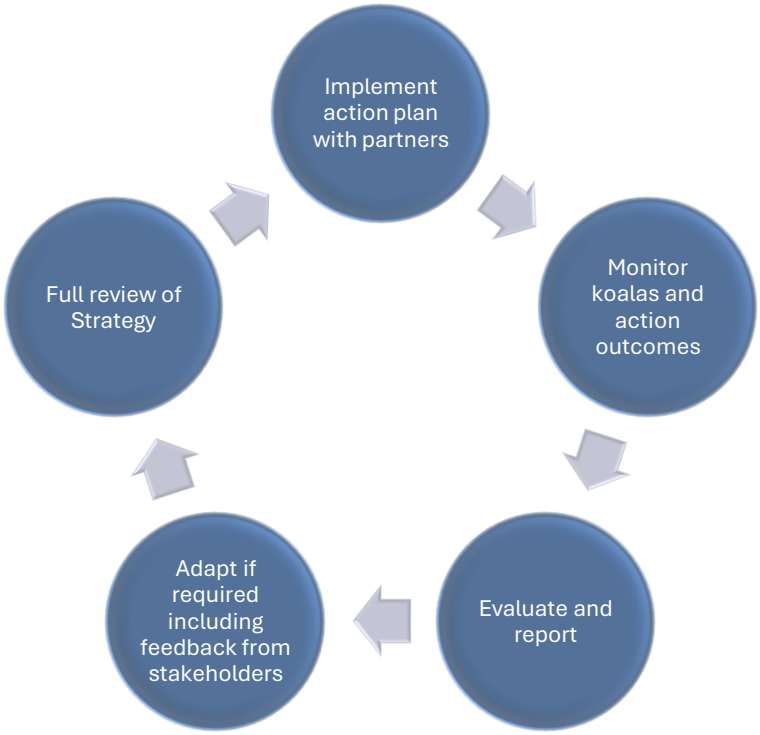


Figure 16 Stakeholder engagement for efficient delivery of koala conservation outcomes.

Aboriginal involvement

Council recognises that Aboriginal knowledge and ongoing connection to Country are essential to effective biodiversity and land management. Beyond consultation, Council commits to ongoing involvement of Dharawal representatives in implementation, monitoring and review of actions under this Plan, including co-design of relevant actions where appropriate and agreed.

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Appendix 1: Koala ecology

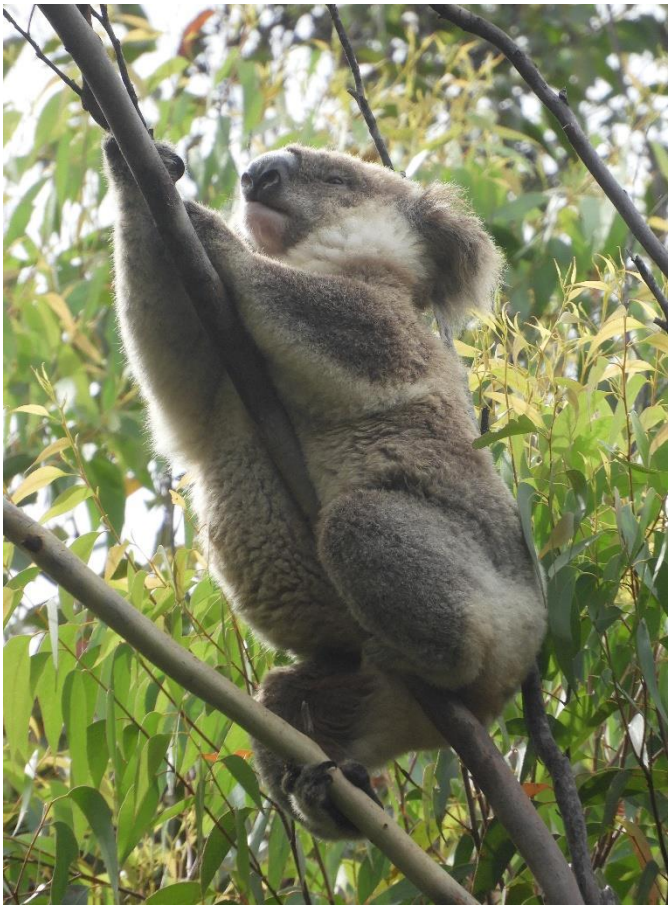
Habitat and home range

Koalas inhabit a variety of open eucalypt forest and woodland communities and can also persist in urban areas where habitat is partially cleared (NSW Government 2024; Queensland Government 2025). Home range sizes vary widely - from less than 2 hectares to several hundred hectares – depending largely on habitat quality. Koalas tend to occupy smaller ranges and are in higher densities in higher-quality habitats, such as areas abundant food tress growing on fertile soils and along a watercourse (NSW Government 2024; Queensland Government 2025). Koala home ranges often overlap with males generally occupying larger territories than females.

Diet

Koalas are specialised folivores that primarily browse on leaves within the *Eucalyptus*, *Corymbia*, and *Angophora* genera (Youngentob et al. 2021). They obtain most of their water from the foliage they consume, thought they will drink from surface water during dry periods supplement their water intake with surface water during dry periods (Ellis et al. 2010).

State Environmental Planning Policy (Biodiversity and Conservation) 2021 Schedules 1 and 3 lists 10 ‘koala feed trees’ and 42 ‘koala use trees’ (Appendix 9: Koala food and shelter trees used in the Sutherland Shire). However, koalas do not feed on all these species uniformly, their diet varies between regions (Stalenberg et al. 2014; Kjeldsen et al. 2019; Kondo et al. 2024). For example, a koala from one region may reject leaves that are readily eaten by koalas elsewhere. Variation in soil type, water availability, and other environmental factors also influence which browse species are suitable in each landscape (Crowther et al. 2014). Therefore, identifying the key species preferred by koalas in the Clarence Valley, and recognising individual trees that are consistently used, is essential for effective habitat protection and regeneration efforts.



"Orlando", image credit: Steve Anyon-Smith

Lifecycle

In the wild, koalas typically live for around 10-12 years, although females often out-live males and may reach 18 years of age (Gordon 1991; Lott et al. 2024). The peak breeding season occurs between August and February (Environment and Heritage n.d.; DAWE 2022b). During this period, koalas become more active and mobile as males defend their territories, search for mates and young koalas disperse across the landscape (Ryan et al. 2013; DAWE 2022b).

Females can begin breeding at two years of age and usually produce one offspring, known as a joey, each year (Johnson & Holt 2014). Young koalas generally stay within or near their mother's home range for their first year before dispersing at around two to three years old to establish their own territories (Dique et al. 2003; DETSI 2005). Koalas commonly disperse around three to five kilometres from their natal site, with individuals capable of longer movements under certain conditions (Dique et al. 2003).

Behaviour

Koalas are largely solitary animals, maintaining individual home ranges that often overlap with those of neighbouring individuals (Davies 2013; Jiang et al. 2022). Although they are primarily nocturnal, koalas are most active at dawn and dusk, with activity levels typically increasing during the warmer months (Ryan et al. 2013; DAWE 2022b).

During periods of high temperatures, koalas actively seek cooler microhabitats, such as riparian areas (Seabrook et al. 2011; Smith et al. 2013; Lunney et al. 2014). As conditions become hotter, they tend to select taller trees at lower elevations, position themselves lower on the trunk, and adopt tree hugging postures that enhance heat exchange with the cooler bark (Crowther et al. 2014; Briscoe et al. 2014; Mella et al. 2024). These trees are often non-feed species with denser foliage and provide greater shade, offering essential thermal refuge (Crowther et al. 2014). This behaviour highlights the importance of conserving and incorporating such shade-providing tree species into habitat restoration and corridor planning – particularly considering the projected increases in heatwave duration and intensity associated with climate change (Lunney et al. 2012; Lunney et al. 2014; DAWE 2022b).

Appendix 2: Legislative and strategic context with relevance to koalas

Level	Instrument	Relevance to koalas	Sutherland Shire responsibilities
National	*Environment Protection and Biodiversity Conservation Act 1999*, Significant Impact Guidelines 1.1 – Matters of National Environmental Significance, Referral Guideline and National Recovery Plan for the Koala (DAWE 2022b)	Koalas are listed as Endangered and protected as a matter of national environmental significance under the EPBC Act. Referral guidelines provide advice on how to avoid significant impacts and ensure compliance with the EPBC Act. The National Recovery Plan for the Koala sets national objectives, actions and performance criteria for koala recovery, including habitat protection, threat mitigation, disease management, and increased Indigenous, community and partner participation.	Ensuring compliance and alignment in Council actions or approvals.
State	*Biodiversity Conservation Act 2016* and NSW Koala Strategy	Koalas are listed as Endangered in NSW, mandating specific protections to prevent further population decline. This Act provides a framework for protecting koalas through habitat conservation, regulated land use, and active involvement of local councils in planning and community engagement. The NSW Koala Strategy provides the primary strategic framework for koala conservation, including describing Areas of Regional Koala Significance.	Informing this Strategy and planning decisions, compliance, and engaging the community through education and conservation initiatives.
	Companion Animals Act 1998	Dog owners are responsible for ensuring their pets do not harm native wildlife, including koalas, by keeping them under control and securely contained; allowing a dog to attack, harass, or chase wildlife is a serious offence punishable by substantial fines and potential prosecution.	Councils can designate public spaces as Wildlife Protection Areas to safeguard native wildlife, such as koalas, by restricting or prohibiting cats and requiring dogs to be leashed. Councils have the authority to enforce these protections, issue fines, and implement local policies limiting pet ownership in sensitive habitats.
	Environmental Planning and Assessment Act 1979	This Act plays a vital role in protecting koala habitats by requiring environmental impact assessments and supporting ecologically sustainable development. It also enables the creation of State Environmental Planning Policies to ensure koala habitats are considered in planning decisions.	Councils can involve the community in planning decisions, allowing residents to have a say in how local developments may impact koala habitats.

Level	Instrument	Relevance to koalas	Sutherland Shire responsibilities
	Local Government Act 1993	This Act supports councils in managing planning, development, environmental protection, and community engagement, allowing for the protection of koalas and their habitats through local decision-making and environmental policies.	Councils can create local environmental plans and policies to help protect koalas and their habitats and involve the community in koala conservation through public consultation, feedback opportunities, and awareness initiatives.
	National Parks and Wildlife Act 1974	Koalas are listed as Endangered, making it illegal to harm them or their habitat without special permission. This Act ensures proper management of national parks and reserves, requires approval for land clearing that may affect koalas, and supports conservation efforts like tree planting and creating koala corridors.	To collaborate with the NPWS and follow environmental approval processes when developments may impact koalas or their habitat. They may also support habitat restoration and public education in partnership with state agencies, and cross tenure land management (e.g. bushfire mitigation and pest animal control programs).
	Rural Fires Act 1997	This Act guides bushfire risk management, ensuring controlled burns are planned to avoid damaging koala habitats and supporting recovery efforts after fires. Development and implementation of a Bush Fire Risk Management Plan is a legal requirement under section 52 of the Act.	To work with the Rural Fire Service to plan safe fire management practices, protect critical koala habitats, and support post-fire rescue and habitat restoration.
	Roads Act 1993	This Act governs how roads are managed in NSW. Road development and maintenance can fragment habitats and increase koala road deaths, making careful planning and mitigation strategies like wildlife crossings essential.	Managing local roads, considering impacts on koalas, and implementing measures such as koala fencing or underpasses, often in collaboration with the state government, to reduce risks to koala populations.
	Biodiversity Offsets Scheme (NSW Government 2025)	The BOS sets triggers to determine when biodiversity offsets are required. If triggered, the BAM is used to assess impacts and calculate offsets for koala habitat and other biodiversity values.	Check if BOS thresholds are triggered for development and council works. Consider offset requirements in development approvals.
	Biodiversity Assessment Method (DPIE 2020a)	Provides the statutory framework for assessing impacts on biodiversity, including koalas and their habitat, and determining avoidance, minimisation and offset requirements.	Ensure development applications that may affect koalas or koala habitat are assessed using the BAM where required, and that BAM outputs inform consent decisions and conditions.
	Koala (*Phascolarctos cinereus*) BAM Survey Guide (DPE 2022b)	Sets out standardised survey methods for identifying koala presence, habitat and movement corridors under the BAM.	Review ecological assessments to confirm surveys meet the Guide's requirements and that koala habitat and movement are

Level	Instrument	Relevance to koalas	Sutherland Shire responsibilities
			accurately identified and considered in planning decisions.
	State Environment Planning Policy (Biodiversity and Conservation) 2021	The policy aims to protect koala habitats by guiding land use and development decisions, ensuring koala habitats are considered in planning, and providing clear rules for councils, developers, and landowners. Koala Plans of Management help identify and protect core habitats, balancing development with conservation by outlining where and how development can occur.	To use the policy to guide decisions on development applications.
	NSW Koala Strategy (DPE 2022c)	Sets statewide priorities and actions for koala conservation, including habitat protection, restoration, monitoring and threat reduction.	Support implementation at the local level through planning controls, habitat management, community education and participation in state-led koala initiatives.
	Design Guidelines for Koala-exclusion Fencing (draft for consultation) (DPIE 2025)	Provides best-practice guidance for the design and placement of fencing to prevent koala road mortality and manage movement near development and infrastructure. These guidelines only apply to new developments in the Greater Macarthur Growth Area and Wilson Growth Area (i.e. within south-west Sydney consistent with the Cumberland Plain Conservation Plan).	Consider and apply the guidelines (once finalised) when designing or conditioning developments, roads or infrastructure projects that pose risks to koalas.
Local	Sutherland Shire Local Environmental Plan 2015	This plan indirectly helps protect koala habitat and fragmentation by limiting developments and encouraging protection of vegetation and natural features. An amendment was made in 2020 that fencing in core koala habitat or movement corridors must be constructed/installed in accordance with relevant council policies or guidelines.	To protect environmentally sensitive land and avoid or minimise adverse impacts on threatened species, including koalas, through development assessment and land-use planning.
	Sutherland Shire Development Control Plan 2015 (DCP) (Sutherland Shire Council 2015)	Contains detailed development controls and guidelines that can incorporate koala-sensitive design, vegetation retention, construction management and mitigation measures.	Consider additional controls in line with this Strategy.
	Sutherland Bush Fire Risk Management Plan (Sutherland Bushfire Management Committee 2025)	Addresses fire management which can impact koala habitat through hazard reduction and prescribed burning.	Balance bushfire risk reduction with biodiversity conservation by planning and implementing fire management activities that minimise impacts on koala habitat. As a land manager, Council is responsible for

Level	Instrument	Relevance to koalas	Sutherland Shire responsibilities
			managing bushfire risk on land it owns and manages consistent with the prescribed treatments in this Plan.
	Greenweb, Sutherland Shire Environmental Specification 2020 (Sutherland Shire Council 2020)	Sets Council's strategic approach to biodiversity protection, habitat conservation and threatened species management.	Integration points for koala conservation actions.
	Sutherland Shire Environment and Sustainability Strategy (Sutherland Shire Council 2012)	Provides an overarching sustainability framework, integrating biodiversity, climate and land management outcomes relevant to koalas.	
	Climate Strategy 2050, Thrive. Design. Lead (Sutherland Shire Council 2025a)	Addresses climate-related risks such as heat, drought and bushfire. Relevant to koala conservation by influencing habitat resilience, canopy cover, fire regimes and long-term landscape condition.	
	Sutherland Shire Tree and Bushland Strategy 2025-2035 (Sutherland Shire Council 2025e)	Supports canopy cover, urban forest resilience and connectivity. Contributes to koala habitat quality, movement pathways and heat stress mitigation in urban areas.	
	Neighbouring Council Koala Plans and Strategies	Landscape threat mitigation, monitoring and community engagement.	

Appendix 3: Sutherland fine scale extant and vegetation mapping 2025 (draft)

Geoff Doret (Sutherland Shire Council)

Dan Clarke (Arcane Botanica)

Mark Cameron, Matt Cook (DCCEEW)

LINEAGE

An extant vegetation map and refined vegetation map for Sutherland Shire Local Government Area was produced as part of the NSW Koala Strategy's Pillar 2.3 – Supporting Councils to do habitat mapping.

Koala habitat maps require a fine scale and accurate vegetation map to underpin delineation of koala habitat. A review of existing mapping datasets resulted in the Native Vegetation of the Sydney Metropolitan Area V3 (OEH 2016a, 2016b) as the best basis for an accurate vegetation map. The Native Vegetation of the Sydney Metropolitan Area (NVSMA) map was clipped to the Sutherland Shire Local Government Area (LGA) boundary and the existing map units were translated to the current NSW PCT classification (Connolly et al. 2021). Translation was supported by the following inputs:

- a lookup table (LUT) that provided a statistically derived best-fit NVSMA map unit to PCT translation
- the NSW Government State Vegetation Type Map (SVTM) (Roff et al. 2022)
- 573 full floristic plots, each of which is allocated a PCT
- 131 rapid validation plots by expert botanical consultant Arcane Botanica. Each plot was allocated a primary best fit PCT and where PCT uncertainty/ambiguity existed a secondary best-fit PCT was allocated.

The translations to PCTs were allocated using a prioritised and sequential process whereby all translations to PCT with high confidence were allocated first. The high confidence translations were polygons where full floristic plots existed or where there was concurrent agreement between the plots, the State Vegetation Type Map (SVTM) and the translation lookup table (LUT). Areas in the Sutherland Shire where translations were not clear were then prioritised for survey for Arcane Botanica.

Survey Priority

Highest priority survey areas were determined by combining map units ranked highest to lowest confidence PCT translation with an interim koala habitat map that ranked high to low habitat quality. The interim koala habitat map was derived from NVSMA map units that contained >15% abundance of food trees preferred by Sutherland koalas. Both rankings were combined to produce a final survey priority map where areas of lowest translation confidence and highest habitat quality were highest priority with the converse being true. The

resulting 131 rapid plots surveyed by Arcane Botanica enabled a draft completion of the PCT translation. Using the draft translated map, two workshops were conducted with botanical experts from DCCEEW, Sutherland Council and Arcane Botanica to spatially review every PCT allocation individually for errors. Errors were rectified within the workshop by experts where possible but further areas were targeted for site inspections to clarify unresolvable conflicts. Sutherland Council and Arcane Botanica conducted the site inspections which were fed back into the vegetation map to finalise all PCT allocations. Also, allocation of PCTs to both state and federally listed Threatened Ecological Communities (TECs) were also reviewed and completed during the workshops.

Extant Vegetation

The map was then further refined to accurate extant vegetation boundaries so that no areas of clearing or incorrect mapping of non-vegetated areas occurred. The extant vegetation layer used for refinement was derived using the vegetation strata data from the 'Greater Sydney canopy and thermal assessment 2014 and 2016' (Caccetta et al. 2019) as a starting point. The Caccetta et al. (2019) data covered all main urban areas of the Sutherland LGA whereas the remainder of the LGA is mainly contiguous vegetation. The Caccetta et al. (2019) data is in 2 metre raster format and was converted to vector and smoothed using the PAEK smoothing algorithm in ESRI ArcGIS Pro software. The urban area of the LGA was segmented into 68 x 2km square tiles for manual editing refinement against a high resolution 16cm RGB aerial image. The image was captured by Arbor Carbon (https://www.arborcarbon.com.au/index.html) from a fixed wing aircraft at 16,000ft between February and October 2022.

The resulting extant vegetation layer for the urban area and rest of the shire was completed using image backdrops at scale of 1:200 – 1:2000. Maximum editing effort was applied to the urban extent of Caccetta et al. (2019) data with less effort required outside due to the contiguous vegetation. All vegetation above the $10m^2$ area threshold was accurately captured with no discrimination between native, exotic, heath, woody or non-woody. All shadows are effectively removed courtesy of the editing and original data capture method of Caccetta et al. (2019).

Vegetation Map Finalisation & Attributes

The accurate extant vegetation layer was then used to correct the boundaries of the final PCT allocated vegetation map. Polygon boundaries were extended into areas of vegetation omitted by the original NVSMA map and conversely, NVSMA polygons that contained non-vegetated areas had those areas excised.

Sutherland LGA is contrasted between distinct urban areas in the north and large contiguous vegetated areas in the south. Due to the highly urbanised and fragmented nature of the urban area in the north, PCT polygons present with areas less than $1000m^2$ were allocated as PCT = 0 (Urban exotic/native) which was determined to be a minimum area threshold for a valid plant vegetation community. Any mapped PCT with areas above $1000m^2$ in the urban area were retained. All non-PCT polygons greater than $10m^2$ in the urban area captured by extant mapping were included in the vegetation map and classified as PCT = 0 (Urban exotic/native).

The attributes for each mapped polygon are comprehensive and designed to give the end user as much information as possible about the vegetation communities. The attributes for each polygon are listed in Table 1 below.

Table 1 Attributes (Field name) and brief descriptions (Description) for each polygon in the vegetation map.

Field name	Description
PCT_ID	Final PCT allocation
PCT_Name	Name of final PCT allocation
PCT_Confidence	Confidence in final PCT allocation
Plot_ID	Unique full-floristic plot ID
Plot_PCTs	PCT allocation from full-floristic plot
Rapid_ID	Unique ID of Rapid Plot undertaken by Arcane Botanica
Rapid_PCT_Primary	Primary PCT allocation from rapid plot
Rapid_PCT_Secondary	Secondary PCT allocation from rapid plot (if necessary)
Rapid_Comment	General comments on rapid plot (optional)
Likely_NSW_TEC	NSW TEC associated with final PCT allocation
NSW_Conservation	Conservation status of NSW TEC
Likely_EPBC_TEC	EPBC TEC associated with final PCT allocation
EPBC_Conservation	Conservation status of EPBC TEC
Other_legislation	Other legislation associated with final PCT allocation
Keith_Formation	Keith formation of final PCT allocation
Keith_Class	Keith class of final PCT allocation
MapUnitCode	Code of Map Unit (OEH, 2016a, 2016b)
MapUnitName	Name of Map Unit (OEH, 2016a, 2016b)
Legacy_PCT_ID	Legacy PCT associated with Map Unit

From Table 1 above, the '*PCT_confidence'* attribute (third row down) provides a per polygon measure of confidence in PCT allocation and accuracy. The measure is presented as 5 linguistic classes informed by points of truth (plots and validation sites) and translation confidence from botanical expert review. Table 2 below shows the range of the linguistic classes in the '*Description*' column with the '*Criteria*' column providing the basis of those class measures.

Table 2 Per polygon confidence ranking for the vegetation map. The Code column is a GIS integer lookup reference only whilst the Description column is the linguistic classes and Criteria column provides the measure for the linguistic class.

Code	Description	Criteria
1	Low	Minimal confidence
2	Medium Low	No sites present and low confidence in translation to ENSW
3	Medium	No sites present but confident in translation to ENSW
4	Medium High	Rapid site present
5	High	Full floristic plot present OR both full floristic and rapid present

Extant Vegetation

Sutherland Shire is approximately 36,853.5 ha in size and 71% (26,239.1 ha) was mapped as extant vegetation (Figure 1).

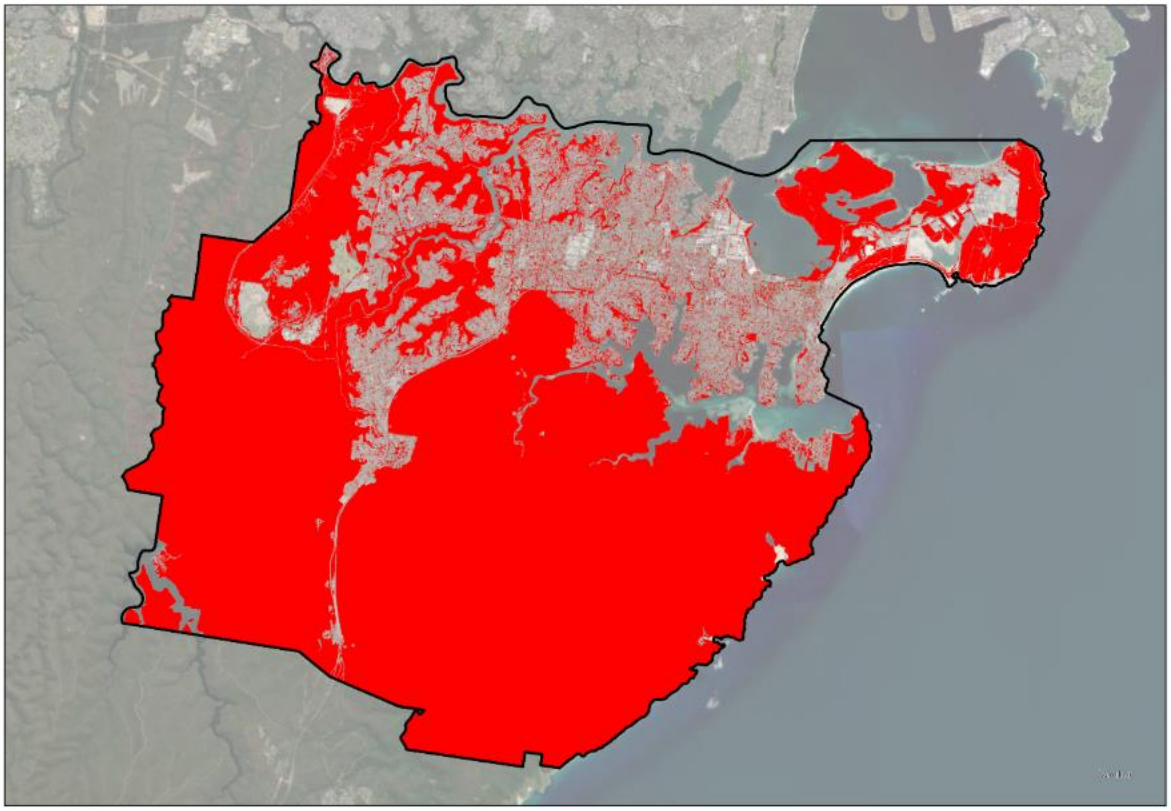


Figure 1Sutherland LGA final extant vegetation map in red (map: Conservation Leaders).

An example of the accuracy and detail of the extant vegetation map is shown for Barden Ridge at a scale of 1:2000 (Figure 2).

Figure 2 An example of the extant vegetation mapping (shown in red) at Barden Ridge at a scale of 1:2000 (map: Conservation Leaders).

Final Vegetation Map

A total of 61 Plant Community Types (PCTs) are present in Sutherland Shire and a range of eight non-PCT's (PCT ID = 0) are included for reference (Table 3).

Table 3 The number, name, and area of all PCTs and non-PCTs mapped in Sutherland Shire.

PCT ID	PCT Name	Area (hectares)
0	Artificial wetland	6.35
0	Plantation (native and/or exotic)	13.19
0	Rock	70.87
0	Seagrass meadows	7.26
0	Unconsolidated sand	0.44
0	Undifferentiated regenerating shrubs	117.71
0	Urban exotic/native	1259.02
0	Weeds and exotics	80.90
3028	Illawarra Escarpment Warm Temperate Rainforest	96.16
3036	South Coast Warm Temperate-Subtropical Rainforest	210.87

PCT ID	PCT Name	Area (hectares)
3038	Sydney Coastal Coachwood Gallery Rainforest	6.25
3039	Sydney Coastal Lilly Pilly-Palm Gallery Rainforest	17.68
3040	Sydney Coastal Foreshores Gully Rainforest	13.53
3125	Illawarra Seacliff Banksia-Bangalay Forest	54.72
3133	Sydney Coast Tuckeroo Littoral Rainforest	10.76
3145	Cumberland Bangalay x Blue Gum Riverflat Forest	27.90
3153	Illawarra Escarpment Bangalay x Blue Gum Wet Forest	91.37
3154	Illawarra Blackbutt Moist Forest	301.73
3155	Illawarra North-Pittwater Bangalay Moist Forest	97.86
3176	Sydney Enriched Sandstone Moist Forest	92.07
3259	Sydney Coastal Shale-Sandstone Forest	292.10
3260	Sydney Foreshores Shale Forest	155.37
3262	Sydney Turpentine Ironbark Forest	42.31
3321	Cumberland Shale-Sandstone Ironbark Forest	36.50
3407	Central Headland Grassland	12.33
3410	Spinifex Strandline Grassland	6.26
3545	Coastal Sands Bloodwood Low Forest	128.40
3546	Coastal Sands Littoral Scrub-Forest	226.50
3590	Southern Sydney Scribbly Gum Woodland	4627.38
3591	Southern Sydney Sheltered Forest	160.64
3592	Sydney Coastal Enriched Sandstone Forest	1081.34
3593	Sydney Coastal Sandstone Bloodwood Shrub Forest	350.38
3594	Sydney Coastal Sandstone Foreshores Forest	81.14
3595	Sydney Coastal Sandstone Gully Forest	5696.44
3596	Sydney Coastal Sandstone Riparian Forest	207.31
3615	Sydney Hinterland Apple-Blackbutt Gully Forest	489.89
3616	Sydney Hinterland Grey Gum Transition Forest	39.27
3619	Sydney Hinterland Enriched Sandstone Bloodwood Forest	970.91
3638	South Coast Sands Bangalay Forest	15.77
3788	Coastal Foredune Wattle Scrub	198.39
3789	Coastal Headland Clay Heath	5.57
3805	Southern Sandplain Heath	410.92
3810	Southern Sydney Rockplate Heath	69.50
3811	Sydney Coastal Headland Cliff Scrub	128.72
3812	Sydney Coastal Sandstone Headland Heath	181.80
3813	Sydney Hinterland Dwarf Apple Low Woodland	1477.52
3814	Woronora Plateau Heath-Mallee	5258.38
3920	Coastal Clifftop Shrubby Marsh	6.86
3921	Coastal Sydney Sand Saw-sedge Wet Shrubland	17.45
3922	Sydney Coastal Sand Swamp Scrub	25.70
3923	Sydney Coastal Sandstone Creekline Swamp Heath	125.04
3924	Sydney Coastal Upland Swamp Heath	169.45
3977	Sydney Coastal Headland Lagoon Sedgeland	0.51
3986	Coastal Sands Swamp Mahogany Rush Forest	8.99
3997	Hunter Coast Sandplain Sedge Paperbark Wetland	36.65
4006	Northern Paperbark-Swamp Mahogany Saw-sedge Forest	5.20
4010	Sydney Hinterland Creekflat Paperbark Scrub	2.87

PCT ID	PCT Name	Area (hectares)
4019	Coastal Alluvial Bangalay Forest	14.78
4024	Cumberland Blue Box Riverflat Forest	3.67
4026	Estuarine Sea Rush Swamp Oak Forest	0.40
4027	Estuarine Swamp Oak-Mangrove Forest	2.28
4028	Estuarine Swamp Oak Twig-rush Forest	146.67
4048	Northern Swamp Oak-Paperbark Forest	0.52
4056	Southern Estuarine Swamp Paperbark Creekflat Scrub	3.16
4057	Sydney Creekflat Swamp Mahogany-Paperbark Forest	1.53
4059	Sydney Hinterland Sandy Creekflat Shrub Forest	4.98
4086	Sydney Coastal Sandstone Riparian Scrub	45.01
4091	Grey Mangrove-River Mangrove Forest	475.47
4097	Samphire Saltmarsh	169.05

There are 15 NSW Threatened Ecological Communities: 12 are listed as Endangered and three are listed as Critically Endangered (Table 4).

Table 4 The 15 Threatened Ecological Communities in Sutherland Shire.

NSW Conservation Status	NSW Threatened Ecological Community
Critically Endangered	Eastern Suburbs Banksia Scrub in the Sydney Basin Bioregion
Critically Endangered	Shale Sandstone Transition Forest in the Sydney Basin Bioregion
Critically Endangered	Sydney Turpentine-Ironbark Forest in the Sydney Basin Bioregion
Endangered	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Endangered	Coastal Upland Swamp in the Sydney Basin Bioregion
Endangered	Duffys Forest Ecological Community in the Sydney Basin Bioregion
Endangered	Kurnell Dune Forest in the Sutherland Shire and City of Rockdale
Endangered	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Endangered	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
Endangered	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Endangered	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion
Endangered	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
Endangered	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

NSW Conservation Status	NSW Threatened Ecological Community
Endangered	Sydney Freshwater Wetlands in the Sydney Basin Bioregion
Endangered	Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions

The 61 PCTs are difficult to discriminate in a single map (Figure 3), as are the 15 Threatened Ecological Communities (Figure 4).

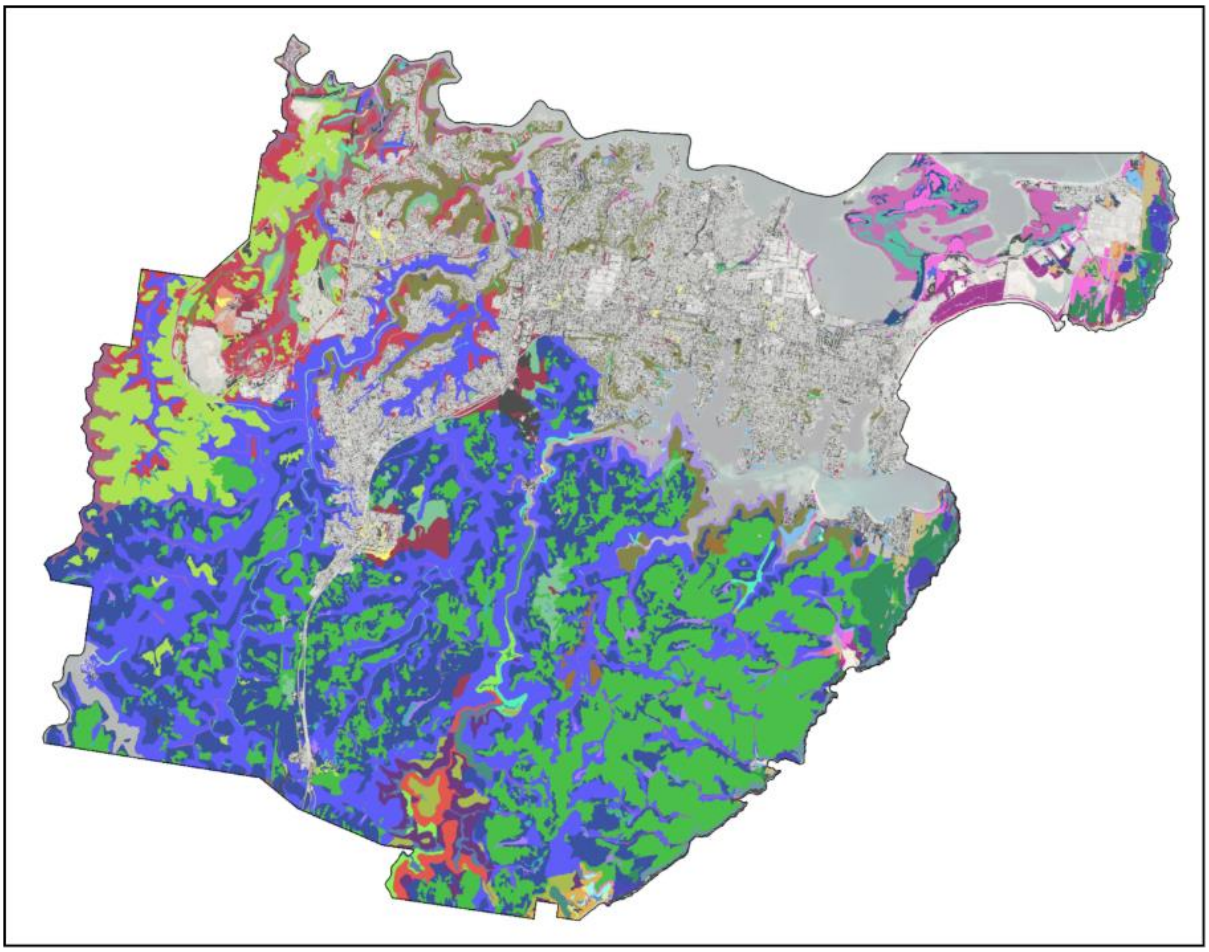


Figure 3 Overview map of the 61 Plant Community Types in Sutherland Shire (map: Conservation Leaders).

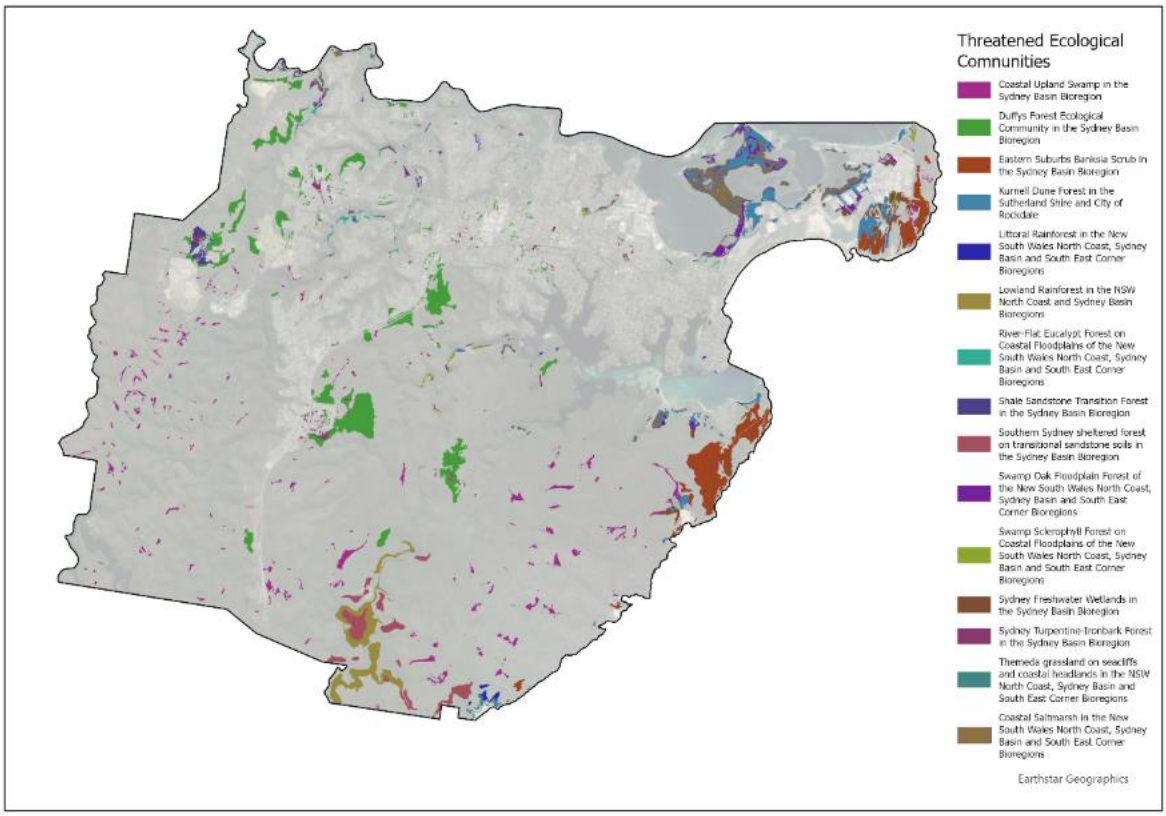


Figure 4 Threatened Ecological Communities in Sutherland Shire (map: Conservation Leaders).

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Caccetta P, Chia J, Collings S, Devereux D, Traylen A and Wu X (2019) Greater Sydney canopy and thermal assessment 2014 and 2016. *Creation of UrbanMonitor landcover and surface baselines: CSIRO*.

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OEH (2016b) *The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 3.0*. Sydney: Unpublished Retrieved from https://datasets.seed.nsw.gov.au/dataset/the-native-vegetation-of-the-sydney-metropolitan-area-oeh-2016-vis-id-4489.

Roff A, Day M, Thonell J and Denholm B (2022) *Vegetation Type Map*. Parramatta.

Appendix 4: Likely koala habitat mapping 2025

Sutherland Shire engaged Conservation Leaders to identify likely koala habitat.

Background

An extant vegetation map and refined vegetation map for Sutherland Shire was produced as part of the NSW Koala Strategy's Pillar 2.3 - Supporting Councils to do habitat mapping.

Koala habitat maps require a fine scale and accurate vegetation map to underpin delineation of a 'Likely Koala Habitat' map. A review of existing mapping datasets resulted in the Native Vegetation of the Sydney Metropolitan Area V3 (OEH 2016a, 2016b) as the best basis for an accurate vegetation map. The Native Vegetation of the Sydney Metropolitan Area (NVSMA) map was clipped to the Sutherland Shire boundary and the existing map units were translated to the current NSW Eastern PCT classification (Connolly et al. 2021). Translation was supported by the following inputs:

- a lookup table that provided a statistically derived best-fit NVSMA map unit to PCT translation
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Likely Koala Habitat Definition

The aim was to develop koala habitat maps consistent with Chapters 3 and 4 of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Koala SEPP).

Both Chapter 3 and Chapter 4 in the Koala SEPP apply exclusively to Koala protection. Both have a list of definitions but the Koala SEPP Chapter 3 '*potential koala habitat*' definition remains unchanged in all five versions of the Koala SEPP instruments since the inception of the first Koala SEPP (Koala SEPP 44 – Koala Habitat Protection) in 1995. The current Koala SEPP Chapter 3 definition (from part 3.2) is:

> *potential koala habitat means areas of native vegetation where trees of the types listed in Schedule 1 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.*

The term ‘likely koala habitat’ was adopted from the Koala SEPP 2021 as Councils may not wish to pursue a formal Koala SEPP instrument and therefore terminology does not imply a Council is adopting a formal Koala SEPP.

It is important to note that ‘likely koala habitat’ was defined independent of koala record locations and predominantly based on food tree abundance.

Method for Mapping ‘Likely Koala Habitat’

The way a 15% food tree count was determined was twofold, firstly the primary food trees pertinent to koalas in the study area was established and secondly, the primary food tree distribution across the study area was mapped via cover abundance scores within an accurate vegetation map.

Primary Food Trees

Local ecologists, Council and NSW DCCEEW koala experts were consulted on what was considered as the primary food trees driving koala populations in Sutherland Shire. The final list was not inclusive of all food trees as some are used only occasionally or opportunistically. There were 17 primary trees in the final list (Table 1). Note, local koala experts all concurred that *Eucalyptus punctata* (grey gum) presence provides the strongest association and diet preference for koalas in Sutherland Shire.

Table 1 Sutherland Shire primary koala food trees in alphabetical order.

Scientific Name	Common Name
Allocasuarina torulosa	Forest oak
Angophora costata	Sydney red gum
Eucalyptus agglomerata	Blue-leaved stringy bark
Eucalyptus amplifolia	Cabbage gum
Eucalyptus capitellata	Brown stringybark
Eucalyptus crebra	Narrow-leaved ironbark
Eucalyptus eugenioides	Thin-leaved stringybark
Eucalyptus fibrosa	Red ironbark
Eucalyptus globoidea	White stringybark
Eucalyptus longifolia	Wollybutt
Eucalyptus paniculata	Grey ironbark
Eucalyptus piperita	Sydney peppermint
Eucalyptus punctata	Grey gum
Eucalyptus racemosa	Scribbly gum
Eucalyptus resinifera	Red mahogany
Eucalyptus tereticornis	Forest red gum
Syncarpia glomulifera	Turpentine tree

Mapping Cover Abundance >15%

Mapping cover abundances of primary food trees required extracting a list of all PCTs from the vegetation map that are present in the LGA. Each PCT was then assessed one-by-one to see if it qualified as 'Likely Koala Habitat'.

The identified koala food trees from Table 1 that are present in a PCT were used to identify which PCTs met the habitat criteria. This was achieved by analysing all the full floristic plots associated with each PCT. To clarify, a statewide analysis of all plots resulted in an exclusive number of plots to define each PCT. As a result, each plot was assigned to one PCT only and this allowed analysis of all plots within a PCT to measure single species abundance.

Every full floristic plot measured the cover abundance of every plant species recorded in the plot and that provided an evidence-based pathway to measure abundance. There were two metrics from full floristic plots that were used in combination to determine single species abundance per PCT:

> *Median_cover_score*, the median value of all Braun-Blanquet cover scores (per species) from all the PCT's plots.
>
> *frequency,* the number of PCT plots that the species occurred in measured as a percentage.

Neither cover score or frequency on their own were adequate for determining a value that could be directly compared to the ≥15% threshold. Both were required in combination, and this is explained below.

Cover score (Braun-Blanquet cover abundance)

For every full floristic plot that defines a PCT, a cover score for each species present in that plot was recorded as a Braun-Blanquet cover abundance score from 1 to 6 (Table 2).

Table 2 Cover score in full floristic plots measured as Braun-Blanquet cover abundance.

BBCA class	Range of cover %	Qualitative abundance terms
1	<5	e.g. present, few, rare, erratic, occasional, uncommon
2	<5	e.g. common, abundant, many, several
3	5 to 25	
4	26 to 50	
5	51 to 75	
6	76 to 100	

From Table 2, it is shown that the Braun-Blanquet cover abundance is simply a list of coded values (1–6) that represent ranges of cover abundance. Where the Braun-Blanquet cover abundance is equal to 3 for range 5 to 25%, both the mean and median of that range is 15% and considered adequate to satisfy the ≥15% threshold defined by the Koala SEPP 2021. Figure 1 below plots the Braun-Blanquet classes from Table 2 with cover scores on the x axis and % abundances on the y-axis. The upper and lower score ranges are plotted showing that a cover score of 2.5 or more can satisfy the ≥15% koala habitat threshold.

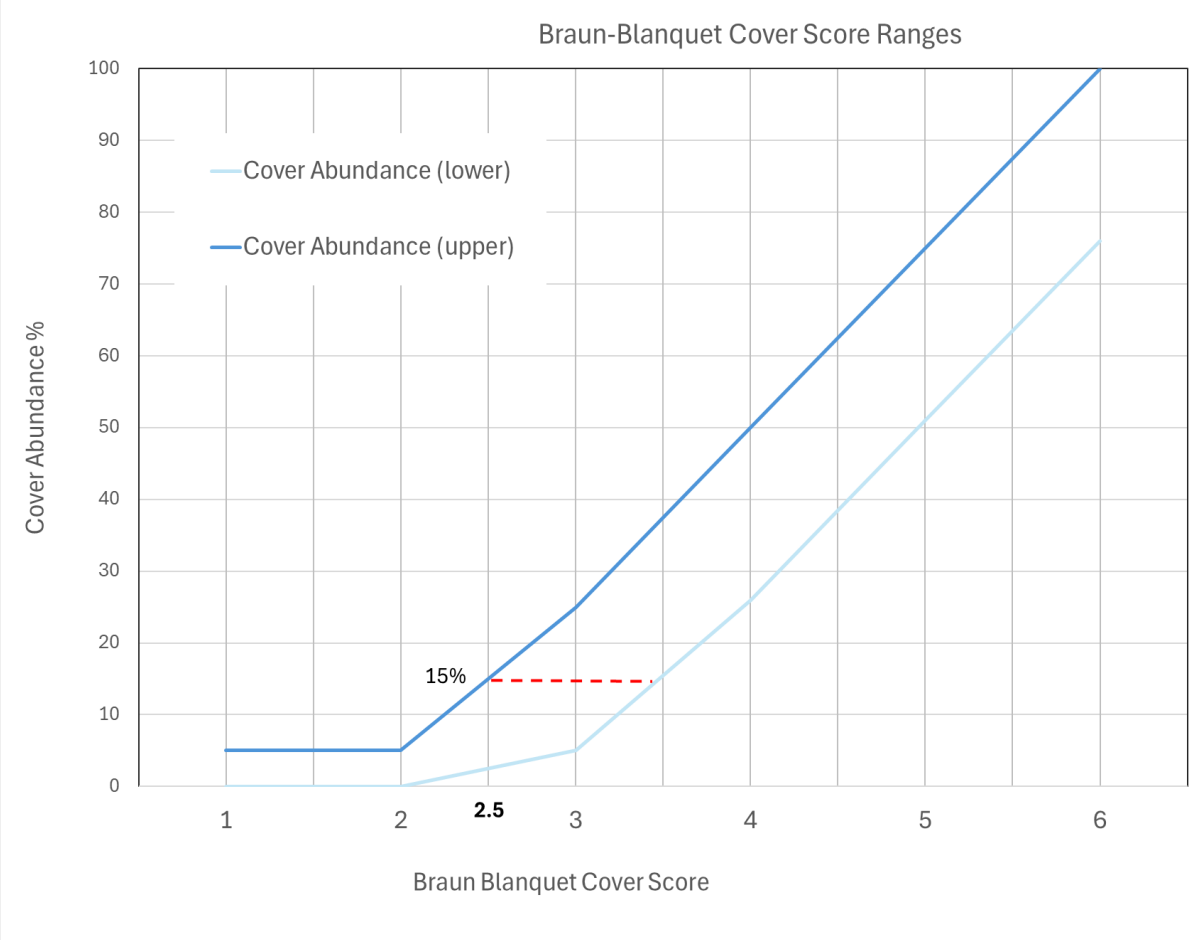

Figure 1 Plot of Braun-Blanquet cover score ranges and percentage abundances. The upper range and lower range of each score is shown in dark blue and light blue respectively. The 15% threshold is highlighted as a red horizontal hatched line that shows scores of 2.5 and above can satisfy the koala habitat threshold.

For each tree species, the median of all cover scores from all contributing plots was used to provide the single cover abundance score for the species in the PCT. Hence, the attribute in the BioNet database is labelled 'Median_cover_score' as mentioned previously.

Frequency

Like cover score, the frequency was a single species metric derived from all floristic plots that define a PCT. Frequency is how often that species occurs in all plots for a PCT. For a hypothetical example, a PCT is defined by 12 primary floristic plots but species *X* only occurs in 3 of those 12 plots, resulting in a 25% frequency score (i.e. 3/12 = 0.25 or 25%).

Equation 1 below uses both cover score and frequency metrics in a PCT to reach a cumulative cover score total per species. This is referred to as a 'Normalised Cover Score'.

$$Normalised\ Cover\ Score\ (S_{PCT}) = \sum_{k=1}^{n} \frac{F_k}{100} \times M_k$$ *Equation 1*

Where ***S*** is the normalised cover score for all Koala food trees listed in a PCT, ***k*** is a Koala SEPP listed Koala food tree, ***n*** is the total number of listed Koala food trees in the PCT, ***F*** is the percentage frequency score for food tree ***k***, and ***M*** is the median cover score for food tree ***k***. Equation 1 initially uses the median cover score ***M*** as if it occurs across all plots in the PCT but when factored by the frequency ***F*** the score becomes distributed proportionally across all plots. A worked example is shown below using actual data from Sutherland habitat mapping.

Sutherland Shire example

Using the primary food tree list for PCT *4059 - Sydney Hinterland Sandy Creekflat Shrub Forest* is detailed below.

Six food trees occur in PCT 4059: *Eucalyptus resinifera, Eucalyptus punctata, Eucalyptus tereticornis, Eucalyptus globoidea, Eucalyptus amplifolia* and *Eucalyptus piperita*.

Eucalyptus resinifera

- Frequency (***F***) = 80
- Median_cover_score (***M***) = 2
- Normalised cover score = $\left(\frac{80}{100}\right) * 2$ = 1.6

Eucalyptus punctata

- Frequency (***F***) = 40
- Median_cover_score (***M***) = 3
- Normalised cover score = $\left(\frac{40}{100}\right) * 3$ = 1.2

Eucalyptus tereticornis

- Frequency (***F***) = 20
- Median_cover_score (***M***) = 2
- Normalised cover score = $\left(\frac{20}{100}\right) * 2$ = 0.4

Eucalyptus globoidea

- Frequency (***F***) = 20
- Median_cover_score (***M***) = 1
- Normalised cover score = $\left(\frac{20}{100}\right) * 1$ = 0.2

Eucalyptus amplifolia

- Frequency (***F***) = 20
- Median_cover_score (***M***) = 1
- Normalised cover score = $\left(\frac{20}{100}\right) * 1$ = 0.2

Eucalyptus piperita

- Frequency (***F***) = 20
- Median_cover_score (***M***) = 1
- Normalised cover score = $\left(\frac{20}{100}\right) * 1$ = 0.2

So,

Normalised Cover Score (**S**) = [1.6 + 1.2 + 0.4 + 0.2 + 0.2 + 0.2] = **3.8**

Therefore PCT 4059 is 'Likely Koala Habitat" because it has an **S** score of 3.8 which is higher than 2.5 and as a result, greater than 15%.

Results

The 61 PCTs in Sutherland Shire were assessed for inclusion as 'Likely koala habitat', 19 PCTs qualified (Table 3, Figure 2).

Table 3 The 19 Plant Community Types that qualified as 'Likely koala habitat' in Sutherland Shire.

PCT ID	PCT Name	Area (ha)
3595	Sydney Coastal Sandstone Gully Forest	5696
3592	Sydney Coastal Enriched Sandstone Forest	1081
3619	Sydney Hinterland Enriched Sandstone Bloodwood Forest	971
3615	Sydney Hinterland Apple-Blackbutt Gully Forest	490
3593	Sydney Coastal Sandstone Bloodwood Shrub Forest	350
3154	Illawarra Blackbutt Moist Forest	302
3259	Sydney Coastal Shale-Sandstone Forest	292
3596	Sydney Coastal Sandstone Riparian Forest	207
3591	Southern Sydney Sheltered Forest	161
3260	Sydney Foreshores Shale Forest	155
3545	Coastal Sands Bloodwood Low Forest	128
3155	Illawarra North-Pittwater Bangalay Moist Forest	98
3176	Sydney Enriched Sandstone Moist Forest	92
3594	Sydney Coastal Sandstone Foreshores Forest	81
3262	Sydney Turpentine Ironbark Forest	42
3616	Sydney Hinterland Grey Gum Transition Forest	39
3321	Cumberland Shale-Sandstone Ironbark Forest	37
3040	Sydney Coastal Foreshores Gully Rainforest	14
4059	Sydney Hinterland Sandy Creekflat Shrub Forest	5

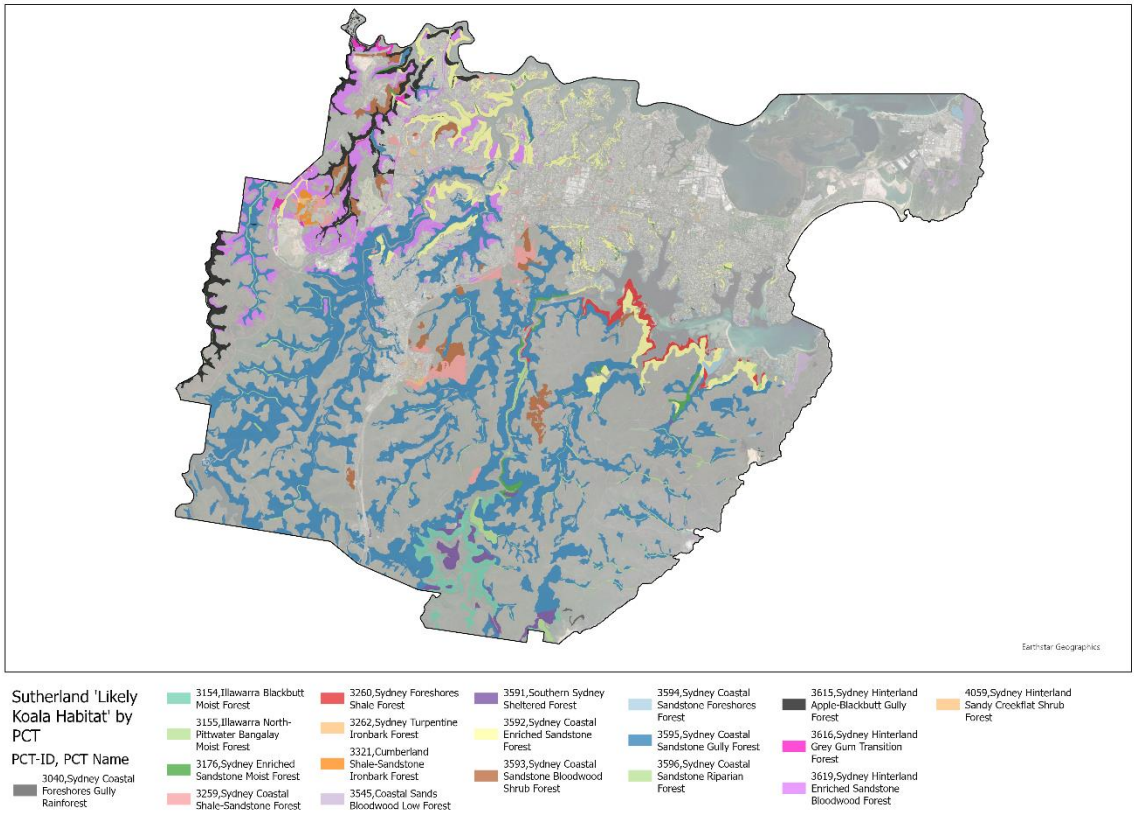

Figure 2 The 19 Plant Community Types that qualified as 'Likely Koala Habitat' in Sutherland Shire (map: Conservation Leaders).

The normalised cover score workings for the primary food trees within each of the 19 PCTs that qualified as 'Likely Koala Habitat' in Sutherland Shire (Table 4). Given the importance of *Eucalyptus punctata* (Grey Gum) it is highlighted yellow in all occurrences.

Table 4 The Plant Community Types that qualified as 'Likely Koala Habitat' in Sutherland Shire; given the importance of Eucalyptus punctata (Grey Gum) it is highlighted yellow in all occurrences .

Plant Community Types (PCTs) qualified as 'likely koala habitat'	Normalised Cover Score
3040 - Sydney Coastal Foreshores Gully Rainforest	
Angophora costata	1.02
Allocasuarina torulosa	0.69
Syncarpia glomulifera	0.42
Eucalyptus piperita	0.36
Eucalyptus paniculata	0.21
Eucalyptus resinifera	0.20
Eucalyptus tereticornis	0.09
Total	**2.99**
3154 - Illawarra Blackbutt Moist Forest	
Syncarpia glomulifera	1.59

Plant Community Types (PCTs) qualified as 'likely koala habitat'	Normalised Cover Score
Eucalyptus paniculata	0.84
Eucalyptus piperita	0.50
Angophora costata	0.42
Allocasuarina torulosa	0.28
Eucalyptus globoidea	0.15
Eucalyptus eugenioides	0.10
Eucalyptus tereticornis	0.03
Total	**3.91**
3155 - Illawarra North-Pittwater Bangalay Moist Forest	
Syncarpia glomulifera	1.98
Allocasuarina torulosa	1.05
Eucalyptus paniculata	0.24
Angophora costata	0.24
Total	**3.51**
3176 - Sydney Enriched Sandstone Moist Forest	
Angophora costata	2.61
Syncarpia glomulifera	2.34
Allocasuarina torulosa	1.62
Eucalyptus piperita	0.78
Eucalyptus resinifera	0.20
Eucalyptus paniculata	0.12
Eucalyptus punctata	0.12
Total	**7.79**
3259 - Sydney Coastal Shale-Sandstone Forest	
Angophora costata	2.40
Eucalyptus capitellata	0.87
Eucalyptus globoidea	0.87
Syncarpia glomulifera	0.72
Eucalyptus resinifera	0.62
Eucalyptus piperita	0.22
Eucalyptus racemosa	0.15
Allocasuarina torulosa	0.09
Eucalyptus fibrosa	0.06
Eucalyptus eugenioides	0.06
Eucalyptus punctata	0.06
Eucalyptus paniculata	0.02
Total	**6.14**
3260 - Sydney Foreshores Shale Forest	
Eucalyptus punctata	2.00
Eucalyptus tereticornis	1.36

Plant Community Types (PCTs) qualified as 'likely koala habitat'	Normalised Cover Score
Angophora costata	1.34
Total	**4.70**
3262 - Sydney Turpentine Ironbark Forest	
Syncarpia glomulifera	2.61
Allocasuarina torulosa	0.90
Angophora costata	0.86
Eucalyptus paniculata	0.84
Eucalyptus punctata	0.76
Eucalyptus globoidea	0.50
Eucalyptus fibrosa	0.30
Eucalyptus resinifera	0.25
Eucalyptus eugenioides	0.16
Eucalyptus tereticornis	0.12
Eucalyptus crebra	0.07
Eucalyptus piperita	0.06
Eucalyptus agglomerata	0.04
Eucalyptus racemosa	0.02
Eucalyptus longifolia	0.02
Total	**7.51**
3321 - Cumberland Shale-Sandstone Ironbark Forest	
Eucalyptus punctata	1.98
Eucalyptus crebra	1.18
Eucalyptus fibrosa	0.96
Eucalyptus globoidea	0.84
Eucalyptus eugenioides	0.75
Eucalyptus tereticornis	0.42
Syncarpia glomulifera	0.34
Allocasuarina torulosa	0.29
Eucalyptus paniculata	0.27
Eucalyptus longifolia	0.18
Eucalyptus resinifera	0.08
Angophora costata	0.05
Eucalyptus piperita	0.03
Eucalyptus amplifolia	0.03
Eucalyptus racemosa	0.02
Eucalyptus agglomerata	0.01
Total	**7.43**
3545 - Coastal Sands Bloodwood Low Forest	
Angophora costata	2.28
Eucalyptus piperita	0.28
Eucalyptus capitellata	0.06

Plant Community Types (PCTs) qualified as 'likely koala habitat'	Normalised Cover Score
Total	**2.62**
3591 - Southern Sydney Sheltered Forest	
Angophora costata	2.64
Eucalyptus piperita	1.95
Syncarpia glomulifera	0.36
Eucalyptus racemosa	0.16
Eucalyptus globoidea	0.12
Allocasuarina torulosa	0.04
Total	**5.27**
3592 - Sydney Coastal Enriched Sandstone Forest	
Angophora costata	2.37
Eucalyptus piperita	1.44
Syncarpia glomulifera	0.78
Allocasuarina torulosa	0.46
Eucalyptus resinifera	0.38
Eucalyptus punctata	0.24
Eucalyptus racemosa	0.18
Eucalyptus eugenioides	0.06
Eucalyptus paniculata	0.06
Eucalyptus capitellata	0.04
Eucalyptus globoidea	0.04
Eucalyptus tereticornis	0.01
Total	**6.06**
3593 - Sydney Coastal Sandstone Bloodwood Shrub Forest	
Angophora costata	0.86
Eucalyptus piperita	0.44
Eucalyptus capitellata	0.42
Eucalyptus punctata	0.34
Eucalyptus racemosa	0.30
Syncarpia glomulifera	0.06
Eucalyptus globoidea	0.06
Eucalyptus resinifera	0.02
Eucalyptus agglomerata	0.01
Total	**2.51**
3594 - Sydney Coastal Sandstone Foreshores Forest	
Angophora costata	2.25
Eucalyptus piperita	0.39
Eucalyptus resinifera	0.24
Eucalyptus punctata	0.12
Eucalyptus tereticornis	0.08

Plant Community Types (PCTs) qualified as 'likely koala habitat'	Normalised Cover Score
Allocasuarina torulosa	0.06
Eucalyptus paniculata	0.04
Syncarpia glomulifera	0.02
Total	**3.20**
3595 - Sydney Coastal Sandstone Gully Forest	
Eucalyptus piperita	2.58
Angophora costata	2.58
Eucalyptus punctata	0.16
Allocasuarina torulosa	0.10
Syncarpia glomulifera	0.08
Eucalyptus resinifera	0.04
Eucalyptus racemosa	0.04
Eucalyptus capitellata	0.03
Eucalyptus globoidea	0.03
Eucalyptus agglomerata	0.02
Total	**5.66**
3596 - Sydney Coastal Sandstone Riparian Forest	
Angophora costata	1.38
Eucalyptus piperita	0.88
Allocasuarina torulosa	0.75
Eucalyptus agglomerata	0.57
Syncarpia glomulifera	0.38
Eucalyptus punctata	0.07
Total	**4.03**
3615 - Sydney Hinterland Apple-Blackbutt Gully Forest	
Angophora costata	2.49
Eucalyptus piperita	1.38
Eucalyptus punctata	0.74
Eucalyptus agglomerata	0.54
Syncarpia glomulifera	0.36
Allocasuarina torulosa	0.32
Eucalyptus resinifera	0.09
Eucalyptus racemosa	0.04
Total	**5.96**
3616 - Sydney Hinterland Grey Gum Transition Forest	
Eucalyptus punctata	2.07
Syncarpia glomulifera	0.58
Angophora costata	0.54
Eucalyptus globoidea	0.54
Eucalyptus eugenioides	0.42

Plant Community Types (PCTs) qualified as 'likely koala habitat'	Normalised Cover Score
Eucalyptus crebra	0.36
Allocasuarina torulosa	0.34
Eucalyptus resinifera	0.28
Eucalyptus fibrosa	0.20
Eucalyptus piperita	0.12
Eucalyptus agglomerata	0.09
Eucalyptus paniculata	0.09
Eucalyptus racemosa	0.08
Total	**5.71**
3619 - Sydney Hinterland Enriched Sandstone Bloodwood Forest	
Eucalyptus punctata	0.88
Eucalyptus globoidea	0.66
Angophora costata	0.64
Syncarpia glomulifera	0.42
Eucalyptus racemosa	0.30
Eucalyptus piperita	0.26
Eucalyptus resinifera	0.10
Allocasuarina torulosa	0.10
Eucalyptus eugenioides	0.10
Eucalyptus agglomerata	0.09
Eucalyptus capitellata	0.04
Eucalyptus crebra	0.04
Eucalyptus fibrosa	0.03
Total	**3.66**
4059 - Sydney Hinterland Sandy Creekflat Shrub Forest	
Eucalyptus resinifera	1.60
Eucalyptus punctata	1.20
Eucalyptus tereticornis	0.40
Eucalyptus globoidea	0.20
Eucalyptus amplifolia	0.20
Eucalyptus piperita	0.20
Total	**3.80**

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Appendix 5: Koala habitat assessment and surveys in Sutherland LGA 2025

Council engaged Conservation Leaders to undertake koala surveys and develop occupancy models using the following methods.

Spatial sampling framework

The study area was partitioned into a systematic grid of 6.25-hectare (250 × 250 m) sampling units to serve as the spatial framework for occupancy modelling. This grid resolution was selected to approximate the core activity area of koalas across a 5-day sampling window, while maintaining high-resolution across the landscape.

Spatial data processing

All geospatial processing was conducted in R version 4.x (R Core Team, 2024) using the *sf* package (Pebesma 2018) for vector operations and the *terra* package (Hijmans 2024) for raster processing. To ensure spatial consistency across all environmental layers, standardised all raster datasets were used to a common coordinate reference system (GDA94 / Australian Albers; EPSG:3577), which preserved area calculations essential for accurate spatial statistics. Rasters were reprojected using bilinear interpolation to minimise distortion of continuous environmental variables. All layers were subsequently cropped to the extent of the sampling grid to reduce computation time and ensure spatial alignment.

Environmental covariates

A suite of environmental covariates hypothesized to influence koala occurrence based on ecological knowledge of habitat requirements, thermoregulatory constraints, and resource availability was compiled (Table 4).

Edaphic variables

Soil characteristics were derived from the Soil and Landscape Grid of Australia (SLGA; Grundy et al. 2015). Available water capacity (AWC) and clay content (CLY) from the 0-5 cm depth interval was extracted, as well as soil organic carbon concentration (SOC). These variables serve as proxies for soil moisture retention and vegetation productivity, which may indirectly influence koala habitat quality through effects on eucalypt foliar chemistry and tree health.

Climatic variables

Bioclimatic variables were incorporated from the WorldClim v2.1 dataset (Fick and Hijmans 2017) at 30 arc-second (~1 km) resolution: maximum temperature of the warmest month

(BIO5) and annual precipitation (BIO12). These variables capture thermal extremes relevant to koala thermoregulation and water availability influencing eucalypt leaf moisture content.

Vegetation structure

Canopy height was characterised using two complementary datasets: (1) a continental-scale forest height product derived from spaceborne lidar (Potapov et al. 2021), and (2) a regional canopy height model. The mean enhanced drought index (EDI) was derived to quantify drought stress across the landscape, which may affect both koala physiological condition and food tree quality.

Habitat composition

Land cover composition within each grid cell was quantified for three vegetation classes: (1) forested areas, (2) heathland, and (3) rainforest. Binary masks were generated for each vegetation type, and the proportion of each grid cell occupied by each class was calculated.

Floristic suitability

Species distribution models for key koala food trees were incorporated as covariates. Habitat suitability for *Eucalyptus punctata* (grey gum) was obtained from an existing ensemble model. Additionally, a tree species index representing the cumulative predicted suitability across 13 known koala food tree species in the region was calculated. For both floristic layers, two metrics were derived: (1) the mean predicted suitability, and (2) the proportion of each grid cell exceeding a suitability threshold of 0.8, representing high-quality foraging habitat.

Spatial covariate extraction

Environmental covariates were extracted for each 6.25-ha grid cell using the *exactextractr* package (Baston 2022), which implements exact polygon-raster intersection to account for partial cell coverage at grid boundaries. This approach provides more accurate zonal statistics than centroid-based extraction or simple overlay methods, particularly for grid cells that do not align perfectly with raster cell boundaries.

For continuous environmental variables (climatic, edaphic, vegetation structure, and floristic suitability layers), the arithmetic mean of all raster cell values within each grid cell was calculated, weighted by the proportion of each raster cell covered by the polygon. For categorical habitat layers represented as binary masks (forested area, heathland, rainforest), the proportion of each grid cell occupied by the habitat class was calculated as the coverage-weighted mean of the binary values, yielding values bounded between 0 and 1.

For floristic suitability layers (*E. punctata* and tree species index), binary high-suitability surfaces were generated by applying a threshold of 0.8 to the continuous predictions, then

extracted the proportion of each grid cell classified as high-suitability habitat using the same coverage-weighted approach.

Data quality assurance

Following extraction, all covariates were assessed for missing values arising from incomplete raster coverage and examined distributional properties to identify potential outliers or data artifacts. Extracted covariates were exported in multiple formats (CSV, RDS, *GeoPackage*, and ESRI Shapefile) to facilitate subsequent occupancy modelling and spatial visualization.

Table 4 Environmental covariates extracted for koala occupancy modelling.

Covariate	Description	Source	Extraction Method
AVP	Available water capacity (0-5 cm)	SLGA	Mean
CLY	Clay content (0-5 cm)	SLGA	Mean
SOC	Soil organic carbon (0-5 cm)	SLGA	Mean
BIO5	Maximum temperature of warmest month	WorldClim v2.1	Mean
BIO12	Annual precipitation	WorldClim v2.1	Mean
Canopy height	Forest canopy height	Potapov et al. (2021)	Mean
EDI	Enhanced Drought Index	—	Mean
E. punctata suitability	Grey Gum habitat suitability	SDM	Mean
E. punctata high suitability	Proportion with suitability >0.8	SDM	Proportion
TSI	Tree Species Index (13 spp.)	SDM ensemble	Mean
TSI high suitability	Proportion with suitability >0.8	SDM ensemble	Proportion
Forest cover	Proportion forested	—	Proportion
Heathland	Proportion heathland	—	Proportion
Rainforest	Proportion rainforest	—	Proportion

Occupancy modelling framework

Koala site occupancy probability was estimated using single-season occupancy models (MacKenzie et al. 2002) implemented in the *unmarked* package (Fiske and Chandler 2011) in R. Occupancy models explicitly account for imperfect detection by jointly estimating the probability of site occupancy (ψ) and the probability of detecting the species given presence (p), thereby avoiding the negative bias inherent in naïve occurrence estimates when detection is incomplete.

Detection data

Koala presence-absence data were collected across three repeat survey occasions using drone-based thermal imaging. Detection histories were compiled for each 6.25-ha grid cell, where each cell was surveyed on up to three occasions, yielding a binary detection matrix indicating whether koalas were detected (1) or not detected (0) at site *i* during survey occasion *j*.

Detection covariates

It was hypothesized that detection probability would vary with survey conditions. Mean wind speed (m s^{-1}) during each drone survey was included as an observation-level covariate on detection probability, as wind can affect thermal signature clarity and animal activity patterns.

Covariate standardisation and collinearity assessment

Prior to model fitting, all continuous site-level covariates were standardized (z-transformed) by subtracting the mean and dividing by the standard deviation to improve numerical stability and facilitate comparison of effect sizes across covariates measured on different scales. Wind speed was similarly standardised across survey occasions.

To address multicollinearity among environmental predictors, pairwise Pearson correlation coefficients were computed for all candidate site covariates. Covariates exhibiting correlations $|r| > 0.7$ were identified, and one member of each highly correlated pair was removed using the *findCorrelation* function in the *caret* package (Kuhn 2008), which iteratively removes the variable with the largest mean absolute correlation. This procedure retained a reduced set of uncorrelated covariates for inclusion in the candidate model set.

Model selection

An information-theoretic approach was employed to model selection using Akaike's Information Criterion corrected for small sample sizes (AICc; Burnham and Anderson 2002). A global model was constructed containing all retained covariates on occupancy and wind speed on detection.

The dredge function was used in the *MuMIn* package (Bartoń 2024) to fit all possible combinations of covariates in the occupancy sub-model while retaining wind speed as a

fixed covariate on detection. Model fitting was parallelised across multiple central processing unit cores using the *pdredge* function to reduce computation time. Detection probability was constrained to include wind in all candidate models based on a priori ecological reasoning.

Models were ranked by AICc, and a confidence set of models was identified with ΔAICc <2 as having substantial empirical support. The best-supported model was selected for prediction and inference.

Best model structure

The best-supported model included five covariates on occupancy probability: mean canopy height, mean soil clay content (0-5 cm depth), mean habitat suitability for *E. punctata*, mean tree species index, and the proportion of each grid cell with tree species index >0.8. A random effect for spatial grouping was included to account for spatial autocorrelation. Detection probability was modelled as a function of wind speed.

Spatial prediction

Occupancy probability was predicted for all grid cells across the study area using the fixed-effect component of the best-supported model. For prediction, covariate values for each grid cell were standardised using the means and standard deviations calculated from the surveyed sites to ensure predictions were made on the same scale as model fitting. Random effects were excluded from predictions (marginal prediction) to provide population-average occupancy estimates across unsurveyed areas.

Predicted occupancy probabilities were rescaled to the interval [0, 1] using min-max normalisation to facilitate interpretation and visualisation.

Spatial masking

To restrict predictions to biologically relevant areas, the occupancy surface to vegetation extent was masked using a regional vegetation layer for Sutherland Shire. Grid cells were spatially intersected with mapped vegetation polygons, and predictions were retained only for areas classified as vegetated habitat. Grid cell geometries were clipped to vegetation boundaries to provide spatially explicit estimates of koala occupancy probability within suitable habitat. Small polygon slivers (<100 m²) arising from geometric intersection were removed.

All spatial outputs were exported in *GeoPackage* format for subsequent visualisation and integration with conservation planning tools.

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Appendix 6: Additional maps

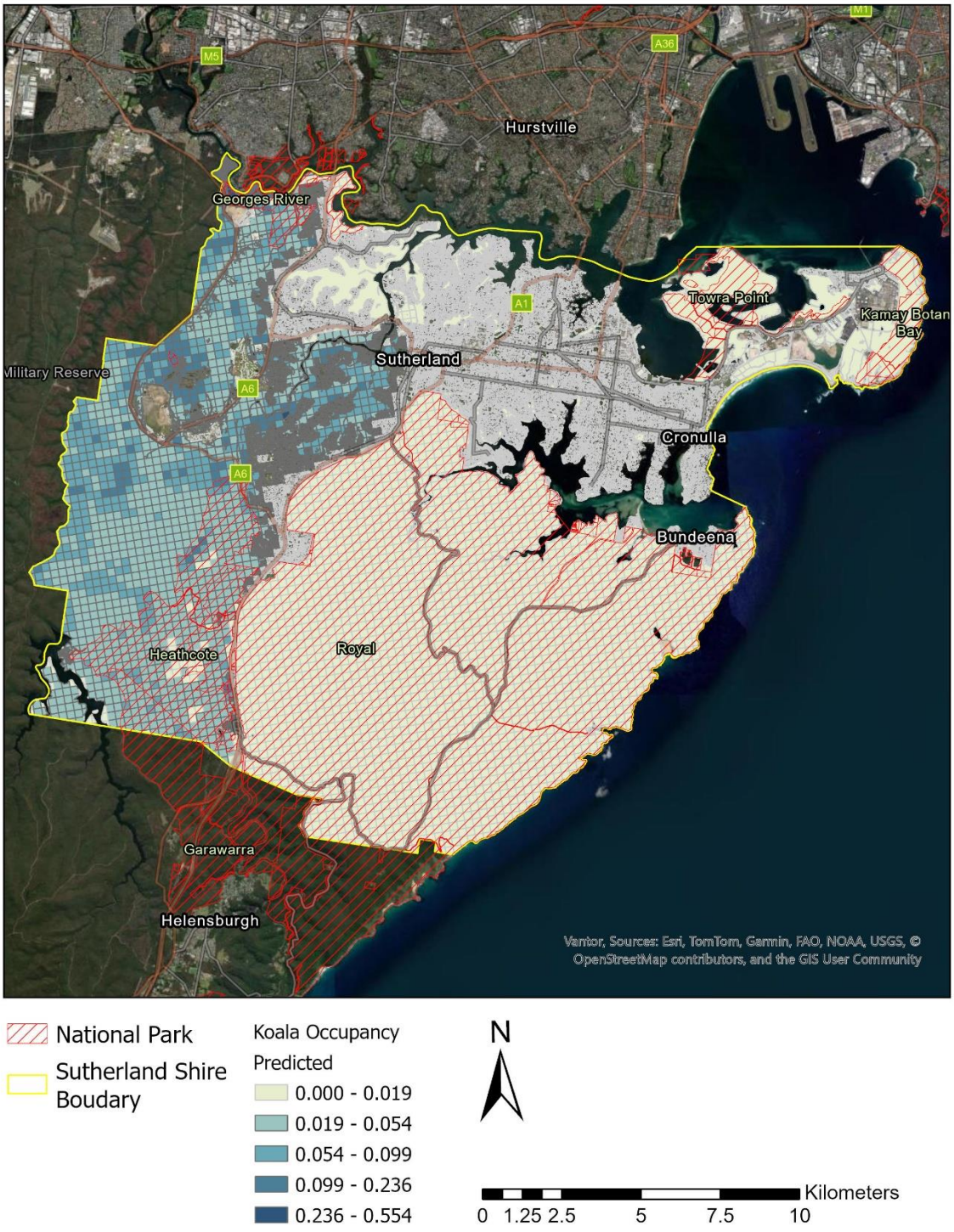

Figure 1 Koala occupancy model (natural breaks (Jenks) scaling) in Sutherland Shire (model by Conservation Leaders; map: Ecosure).

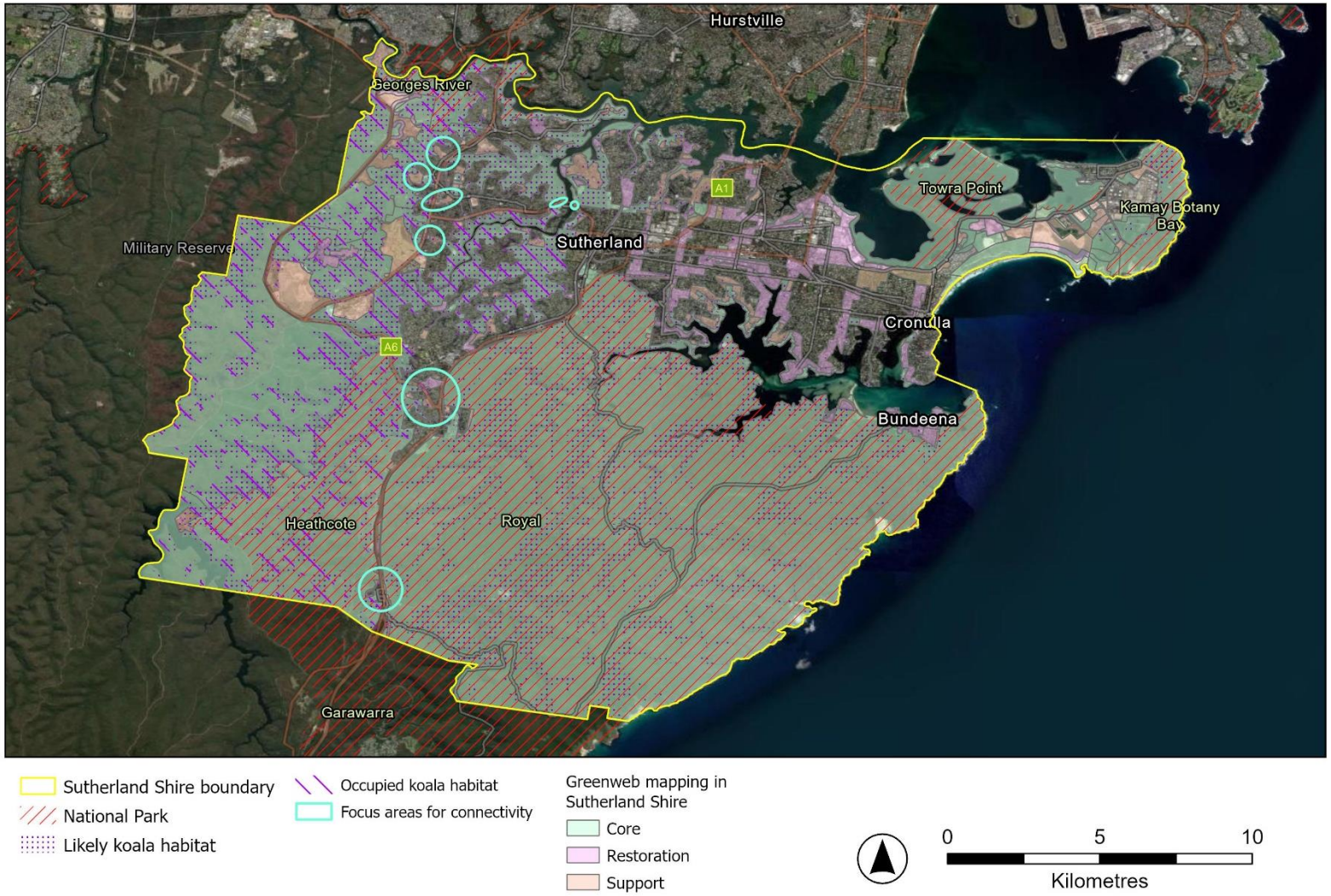

Figure 2 Areas identified for enhancing koala habitat connectivity in Sutherland Shire (occupied and likely habitat was modelled by Conservation Leaders, Greenweb mapping layers provided by Council, map: Ecosure).

Appendix 7: Koala vehicle strike data

BioNet Koala vehicle strike data for Sutherland Shire LGA; data extracted 14 November 2025

Dataset name	Latitude	Longitude	Date	Observation	Count
DPIE Default Sightings	-34.13828	150.99500	10/09/2004	Road kill	1
DPIE Default Sightings	-34.05408	150.97072	04/11/2006	Road kill	1
DPIE Default Sightings	-34.06258	150.99612	18/09/2010	Road kill	1
Wildlife Rehab Database	-33.97619	150.99352	19/09/2012	Road kill	1
Wildlife Rehab Database	-33.97619	150.99352	26/11/2014	Road kill	1
Wildlife Rehab Database	-33.97619	150.99352	12/08/2015	Road kill	1
Wildlife Rehab Database	-33.97619	150.99352	28/04/2016	Road kill	1
Wildlife Rehab Database	-33.97619	150.99352	28/04/2016	Road kill	1
Wildlife Rehab Database	-34.00692	151.00368	26/07/2016	Road kill	1
Wildlife Rehab Database	-33.97619	150.99352	11/09/2016	Road kill	1
Wildlife Rehab Database	-33.97619	150.99352	07/05/2017	Road kill	1
DPIE Default Sightings	-34.11218	150.99249	24/07/2017	Road kill	1
Wildlife Rehab Database	-34.10473	150.97964	20/09/2017	Narrow collision	1
DPIE Default Sightings	-34.07953	151.05860	9/10/2017	Road kill	1
DPIE Data from Scientific Licences dataset	-34.03924	151.00637	12/05/2018	Road kill	1
DPIE Data from Scientific Licences dataset	-34.04549	150.99007	18/05/2018	Road kill	1
Wildlife Rehab Database	-34.03410	151.00408	31/07/2018	Narrow collision	1
DPIE Default Sightings	-34.09874	150.99639	6/08/2018	Road kill	1
Wildlife Rehab Database	-34.01455	150.98378	22/08/2018	Narrow collision	1
DPIE Default Sightings	-34.06185	150.99626	31/08/2018	Road kill	1
DPIE Default Sightings	-33.98133	150.99175	18/09/2018	Road kill	2
DPIE Data from Scientific Licences dataset	-33.99137	150.99587	03/10/2018	Road kill	1
I Spy Koala app	-34.05641	150.98476	06/09/2019	Road kill	1
Wildlife Rehab Database	-34.01217	151.10183	12/01/2020	Narrow collision	1
Wildlife Rehab Database	-33.97618	150.99352	29/09/2020	Narrow collision	1
I Spy Koala app	-33.99343	150.99697	15/11/2020	Road kill	1
I Spy Koala app	-34.14243	150.99450	05/01/2021	Road kill	1

Dataset name	Latitude	Longitude	Date	Observation	Count
I Spy Koala app	-34.14115	150.99440	05/01/2021	Road kill	1
I Spy Koala app	-34.14243	150.99450	05/01/2021	Road kill	1
Wildlife Rehab Database	-34.05528	151.01366	27/06/2021	Narrow collision	1
I Spy Koala app	-33.99893	150.99484	28/06/2021	Road kill	1
I Spy Koala app	-34.08942	151.00551	09/08/2021	Road kill	1
I Spy Koala app	-34.05815	150.99365	18/08/2021	Road kill	1
Wildlife Rehab Database	-34.02680	151.04698	12/09/2021	Narrow collision	1
Wildlife Rehab Database	-34.00383	150.99325	16/09/2021	Narrow collision	1
Wildlife Rehab Database	-34.04119	150.97758	12/10/2021	Narrow collision	1
Wildlife Rehab Database	-34.01694	150.98095	26/09/2022	Narrow collision	1
DPIE Default Sightings	-33.98173	150.99202	11/10/2022	Road kill	1
I Spy Koala app	-34.05844	150.99446	30/12/2022	Road kill	1
DPIE Default Sightings	-34.06116	150.99615	30/12/2022	Road kill	1
I Spy Koala app	-34.05844	150.99446	30/12/2022	Road kill	1
Wildlife Rehab Database	-33.98183	150.99207	14/01/2023	Narrow collision	1
DPIE Default Sightings	-33.98181	150.99200	30/05/2023	Road kill	1
DPIE Default Sightings	-34.06232	150.99636	05/06/2023	Road kill	1
Wildlife Rehab Database	-34.03798	151.00708	20/06/2023	Narrow collision	1
DPIE Default Sightings	-34.06197	150.99613	20/06/2023	Road kill	1
Wildlife Rehab Database	-34.07295	151.00334	24/07/2023	Narrow collision	1
Wildlife Rehab Database	-33.99170	150.99722	04/09/2023	Narrow collision	1
Wildlife Rehab Database	-34.05444	150.97577	30/09/2023	Narrow collision	1
Wildlife Rehab Database	-34.03451	151.02698	23/10/2023	Narrow collision	1
I Spy Koala app	-34.02655	150.96718	14/11/2023	Road kill	1
DPIE Default Sightings	-34.04935	150.97736	24/07/2024	Road kill	1
DPIE Default Sightings	-33.99536	150.99658	24/07/2024	Road kill	2
DPIE Default Sightings	-34.00521	150.99202	12/08/2024	Road Injured	1
DPIE Default Sightings	-33.98278	150.99272	21/09/2024	Road kill	1
DPIE Default Sightings	-34.12083	150.99139	23/09/2024	Road kill	1
DPIE Default Sightings	-34.01083	150.98694	13/11/2024	Road kill	1
DPIE Default Sightings	-34.09636	150.99886	06/12/2024	Road kill	1

Dataset name	Latitude	Longitude	Date	Observation	Count
DPIE Default Sightings	-34.09472	151.00038	06/12/2024	Road kill	1
DPIE Default Sightings	-34.09156	151.00328	09/12/2024	Road kill	1
DPIE Default Sightings	-34.00303	150.99400	15/01/2025	Road kill	1
DPIE Default Sightings	-34.03978	150.95961	21/04/2025	Road kill	1

*Koala deaths from vehicle strikes in the south western Sydney area between 2022-2026; table provided from DCCEEW; data collated from various sources (*suburbs in Sutherland Shire)*

Suburb/Road	2022	2023	2024	2025	2026	Grand Total
Airds	**1**					1
Georges River Rd	1					1
Appin		**3**	**10**	**4**		**17**
Appin Rd		3	10	1		14
King St				2		2
Picton Rd				1		1
Bargo			**1**			**1**
Hume Hwy			1			1
Campbelltown				**2**		**2**
Georges River Rd				2		2
Cataract				**1**		**1**
Picton Rd				1		1
Cordeaux				**1**		**1**
Picton Rd				1		1
Douglas Park					**1**	**1**
Hume Hwy					1	1
***Engadine**				**1**		**1**
Heathcote Rd				1		1
Gilead		**5**	**11**	**3**	**2**	**21**
Appin Rd		5	11	3	2	21
Glenfield		**1**	**2**			**3**
Cambridge Ave		1	1			2
Canterbury Rd			1			1
***Heathcote**			**1**			**1**
Princes Hwy			1			1
Holsworthy	**1**	**1**	**4**	**3**	**1**	**10**
Heathcote Rd	1		4	2	1	8
Moorebank Ave		1				1
Cambridge Ave				1		1
Kentlyn				**4**		**4**
Georges River Rd				2		2
Peter Meadows Rd				1		1
Hansens Rd				1		1
Kurrajong			**1**			**1**
Mill Rd			1			1
Leumeah			**1**	**5**	**1**	**7**
Hansens Rd				4		4
Leumeah Rd			1			1
Wyangala Cres				1		1
Junction Rd					1	1
***Lucas Heights**			**1**	**2**	**2**	**5**
Heathcote Rd				2	1	3
New Illawarra Rd			1		1	2
***Menai**		**1**	**4**	**1**		**6**
Heathcote Rd		1	4	1		6
Minto Heights	**1**	**2**	**3**	**1**		**7**

Suburb/Road	2022	2023	2024	2025	2026	Grand Total
Ben Lomond Rd	1	2	2			5
Hansens Rd			1	1		2
Moorebank				**3**		**3**
Moorebank Ave				2		2
Cambridge Ave				1		1
Pleasure Point			**2**	**1**		**3**
Heathcote Rd			2	1		3
Rosemeadow				**1**		**1**
Appin Rd				1		1
Ruse		**1**				**1**
Junction Rd		1				1
***Sandy Point**			**1**		**1**	**2**
Heathcote Rd			1		1	2
St Helens Park	**1**	**3**	**1**	**1**		**6**
Appin Rd		3				3
Wedderburn Rd			1			1
Woodland Rd				1		1
Rangers Rd	1					1
***Waterfall**			**1**		**1**	**2**
Princes Hwy			1		1	2
Wedderburn			**3**	**7**		**10**
Wedderburn Rd			2	2		4
Victoria Rd				2		2
O'Hares Rd				2		2
Katanna Rd			1			1
Lysaght Rd				1		1
Wilton		**4**	**1**			**5**
Picton Rd		3				3
Almond St			1			1
Hume Hwy		1				1
Wollongong		**1**				**1**
Picton Rd		1				1
Yanderra			**1**			**1**
Old Hume Highway			1			1
Yerrinbool			**1**			**1**
Hume Hwy			1			1
No suburb provided	15	14		2		31
Appin Rd	8	5				13
Heathcote Rd	4	6		2		12
Picton Rd	3	3	1			7
Grand Total	**19**	**36**	**51**	**43**	**9**	**158**

Appendix 8: Summary of community requests and concerns to Sutherland Shire Council relevant to this Plan

The following requests have been incorporated into this Plan where possible.

Request or concern format	Further detail
Community online requests to Council between 2020 to 2023 (Sutherland Shire Council 2025d, 2005d)	Sixteen requests related to installing wildlife signage2F2F[5]. Four requests related to installing a fauna bridge on Heathcote Road. Five requests to reduce speed limits for wildlife safety on Heathcote Road and Eton Street to improve koala safety. Six development or planning enquiries. Seven koala sightings, including deceased or injured koalas. One concern regarding potential koala-dog interactions and irresponsible dog ownership in a public area. Four general koala conservation enquiries. Five requests related to koala policies.
Opportunity to provide input for Koala Strategy	Suggestions related to roads included reduced speeds, improved lighting, fauna crossing infrastructure, koala fencing and better placement of non-static road signs. Concerns were also raised about poorly maintained koala fencing, which can result in animals squeezing through gaps and getting struck by vehicles. Strong suggestion of Indigenous led cool burns in occupied koala habitat, particularly following a backburn conducted in Holsworthy Army Base (koala occupied habitat), which reached the canopy, despite assurances that it would not. Suggested requirements to retain koala food and shelter trees, requirements for all new swimming pools to include egress for koalas, requirements that fencing for residential lots do not impede koala movement and restrictions on keeping domestic dogs.
Community webinar hosted by Sutherland Shire Environment Centre (Sutherland Shire Environmental Centre 2022)	Addressed concerns on koalas and other wildlife being hit by vehicles, and advocated for fauna bridges at Heathcote Road and Royal National Park.
Submission to Transport NSW from the Sutherland Shire Environment Centre and backed by local community groups and conservationists (Sutherland Shire Environment Centre 2021a, 2021b)	Supported by community groups and conservationists. Recommended wildlife underpasses or overpasses specifically designed for koalas, wallabies, and gliders, with guiding features and exclusion fencing to prevent road access.
Sutherland Shire Environmental Centre wildlife corridor campaign (Sutherland Shire Environment Centre 2024)	Advocated for wildlife crossings to support safe koala movement across roads. Proposed modifications to the Deadman's Creek underpass and directional fencing on Compton Road to guide wildlife toward the safe crossing point.

[5]Wildlife signage location requests include roads: Heathcote Road, Thomas Mitchell Drive, St George Crescent and Prince Edward Park Road and suburbs: Engadine and Wooroona Heights.

Appendix 9: Koala food and shelter trees used in the Sutherland Shire

Table 1 Koala feed tree species described in the State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Koala SEPP) Schedule 1, Chapter 3 (NSW Government 2025)

Scientific name	Common name
Eucalyptus tereticornis	forest red gum
Eucalyptus microcorys	tallowwood
Eucalyptus punctata	grey Gum
Eucalyptus viminalis	ribbon or manna gum
Eucalyptus camaldulensis	river red gum
Eucalyptus haemastoma	broad leaved scribbly gum
Eucalyptus signata	scribbly gum
Eucalyptus albens	white box
Eucalyptus populnea	Bimble box or poplar box
Eucalyptus robusta	swamp mahogany

Table 2 Koala use trees described in Koala SEPP Schedule 3, Chapter 4, for the North Coast koala management area (NSW Government 2025)

Scientific name	Common name
Allocasuarina torulosa	forest oak
**Angophora floribunda*	rough-barked apple
**Corymbia gummifera*	red bloodwood
**Corymbia henryi*	large-leaved spotted gum
**Corymbia intermedia*	pink bloodwood
Corymbia maculata	spotted gum
Eucalyptus acmenoides	white mahogany
Eucalyptus amplifolia	cabbage gum
**Eucalyptus bancroftii*	orange gum
Eucalyptus biturbinata	grey gum
Eucalyptus campanulata	new england blackbutt
Eucalyptus canaliculata	large-fruited grey gum
Eucalyptus carnea	thick-leaved mahogany
Eucalyptus crebra	narrow-leaved ironbark
Eucalyptus eugenoides	narrow-leaved stringybark
Eucalyptus fibrosa	broad-leaved red ironbark
Eucalyptus glaucina	slaty red gum
Eucalyptus globoidea	white stringybark
**Eucalyptus grandis*	flooded gum
Eucalyptus laevopinea	silver-top stringybark
Eucalyptus largeana	craven grey box
**Eucalyptus microcorys*	tallowwood
**Eucalyptus moluccana*	grey box
Eucalyptus nobilis	forest ribbon gum
**Eucalyptus pilularis*	blackbutt
Eucalyptus placita	grey ironbark
Eucalyptus planchoniana	bastard tallowwood
**Eucalyptus propinqua*	small-fruited grey gum
Eucalyptus psammitica	bastard white mahogany
**Eucalyptus punctata*	grey gum
Eucalyptus resinifera	red mahogany
**Eucalyptus robusta*	swamp mahogany
Eucalyptus rummeryi	steel box
**Eucalyptus saligna*	Sydney blue gum

Scientific name	Common name
Eucalyptus scias	large-fruited red mahogany
**Eucalyptus seeana*	narrow-leaved red gum
**Eucalyptus siderophloia*	grey ironbark
**Eucalyptus signata/Eucalyptus racemosa*	scribbly gum/narrow-leaved scribbly gum
**Eucalyptus tereticornis*	forest red gum
Eucalyptus tindaliae	stringybark
Eucalyptus umbra	bastard white mahogany
Melaleuca quinquenervia	broad-leaved paperbark

Table 3 Koala food and shelter trees utilised by koalas in Sutherland Shire

Scientific Name	Common Name
Allocasuarina torulosa	forest she-oak
Allocasuarina littoralis	black she-oak
Angophora bakeri	narrow-leaved apple
Angophora costata	smooth-barked apple
Angophora floribunda	rough-barked apple
Eucalyptus agglomerata	blue-leaf stringybark
Eucalyptus amplifolia	cabbage gum
Eucalyptus capitellata	brown stringybark
Eucalyptus crebra	narrow-leaved ironbark
Eucalyptus eugenioides	narrow-leaved stringybark
Eucalyptus globoidea	white stringybark
Eucalyptus longifolia	wollybutt
Eucalyptus oblonga	stringybark
Eucalyptus paniculata	grey ironbark
Eucalyptus piperita	Sydney peppermint
Eucalyptus pilularis	blackbutt
Eucalyptus punctata	grey gum
Eucalyptus racemosa	Narrow-leaved scribbly gum
Eucalyptus resinifera	Red mahogany
Eucalyptus tereticornis	forest red gum
Syncarpia glomulifera	turpentine

Appendix 10: Koala habitat compensation measures

Offsets are measures that compensate for the adverse impacts of development on koala habitat that cannot be avoided or mitigated and are a last resort, consistent with NSW and Commonwealth policies. These provisions are broadly consistent with mechanisms included in adopted Koala Management Plans in the City of Campbelltown, Lismore, and Tweed LGAs and take into consideration the quantity, quality and connectivity value of the habitat being impacted.

The Plan requires the use of 'direct offsets' resulting in measurable conservation gain for koalas and koala habitat. Offsetting is therefore limited to the creation of new koala habitat at a suitable location on the impact site (where ongoing threats have been mitigated) or offsite areas in accordance with the priority areas identified by this Plan.

Aim

To provide for ecologically sustainable development, to protect and enhance areas of existing koala habitat, particularly those currently or previously used by koalas, and to create koala habitat where there is a sound ecological reason to do so.

Guiding principles (taken from the Comprehensive KPoM for the Ashby, Woombah and Iluka localities in the Clarence Valley LGA 2015)

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

Types of offset

Offsets will apply to ‘minor developments’, defined as any development application that relates to the construction of a single residential dwelling, and/or subdivision of land into no more than two lots, and/or requires the removal of no more than two koala use trees. ‘Major development’ is defined as a development application that relate to the subdivision of land into three or more lots, and/or requires the removal of three or more koala use trees.

For minor development the proponent will be required to compensate for the loss of each koala feed or shelter tree at the following ratio of replacement trees:

- Small trees impacted (DBH less than or equal to 100 mm) 1:10 ratio.
- Medium tree impacted (DBH >100 mm to less than 300 mm) 1:15 ratio.
- Large tree impacted (DBH > 300 mm) 1:20 ratio.

For major development, the proponent will be required to enter into a legally binding agreement with Council to make a monetary contribution towards the koala habitat rehabilitation program described in this Plan and provide a Compensation Guarantee in the form of a Bond that will be released once the required works have been implemented in accordance with the agreement.

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