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CUMBERLAND PLAIN ASSESSMENT REPORT

ADDENDUM REPORT – CHANGES TO MATTERS LISTED UNDER THE EPBC ACT

PREPARED FOR THE NSW GOVERNMENT DEPARTMENT OF PLANNING AND ENVIRONMENT

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Addendum Report Contents

1 Introduction

1.1 CONTEXT

1.1.1 OVERVIEW OF THE PLAN AND ASSESSMENT REPORT

The NSW Department of Planning and Environment (the Department) has prepared the Cumberland Plain Conservation Plan (the Plan) (2021) as part of the environmental approvals for development in four urban growth areas ('nominated areas') and a series of major transport corridors to support the future growth of Western Sydney until 2056.

The Plan describes the proposed urban and other development and sets out a conservation program comprising a range of specific commitments to avoid, mitigate and offset the impacts of the development on biodiversity values.

The Cumberland Plain Assessment Report (Assessment Report) (2021) evaluates the Plan's acceptability under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and NSW *Biodiversity Conservation Act 2016* (BC Act). The Assessment Report comprises both:

- A Biodiversity Certification Assessment Report (BCAR) under the BC Act
- A Strategic Assessment Report (SAR) under the Commonwealth EPBC Act

The Department is seeking the following approvals for the Plan:

- Conferral of biodiversity certification under Part 8 of the BC Act
- Endorsement under Part 10 of the Commonwealth EPBC Act

The Plan was submitted to the Environment and Heritage Group (EHG) of the NSW Department of Planning and Environment, and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), for consideration in late 2021. This followed public exhibition of these documents in August to November 2020.

1.1.2 CHANGES WHICH HAVE OCCURRED SINCE SUBMISSION TO REGULATORS IN 2021

Since the Plan was submitted, several changes have occurred that are relevant to the Plan, including changes to the Plan to address feedback from regulators and changes associated with species listings under the EPBC Act.

The main changes include:

- Removing the proposed OSO Stage 2 transport corridor located within the Greater Macarthur Growth Area (GMAC) from the maps shown in the Plan and changing the land categories of the affected land
- Changes to matters listed under the EPBC Act, including:
    - Changes to the conservation status of Koala, which has been uplisted to Endangered, and which has had a new Conservation Advice and Recovery Plan endorsed
    - Endorsement of new Conservation Advices for the Large-eared Pied Bat and Deane's Melaleuca
    - New listings of four species which are relevant to the Plan and need to be assessed (Sydney Hawk Dragonfly, Gang-gang Cockatoo, Yellow-bellied Glider, and Pilotbird)
    - A newly listed key threatening process (KTP) relevant to the Plan, which is called 'fire regimes that cause declines in biodiversity'
- Small changes to the Plan, including:
    - Updating the outcome in the Plan for Koala
    - A small change to Commitment 7, Action 8 in relation to the Koala underpass under Appin Road to improve implementation and environmental outcomes
    - Minor updates to clarify the offset liability and reconciliation accounting approaches
    - Several minor updates to text in the Plan

1.1.3 HOW THESE CHANGES HAVE BEEN ASSESSED

The changes that have occurred since submission of the Plan and Assessment Report to regulators for consideration are addressed in two addendums to the Assessment Report.

- Addendum 1 – 'Outer Sydney Orbital' addresses changes relating to the OSO Stage 2 transport corridor
- Addendum 2 – 'Changes to matters listed under the EPBC Act' (this report) addresses:
  - The changes to the matters listed under the EPBC Act
  - The changes to the Plan which relate to Koala, specifically the changes to the Koala outcome and changes to Commitment 7, Action 8

The other changes to the Plan are not material and do not affect the conservation outcomes of the Plan or the analysis or conclusions in the Assessment Report and are therefore not addressed further in the addendums.

Note that statistics in this report are based on the development footprint in the 2021 version of the Plan and Assessment Report. The minor changes to the footprint due to the changes to land categories associated with removing the proposed OSO Stage 2 transport corridor in GMAC and changing the land categories of the affected land are addressed in Addendum 1, including for the newly listed species covered under this Addendum.

1.2 PURPOSE OF THIS REPORT

This report comprises Addendum 2, and assesses each of the following with regards to the adequacy of the assessment completed in the Assessment Report and the overall acceptability of the Plan:

- Changes affecting Koala (including new threat status, and new Conservation Advice and Recovery Plan), including an assessment of changes made in the Plan which relate to Koala
- The new Conservation Advices for the Large-eared Pied Bat and Deane's Melaleuca
- The four newly listed species under the EPBC Act (Sydney Hawk Dragonfly, Gang-gang Cockatoo, Yellow-bellied Glider, and Pilotbird)
- The newly listed KTP (fire regimes that cause declines in biodiversity)

1.3 SUMMARY OF KEY FINDINGS

This assessment has found:

- With regards to Koala:
  - The increased offset target for Koalas under Commitment 9 in the Plan resulting from the change in listing status will ensure the Plan's outcome for the species remains acceptable
  - The Plan and Assessment Report adequately considers the requirements of the species' new Conservation Advice, and is not inconsistent with the species' new Recovery Plan
  - The minor updates to the wording of Plan's outcome for the species, and to Commitment 7 Action 8, will not result in changes to the overall outcome for Koalas under the Plan
- The Assessment Report provides an appropriate impact assessment for the Large-eared Pied Bat and Deane's Melaleuca
- The Plan provides an appropriate outcome for the four newly listed species (Sydney Hawk Dragonfly, Gang-gang Cockatoo, Yellow-bellied Glider, and Pilotbird)
- The Assessment Report adequately considers the new KTP (fire regimes that cause declines in biodiversity) through consideration of altered fire regimes as an indirect impact, and the Plan suitably manages the risk posed by altered fire regimes

2 Assessment of changes to Koala

2.1 INTRODUCTION

The Koala recently had its threatened species listing status under the EPBC Act upgraded from Vulnerable to Endangered. This chapter considers the implications of this change, and is structured in two parts:

- Part One considers the implications of the change in listing status of Koala. This assessment:
  - Demonstrates that the increased offset target for Koalas under Commitment 9 in the Plan resulting from the change in listing status, in addition to the range of existing Koala conservation measures within the Plan, ensures that the overall impacts to the species under the Plan remain acceptable in light of its new listing
- Part Two demonstrates that the Plan and Assessment Report:
  - Adequately considers the requirements of the new Conservation Advice (DAWE, 2022a)
  - Is not inconsistent with the new Recovery Plan (DAWE, 2022c)

2.2 PART ONE: IMPLICATIONS OF THE CHANGE IN LISTING STATUS

It is considered that the Plan and Assessment Report are adequate to address impacts to Koala and that impacts remain acceptable in the context of the change in listing status of the species, for the following main reasons:

- The Plan recognises the importance of the Southern Sydney Koala population. The commitments in the Plan are designed to ensure this population 'persists and thrives' into the future. This outcome represents the highest level of conservation objective for a species and remains appropriate for the new listing status of the species
- The commitments in the Plan are consistent with the recommendations of the Office of the NSW Chief Scientist & Engineer. These recommendations consider the increasingly imperilled status of the Koala in NSW within recent years and outline what is required to ensure the long-term persistence of the Southern Sydney Koala population
- Important Koala habitat was made a key priority for avoidance throughout the development of the Plan and was a primary driver for determining the final development footprint reflected in the Plan
- The important habitat offset target for Koala as part of Commitment 9 of the Plan will increase from 570 ha to 705 ha to reflect the species' new listing
- Additional commitments in the Plan (Commitment 10, Commitment 12, Commitment 13) will result in the protection of substantial areas of important Koala habitat to offset the impacts of the Plan on Koala, well beyond the amount determined to be an appropriate offset target for the species
- A wide range of additional mitigation measures have been included within the Plan's conservation program that have been designed to protect the Southern Sydney population and ensure it persists and thrives in the long-term

Each of these points is explained further below.

2.2.1 RECOGNITION OF THE IMPORTANCE OF THE SOUTHERN SYDNEY KOALA POPULATION

CURRENT KOALA OUTCOME UNDER THE PLAN

The Plan recognises the significance and importance of the Southern Sydney Koala population and includes a specific outcome for this population that reflects this recognition. The Plan's Koala outcome is as follows:

> *Condition of protected Koala habitat is improved, connectivity between Koala sub-populations is maintained, threats to Koalas are managed and the Koala population in South Western Sydney persists and thrives*

Note that protected Koala habitat includes substantial areas of important Koala habitat which will be protected under the Plan, in addition to cleared areas which have been identified as priority locations for rehabilitation to increase Koala habitat availability.

This outcome – ensuring the populations 'persists and thrives' into the future – represents the highest level of conservation objective for a species and remains appropriate for the new listing status of the species. The outcome is a key deliverable against which the success of the Plan will be evaluated over time. It is noted that no other threatened

species has a species-specific outcome under the Plan. This underlines the importance with which the Plan considers Koalas.

The outcome has been developed with consideration of the advice of the Office of the NSW Chief Scientist & Engineer (Office of the NSW Chief Scientist & Engineer, 2020, 2021a, 2021b), and has been a key consideration in the development of avoidance, mitigation and offsetting of impacts to Koalas under the Plan.

Delivery of this outcome will ensure long-term protection of the Southern Sydney Koala population.

ANALYSIS OF CHANGE TO KOALA OUTCOME WHICH HAS OCCURRED SINCE 2021

The original Koala outcome under the Plan which was included in documents submitted for approval in 2021 was:

> *Condition of important Koala habitat is improved, connectivity between Koala sub-populations is maintained, threats to Koalas are managed and the Koala population in South Western Sydney persists and thrives*

The change in the outcome is associated with the identification of which Koala habitat is targeted for improvement. The initial outcome identified 'important Koala habitat', whereas the new outcome refers to 'protected Koala habitat'.

It is more appropriate for the Koala outcome to measure the condition of protected Koala habitat, rather than important Koala habitat, because:

- There are large areas of mapped important Koala habitat which are outside the scope of the Plan (including habitat mapped to occur outside of the Strategic Assessment Area). By referring only to important Koala habitat without further detail, there is a lack of clarity over which areas of important Koala habitat would be used as a baseline to measure success or failure of the outcome under the Plan
- Protected Koala habitat encompasses areas which do not currently support Koala habitat, yet which are identified as priority restoration sites to increase available Koala habitat. The change in wording to 'protected Koala habitat' allows for evaluation of improvements in habitat condition at restoration sites, rather than limiting the evaluation of the success of the Koala outcome to habitat condition only at sites with existing important habitat present

2.2.2 CONSISTENCY WITH THE RECOMMENDATIONS OF THE OFFICE OF THE NSW CHIEF SCIENTIST & ENGINEER

In 2019-2021, the NSW Government lodged a series of requests to the Office of the NSW Chief Scientist & Engineer (Chief Scientist), to (Office of the NSW Chief Scientist & Engineer, 2020, 2021a, 2021b):

- Assess the adequacy of proposed developments within southern Sydney with regards to their potential impacts to Koalas
- Identify specific conservation measures which should be required of current proposed developments to protect Koalas
- Identify overarching principles for Koala protection

The commitments in the Plan are consistent with the recommendations of the Office of the NSW Chief Scientist & Engineer.

It is important to note that the advice received from the Chief Scientist with regards to the Plan was prepared after the 2019/20 bushfire season and drew on the best available information and expertise of a range of leading Koala experts. While the Chief Scientist's advice did not explicitly consider the Koala's listing status under the EPBC Act to inform their assessment, it is noted that their assessments (Office of the NSW Chief Scientist & Engineer, 2020, 2021a, 2021b):

- Actively consider the impacts of the 2019/20 bushfire season upon threatened Koala populations, and identify the relative increase in the importance of populations not impacted by fire for conservation purposes
- Consider that substantial declines had occurred since 2012 across multiple Koala populations within the years pre-dating the fires, particularly in the western edges of the species' range in NSW

The active consideration of the increasingly imperilled status of the Koala within NSW within recent years indicates that the Chief Scientist's assessment included an appropriate contemporary consideration of the species' ongoing decline, which has been reflected in the recent change in listing status from vulnerable to endangered.

2.2.3 PRIORITISING AVOIDANCE OF IMPACTS TO KOALAS

The purpose of avoidance of Koala habitat under the Plan is to ensure that the Koala outcome is met - i.e. that the Southern Sydney Koala population 'persists and thrives' into the future. Achieving this outcome depends upon there being sufficient areas of high quality, usable habitat for the species to ensure its long-term persistence.

Important Koala habitat was made a key priority for avoidance throughout the development of the Plan and was a primary driver for determining the final development footprint reflected in the Plan.

Koala habitat was specifically made Priority 1 for avoidance alongside habitat for critically endangered species and Serious and Irreversible Impact entities in the avoidance criteria that was applied during the planning process to determine the final development footprint (refer to Chapter 14 of the Assessment Report for further detail).

Avoidance decisions were also consistent with the recommendations of the Office of the NSW Chief Scientist & Engineer. The Department updated the development footprint following public consultation to achieve additional avoidance within GMAC and Wilton to meet the Chief Scientist's recommendations for average corridor widths in these areas (Office of the NSW Chief Scientist & Engineer, 2020, 2021a, 2021b). This included:

- Additional avoidance of existing Koala habitat
- Additional avoidance of currently cleared areas adjacent to Koala habitat, which will be revegetated under the Plan to support corridor habitat and increase Koala habitat availability in these localities

Furthermore, a decision was made by the Department of Planning, Industry and Environment (the Department) not to allow intensification of development to the east of Appin Road (which was at one point proposed early in the process). This decision was made specifically to protect Koalas and facilitate the implementation of the Georges River Koala Reserve

Through application of the iterative approach to avoidance of impacts to Koalas, the following outcomes were achieved:

- A total of 2,908 ha of important Koala habitat was avoided within the nominated areas:
    - This represents 92 per cent of important habitat for Koalas within the nominated areas (not including excluded areas)
    - 2,222 ha of this was avoided for biodiversity purposes
- A total of 624.7 ha of cleared land was avoided for potential Koala habitat restoration areas:
    - Restoration of Koala habitat to augment existing corridors is a key mechanism by which the Plan will meet the species' outcome of protecting Koala habitat and connectivity
    - Note that the area of cleared land avoided for potential Koala habitat restoration increased by 154.1 ha during the development of the Plan, to meet corridor width requirements specified by the Chief Scientist (Office of the NSW Chief Scientist & Engineer, 2020, 2021a, 2021b)
- The total impacts to important Koala habitat reduced by 35.9 ha over the course of the development of the Plan due to the ongoing avoidance process

Avoidance of impacts to Koala habitat under the Plan is substantial and is sufficient to ensure that the Koala outcome under the Plan is achieved and therefore also adequately addresses the change in listing status of the species.

2.2.4 SUBSTANTIAL OFFSETS FOR KOALA BEYOND THE OFFSET TARGET

Through the iterative development of the Plan, impacts to Koala habitat reduced as avoidance of Koala habitat was prioritised. The final area of impact to Koala habitat under the Plan is 242.1 ha of important Koala habitat.

An offset target for Koalas was deemed necessary, as the species was identified to be at high risk of residual adverse impacts under the Plan (based on the species' assessment outlined in Chapter 30 of the Assessment Report).

The offset target was determined by a method developed by the Department that was based on the amount (ha) of important Koala habitat impacted multiplied by a ratio that was informed by the following principles:

- Impacts to higher listing status matters require more offsets that lower listing status matters (see column 1, Table 2-1)
- Impacts to higher condition habitat require more offsets than lower condition habitat (see columns 2 to 4, Table 2-1)

Table 2-1: Threatened species offset target method

	Offset target ratio		
	Condition of Koala habitat		
Conservation significance	DNG*/ Scattered	Thinned	Intact
Vulnerable	2	2.5	3
Endangered	2.5	3	4
Critically Endangered	3	4	5

*Derived native grasslands

The offset target approach is described in more detail in Section 8.4.3 of the Assessment Report.

The original offset target in the Plan, which is based on the status of the Koala as Vulnerable, was 570 ha.

Re-application of the offset method to Koala to reflect the new listing status of Endangered has increased the offset ratio by 0.5 for the impacted important Koala habitat in DNG/Scattered and Thinned conditions, and by 1.0 for the impacted important Koala habitat in Intact condition (see Table 2-1). This has resulted in an increased offset target of 705 ha.

Accordingly, the Commitment 9 of the Plan has been updated, such that the important habitat offset target for Koalas will increase from 570 ha to 705 ha.

It is noted that the Plan includes several additional commitments to protect important Koala habitat, including:

- Establishment of the Georges River Koala Reserve (Commitment 10)
- A commitment to protect Koala corridors in the Cumberland subregion (Commitment 12)
- A commitment to deliver ecological restoration activities (Commitment 13), which includes an action (Action 4) to restore Koala habitat in a number of priority locations

Commitments in the Plan will result in the protection of substantial areas of important Koala habitat to offset impacts on Koala that are well beyond the amount determined to be an appropriate offset target for the species. In particular:

- The Georges River Koala Reserve (Commitment 10) includes approximately 1,548 ha of existing important Koala habitat (noting that the exact boundaries of this reserve are still in draft form and yet to be finalised). This commitment also includes an action to restore up to an additional 80 ha of cleared land in priority areas including the Georges River Koala Reserve to strengthen the north-south Koala movement corridor
- The Strategic Conservation Area (SCA) under the Plan contains a total of 7,634.8 ha of important Koala habitat (of which approximately 1,548 ha located within the proposed Georges River Koala Reserve, with the remaining 6,086 ha outside of the Georges River Koala Reserve). It is likely that a substantial proportion of this will be secured as offset sites to meet specific commitments and offset targets for the Koala, in addition to offsets secured to meet commitments for threatened ecological communities and other threatened species that share habitat with Koalas

The reasons that the Plan's commitments to protect Koala habitat exceed the amount determined to be an appropriate offset target for the species include because the Plan:

- Recognises the importance of Southern Sydney Koala population in the context of the broader conservation of the species
- Includes commitments that were developed consistent with the recommendations of the Office of the NSW Chief Scientist & Engineer (Office of the NSW Chief Scientist & Engineer, 2020, 2021a, 2021b), which outline what is required to ensure long-term persistence of the Southern Sydney Koala population

2.2.5 ADDITIONAL MITIGATION MEASURES UNDER THE PLAN TO PROTECT KOALAS

A wide range of mitigation measures have been included within the Plan's conservation program to ensure the long-term protection of the Southern Sydney Koala population. These measures were designed to ensure that the Koala outcome can be met, and have taken into account expert advice from the Office of the NSW Chief Scientist & Engineer (Office of the NSW Chief Scientist & Engineer, 2020, 2021a, 2021b). Examples of mitigation measures in the Plan to

protect Koalas from indirect impacts are listed below (refer to Section 30.5 of the Assessment Report for further information):

- Installing exclusion fencing to separate Koalas from busy roads and urban development, and connectivity structures to maintain landscape connectivity
- Implementing a wide range of development controls to protect Koalas from urban threats
- Implementing measures to support community awareness, research priorities and welfare programs for Koalas
- Implementing a monitoring and adaptive management process to ensure that the Southern Sydney Koala population continues to thrive

These measures are considered sufficient to ensure that the Koala outcome under the Plan is achieved and therefore also adequately addresses the change in listing status of the species.

ASSESSMENT OF THE IMPLICATIONS OF THE CHANGE IN WORDING OF COMMITMENT 7, ACTION 8 OF THE PLAN

It is recognised that the wording of Commitment 7, Action 8a under the Plan has changed. The original wording of the action was:

8. *Provide safe fauna crossings, based on current best practice design, across Appin Road and other linear infrastructure by:*
    a) *Installing a koala underpass ~~culvert~~ under Appin Road, near the intersection with Brian Road to support east-west koala movement from the Georges River to the Nepean River*

This wording has been changed to remove the word 'culvert' (as indicated by the strikethrough in the text above). The wording change has been undertaken to enable greater flexibility in the type of underpass which may be installed.

It is noted that Transport for NSW (TfNSW) has proposed the installation of a pipe instead of a box culvert for the Koala underpass along Appin Road. This is because TfNSW has determined that a pipe structure would be a more practical and effective structure to install at the underpass location, and addressed space constrains that a box culvert structure would otherwise face along Appin Road. Further, the use of a pipe instead of a culvert would minimise native vegetation clearing, and the proposed pipe design has previously been demonstrated to be used by Koalas. It is considered therefore that this slight change to the commitment will not affect the outcome for Koalas under the Plan.

2.3 PART TWO: CONSISTENCY OF THE PLAN WITH THE NEW CONSERVATION ADVICE AND RECOVERY PLAN

The Assessment Report recognises the FPAL status of the Koala at the time of preparation, and considers the information and requirements of the draft versions of the Conservation Advice (DAWE, 2021c) and Recovery Plan (DAWE, 2021d).

The newly available Conservation Advice (DAWE, 2022a) and Recovery Plan (DAWE, 2022c) have been reviewed and compared to the draft versions that were considered in the Assessment Report. Key components of each of the new documents in relation to the assessment are briefly discussed below.

Overall, it is considered that the outcomes of the Plan:

- Are not inconsistent with the new Recovery Plan (DAWE, 2022c)
- Have regard for the new Conservation Advice (DAWE, 2022a)

2.3.1 HOW THE ASSESSMENT REPORT CONSIDERS THE REQUIREMENTS OF THE NEW CONSERVATION ADVICE AND RECOVERY PLAN

KOALA ECOLOGICAL INFORMATION

While the new Conservation Advice (DAWE, 2022a) and Recovery Plan (DAWE, 2022c) provide generalised information on the ecology of Koalas, both documents recognise that the ecology and requirements of Koala populations varies across the species' range, and that consideration of local information is essential when planning conservation actions for a specific Koala population.

The Plan and Assessment Report were both prepared based on detailed consideration of specific information pertaining to the local Koala population. Information considered includes:

- Advice published by the Office of the NSW Chief Scientist & Engineer, which provided expert assessment and recommendations specifically for the Southern Sydney Koala population (Office of the NSW Chief Scientist & Engineer, 2020, 2021a).
- *Conserving Koalas in the Wollondilly and Campbelltown Local Government Areas* (DPIE, 2019), which set out principles for the long term protection of the population and informed the approach used to map important habitat
- A wide range of scientific literature to understand the specific characteristics and requirements of the local Koala population

HABITAT CRITICAL TO THE SURVIVAL OF THE SPECIES

Both the new Conservation Advice (DAWE, 2022a) and Recovery Plan (DAWE, 2022c) identify the following key factors for determining whether habitat constitutes habitat critical to the survival of the species (HCTTS):

a) whether the habitat is used during periods of stress (examples: flood, drought or fire)
b) whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, social behaviour. dispersal)
c) the extent to which the habitat is used by important populations
d) whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development
e) whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements
f) whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation
g) any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community

The two documents provide slightly difference guidance with regards to the appropriate method to map HCTTS. These are outlined below.

Conservation Advice

The new Conservation Advice (DAWE, 2022a) refers to the mapping methodology outlined in the *EPBC Act referral guidelines for the vulnerable Koala* (DoE, 2014) as recommended guidance material for mapping HCTTS for the species. The Assessment Report maps HCTTS based on this methodology and is therefore consistent with the definition of HCTTS included in the new Conservation Advice.

Recovery Plan

The new Recovery Plan (DAWE, 2022c) notes that, to identify HCTTS, it is important to:

- Examine up to date literature
- Consider local sources of information (especially with regards to preferred food and resting trees)
- Collect complementary data as close as practicable to the site
- Refer to supporting documents that are available on the species' SPRAT profile, which may include referral or significant impact guidelines

It is noted that the new Recovery Plan does not refer to the *EPBC Act referral guidelines for the vulnerable Koala* (DoE, 2014) for guidance to mapping HCTTS, as these guidelines are no longer considered to be current.

Instead, a new publication titled *A review of Koala habitat assessment criteria and methods* (Youngentob, Marsh et al., 2021) is now available on the species' SPRAT profile, and provides guidance for identifying Koala habitat. The document provides region-specific guidance to be used as a starting point for field ecologists to determine whether specific local areas may constitute Koala habitat.

The Plan employs a range of methods to map local Koala habitat within the Strategic Assessment Area, including:

- A species distribution model
- Corridor mapping in a way that is consistent with EES work in the area (DPIE, 2019)

These mapping methods consider up to date literature and local information sources relevant to the local Koala populations.

The species distribution model (Attachment F of the Assessment Report) was used to identify the broad localities within the Strategic Assessment Area where the species is most likely to occur. This mapping provides useful context about the occurrence of the species within the Strategic Assessment Area.

More detailed analysis of species' habitat was based on corridor mapping adapted from EES mapping within the region (DPIE, 2019). This is a key mapping method used within the report to identify important Koala habitat, and considers:

- Preferred habitat features (such as tree species, soil types) used by the local Koala population
- The dispersal capabilities and connectivity requirements of the local Koala population which assists in identifying the more important, better-connected areas of habitat for the species

The habitat mapping approaches used to understand Koala occurrence within the Strategic Assessment Area are consistent with the mapping requirements outlined in the new Recovery Plan, as the mapping approaches consider up to date literature, local sources of information (especially with regards to preferred food and resting trees) and draw on detailed local data available for the subject site.

DEFINITIONS OF IMPORTANT POPULATIONS

The Assessment Report considers the Southern Sydney Koala population to be an important population, as it is a disease-free and expanding population. This definition is consistent with:

- New requirements for identifying important populations based on species listing upgrade
- New Conservation Advice
- New Recovery Plan

These are discussed further below.

How the Koala's new listing as an Endangered species affects consideration of important populations

The *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DoE, 2013) is a key guideline under the EPBC Act which provides guidance as to whether or not an action is likely to have a significant impact upon a Matter of National Environmental Significance (MNES). These guidelines provide different thresholds for significance for Vulnerable and Endangered species. For Vulnerable species, the assessment criteria largely focus on important populations (which are defined as populations which are considered necessary for a species' long-term survival and recovery). However, for Endangered species, all populations of the species are considered by default to be important populations.

The Koala's new listing as Endangered requires that all populations of the species be considered important for assessment purposes under the EPBC Act. This is consistent with the Plan, which considers all Koala populations within the Strategic Assessment Area to be important.

Conservation Advice

The new Conservation Advice (DAWE, 2022a) recognises that populations with the following characteristics are important populations:

- Populations that have the potential to act as source populations to adjacent areas of suitable, or potentially suitable, habitat
- Populations that are disease free and/or exhibit low rates of infection with important pathogens

The information outlined in the Conservation Advice (DAWE, 2022a) therefore supports the conclusion in the Assessment Report that the Southern Sydney Koala population is an important population.

Recovery Plan

The new Recovery Plan (DAWE, 2022c) states that:

"No population is more important than another – for a threatened species, all populations are of value in contributing to the total population size and recovery. Some populations are also valued for social, cultural or economic reasons, while some have functionally important roles for recovery."

The Recovery Plan further states that it is imperative to maintain populations which have the potential to act as source populations to adjacent areas of suitable, or potentially suitable, habitat (DAWE, 2022c).

The information outlined in the Recovery Plan (DAWE, 2022c) therefore supports the conclusion in the Assessment Report that the Southern Sydney Koala population is an important population.

THREATS TO KOALAS

The new Conservation Advice (DAWE, 2022a) and Recovery Plan (DAWE, 2022c) identifies the following key threats to Koalas: climate change (and associated heat, drought and fire risks), land clearing, fragmentation, habitat degradation, traffic mortality, dog mortality and disease. All of these threats are identified and considered within the Assessment Report (See Section 30.5.7, and Part 6a Attachment B).

STRATEGIES AND ACTIONS

The strategies and actions to protect koalas set out in the new Conservation Advice (DAWE, 2022a) and Recovery Plan (DAWE, 2022c) were considered in the Assessment Report. In particular, the evaluation (Section 30.5.9) addresses these issues. The Plan supports a number of these strategies and actions and is not inconsistent with any of them. Relevant measures under the Plan which support strategies within the Conservation Advice and Recovery Plan are outlined in Table 2-2.

Table 2-2: How the Plan supports conservation strategies in the Conservation Advice and Recovery Plan

Conservation Advice and Recovery Plan strategies	Relevant commitments and actions under the Plan
Strategy 1: Build and share knowledge	• Commitment 7, Action 6 • Commitment 20, Action 4 • Commitment 22, Action 2 • Commitment 23, Action 1
Strategy 2: Strong community engagement and partnerships	• Commitment 7, Action 5 • Commitment 20, Action 4
Strategy 3: Increase habitat protection	• Commitment 2, Actions 1, 2, 3 • Commitment 9 • Commitment 10 • Commitment 12, Action 1
Strategy 4: Koala conservation is integrated into policy, and statutory and land-use plans	• Commitment 2, Actions 1, 2, 3 • Commitment 7 and associated measures in Appendix E of the Plan
Strategy 5: Strategic habitat restoration	• Commitment 12, Action 2 • Commitment 13, Action 4
Strategy 6: Active metapopulation management	• Commitment 7 • Commitment 9 • Commitment 10 • Commitment 12 • Commitment 23

GOAL AND OBJECTIVES OF THE NEW RECOVERY PLAN

The main goal of the new Recovery Plan is (DAWE, 2022c):

"To stop the trend of decline in population size of the listed Koala, by having resilient, connected, and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied"

The Recovery Plan aims to achieve this goal through meeting three objectives which are set for the 10-year life of the Recovery Plan. These goals are (DAWE, 2022c):

- *Goal 1:*
  - *A: The area of occupancy and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised then increased*
  - *B: The area of occupancy and estimated size of populations that are suspected and predicted to be stable are maintained or increased*
- *Goal 2: Metapopulation processes are maintained or improved*
- *Goal 3: Partners, communities and individuals have a greater role and capability in listed Koala monitoring, conservation and management*

The Plan will not prevent the achievement of any of these goals, as:

- Achievement of the Koala outcome for the Plan will ensure that the Southern Sydney Koala population will continue to persist and thrive into the future
- Increased protection of Koala habitat and restoration of Koala habitat will protect the area of occupancy and size of the Southern Sydney Koala population
- Protection of habitat connectivity and threat mitigation measures under the Plan will protect metapopulation process for the Southern Sydney Koala population
- The Plan will enable greater engagement with partners and communities to monitor, conserve, manage and protect the Southern Sydney Koala population

2.3.2 CONCLUSION

Overall, it is considered that the outcomes of the Plan:

- Are not inconsistent with the new Recovery Plan (DAWE, 2022c)
- Have regard for the new Conservation Advice (DAWE, 2022a)

3 Assessment of new Conservation Advices

3.1 INTRODUCTION

This chapter assesses the endorsement of new Conservation Advices for two species assessed within the Assessment Report. These species are:

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Melaleuca deanei* (Deane's Melaleuca)

Overall, this chapter considers the implications of these changes, and confirms that the Assessment Report provides an appropriate impact assessment for the Large-eared Pied Bat and Deane's Melaleuca.

3.2 CONSIDERATION OF NEW CONSERVATION ADVICE FOR THE LARGE-EARED PIED BAT

A new Conservation Advice for the Large-eared Pied Bat (DAWE, 2021a) has been in effect since 23 November 2021. Information in the new advice has been reviewed and compared to the existing assessment of the Large-eared Pied Bat in the Assessment Report (Part 6a, Chapter 30, Section 30.9) to determine whether the assessment adequately incorporates key species information.

The assessment of Large-eared Pied Bat in the Assessment Report draws on the information included within the following key resources:

- The species' Recovery Plan (DERM, 2011)
- The species' SPRAT profile (DoEE, 2018)

- The species' NSW profile (OEH, 2019b)

These resources provide information regarding the species' distribution, ecology, habitat use, populations and threats, and have been used to:

- Inform and develop maps of species' habitat
- Inform the understanding of the importance of populations of the species within the Strategic Assessment Area
- Understand the potential impact pathways through which development under the Plan may threaten the species

The review of the new Conservation Advice found that the advice:

- Does not change the broad understanding of habitat use by the species. This means that habitat mapping and analysis undertaken within the Assessment Report is consistent with the information in the new Conservation Advice
- Notes that all populations of the species should be considered as important. This is consistent with the approach adopted in the Assessment Report, as all records of the species within the Strategic Assessment Area were considered to belong to a single important population
- Identifies the additional threats of potential introduction of new diseases such as White-nose Syndrome, and use of agricultural pesticides. Neither of these threats are considered relevant to the implementation of the Plan as the Plan is unlikely to exacerbate these threats across the Strategic Assessment Area

Overall, key information within the new Conservation Advice is consistent with the information which has been used to inform the assessment of the Large-eared Pied Bat in Chapter 30 of the Assessment Report. Therefore, the assessment conducted for the species is considered to remain an appropriate and adequate assessment for the species.

3.3 CONSIDERATION OF NEW CONSERVATION ADVICE FOR DEANE'S MELALEUCA

A new Conservation Advice for Deane's Melaleuca (DAWE, 2021b) has been in effect since 23 November 2021. Information in the new advice has been reviewed and compared to the existing assessment of Deane's Melaleuca in the Assessment Report (Part 6a, Chapter 29, Section 29.11) to determine whether the assessment adequately incorporates key species information.

The assessment of Deane's Melaleuca in the Assessment Report draws on the information included within the following key resources:

- The species' Recovery Plan (NSW DECCW, 2010)
- The species' SPRAT profile (DoEE, 2018)
- The species' NSW profile (OEH, 2019a)
- An expert report prepared for the species (Douglas, 2019)

The assessment was also informed by the species' inclusion on the NSW SAII list.

These resources provide information regarding the species' distribution, ecology, habitat use, populations and threats, and have been used to:

- Inform and develop maps of species' habitat
- Inform the understanding of the importance of populations of the species within the Strategic Assessment Area
- Understand the potential impact pathways through which development under the Plan may threaten the species

The review of the new Conservation Advice found that the advice:

- Does not change the broad understanding of habitat use by the species. This means that habitat mapping and analysis undertaken within the Assessment Report is consistent with the information in the new Conservation Advice
- Notes that all populations of the species should be considered as important. This is consistent with the approach adopted in the Assessment Report, as all populations were mapped as important as the species is an SAII species
- Identifies the additional threats of climate change and myrtle rust:

- The Assessment Report considers the threat posed by climate change and relevant adaptions in Chapter 41. This assessment is sufficient to ensure that impacts of climate change to Deane's Melaleuca are adequately addressed
- Myrtle rust is not considered relevant to the implementation of the Plan as the Plan is unlikely to exacerbate this threat across the Strategic Assessment Area. It is noted that myrtle rust is an airborne disease

Overall, key information contained within the new Conservation Advice is consistent with the information which has been used to inform the assessment of Deane's Melaleuca in Chapter 29 of the Assessment Report. Therefore, the assessment conducted for the species is considered to remain an appropriate and adequate assessment for the species.

4 Assessment of newly listed species

4.1 INTRODUCTION

This chapter assesses the listing of four new threatened species which occur within, or in the vicinity of, the Cumberland subregion. These include:

- *Austrocordulia leonardi* (Sydney Hawk Dragonfly)
- *Callocephalon fibriatum* (Gang-gang Cockatoo)
- *Petaurus australis australis* (Yellow-bellied Glider (south-eastern))
- *Pycnoptilus floccosus* (Pilotbird)

The assessment of each of the newly listed species is structured in two parts:

- Part One involves application of the categorisation approach used in the Assessment Report to determine whether each of the species would require a detailed assessment as a Category 1 species
- Part Two involves a detailed assessment of each of the species determined to meet the criteria of a Category 1 species

This chapter confirms that the Plan provides an appropriate outcome for the four newly listed species.

4.2 PART ONE: CATEGORISATION TO DETERMINE IF ASSESSMENT IS REQUIRED

A categorisation approach has been applied to the four newly listed threatened species to identify the species that may be impacted by actions under the Plan. The categorisation approach is consistent with the approach used within the Assessment Report (Chapter 11) to determine which threatened species require detailed assessment.

A species was allocated to Category 1 (meaning it required detailed assessment) if it met any of the criteria outlined below. Species that did not meet one or more of the criteria were assigned to Category 2 (no further assessment required).

The following categorisation criteria were applied (see Section 11.1.2 of the Assessment Report):

1. The species was identified as a species requiring assessment as part of the BAM process for the nominated areas
2. The species was subject to a commitment in the Sydney Growth Centres Strategic Assessment Program Report (DECCW, 2010)
3. The Strategic Assessment Area contains a known important population
4. The Strategic Assessment Area contains >5 per cent of all known records in NSW of a species since 1990 on the BioNet Atlas of NSW Wildlife
5. The Strategic Assessment Area comprises >5 per cent or more of the mapped distribution of the species according to the Department of Agriculture, Water and the Environment's (DAWE) current distribution mapping
6. It is an FPAL species, and available information suggests it occurs in the Strategic Assessment Area

The results of the categorisation approach are outlined in Table 4-1.

Table 4-1: Categorisation of newly listed threatened species

Species	EPBC status*	Categorisation criteria						Species category	Comment
		1	2	3	4	5	6		
Sydney Hawk Dragonfly	E	No	No	Yes	N/A^	Yes	No	1	The species is a rare species with a very small Area of Occupancy, currently known only from three highly localised locations in Sydney, and two highly localised locations north of Newcastle. The three known Sydney locations of this species occur within the Strategic Assessment Area, with one of the known locations occurring within the Wilton nominated area, and one occurring on the border of GMAC. This species has been assigned to Category 1.
Gang-gang Cockatoo	E	Yes	No	Yes	No	No	No	1	This species is assessed under the BAM, and an important population occurs within the Strategic Assessment Area. This species has been assigned to Category 1.
Yellow-bellied Glider	V	Yes	No	Yes	No	No	No	1	This species is assessed under the BAM, and an important population occurs within the Strategic Assessment Area. This species has been assigned to Category 1.
Pilotbird	V	No	No	No	No	No	No	2	The species has a wide range, occurring from north of Newcastle down to south east Victoria. As of April 2022, the species has a total of 10 post-1990 BioNet records within the Cumberland subregion, compared to 1,352 records in total in NSW. Further, the species' Conservation Advice maps the Cumberland subregion as an area where the species may occur, not as an area where the species is known or likely to occur (DAWE, 2022b). This species is unlikely to be reliant on the Strategic Assessment Area. It has been assigned to Category 2.

* E = Endangered; V = Vulnerable

^ There are no records of the Sydney Hawk Dragonfly on the BioNet Atlas of NSW Wildlife

4.3 PART TWO: ASSESSMENTS OF CATEGORY 1 SPECIES

4.3.1 ASSESSMENT OF THE SYDNEY HAWK DRAGONFLY

A detailed assessment of the Sydney Hawk Dragonfly (*Austrocordulia leonardi*) with regards to the Plan has been completed. A summary of the outcome of the assessment is presented here. Refer to Attachment A for the full detailed assessment.

Overall, it is considered that the Plan will not adversely influence the long-term viability of the Sydney Hawk Dragonfly.

As the species is an aquatic species, the Plan will not result in direct impacts to the species.

The potential indirect impacts associated with habitat degradation due to development, and potential changes to water flow from the risk of river subsidence, will be managed and mitigated through the management strategies in the Plan. Further, the extent to which the Plan has considered adaptation to climate change impacts is addressed in Chapter 41 of the Assessment Report.

In addition, the conservation program of the Plan is likely to provide benefits to the species. It is noted that the sites of known occurrence of the Sydney Hawk Dragonfly within the Georges River occur within the proposed footprint of the Georges River Koala Reserve (Commitment 10), and therefore will be within a locality managed for conservation purposes under the Plan. This is a potential significant benefit to the species, as the Georges River sites have been identified to support multiple individuals of the species (Theischinger, Miller et al., 2009), and there are only four other known current locations of the species, each of which have recorded very few individuals in recent years (Greive & Theischinger, 2020; Theischinger, Jacobs et al., 2013).

4.3.2 ASSESSMENT OF GANG-GANG COCKATOO

A detailed assessment of the Gang-gang Cockatoo (*Callocephalon fibriatum*) with regards to the Plan has been completed. A summary of the outcome of the assessment is present here. Refer to Attachment B for the full detailed assessment.

Overall, it is considered that the Plan will not adversely influence the long-term viability of the Gang-gang Cockatoo.

The assessment considers impacts to mapped potential foraging habitat, in addition to mapped potential breeding habitat.

With regards to potential foraging habitat, the species has been assessed to have a low risk of residual adverse impacts due to impacts under the Plan. While the Plan authorises the clearing of 1,244.2 ha of potential foraging habitat (2.1 per cent of potential foraging habitat within the Strategic Assessment Area), this is considered unlikely to have a significant effect on the species because:

- There are no direct impacts to areas with known records of the species or important populations
- The majority of direct impacts occur on the edges of habitat corridors and to areas that are already highly fragmented
- The areas of potential habitat within the Strategic Assessment Area are connected to a much larger network of intact habitat to the north, west and south. In this regional context, implementation of the Plan impacts a very small proportion of the habitat available to the species

With regards to potential breeding habitat, the species is unlikely to be at risk of residual adverse impacts due to impacts under the Plan. A total of 521.4 ha of potential breeding habitat for the Gang-gang Cockatoo occurs within the nominated areas (not including excluded lands). While the Plan authorises the clearing of 3.74 ha of mapped potential breeding habitat (0.7 per cent of potential breeding habitat within the nominated areas, not including excluded land), this is considered unlikely to result in residual adverse impacts to the species, as:

- The total size of the impact area is small compared to the available area of potential breeding habitat
- Appendix E of the Plan includes a measure to retain large trees (≥50cm DBH) during precinct planning where possible, which will assist in minimising impacts to potential breeding habitat for the Gang-gang Cockatoo
- Conservation measures under the Plan (including commitments for habitat restoration, threat management and increased protection of habitat) will contribute to protection of the species across substantial areas of habitat, including breeding habitat within the region

The potential indirect impacts associated with inappropriate fire regimes and habitat decline due to weed invasion will be managed and mitigated through the generic management strategies in the Plan.

In addition, the conservation program is likely to provide significant benefits to the species within the Strategic Assessment Area. For instance, the Strategic Conservation Area (SCA) contains 17,258.9 ha of potential habitat for the species, and land secured for conservation within the SCA is likely to include habitat for the species. For example, 1,544.5 ha of potential habitat for the Gang-gang Cockatoo is contained within the proposed Georges River Koala Reserve.

4.3.3 ASSESSMENT OF YELLOW-BELLIED GLIDER (SOUTH-EASTERN)

A detailed assessment of the Yellow-bellied Glider (south-eastern) (*Petaurus australis australis*) with regards to the Plan has been completed. A summary of the outcome of the assessment is present here. Refer to Attachment C for the full detailed assessment.

Overall, it is considered that the Plan will not adversely influence the long-term viability of the Yellow-bellied Glider.

The risk of residual adverse impacts to the species from habitat loss is low.

While a record of the species is mapped to occur within the footprint of the OSO within GPEC, the Plan includes a species-specific commitment (Commitment 3) to avoid impacts to the Yellow-bellied Glider and its habitat during the development of major infrastructure corridors within the nominated areas. This commitment will provide protection for any individuals of the species which may occur at this site.

While the Plan authorises the clearing of 974.7 ha of potential habitat (2.3 per cent of potential habitat within the Strategic Assessment Area), this is considered unlikely to have a significant effect on the species because:

- The majority of direct impacts occur on the edges of habitat corridors and to areas that are already highly fragmented, and which are unlikely to be of a sufficient size to support a viable population
- The majority (90 per cent) of impacts occur to habitat in poorer condition (thinned vegetation and scattered trees)
- The areas of potential habitat within the Strategic Assessment Area are connected to a much larger network of intact habitat to the north, west and south. In this regional context, implementation of the Plan impacts a very small proportion of the habitat available to the species

The potential indirect impacts associated with inappropriate fire regimes and predation by cats will be managed and mitigated through the generic management strategies in the Plan.

In addition, the conservation program is likely to provide significant benefits to the species within the Strategic Assessment Area. For instance, the SCA contains 14,286.5 ha of potential habitat for the species, and that land secured for conservation within the SCA is likely to include habitat for the species. For example, 1,516.9 ha of potential habitat (of which 1,309.7 ha comprises vegetation in intact condition) is mapped to occur within the proposed Georges River Koala Reserve.

5 Assessment of newly listed KTP

5.1 INTRODUCTION

A new Key Threatening Process (KTP) has recently been listed under the EPBC Act, coming into effect on 21 April 2022. The KTP is called 'fire regimes that cause declines in biodiversity'.

Clause 3.2 of the ToR requires that the Assessment Report must identify and describe each protected matter that may be impacted directly, indirectly and cumulatively by actions taken under the Plan, including KTPs.

This assessment considers whether the Assessment Report has adequately considered the new KTP through assessing the indirect impact of altered fire regimes. It recognises that the Assessment Report:

- Describes the nature of this indirect impact
- Assesses the potential impacts of altered fire regimes upon MNES under the Plan
- Evaluates the Plan with regards to the risk of altered fire regimes

Overall, it is determined that:

- The Assessment Report adequately considers the new KTP through consideration of altered fire regimes as an indirect impact
- The Plan suitably manages the risk posed by altered fire regimes

5.2 HOW THE ASSESSMENT REPORT IS STRUCTURED TO CONSIDER KEY THREATENING PROCESSES

Chapter 15 of the Assessment Report provides an overview and assessment of indirect impacts which may occur under the Plan, and how each of these indirect impacts will be managed. The report is structured such that:

- Indirect impacts which may occur under the Plan are identified, defined and assessed
- The relevant KTPs which relate to each indirect impact are identified for each indirect impact

In this manner, KTPs are identified within the Assessment Report, but the assessment is structured around the defined indirect impacts themselves, rather than the KTPs. This structure:

- Ensures that relevant KTPs within the report are identified and the nature of the threat is described
- Minimises potential repetition within the report, as there can be substantial overlap between the content of multiple KTPs (for instance, there are multiple KTPs relating to threats posed by invasive species)
- Enables assessment of potential indirect impacts which may not have a corresponding KTP in force

5.3 HOW THE NEW KEY THREATENING PROCESS IS DEFINED WITHIN THE ASSESSMENT REPORT

The Assessment Report is considered to adequately identify and describe the threats associated with the new KTP through its consideration and assessment of the indirect impact type defined in the report as 'altered fire regimes'.

Altered fire regimes are defined in the Assessment Report (Chapter 15, Table 15-1) as follows:

- **Nature of indirect impact:** Altered fire regimes as a result of increased burns for asset protection, reduced ability to burn due to risk to surrounding urban areas or increased risk of unmanaged fires or accidental fires
- **Extent/general location of indirect impact and/or high-risk areas:** Native vegetation and habitat retained within or immediately adjacent to development, particularly asset protection zones
- **Duration of indirect impact**: Long-term

The Assessment Report also recognises the relationship between altered fire regimes and its potential to exacerbate other indirect impacts (for example, altered fire regimes are acknowledged to increase the risk of the spread of weeds).

5.4 HOW THE ASSESSMENT REPORT ASSESSES THE IMPACTS OF ALTERED FIRE REGIMES ON MNES

Tables 15-17, 15-18 and 15-19 in Chapter 15 of the Assessment Report provide summaries of how each Commonwealth-listed threatened flora, fauna and TEC may be impacted by indirect impacts under the Plan. They provide assessments as to whether generic mitigation measures under the conservation program of the Plan provide adequate protection for the matter from indirect impacts, or whether additional measures would be required to manage residual impacts. These assessments include consideration of altered fire regimes, where the threat is relevant to the matter being assessed.

The indirect impact assessments in Tables 15-17, 15-18 and 15-19 in Chapter 15 are further supported by detailed assessments of MNES in the following chapters:

- Chapter 29 – Commonwealth-listed flora
- Chapter 30 – Commonwealth-listed fauna
- Chapter 31 – Commonwealth-listed TECs
- Chapter 32 – Migratory species
- Chapter 33 – Ramsar wetlands
- Chapter 34 – World and National Heritage
- Chapter 35 – Commonwealth Land

5.4.1 MEASURES INCLUDED WITHIN THE PLAN TO MANAGE THE RISK OF ALTERED FIRE REGIMES

The Plan incorporates a range of general measures to manage the altered fire risk to biodiversity. These include:

- A commitment (Commitment 17) to manage fire in strategic locations across the strategic assessment area. This includes a number of actions, including:
    - Consultation with fire management authorities and traditional owners about how best to manage fire and maintain biodiversity values
    - Preparation of a Fire Management Strategy in priority locations that will (amongst other things) provide guidance on fire management to maintain and promote biodiversity values
    - A process to work with delivery partners to implement the Fire Management Strategy

  - Integration of the fire management actions for conservation land identified in the Fire Management Strategy in stewardship agreements and reserve management plans
- Introduction of a SEPP (Strategic Conservation Planning) that will:
  - Require asset protection zones (APZs) wholly within urban capable land. This will ensure the highest intensity bushfire risk mitigation activities occur away from potential occurrences of or habitat for MNES. While these APZs are designed to provide a buffer zone between a bushfire hazard and buildings or other infrastructure that need to be protected, they will also act as a protective buffer for the bushland areas from the sorts of activities within the urban capable land and transport corridors that might increase fire frequency or changes to natural fire regimes
  - Set out development controls to avoid and minimise impacts of future development on biodiversity values in avoided land and the SCA. The SEPP (Strategic Conservation Planning) requires the consent authority to be satisfied that the development is managed to avoid adverse impacts to biodiversity values prior to granting approval. This would include ensuring measures to manage fire risk avoid and minimise impacts to biodiversity

The Plan also includes a range of species-specific measures to manage the risk of altered fire regimes to several MNES which have been identified to require additional protection. These are outlined in Appendix E of the Plan and include:

- *Pultenaea parviflora*
- *Persoonia nutans*
- *Grevillea parviflora* subsp. *parviflora*
- *Persoonia bargoensis*

Finally, it is recognised that the Plan will secure substantial areas of native vegetation within the Cumberland subregion for conservation purposes. This includes:

- Protecting a minimum of 5,325 ha of native vegetation in the Cumberland subregion, which includes a series of offset targets for EPBC-listed TECs (Commitment 8)
- Securing offset sites of known locations of a range of EPBC-listed threatened species (Commitment 9)
- Establishment of the Georges River Koala Reserve (Commitment 10), in addition to two other reserves (Commitment 11)

Through increasing the total area of protected habitat within the Strategic Assessment Area, this will increase the total area within the Strategic Assessment Area which is managed for conservation purposes, which will include suitable fire management practices.

Overall, it is considered that the Plan suitably manages the risk posed by altered fire regimes.

6 References

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DAWE (2021b) *Conservation Advice for Melaleuca deanei (Deane's Melaleuca)* Department of Agriculture, Water and the Environment

DAWE (2021c) *Consultation on Species Listing Eligibility and Conservation Actions Phascolarctos cinereus (Koala)* Department of Agriculture, Water and the Environment

DAWE (2021d) *Draft National Recovery Plan for the Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)* Department of Agriculture, Water and the Environment

DAWE (2022a) *Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory* Department of Agriculture, Water and the Environment

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Office of the NSW Chief Scientist & Engineer (2021a) *Advice regarding the protection of koala populations associated with the Cumberland Plain Conservation Plan*

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Youngentob, K. N., Marsh, K. F., & Skewes, J. (2021) *A review of koala habitat assessment criteria and methods* The Australian National University

7 Attachment A: Sydney Hawk Dragonfly assessment

7.1 SPECIES OVERVIEW

The Sydney Hawk Dragonfly (*Austrocordulia leonardi*) is a black and yellow dragonfly. Adults are 60-70 mm in length with clear wings. Larvae are aquatic, with a body length of 22-24 mm and a distinctive abdominal colour pattern (DAWE, 2022). The species is listed as Endangered.

The species has three developmental stages - egg, larvae, and adult - with the first two stages occurring as aquatic stages. Most of the life cycle of the species occurs in the aquatic larvae stage, with adults emerging for only a few weeks. Many of the sightings of the species are either of larvae, or of the moulted shell of larvae from which adults have emerged, with only 12 known adult specimens ever recorded (DAWE, 2022).

The species is rare, known from fewer than 10 sites in total (Greive & Theischinger, 2020). The estimated Extent of Occurrence of the species is 5,600 km^2, while the Area of Occupancy is 32 km^2 (DAWE, 2022). The species has been reported to occur in the following drainage lines:

- Nepean River:
  - The species has been recorded multiple times at Maldon Bridge near Wilton. At this locality, the species was noted to be quite common in the 1980's. However, by 2009, the species' occurrence at this site was described as 'tenuous', with only 3 individuals recorded during survey in 2008 (Theischinger, Miller et al., 2009). Further survey in 2019 identified four larvae at this location, at various stages of development (Greive & Theischinger, 2020)
  - In 2019, the species was also discovered at a new site approximately 23 km downstream from Maldon Bridge near Menangle Weir. The discovery of the species at this site consisted of a single larva of the species (Greive & Theischinger, 2020)
- Georges River, where a coordinated survey effort in 2008 led to the discovery of the species in three locations along the river (Theischinger, Miller et al., 2009):
  - A riverine pool near Campbelltown where 20 individuals were recorded
  - A second riverine pool near Campbelltown where 12 individuals were recorded
  - At Freres Crossing near Campbelltown, where 20 individuals were recorded
- South of Sydney, along the drainage lines of the Woronora River and the Hacking River, where it is currently thought to be extinct (DAWE, 2022)
- Karuah River and Chichester River, which occur north of Newcastle. The occurrence of the species in these localities has only been recently discovered, and consist of observations of a single larvae at Karuah River and a single adult at Chichester River (Theischinger, Jacobs et al., 2013)

The ecological requirements and habitat use of the species remains poorly understood (Greive & Theischinger, 2020). It is thought that the species has highly specific habitat requirements (DAWE, 2022). Larvae seem to require cool, oxygenated water (Greive & Theischinger, 2020). The species has been found at sites with slow-flowing water in rocky rivers with steep sides and shady areas (DAWE, 2022). Prior to 2019, larvae of the species had only been found in rocky environments, particularly the underside of rocks, yet surveys in 2019 discovered larvae in the crevices on the underside of deeply submerged (around 1 m depth) logs. These recent findings expand the known microhabitats used by the species and suggest that the larvae of the species are cryptic (Greive & Theischinger, 2020). All specimens collected from the Sydney region are from deep riverine pools with cooler water. Deep pools are considered critical to the survival of the species, and the loss of natural pools or man-made weirs may result in local extinctions (DAWE, 2022).

There is insufficient data available to determine the species' population size or to confirm a decline in population size. Recent new discoveries of the species in new locations (north of Newcastle) and in new microhabitats (submerged wooden structures) may suggest that existing survey efforts for the species to date may have been too narrowly focused to adequately determine species' population size and range (DAWE, 2022).

7.2 APPROACH TO AVAILABLE DATA TO UNDERSTAND SPECIES' OCCURRENCE

There are no records of the species on the BioNet Atlas of NSW Wildlife. Assessment of species' occurrence has therefore been based on written descriptions of the locations of species occurrences, and mapping of the species' occurrence provided within the Conservation Advice.

The Conservation Advice maps the current known occurrences of the Sydney Hawk Dragonfly. This map has been adapted for use within the species' assessment (DAWE, 2022).

However, it is noted that the map within the Conservation Advice (DAWE, 2022) does not include the newly discovered confirmed location of the species in the vicinity of the Menangle Weir (Greive & Theischinger, 2020). The map within the Conservation Advice appears to have been prepared by buffering the species' known current occurrences by a radius of approximately 2 km. For consistency with this approach, the location of the Menangle Weir has been included and buffered by 2 km, to indicate this newly discovered broad location of the species.

Therefore, the overall map approach used to indicate the species' occurrence within the Strategic Assessment Area is therefore based on a combination of adapting the map presented within the Conservation Advice (DAWE, 2022), in addition to mapping the locality of Menangle Weir.

7.3 SPECIES' OCCURRENCE WITHIN THE STRATEGIC ASSESSMENT AREA

The species is mapped to occur within three broad regions within the Strategic Assessment Area:

- In the locality of Maldon Bridge in the north western corner of Wilton
- In the locality of the Menangle Weir, along the central eastern boundary of GMAC
- In the locality of Kentlyn along the boundary of the Strategic Assessment Area, to the east of GMAC

It is noted that the map is not a representation of potential habitat for the species, and only indicates broad locations of occurrence. The species is an aquatic species and its occurrence in these localities is aquatic, within the Nepean and Georges River respectively.

Refer to Map A in the associated data package of this report for a map of indicative locations of the Sydney Hawk Dragonfly within the Strategic Assessment Area.

7.4 AVOIDANCE OF IMPACTS

All riparian corridors and waterways that are potential habitat for the species were avoided as part of the planning process within the nominated areas. No potential habitat occurs within proposed transport corridors.

7.5 DIRECT IMPACTS AND OFFSETS

There will be no direct impacts to known populations or areas of potential habitat for the Sydney Hawk Dragonfly as a result of the Plan and offsets are not considered necessary.

7.6 IMPACTS ASSOCIATED WITH ESSENTIAL INFRASTRUCTURE

The Sydney Hawk Dragonfly has been recorded in avoided land within the Nepean River in Wilton. The species is an aquatic species which occurs within deep riverine pools. Potential mechanisms by which the species could be impacted by essential infrastructure development includes:

- Direct impacts in the event of development which directly impacts river habitat (for example, through the construction of piers of a bridge)
- Indirect impacts which may occur as a result of development adjacent to the river (for example, through run-off from construction or altered local water flows)

The *Cumberland Plain Conservation Plan Guidelines for Infrastructure* provides assurance that any potential impacts from essential infrastructure on the species will be avoided and mitigated. Part 2 of the guidelines (the section of the guidelines that set out what measures need to be followed for essential infrastructure to be covered by an EPBC approval under the Plan) requires:

- Infrastructure to be designed and sited to avoid impacts on biodiversity, and where this is not feasible, to minimise impacts (this would include the dragonfly)
- Mitigation measures to be developed and implemented to address indirect and prescribed impacts on threatened species and habitat (this would also include the dragonfly)

The notification and reporting requirements in the new SEPP (Strategic Conservation Planning) and EP&A Regulation 2000 (including requirements to provide DPE a plan of works, an ecology report that quantifies impacts on threatened species, and a description of how the infrastructure guidelines are met) provide further assurance that the dragonfly will be properly surveyed and assessed.

In addition, the existing assessment processes under Part 5 of the EP&A Act that will apply to essential infrastructure on avoided land will ensure the dragonfly is properly surveyed and assessed and measures put in place to avoid and minimise and mitigate direct and indirect impacts. The species is listed as Endangered under the NSW *Fisheries Management Act 1994*. This means proposals for development or activities under the EP&A Act must consider whether there is likely to be a significant impact on the species in accordance with a set of criteria under the *Fisheries Management Act 1994* (the '7-part test'). If the impacts are likely to be significant a detailed Species Impact Statement (SIS) for the species must be prepared.

Infrastructure affecting rivers and riparian land may also require separate assessment and approval under the *Water Management Act 2000*.

Overall, it is considered that the *Cumberland Plain Conservation Plan Guidelines for Infrastructure*, new SEPP (Strategic Conservation Planning), amendments to the EP&A Regulation 2000, and the existing assessment processes under the EP&A Act, *Fisheries Management Act 1994* and *Water Management Act 2000*, will ensure that the Sydney Hawk Dragonfly will be adequately protected from potential impacts associated with essential infrastructure.

7.7 IMPACTS ASSOCIATED WITH TUNNELS

The Outer Sydney Orbital major transport corridor tunnel passes underneath the Nepean River in the vicinity of Camden. While the Sydney Hawk Dragonfly has not been recorded in the Camden locality, it is known to occur within the Nepean River, and the cryptic nature of the species means that there may be additional locations in the region in which the species is present which are currently unknown. Changes to water flow as a result of river subsidence is recognised as a threat to the species (DAWE, 2022). River subsidence is a potential indirect impact related to tunnelling activities under the Nepean River.

As outlined in Chapter 36 of the Assessment Report, the Plan includes commitments (Commitment 4 and Commitment 6) to avoid and minimise direct impacts and mitigate indirect impacts to MNES values where disturbance to the land surface within or in the vicinity of the tunnel footprints is necessary. This must be undertaken in accordance with:

- Major transport corridors class of action description in the Plan, including the NSW State Significant Infrastructure (SSI) (or equivalent) approval, as well as the BC Act (or equivalent) for the non-certified major transport corridors (strategically assessed)
- Specific mitigation measures to address indirect impacts on biodiversity values prescribed in Appendix E

Actions under commitment 4 and 6 require Transport for NSW to implement:

- On-ground surveys to determine the biodiversity values within the tunnel footprints to inform avoidance and minimisation of impacts
- Measures to avoid impacts to biodiversity values through detailed design, with specific consideration to the MNES values identified in Commitments 4.2 and 4.3 relating to the tunnels
- Measures to mitigate any potential indirect impacts, including specific measures identified Appendix E of the Plan
- Measures to offset any residual impacts in accordance with the offset requirements of the BAM and EPBC Act Environmental Offsets Policy should there be long-term detrimental impacts from subsidence due to the tunnels
- Reporting to the Department and executive implementation committee on avoidance outcomes and mitigation measures proposed to manage the impacts of each transport project

These commitments are expected to adequately address threats to the species from the construction and operation of the tunnels. See Section 36.6 in Chapter 36 of the Assessment Report for more details.

7.8 INDIRECT IMPACTS

The species' Conservation Advice (DAWE, 2022) identifies a range of threats to the species. Where these threats are present in the Strategic Assessment Area and have the potential to be exacerbated under the Plan, the Plan includes management strategies to mitigate their impacts.

The following potential indirect impact is considered relevant to implementation of the Plan: habitat degradation due to development, including increased siltation and water quality declines.

Habitat destruction (through modification of streams or dams) has also been identified as a threat to the species. However, this is not considered relevant to implementation of the Plan as the Plan is unlikely to exacerbate this threat across the Strategic Assessment Area.

Changes to water flow (due to a range of potential sources including river subsidence) is also identified as a threat to the species. This may have potential to occur under the Plan with regards to the construction of the OSO tunnel under the Nepean River near Camden. This threat is discussed in the section above and is considered to be adequately managed under Commitments 4 and 6 of the Plan.

Climate change is also a relevant threat to the species. The extent to which the Plan has considered adaptation to climate change impacts is addressed in Chapter 41 of the Assessment Report.

7.8.1 HABITAT DEGRADATION

The Sydney Hawk Dragonfly requires specific microhabitats, including deep pools, cool water and good water quality (specifically, well oxygenated water) (Greive & Theischinger, 2020). Increased development may increase sediment loads through reducing vegetation cover and increasing erosion, which in turn can fill in deep riverine pools. Further, development may reduce water quality through increasing pollutants, which can in turn change key water quality parameters (such as water oxygen content).

The areas which are most at risk of impact under the Plan are the species' occurrences within the Nepean River, at Maldon Bridge within Wilton, and further downstream near Menangle Weir. These localities occur adjacent to/downstream of areas of development under the Plan within Wilton and GMAC.

The occurrences of the species within the Georges River are not considered to be at risk of the habitat degradation due to the Plan, given that minimal development under the Plan will occur within the catchment of the Georges River (note that the vast majority of development within the southern half of GMAC is located within the catchment of the Nepean River). It is also recognised that the sites of known occurrence of the Sydney Hawk Dragonfly within the Georges River occur within the proposed footprint of the Georges River Koala Reserve (Commitment 10), and therefore will be managed for conservation purposes under the Plan.

The Plan incorporates a range of general measures to mitigate the risks associated with changes to hydrology. In summary, these include:

- Incorporation of development controls into DCPs for each nominated area that will require proponents undertaking development to implement measures to manage hydrological impacts, including in relation to:
    - Water cycle management. For example:
        - Water management measures must comply with council's requirements for detention, drainage, and water sensitive urban design principles
        - Water management measures must be designed to prevent damage by stormwater to the natural environment and minimise urban water run-off and sediment and pollutants to waterways
    - Water quality. For example, stormwater systems must be constructed and maintained to achieve EES water quality targets
    - Soil erosion and sedimentation. For example:
        - Development must incorporate measures to minimise soil erosion and sedimentation during construction and following completion of development
        - Soil and Water Management Plans must be prepared in accordance with Managing Urban Stormwater (Landcom, 2004) and submitted with each subdivision development application
- The implementation of mitigation measures for major transport corridors based on the outcomes of environmental assessment of detailed designs in accordance with published, best practice guidelines, including but not limited to, the RMS Biodiversity Guidelines (NSW RTA & NGH Environmental Consultancy, 2011). These include a range of provisions to mitigate and minimise changes to hydrology

These measures are considered to adequately mitigate the level of risk to the Sydney Hawk Dragonfly.

7.9 IMPLICATIONS FOR LONG-TERM VIABILITY OF THE SPECIES

The species' Conservation Advice (DAWE, 2022) identifies the following indirect impacts that are likely to have the greatest influence on the long-term viability of the Sydney Hawk Dragonfly in relation to implementation of the Plan:

- Habitat degradation due to development, including increased siltation and water quality declines
- Changes to water flow as a result of river subsidence
- Climate change

It is noted that the Plan will not result in direct impacts to the species.

7.9.1 INDIRECT IMPACTS

The potential indirect impacts associated with habitat degradation due to development, and changes to water flow as a result of river subsidence, will be managed and mitigated through the generic management strategies in the Plan. The extent to which the Plan has considered adaptation to climate change impacts is addressed in Chapter 41 of the Assessment Report.

Indirect impacts are not expected to influence the long-term viability of the species.

7.9.2 CONCLUSION

The Sydney Hawk Dragonfly is not at risk of direct impact under the Plan. Potential indirect impacts are addressed through general management strategies defined in the Plan.

Further, the conservation program of the Plan will result in the protection of sites of known occurrence of the Sydney Hawk Dragonfly along the Georges River, as part of the proposed Georges River Koala Reserve (Commitment 10). This is a significant benefit to the species, as the Georges River sites have been identified to support multiple individuals of the species (Theischinger, Miller et al., 2009), and there are only four other known current locations of the species, each of which have recorded very few individuals in recent years (Greive & Theischinger, 2020; Theischinger, Jacobs et al., 2013).

Collectively these will ensure that the implementation of the Plan does not adversely influence the long-term viability of the Sydney Hawk Dragonfly.

7.10 CONSISTENCY WITH THE RECOVERY PLAN

There is no adopted or made Recovery Plan for this species.

7.11 KEY THREATENING PROCESSES AND CONSISTENCY WITH THREAT ABATEMENT PLANS

Relevant Key Threatening Processes (KTPs) and any of their associated Threat Abatement Plans (TAPs) have been identified in Table 7-1 where they relate to:

- The potential direct impacts of the Plan, or
- The relevant indirect impacts

The consistency of the Plan with relevant Threat Abatement Plans is discussed in detail in Chapter 15 of the Assessment Report. The Plan is not inconsistent with any Threat Abatement Plans.

Table 7-1: Relevant Key Threatening Processes and associated Threat Abatement Plans for the Sydney Hawk Dragonfly

RELEVANT KEY THREATENING PROCESS	ASSOCIATED THREAT ABATEMENT PLAN
Land clearance	There is no relevant TAP
Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases	There is no relevant TAP

7.12 REFERENCES

DAWE (2022) *Conservation Advice Austrocordulia leonardi (Sydney Hawk Dragonfly)* Department of Agriculture, Water and the

Environment

Greive, A., & Theischinger, G. (2020) A new record and microhabitat of Austrocordulia leonardi (Anisoptera, Libelluloidea incertae sedis) *Agrion*, 24, 43–45

Landcom (2004) *Managing Urban Stormwater: Soils and Construction.* Landcom

NSW RTA, & NGH Environmental Consultancy (2011) *Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects* NSW Roads and Traffic Authority

Theischinger, G., Jacobs, S., & Bush, A. (2013) Significant range extension of two iconic Australian dragonfly species (Odonata: Anisoptera: Libelluloidea) *Victorian Entomologist*, 43(1), 6–10

Theischinger, G., Miller, J., Miller, R., & Krogh, M. (2009) Rediscovery of Austrocordulia leonardi (Sydney Hawk) in the suburbia of Sydney *Agrion*, 13, 50–53

8 Attachment B: Gang-gang Cockatoo assessment

8.1 SPECIES OVERVIEW

Gang-gang Cockatoos are small, dark grey cockatoos. Males have bright red heads and a curled crest. The species is listed as Endangered under the EPBC Act.

The species is endemic to south-east Australia, occurring from Coffs Harbour in the north, down along the east coast through Victoria towards the south-eastern portion of South Australia. The species occurs as far inland as Mudgee. It is rare on the edges of its range. The species has an Extent of Occurrence of 400,000 km^2 and an Area of Occupancy of 30,000 km^2, both of which are stable (DAWE, 2022).

The estimated total population of the species is 25,300 mature individuals. The total species' population is estimated to have declined by approximately 69 per cent from 1999-2019 (prior to the 2019/20 bushfire season). The impact of the 2019/20 bushfire season on the species is predicted to result in further declines of between 10 and over 50 per cent of the pre-fire population size (DAWE, 2022).

The species used to be abundant within the Sydney Basin bioregion, yet its reporting rate had declined in this area by 57 per cent between 1977 and 2001, with further declines occurring since that time. The last known breeding subpopulation within the Sydney metropolitan area contains no more than 40 pairs, is confined to the Hornsby and Ku-rin-gai Local Government Areas, and has a high prevalence of disease (DAWE, 2022).

The species migrates between different habitats across seasons. During summer, the species primarily inhabits mature wet sclerophyll forests dominated by eucalypts, yet also occurs in more open eucalypt forests, subalpine snow gum woodland, temperate rainforest, and occasionally regenerating forest. During winter, the species occurs woodlands in lower, drier altitudes, including open eucalypt assemblages, river red gum assemblages, dense coastal thickets, or heathlands. During winter, the species has been observed in suburban areas of Sydney and Melbourne, including parks, gardens, and roadside tree plantations. Overlapping winter and summer ranges is common (DAWE, 2022).

The species forages in small groups, and feeds on flower buds, seed pods, leaf buds, fruits and seeds of a range of native and introduced species. When feeding on native plants, the species relies heavily upon eucalypts and acacias (DAWE, 2022).

Gang-gang Cockatoos are monogamous, with breeding usually occurring between October and January. Old growth forest is favoured for nesting, loafing and roosting, with nesting occurring in the eucalypt hollows. Breeding is dependent upon suitable hollow-bearing trees. Gang-gang Cockatoo pairs utilise multiple nest trees over multiple years (DAWE, 2022).

Habitat critical to the survival of the species is defined as all foraging habitat during both the breeding and non-breeding season. This does not include exotic feeding grounds such as ornamental trees, shrubs and hedges within urban and suburban areas. Habitat critical to the survival of the species also includes hollow bearing trees with known or potential Gang-gang Cockatoo hollow chambers that are generally around 20 cm in floor diameter, around 50.5 cm deep (range 22–90 cm) and occur between around 7.5 m (range 5–9.4 m) above the ground. Stands of trees within or adjacent to known breeding areas, that are likely to become hollow-bearing in future years, are also key components of this species' habitat (DAWE, 2022).

8.2 APPROACH TO AVAILABLE DATA TO UNDERSTAND SPECIES' OCCURRENCE

8.2.1 SPECIES RECORDS

All available BioNet records from 1990 onwards were considered within the assessment. The BioNet records were downloaded in May 2021.

8.2.2 HABITAT MAPPING

POTENTIAL FORAGING HABITAT

A map of potential foraging habitat for the Gang-gang Cockatoo was generated using BioNet PCT associations of intact and thinned vegetation, and scattered trees, and small areas of mapped vegetation for which condition data is not available.

The mapping represents the distribution of potential foraging habitat for the Gang-gang Cockatoo within the Strategic Assessment Area.

POTENTIAL BREEDING HABITAT

A map of potential breeding habitat for the Gang-gang Cockatoo was generated using the following parameters:

- BioNet PCT associations for the species, where PCTs are in intact condition
- Habitat patch size of over 25 ha
- Trees over 20 m in height (identified using a canopy height model)

Modelled habitat was then further refined based on data collected during site surveys. Further explanation and justification for the modelling approach used for the species is provided in the Assessment Report, in Chapter 11, Section 11.5.2, and in Attachment B of Part 3.

This mapping was prepared as part of the species' assessment under the BAM process for the NSW BC Act, and as such, the extent of this mapping is limited to inside the nominated areas only.

The mapping represents the distribution of potential breeding habitat for the Gang-gang Cockatoo within the nominated areas.

8.3 SPECIES' OCCURRENCE WITHIN THE STRATEGIC ASSESSMENT AREA

8.3.1 RECORDS

There are 61 records from 1990 onwards of the Gang-gang Cockatoo within the Strategic Assessment Area. These records occur between 1993 and 2020. Of these:

- 3 occur within Wilton. These include two records from 1999 and one record from 2015
- 8 occur within GMAC. One of these records is dated from 2003, and the remaining records range in dates between 2012 and 2018

8.3.2 POTENTIAL FORAGING HABITAT

The baseline mapping for this assessment has mapped 59,176.1 ha of potential foraging habitat within the Strategic Assessment Area. Foraging habitat occurs in scattered areas throughout the Strategic Assessment Area and is typically strongly associated with areas of remnant vegetation.

See Table 8-2 at the end of this assessment for a breakdown of the occurrence of potential foraging habitat for the Gang-gang Cockatoo in the Strategic Assessment Area.

8.3.3 POTENTIAL BREEDING HABITAT

The baseline mapping for this assessment has mapped 920.1 ha of potential breeding habitat within the nominated areas. Potential breeding habitat is strongly associated with areas of remnant vegetation.

Note that potential breeding habitat has only been mapped within the nominated areas, and as such, statistics on the availability of potential breeding habitat across the wider Strategic Assessment Area are not available.

See Table 8-3 at the end of this assessment for a breakdown of the occurrence of potential breeding habitat for the Gang-gang Cockatoo in the Strategic Assessment Area.

8.3.4 MAPS

Refer to Map B in the associated data package of this report for a map of records (constituting BioNet records from 1990 onwards) and mapped potential foraging habitat for the Gang-gang Cockatoo within the Strategic Assessment Area.

Refer to Map C in the associated data package of this report for a map of records (constituting BioNet records from 1990 onwards) and mapped potential breeding habitat for the Gang-gang Cockatoo within the nominated areas.

It is important to note that the records of the Gang-gang Cockatoo have been denatured in both maps, as the species is a sensitive species.

8.4 AVOIDANCE OF IMPACTS

8.4.1 RECORDS

Records of the Gang-gang Cockatoo occur within avoided and excluded lands within Wilton and GMAC. No records of the species occur within WSA or GPEC.

There are no recent records of the Gang-gang Cockatoo within areas which will be directly impacted under the Plan (such as major transport corridors and urban capable land), either inside or outside of the nominated areas.

8.4.2 POTENTIAL FORAGING HABITAT

The baseline mapping for the assessment mapped 4,443.2 ha of potential foraging habitat for the Gang-gang Cockatoo within the nominated areas (not including excluded lands). Approximately 3,369.7 ha of this has been avoided as part of the design of the urban capable lands and transport corridors (not including excluded lands). Of this:

- 2,552.2 ha was avoided for biodiversity purposes
- 817.5 ha was avoided for other purposes

A breakdown of avoidance across each nominated area is provided in Table 8-2.

It is important to note that the avoidance calculations in Table 8-2, including for 'avoidance for biodiversity purposes', 'avoidance for other reasons', and 'total avoidance', have been calculated without including excluded lands as these lands are not covered by the Plan. Table 8-2 shows the amounts of habitat within excluded lands for context only, and Chapter 14 of the Assessment Report defines the land types that are excluded.

8.4.3 POTENTIAL BREEDING HABITAT

The baseline mapping for the assessment mapped 521.4 ha of potential breeding habitat for the Gang-gang Cockatoo within the nominated areas (not including excluded lands). Approximately 517.8 ha of this has been avoided as part of the design of the urban capable lands and transport corridors (not including excluded lands). Of this:

- 290.6 ha was avoided for biodiversity purposes
- 227.2 ha was avoided for other purposes

A breakdown of avoidance across each nominated area is provided in Table 8-3.

It is important to note that the avoidance calculations in Table 8-3, including for 'avoidance for biodiversity purposes', 'avoidance for other reasons', and 'total avoidance', have been calculated without including excluded lands as these lands are not covered by the Plan. Table 8-3 shows the amounts of habitat within excluded lands for context only, and Chapter 14 of the Assessment Report defines the land types that are excluded.

Further, it is recognised that the species is dependent upon tree hollows for breeding and therefore retention of large trees will assist in protecting the species. To minimise the risk of impacts to large trees, Appendix E of the Plan includes a measure to retain large trees (≥50cm DBH) during precinct planning where possible and avoid impacts to soil within the dripline of these trees during construction. This measure applies across all nominated areas and will be implemented via the DCP template, Mitigation Measures Guideline, and *Cumberland Plain Conservation Plan Guidelines for Infrastructure*, and will assist in minimising impacts to potential breeding habitat for the Gang-gang Cockatoo.

8.5 DIRECT IMPACTS AND OFFSETS

Implementation of the Plan will lead to loss and fragmentation of potential habitat. There are no records of the species which are impacted. A breakdown of impacts across the Strategic Assessment Area is given in Table 8-2 and Table 8-3.

8.5.1 IMPACTS TO POTENTIAL FORAGING HABITAT

Approximately 1,244.2 ha of potential Gang-gang Cockatoo habitat will be lost due to the implementation of the Plan (1,073.5 ha within the nominated areas and 170.7 ha within transport corridors outside the nominated areas). This habitat represents 2.1 per cent of potential foraging habitat within the Strategic Assessment Area.

The main impact areas include:

- GMAC: Loss of 248.6 ha of potential foraging habitat on the edges of riparian corridors adjacent to urban capable land
- Wilton: Loss of 149.3 ha of potential foraging habitat on the edges of riparian corridors adjacent to urban capable land
- GPEC: Loss of 324.9 ha of potential foraging habitat, which mainly occurs as:
    - Impacts from major transport corridors to larger and more intact areas of vegetation at Wianamatta Regional Park and along the South Creek riparian corridor
    - Impacts from urban capable land to smaller scattered areas of potential foraging habitat, or to the edges of larger and more intact areas of potential foraging habitat across the nominated area
- WSA: Loss of 350.7 ha of potential foraging habitat, which affects an area of remnant vegetation near Twin Creeks and otherwise impacts the edges of small and scattered areas of vegetation
- Transport outside nominated areas: Loss of 170.7 ha of potential foraging habitat which primarily occurs within the OSO footprint to the west and south of WSA. Smaller areas of impact also occur in the OSO footprint to the west of GMAC in the Camden/Menangle region

8.5.2 IMPACTS TO POTENTIAL BREEDING HABITAT

Approximately 3.74 ha of potential Gang-gang Cockatoo breeding habitat will be lost due to the implementation of the Plan. This habitat represents 0.7 per cent of potential breeding habitat within the nominated areas (not including excluded land).

The main impact areas include:

- GMAC: Loss of 3.1 ha of potential breeding habitat on the edges of riparian corridors adjacent to urban capable land
- Wilton: Loss of 0.6 ha of potential breeding habitat on the edges of riparian corridors adjacent to urban capable land
- GPEC: Loss of 0.04 ha of potential breeding habitat within the footprint of the OSO within Wianamatta Regional Park

8.5.3 FRAGMENTATION IMPACTS

Given the wide-ranging nature of the species and broad availability of potential habitat, it is considered unlikely that development within the nominated areas or transport corridors would lead to any fragmentation effects.

8.5.4 RISK OF RESIDUAL DIRECT IMPACTS TO THE SPECIES

The risk assessment method outlined in Section 30.3.5 of the Assessment Report has been applied with regards to mapped potential foraging habitat for the species.

Based on the application of this risk assessment method, the risk of residual adverse impacts occurring to the species as a result of the loss of potential foraging habitat is considered to be low. This is because:

- The likelihood of substantial impacts occurring to the species has been categorised as possible. There will be moderate impacts to potential foraging habitat for the species
- The consequence of any impacts to the species has been categorised as minor. There will be loss of approximately 2 per cent of mapped potential foraging habitat in the Strategic Assessment Area

Given that the risk assessment method is designed to consider habitat availability across the full Strategic Assessment Area, it was not possible to apply the risk assessment approach for potential breeding habitat, as mapping of this habitat is only available within the nominated areas. However, the total area of impact to potential breeding habitat for the species is small. Further, the Plan includes a mitigation measure under Appendix E to retain large trees during precinct planning which will further contribute to avoidance of impacts to breeding habitat for the species. It is therefore considered unlikely that the species would be at risk of residual adverse impacts due to development of potential breeding habitat under the Plan.

8.5.5 OFFSETS FOR RESIDUAL DIRECT IMPACTS

The application of the risk assessment method outlined in Section 30.3.5 of the Assessment Report has resulted in the species being determined to have a low risk of residual adverse impacts to the species, with regards to impacts to potential foraging habitat. Following the method of this risk assessment as outlined in Part 2, Section 8.4.3 of the Assessment Report, offsets would normally not be required for a species with a low risk rating.

However, it is noted that the species' Conservation Advice (DAWE, 2022) defines all foraging habitat for the species as habitat critical to the survival of the species, and that any impacts to habitat critical to the survival of the species require suitable offsets.

The habitat which is being impacted under the Plan includes foraging habitat, and therefore constitutes impacts to habitat critical to the survival of the species.

The Conservation Advice notes suitable offsets may include:

- *"Restoration of the quality and extent of feeding and breeding habitat.*
- *Restoration of native forest and woodlands adjacent to habitat critical to the survival to reduce edge effects.*
- *Management of threats (see Threats) in and adjacent to habitat critical to the survival.*
- *Other compensatory measures that will help address knowledge gaps to improve and maximise efficiency of the recovery of the species."* (DAWE, 2022)

The Plan includes a range of measures which meet the offset requirements identified in the Conservation Advice (DAWE, 2022) for protection of the species. These include:

- A commitment (Commitment 13) to undertake ecological restoration including ecological reconstruction in conservation land across a range of vegetation types. This commitment will contribute to the restoration of the quality and extent of feeding and breeding habitat for the species
- Increased protection of 17,258.9 ha of potential foraging habitat which will benefit the species within the SCA:
    - A proportion of this area of potential foraging habitat within the SCA will be secured for conservation purposes. For example, 1,544.5 ha of potential foraging habitat for the Gang-gang Cockatoo is contained within the proposed Georges River Koala Reserve. Securing habitat for conservation purposes for this species will increase the management of threats within these locations of habitat critical to the survival, and contribute to protecting the quality of this habitat for the species
    - Increased protection from threats for potential foraging habitat located within the SCA which is not secured for conservation. A new SEPP (Strategic Conservation Planning) will be introduced, which will apply additional development controls to land within the SCA to limit the impacts of future development and subdivision and ensure biodiversity values are protected if development is proposed on these lands. This measure contributes to reducing development threats across a substantial area of habitat critical to the survival of the species
- A range of commitments and actions within the Plan's conservation program to address landscape threats to the species. Measures within the Plan which will contribute to reducing threats to the species are further discussed below with regards to indirect impacts

Overall, the conservation measures under the Plan contain suitable offsets for the species to account for impacts to habitat critical to the survival of the species. Therefore, the overall outcome of impacts to species habitat under the Plan is considered to be appropriate and consistent with the requirements of the Conservation Advice.

8.6 IMPACTS ASSOCIATED WITH ESSENTIAL INFRASTRUCTURE

The Gang-gang Cockatoo has been recorded in avoided land in Wilton and GMAC. Potential habitat has been mapped on avoided lands in all nominated areas. As a result, the species may be subject to additional impacts from essential infrastructure.

As outlined in Part 2 and Chapter 37 of the Assessment Report, essential infrastructure may be undertaken on avoided land if consistent with the requirements of the Plan. The Plan specifies that:

- Every effort should be made to ensure that essential infrastructure development is limited to urban capable land
- Where essential infrastructure is proposed on avoided land:
    - It must comply with the Cumberland Plain Conservation Plan Guidelines for Infrastructure Development
    - It must meet the commitments for avoidance (Commitments 2.1 and 2.2), including prioritising avoidance of impacts for certain species

The Cumberland Plain Conservation Plan Guidelines for Infrastructure Development will include development controls that apply to essential infrastructure on avoided land to ensure consistency with the requirements of the Plan. The guideline states that essential infrastructure development must:

- Avoid and minimise impacts to biodiversity values and specific TECs and species, including koala habitat and corridors
- Identify and implement mitigation measures to address indirect impacts on biodiversity values, including installing and maintaining the integrity of koala exclusion fencing
- Offset any impacts in accordance with the BAM and BC Act

In addition, proposed essential infrastructure on avoided land may require approval under the BC Act and if so, will be required to apply the BAM, which includes:

- On-ground surveys to determine the biodiversity values within the potential development area
- Measures to avoid impacts to the species through development design
- Measures to mitigate any potential indirect impacts
- Measures to offset any residual impacts in accordance with the requirements of the BAM

It is not expected that substantial impacts to the species will occur as a result of essential infrastructure, and that any impacts that did occur would be adequately mitigated and offset. See Section 37.6 in Chapter 37 of the Assessment Report for more details.

8.7 IMPACTS ASSOCIATED WITH TUNNELS

A total of 175.6 ha of potential foraging habitat for the Gang-gang Cockatoo occurs within tunnel footprints under the Plan.

As outlined in Chapter 36 of the Assessment Report, the Plan includes commitments (Commitment 4 and Commitment 6) to avoid and minimise direct impacts and mitigate indirect impacts to MNES values where disturbance to the land surface within or in the vicinity of the tunnel footprints is necessary. This must be undertaken in accordance with:

- Major transport corridors class of action description in the Plan, including the NSW State Significant Infrastructure (SSI) (or equivalent) approval, as well as the BC Act (or equivalent) for the non-certified major transport corridors (strategically assessed)
- Specific mitigation measures to address indirect impacts on biodiversity values prescribed in Appendix E

Actions under commitment 4 and 6 require Transport for NSW to implement:

- On-ground surveys to determine the biodiversity values within the tunnel footprints to inform avoidance and minimisation of impacts
- Measures to avoid impacts to biodiversity values through detailed design, with specific consideration to the MNES values identified in Commitments 4.2 and 4.3 relating to the tunnels
- Measures to mitigate any potential indirect impacts, including specific measures identified Appendix E of the Plan
- Measures to offset any residual impacts in accordance with the offset requirements of the BAM and EPBC Act Environmental Offsets Policy should there be long-term detrimental impacts from subsidence due to the tunnels
- Reporting to the Department and executive implementation committee on avoidance outcomes and mitigation measures proposed to manage the impacts of each transport project

These commitments are expected to adequately address threats to the species from the construction and operation of the tunnels. See Section 36.6 in Chapter 36 of the Assessment Report for more details.

8.8 INDIRECT IMPACTS

The species' Conservation Advice (DAWE, 2022) and other key documents (DPIE, 2022) identifies a range of threats to the species. Where these threats are present in the Strategic Assessment Area and have the potential to be exacerbated under the Plan, the Plan includes management strategies to mitigate their impacts.

The following potential indirect impacts are considered relevant to implementation of the Plan:

- Inappropriate fire regimes
- Habitat decline caused by weed invasion

Increased competition for nest hollows with other species, nest predation by Common Brushtail Possums, Psittacine Beak and Feather Disease, native forest timber harvesting, and aggressive exclusion from habitat by overabundant Noisy Miners have also been identified as threats to the species. However, these are not considered relevant to implementation of the Plan as the Plan is unlikely to exacerbate these threats across the Strategic Assessment Area.

Climate change is also a relevant threat to the species. The extent to which the Plan has considered adaptation to climate change impacts is addressed in Chapter 41 of the Assessment Report

8.8.1 INAPPROPRIATE FIRE REGIMES

Gang-gang Cockatoos are threatened by inappropriate fire regimes (including planned burning), including fire regimes which are too frequent, too infrequent, too hot, or too extensive. Inappropriate fires may cause mortality of individuals, result in destruction of nesting sites, reduce availability and quality of foraging sites, and may increase the species' vulnerability to other threatening processes (DAWE, 2022).

Increased human activity within the nominated areas has the potential to alter fire regimes, through potentially increasing fire frequencies in some areas, and decreasing fire frequencies in others, through the following mechanisms:

- Increased fire frequency due to arson and accidental lighting of fires
- Increased fire frequency due to the application of fire by authorities to manage fire risk
- In other cases, a lack of fire due to challenges in burns in proximity to human habitation

Key risk areas are those that are easily accessible to the public and in close proximity to urban development and roads.

The Plan incorporates a range of measures to manage the bushfire risk to biodiversity. In summary, these include:

- A commitment (Commitment 17) to manage fire in strategic locations across the strategic assessment area. This includes a number of actions with the most relevant to the outcome for the Gang-gang Cockatoo being:
    - Consultation with fire management authorities and traditional owners about how best to manage fire and maintain biodiversity values
    - Preparation of a Fire Management Strategy in priority locations that will (amongst other things) provide guidance on fire management to maintain and promote biodiversity values
    - A process to work with delivery partners to implement the Fire Management Strategy
    - Integration of the fire management actions for conservation land identified in the Fire Management Strategy in stewardship agreements and reserve management plans
- Introduction of a new SEPP (Strategic Conservation Planning) that will:
    - Set out development controls to avoid and minimise impacts of future development on biodiversity values in avoided land and the SCA. The SEPP requires the consent authority to be satisfied that the development is managed to avoid adverse impacts to biodiversity values prior to granting approval. This would include consideration of risks to biodiversity values relating to managing fire risk
    - Require asset protection zones (APZs) to be wholly within urban capable land. This will ensure the highest intensity bushfire risk mitigation activities occur away from habitat for the Gang-gang Cockatoo. While these APZs are designed to provide a buffer zone between a bushfire hazard and buildings or other infrastructure that need to be protected, they will also act as a protective buffer for the bushland areas from the sorts of activities within the urban capable land and transport corridors that might increase fire frequency or changes to natural fire regimes

The package of measures in the Plan is expected to adequately manage the risk to the Gang-gang Cockatoo from inappropriate fire regimes due to development. This is because:

- Asset Protection Zones (APZs) for fire management are required to be located within urban capable lands which will reduce the risk of fire mitigation activities impacting habitat
- Fire management authorities will be engaged to ensure they understand the values relevant to the Gang-gang Cockatoo and incorporate these values into their fire management practices. This will include specific fire management approaches for conservation areas

8.8.2 HABITAT DECLINE CAUSED BY WEED INVASION

Infestation of habitat by invasive weeds has been identified as a threat to the Gang-gang Cockatoo (DPIE, 2022).

Weeds are already present within the Strategic Assessment Area. However, urban development and transport have the potential to increase the spread of these weeds by providing more opportunities for weed dispersal or changing conditions to favour weeds.

Potential habitat is most susceptible to the threat of weeds from development under the Plan where new urban development occurs adjacent to the habitat and introduces edge effects.

The Plan incorporates a range of general measures to manage the risk posed by weed invasion to biodiversity. In summary, these include:

- A commitment (Commitment 15) to manage priority weeds in strategic locations in the Cumberland subregion to reduce threats to land secured within the SCA. This includes a number of actions, of which the following are the most relevant to the outcome for the Gang-gang Cockatoo:
  - Preparation of a Weed Control Strategy, and entering into written agreements with delivery partners to implement the weed control program
  - Integration of weed control actions for conservation land into biodiversity stewardship agreements and reserve management plans
  - Provision of grants to relevant stakeholders to reduce weeds in the following locations: on public land adjoining or near conservation land, and on Aboriginal-owned land adjoining or near to conservation land
- Incorporation of development controls into Development Control Plans (DCPs) for each nominated area that will require proponents undertaking development to implement weed control measures, including:
  - Submitting a weed eradication and management plan with development applications for subdivisions, outlining weed control measures during and after construction
  - Undertaking subdivision design and earthworks to minimise environmental weed spread, and require the inclusion of measures to eradicate weeds in accordance with relevant council weed policies
  - Managing and eradicating Weeds of National Significance and weeds on the National Environmental Alert List under the National Weeds Strategy. The proponent is to refer to NSW Weed Wise for current weed identification and management approaches
- Introduction of a new SEPP (Strategic Conservation Planning) that will set out development controls to avoid and minimise impacts of future development on biodiversity values in avoided land and the SCA. The SEPP requires the consent authority to be satisfied that the development is managed to avoid adverse impacts to biodiversity values prior to granting approval. This would include consideration of risks to biodiversity values relating to the spread of weeds

Weeds will be actively managed within all areas added to conservation as part of the offset program.

The package of measures in the Plan is expected to adequately manage the risk posed to the Gang-gang Cockatoo from invasive weeds. This is because:

- The Plan provides for a landscape scale approach to managing weeds through the development and implementation of a weed management strategy. This includes the land to be protected under the conservation program which is expected to provide large areas of potential habitat for the Gang-gang Cockatoo
- There will be a range of planning controls to minimise the potential spread of weeds during and after construction

8.9 IMPLICATIONS FOR LONG-TERM VIABILITY OF THE SPECIES

The species' Conservation Advice (DAWE, 2022) and other key documents (DPIE, 2022) identifies the following key issues that are likely to have the greatest influence on the long-term viability of the Gang-gang Cockatoo in relation to implementation of the Plan:

- Habitat loss
- Indirect impacts such as:
  - Inappropriate fire regimes
  - Habitat decline caused by weed invasion

8.9.1 HABITAT LOSS

The application of the risk assessment method outlined in Section 30.3.5 of the Assessment Report has resulted in the species being determined to have a low risk of residual adverse impacts. While the Plan authorises the clearing of 1,244.2 ha of potential foraging habitat (2.1 per cent of potential foraging habitat within the Strategic Assessment Area), this is considered unlikely to have a significant effect on the species because:

- There are no direct impacts to areas with known records of the species or important populations
- The majority of direct impacts occur on the edges of habitat corridors and to areas that are already highly fragmented

- The areas of potential habitat within the Strategic Assessment Area are connected to a much larger network of intact habitat to the north, west and south. In this regional context, implementation of the Plan impacts a very small proportion of the habitat available to the species

Further, it is considered unlikely that the species would be at risk of residual adverse impacts due to development of potential breeding habitat under the Plan, given the small size of the mapped impacts to potential breeding habitat. Further, the mitigation measure contained within Appendix E of the Plan will encourage avoidance of impacts to large trees during the precinct planning process, which will also contribute to protection of the species' breeding habitat.

It is noted that the species' Conservation Advice identifies all foraging habitat as habitat critical to the survival of the species, and that all impacts to habitat critical to the survival of the species requires suitable offsets. The conservation program of the Plan is considered to provide suitable offsets for impacts to habitat for the species through:

- Securing areas of potential habitat within the SCA for conservation purposes, meaning that those sites will be managed to reduce threats and protect habitat quality
- Introducing additional protection against development pressures of substantial areas of potential habitat within the SCA through the introduction of a new SEPP (Strategic Conservation Planning)
- Addressing landscape scale threats to the species through the conservation program

These measures are considered to provide suitable offsets to account for impacts to habitat critical to the survival of the species within the Strategic Assessment Area.

Overall, habitat loss and fragmentation are not expected to adversely influence the long-term viability of the species.

8.9.2 INDIRECT IMPACTS

The potential indirect impacts associated with inappropriate fire regimes and habitat decline due to weed invasion will be managed and mitigated through the generic management strategies in the Plan.

Indirect impacts are not expected to influence the long-term viability of the species.

8.9.3 CONCLUSION

There are large areas of potential foraging habitat (59,176.1 ha) and impacts to this are relatively minor (1,244.2 ha) given the larger areas of intact habitat surrounding the Strategic Assessment Area.

A total of 920.1 ha of potential breeding habitat for the species has been mapped within the nominated areas, and impacts to this are minor (3.74 ha). Further, Appendix E of the Plan contains a mitigation measure to avoid impacts to large trees during the precinct planning process, which will assist in minimising impacts to potential breeding habitat for this species.

Potential indirect impacts are addressed through general management strategies defined in the Plan and implementation of the conservation program will protect large areas associated with potential habitat for the species.

Collectively these will ensure that the implementation of the Plan does not adversely influence the long-term viability of the Gang-gang Cockatoo.

8.10 CONSISTENCY WITH THE RECOVERY PLAN

There is no adopted or made Recovery Plan for this species.

8.11 KEY THREATENING PROCESSES AND CONSISTENCY WITH THREAT ABATEMENT PLANS

Relevant Key Threatening Processes (KTPs) and any of their associated Threat Abatement Plans (TAPs) have been identified in Table 7-1 where they relate to:

- The potential direct impacts of the Plan, or
- The relevant indirect impacts

The consistency of the Plan with relevant Threat Abatement Plans is discussed in detail in Chapter 15 of the Assessment Report. The Plan is not inconsistent with any Threat Abatement Plans.

Table 8-1: Relevant Key Threatening Processes and associated Threat Abatement Plans for the Gang-gang Cockatoo

RELEVANT KEY THREATENING PROCESS	ASSOCIATED THREAT ABATEMENT PLAN
Land clearance	There is no relevant TAP
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	There is no relevant TAP
Novel biota and their impact on biodiversity	There is no relevant TAP

8.12 KEY STATISTICS

Table 8-2: Occurrence, avoidance and impacts of Gang-gang Cockatoo potential foraging habitat

	WILTON	GMAC	WSA	GPEC	TRANSPORT OUTSIDE NOMINATED AREAS	TOTAL IN NOMINATED AREAS AND TRANSPORT CORRIDORS
TOTAL HABITAT (ha)	1,702.8	3,033.1	718.1	3,037.9	170.7	8,662.7
HABITAT WITHIN EXCLUDED LANDS (ha)	301.0	1,077.2	89.2	2,581.4	N/A	4,048.8
HABITAT WITHOUT EXCLUDED LANDS (ha)	**1,401.8**	**1,955.9**	**629.0**	**456.5**	N/A	**4,443.2**
AVOIDANCE FOR BIODIVERSITY PURPOSE (ha)	960.9	1,305.7	190.2	95.3	N/A	2,552.2
AVOIDANCE FOR OTHER REASONS (ha)	291.6	401.6	88.1	36.2	N/A	817.5
TOTAL AVOIDANCE (ha)	**1,252.5**	**1,707.4**	**278.2**	**131.6**	N/A	**3,369.7**
DIRECT IMPACTS TO HABITAT (ha)	**149.3**	**248.6**	**350.7**	**324.9**	**170.7**	**1,244.2**

Table 8-3: Occurrence, avoidance and impacts of Gang-gang Cockatoo potential breeding habitat

	WILTON	GMAC	WSA	GPEC	TOTAL IN NOMINATED AREAS
TOTAL HABITAT (ha)	195.6	464.4	0	260.1	920.1
HABITAT WITHIN EXCLUDED LANDS (ha)	34.2	104.3	0	260.1	398.7
HABITAT WITHOUT EXCLUDED LANDS (ha)	**161.4**	**360.1**	**0**	**0**	**521.4**
AVOIDANCE FOR BIODIVERSITY PURPOSE (ha)	75.0	215.6	0	0	290.6
AVOIDANCE FOR OTHER REASONS (ha)	85.9	141.4	0	0	227.2
TOTAL AVOIDANCE (ha)	**160.9**	**357**	**0**	**0**	**517.8**
DIRECT IMPACTS TO HABITAT (ha)	**0.6**	**3.1**	**0**	**0.04**	**3.74**

8.13 REFERENCES

DAWE (2022) *Conservation Advice for Callocephalon fimbriatum (Gang-gang Cockatoo)* Department of Agriculture, Water and the Environment

DPIE (2022) *Gang-gang Cockatoo - profile* Department of Planning, Industry and Environment

9 Attachment C: Yellow-bellied Glider assessment

9.1 SPECIES OVERVIEW

There are two recognised subspecies of the Yellow-bellied Glider - the Yellow-bellied Glider (south-eastern) and the Yellow-bellied Glider (Wet Tropics) (DAWE, 2022). This assessment refers to the Yellow-bellied Glider (south-eastern), which will hereafter be referred to simply as the Yellow-bellied Glider.

The Yellow-bellied Glider is an arboreal marsupial and is the second largest Australian glider. It has a grey-brown body and a white to yellow belly and pale prominent ears. It has a black stripe down the back, mostly black tail, black markings on the feet, a black stripe on each thigh, and black markings along the edge of the gliding membrane (DAWE, 2022). The species is listed as Vulnerable under the EPBC Act.

The species occurs from south-eastern Queensland through to the South Australia-Victorian border. In NSW, it mainly occurs in forests along the eastern coast, yet also extends inland to the western slopes of the Great Dividing Range. In Victoria, the species primarily occurs in the eastern portion of the state. It may have once been widespread in South Australia yet is likely to now be extinct in the state. Across its range, the species' occurrence is highly disjunct due to a combination of land clearing in addition to specific habitat requirements which means the species will not occupy all types of forest (DAWE, 2022).

The Yellow-bellied Glider occurs in eucalypt-dominated woodlands and forests, showing a preference for large patches of mature old growth forest. It is dependent upon tree hollows in large old trees, used for sheltering during the day. Hollow-bearing trees are considered a critical habitat feature. The species also requires some degree of floristic diversity to provide year-round food supply and is unlikely to persist in habitat dominated by a small number of tree species (DAWE, 2022).

Yellow-bellied Gliders feed on tree sap, insects, spiders, eucalypt nectar and pollen, insect exudates and manna. Sap feed trees are a critical habitat feature of the species. A variety of tree species are used as sap trees, although less than 10 trees are used by an individual or family group, and use of tree species changes between different sites (DAWE, 2022).

The Yellow-bellied Glider is social and lives in family groups of two to six individuals. Each group occupies necessarily large home ranges (of around 50-65 ha) as foraging resources used by the species are spread out and change seasonally. Home ranges are used exclusively and are defended. Due to large home ranges and territorial behaviours, the species requires large areas of forest to maintain viable subpopulations. It has been suggested that minimum habitat areas of between 180-350 km^2 are required to maintain viable subpopulations (DAWE, 2022).

Yellow-bellied Gliders have low dispersal capabilities, limited by its gliding distance. In low forest, the average gliding distance is around 25 m. It is recommended that a gliding ratio of 2 m of horizontal distance to 1 m of lost height is used to estimate gliding distance to inform management decisions (DAWE, 2022).

Reproduction is seasonal, with reproduction timing varying across the species' range. Individuals typically form monogamous relationships, and litter sizes are usually a single offspring. Generation length is four to five years (DAWE, 2022).

As a precautionary approach given absence of sufficient information, all known populations of the species are considered important (DAWE, 2022).

The species' Conservation Advice provides the following definition of habitat critical to the survival of the species (DAWE, 2022):

Habitat critical to the survival of the yellow-bellied glider (south-eastern) may be broadly defined as areas containing the following attributes (noting that geographic areas containing habitat critical to survival needs to be defined by forest type on a regional basis):

- *"Large contiguous areas of floristically diverse eucalypt forest, which are dominated by winter-flowering and smooth-barked eucalypts, including mature living hollow-bearing trees and sap trees*
- *Areas identified as refuges under future climate change scenarios*
- *Short or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas*
- *Habitat corridors required to facilitate dispersal of the subspecies between fragmented habitat patches and/or that enable recolonization or movement away from threats. Yellow-bellied Gliders (south-eastern) have a glide ratio (horizontal distance/height dropped) of around 2.0, and corridors spanning gaps larger than the distance gliders are likely to be able to travel should be considered critical to the survival. There is not enough evidence to define the canopy and width characteristics of appropriate corridors. In the absence of such*

information, a precautionary approach should be taken to maximise dispersal by considering all habitat corridors in the species' range to be habitat critical to the survival; and

- *Areas in which some trees have evidence of use for sap extraction by Yellow-bellied Glider (south-eastern)"* (DAWE, 2022)

Habitat meeting any one of the criteria above is considered habitat critical to the survival of the yellow-bellied glider (south-eastern), irrespective of the abundance or density of the species or the perceived quality of the site. Forest areas currently unoccupied by the yellow-bellied glider (south-eastern) may still represent habitat critical to survival, if the recruitment of hollow bearing trees in the future could allow the species to colonise these areas and ensure persistence of a population."

The Conservation Advice (DAWE, 2022) further notes that "*Key considerations in environmental impact assessments relevant to the yellow-bellied glider (south-eastern) should include the following factors about the subspecies:*

- *Highly specialised diet and requirement of trees with unknown characteristics for sap feeding;*
- *Prefer to den in living hollow-bearing trees;*
- *Groups live in large, exclusive home ranges as foraging substrates are dispersed and variable through time and space; and*
- *Large areas of forest are required to maintain population viability"*

9.2 APPROACH TO AVAILABLE DATA TO UNDERSTAND SPECIES' OCCURRENCE

9.2.1 SPECIES RECORDS

All available BioNet records from 1990 onwards were considered within the assessment. The BioNet records were downloaded in May 2021.

9.2.2 HABITAT MAPPING

Habitat maps for the Yellow-bellied Glider were generated using BioNet PCT associations of intact and thinned vegetation, scattered trees, and a small area of mapped vegetation for which condition data is not available.

The mapping represents the distribution of potential habitat for the Yellow-bellied Glider within the Strategic Assessment Area.

Note that the mapping approach adopted is highly precautionary, as it incorporates more disturbed vegetation conditions (such as thinned vegetation and scattered trees) which, depending on their level of disturbance on the ground, may or may not have capacity to support the species. It is recognised that the Yellow-bellied Glider is sensitive to impacts of fragmentation and requires relatively closely spaced trees to enable movement across the landscape (DAWE, 2022). It is likely that the mapping approach used here over-predicts potential habitat for the species.

9.3 SPECIES' OCCURRENCE WITHIN THE STRATEGIC ASSESSMENT AREA

9.3.1 RECORDS

There are 12 records from 1990 onwards of the Yellow-bellied Glider within the Strategic Assessment Area. These records occur between 1994 and 2020.

Of these, one record (dated 2018) is located within small, scattered patches of mapped habitat within the OSO corridor in GPEC. This record was based on evidence of fresh scratch marks on a forest red gum.

The remaining records are located outside of the nominated areas, towards the northern and southern ends of the Strategic Assessment Area.

9.3.2 POTENTIAL HABITAT

The baseline mapping for this assessment has mapped 42,576 ha of potential habitat within the Strategic Assessment Area. Of this:

- 19,095.8 ha consists of vegetation in intact condition (45 per cent of total mapped habitat)
- 23,294.5 ha consists of thinned vegetation or scattered trees (55 per cent of total mapped habitat)
- 186.6 ha does not have vegetation condition information available (<0.01 per cent of total mapped habitat)

Mapped habitat occurs scattered throughout the Strategic Assessment Area, with larger and more connected areas of potential habitat occurring along the edges of the Strategic Assessment Area.

Due to the level of historical land clearing, potential habitat within the Strategic Assessment Area is more fragmented and disturbed compared to surrounding areas of vegetation. The species is particularly sensitive to fragmentation, with a low dispersal ability and a requirement for large native patches of vegetation containing a high enough density of tree hollows. Potential habitat within the Strategic Assessment Area is therefore, in general, likely to be marginal compared to the much broader and intact areas of habitat to the north and west of the Strategic Assessment Area and to the south of Sydney.

However, it is also recognised that substantial areas of vegetation in the north, west and south of Sydney were heavily impacted by bushfires in the 2019/20 fire season. This may increase the relative importance of habitat within the Strategic Assessment Area (particularly larger and more intact areas of potential habitat along the edges of the Strategic Assessment Area), as such areas of habitat may be acting as a refuge site for individuals of the species following the fires.

See Table 9-2 at the end of this assessment for a breakdown of the occurrence of habitat for the Yellow-bellied Glider in the Strategic Assessment Area.

9.3.3 MAP

Refer to Map D in the associated data package of this report for a map of records (constituting BioNet records from 1990 onwards) and mapped potential habitat for the Yellow-bellied Glider within the Strategic Assessment Area.

9.4 AVOIDANCE OF IMPACTS

9.4.1 RECORDS

There is one record of the Yellow-bellied Glider within GPEC, located within the South Creek riparian corridor, near the existing Western Motorway. This record is located within the footprint of the OSO within GPEC.

The Plan includes a species-specific commitment (Commitment 3) to avoid and minimise impacts to the Yellow-bellied Glider and its habitat within certified major transport corridors through detailed planning and design. This includes avoiding areas of potential habitat connectivity within riparian corridors where possible. This measure will help to minimise potential impacts to riparian habitat for the Yellow-bellied Glider within GPEC.

There are no other records of the species located within the nominated areas, or the transport corridors outside the nominated areas.

9.4.2 POTENTIAL HABITAT

The baseline mapping for the assessment mapped 3,950.3 ha of potential habitat for the Yellow-bellied Glider within the nominated areas (not including excluded lands). Approximately 3,100.3 of this has been avoided as part of the design of the urban capable lands and transport corridors (not including excluded lands). Of this:

- 2,405.7 ha was avoided for biodiversity purposes (1,551.8 ha of this comprises vegetation in intact condition)
- 694.6 ha was avoided for other purposes (615.5 ha of this comprises vegetation in intact condition)

A breakdown of avoidance across each nominated area is provided in Table 9-2.

It is important to note that the avoidance calculations in Table 9-2, including for 'avoidance for biodiversity purposes', 'avoidance for other reasons', and 'total avoidance', have been calculated without including excluded lands as these lands are not covered by the Plan. Table 9-2 shows the amounts of habitat within excluded lands for context only, and Chapter 14 of the Assessment Report defines the land types that are excluded.

9.5 DIRECT IMPACTS AND OFFSETS

Implementation of the Plan will lead to loss and fragmentation of potential habitat. A breakdown of impacts across the Strategic Assessment Area is given in Table 9-2.

While it is recognised that a record of the Yellow-bellied Glider occurs within the footprint of the OSO within GPEC, it is considered unlikely that notable direct impacts to the species within this locality will occur. This is because:

- There is a species-specific commitment (Commitment 3) to avoid and minimise impacts to the Yellow-bellied Glider and its habitat within certified major transport corridors through detailed planning and design. This commitment minimises potential impacts which may occur to key habitat features used by the species, such as tree hollows or trees supporting evidence of use as sap feeding trees
- The species is a mobile species which moves through the landscape

9.5.1 IMPACTS TO POTENTIAL HABITAT

Approximately 974.7 ha of potential Yellow-bellied Glider habitat will be lost due to the implementation of the Plan (849.9 ha within the nominated areas and 124.7 ha within transport corridors outside the nominated areas). The vast majority of impacted habitat is in a modified condition:

- 99.2 ha of impacts are to vegetation in an intact condition (10 per cent of impacts)
- 875.5 ha of impacts are to thinned vegetation or scattered trees (90 per cent of impacts)

Total impacts (including all vegetation classes) represent 2.3 per cent of potential habitat within the Strategic Assessment Area. However, when considering intact vegetation classes (the areas most likely to support suitable habitat for the species), impacts account for 0.5 per cent of mapped habitat in intact condition within the Strategic Assessment Area.

The main impact areas include:

- GMAC: Loss of 239.9 ha of potential habitat on the edges of riparian corridors adjacent to the urban capable land. Of this:
  - 49.6 ha is in intact condition
  - 170.2 ha is thinned vegetation or scattered trees
- Wilton: Loss of 149.3 ha of potential habitat on the edges of riparian corridors adjacent to the urban capable land. Of this:
  - 12.5 ha is in intact condition
  - 136.8 ha is thinned vegetation or scattered trees
- GPEC: Loss of 172.0 ha of potential habitat, which mainly occurs as impacts from the OSO to vegetation at Wianamatta Regional Park, and impacts from urban capable land to smaller scattered areas of potential habitat, or to the edges of larger and more intact areas of potential habitat across the nominated area. Of this:
  - 11.5 ha is in intact condition
  - 160.5 ha is thinned vegetation or scattered trees
- WSA: Loss of 288.8 ha of potential habitat which affects an area of remnant vegetation near Twin Creeks and otherwise impacts the edges of small and scattered areas of vegetation. Of this:
  - 10.9 ha is in intact condition
  - 277.9 ha is thinned vegetation or scattered trees
- Transport outside nominated areas: Loss of 124.7 ha of potential habitat which primarily occurs within the OSO footprint to the west and south of WSA. Smaller areas of impact also occur in the OSO footprint to the west of GMAC in the Camden/Menangle region. Of this:
  - 14.6 ha is in intact condition
  - 110.1 ha is thinned vegetation or scattered trees

9.5.2 FRAGMENTATION IMPACTS

The majority of impacts under the Plan either occur along the edges of larger corridors of intact habitat (and will not result in fragmentation), or impact patches of habitat which are already fragmented within the landscape.

Fragmentation of potential habitat may occur at some sites under the Plan. The areas with the greatest potential to be impacted are patches of habitat which are intersected by the OSO to the south of WSA, and potential habitat within Wianamatta Regional Park that is impacted by the OSO within GPEC. However, the species-specific commitment (Commitment 3) to avoid and minimise impacts to the Yellow-bellied Glider and its habitat within certified major transport corridors through detailed planning and design (including avoiding areas of potential habitat connectivity within riparian corridors where possible) is expected to minimise the potential for further fragmentation of habitat.

9.5.3 RISK OF RESIDUAL DIRECT IMPACTS TO THE SPECIES

RISK OF RESIDUAL IMPACTS DUE TO IMPACTED HABITAT

The risk assessment method outlined in Section 30.3.4 of the Assessment Report has been applied with regards to mapped potential habitat for the species.

Based on the application of this risk assessment method, the risk of residual adverse impacts occurring to the species as a result of the loss of potential foraging habitat is considered to be low. This is because:

- The likelihood of direct impacts to potential habitat has been categorised as likely. There will be direct impacts to potential habitat
- The consequence of any impacts to the species has been categorised as minor. There will be loss of approximately 2 per cent of mapped potential habitat in the Strategic Assessment Area

RISK OF RESIDUAL IMPACTS DUE TO FRAGMENTATION

The risk of residual adverse impacts occurring to the species as a result of the loss of fragmentation is considered to be very low. This is because:

- The likelihood of fragmentation has been categorised as possible. This is because the OSO transport corridor fragments potential habitat that could be used by the Yellow-bellied Glider for dispersal
- The consequence of fragmentation has been categorised as negligible. This is because the area that may be subject to fragmentation within Wianamatta Regional Park consists of a small area of potential habitat with no associated records

OVERALL RISK OF RESIDUAL IMPACTS

Based on application of the risk assessment method outlined in Section 30.3.4 of the Assessment Report, the overall risk of residual impacts to the Yellow-bellied Glider is low.

While the species may occasionally use habitat within the Strategic Assessment Area, the area impacted under the Plan is likely to be comparatively more marginal habitat for the species than other areas of suitable habitat. This is because:

- Habitat to be impacted under the Plan occurs within a heavily fragmented landscape. The Conservation Advice notes that large areas of forest (estimated minimum area of between 180-350 km^2) are required to maintain population viability and recommends that this factor be included as a key consideration in environmental impact assessments (DAWE, 2022)
- The single location of the species record within GPEC occurs within a thin riparian habitat corridor within an otherwise developed area. The site is therefore likely to be relatively degraded due to impacts of edge effects and increased pressures from urban threats such as predation from cats. This reduces the potential for the species to maintain a permanent presence at this location. The site is also not mapped to support PCT's which are associated with the species, suggesting habitat values which may be present (such as suitable foraging resources) may be more marginal or occur at lower densities than in other areas

9.5.4 OFFSETS FOR RESIDUAL DIRECT IMPACTS

Given the low risk of residual adverse impacts to the species, offsets were not considered necessary for the Yellow-bellied Glider under the application of the risk assessment method outlined in Section 30.3.4 of the Assessment Report.

However, the species will benefit from a range of conservation measures under the Plan which will ensure suitable protection of key habitat features from impacts and provide for long-term protection of potential habitat areas. These include:

- A species-specific commitment (Commitment 3) to avoid and minimise impacts to the Yellow-bellied Glider and its habitat within certified major transport corridors through detailed planning and design. This includes avoiding areas of potential habitat connectivity within riparian corridors where possible
- Increased protection of 14,286.5 ha of potential habitat (of which 8,416.8 ha is vegetation in intact condition) for the species within the SCA:
    - A proportion of this area of potential habitat within the SCA will be secured for conservation purposes. For example, 1,516.9 ha of potential habitat (of which 1,309.7 ha is in intact condition) for the Yellow-bellied Glider is contained within the proposed Georges River Koala Reserve
    - Increased protection from threats for potential habitat located within the SCA which is not secured for conservation. A new SEPP (Strategic Conservation Planning) will be introduced, which will apply additional development controls

to land within the SCA to limit the impacts of future development and subdivision and ensure biodiversity values are protected if development is proposed on these lands

- A commitment (Commitment 13) to undertake ecological restoration including ecological reconstruction in conservation land across a range of vegetation types. This commitment will contribute to the restoration of the quality and extent of habitat for the species

The overall outcome under the Plan is considered to be appropriate and consistent with the requirements of the Conservation Advice.

9.6 IMPACTS ASSOCIATED WITH ESSENTIAL INFRASTRUCTURE

Potential habitat for the Yellow-bellied Glider has been mapped on avoided lands in all nominated areas. As a result, the species may be subject to additional impacts from essential infrastructure.

As outlined in Part 2 and Chapter 37 of the Assessment Report, essential infrastructure may be undertaken on avoided land if consistent with the requirements of the Plan. The Plan specifies that:

- Every effort should be made to ensure that essential infrastructure development is limited to urban capable land
- Where essential infrastructure is proposed on avoided land:
  - It must comply with the Cumberland Plain Conservation Plan Guidelines for Infrastructure Development
  - It must meet the commitments for avoidance (Commitments 2.1 and 2.2), including prioritising avoidance of impacts for certain species

The Cumberland Plain Conservation Plan Guidelines for Infrastructure Development will include development controls that apply to essential infrastructure on avoided land to ensure consistency with the requirements of the Plan. The guideline states that essential infrastructure development must:

- Avoid and minimise impacts to biodiversity values and specific TECs and species, including koala habitat and corridors
- Identify and implement mitigation measures to address indirect impacts on biodiversity values, including installing and maintaining the integrity of koala exclusion fencing
- Offset any impacts in accordance with the BAM and BC Act

In addition, proposed essential infrastructure on avoided land may require approval under the BC Act and if so, will be required to apply the BAM, which includes:

- On-ground surveys to determine the biodiversity values within the potential development area
- Measures to avoid impacts to the species through development design
- Measures to mitigate any potential indirect impacts
- Measures to offset any residual impacts in accordance with the requirements of the BAM

It is not expected that substantial impacts to the species will occur as a result of essential infrastructure, and that any impacts that did occur would be adequately mitigated and offset. See Section 37.6 in Chapter 37 of the Assessment Report for more details.

9.7 IMPACTS ASSOCIATED WITH TUNNELS

A total of 140.2 ha of potential habitat for the Yellow-bellied Glider occurs within tunnel footprints under the Plan.

As outlined in Chapter 36 of the Assessment Report, the Plan includes commitments (Commitment 4 and Commitment 6) to avoid and minimise direct impacts and mitigate indirect impacts to MNES values where disturbance to the land surface within or in the vicinity of the tunnel footprints is necessary. This must be undertaken in accordance with:

- Major transport corridors class of action description in the Plan, including the NSW State Significant Infrastructure (SSI) (or equivalent) approval, as well as the BC Act (or equivalent) for the non-certified major transport corridors (strategically assessed)
- Specific mitigation measures to address indirect impacts on biodiversity values prescribed in Appendix E

Actions under commitment 4 and 6 require Transport for NSW to implement:

- On-ground surveys to determine the biodiversity values within the tunnel footprints to inform avoidance and minimisation of impacts
- Measures to avoid impacts to biodiversity values through detailed design, with specific consideration to the MNES values identified in Commitments 4.2 and 4.3 relating to the tunnels
- Measures to mitigate any potential indirect impacts, including specific measures identified Appendix E of the Plan
- Measures to offset any residual impacts in accordance with the offset requirements of the BAM and EPBC Act Environmental Offsets Policy should there be long-term detrimental impacts from subsidence due to the tunnels
- Reporting to the Department and executive implementation committee on avoidance outcomes and mitigation measures proposed to manage the impacts of each transport project

These commitments are expected to adequately address threats to the species from the construction and operation of the tunnels. See Section 36.6 in Chapter 36 of the Assessment Report for more details.

9.8 INDIRECT IMPACTS

The species' Conservation Advice (DAWE, 2022) identifies a range of threats to the species. Where these threats are present in the Strategic Assessment Area and have the potential to be exacerbated under the Plan, the Plan includes management strategies to mitigate their impacts.

The following potential indirect impacts are considered relevant to implementation of the Plan:

- Inappropriate fire regimes
- Predation by cats

Timber harvesting, predation by foxes, habitat degradation from feral deer and fencing of agricultural land resulting in entanglement have also been identified as threats to the species. However, these are not considered relevant to implementation of the Plan as the Plan is unlikely to exacerbate these threats across the Strategic Assessment Area.

Climate change is also a relevant threat to the species. The extent to which the Plan has considered adaptation to climate change impacts is addressed in Chapter 41 of the Assessment Report.

9.8.1 INAPPROPRIATE FIRE REGIMES

Inappropriate fire regimes (including prescribed burns) resulting in increased fire frequency, size and severity poses a threat to the Yellow-bellied Glider. Fires that are too large, frequent or intense may result in elevated direct mortality of individuals and loss of important habitat features (including foraging resources and tree hollows). It is thought that Yellow-bellied Glider populations may remain stable under natural fire regimes (DAWE, 2022).

Increased human activity within the nominated areas has the potential to alter fire regimes, through potentially increasing fire frequencies in some areas, and decreasing fire frequencies in others, through the following mechanisms:

- Increased fire frequency due to arson and accidental lighting of fires
- Increased fire frequency due to the application of fire by authorities to manage fire risk
- In other cases, a lack of fire due to challenges in burns in proximity to human habitation

Key risk areas are those that are easily accessible to the public and in close proximity to urban development and roads.

The Plan incorporates a range of measures to manage the bushfire risk to biodiversity. In summary, these include:

- A commitment (Commitment 17) to manage fire in strategic locations across the strategic assessment area. This includes a number of actions with the most relevant to the outcome for the Yellow-bellied Glider being:
    - Consultation with fire management authorities and traditional owners about how best to manage fire and maintain biodiversity values
    - Preparation of a Fire Management Strategy in priority locations that will (amongst other things) provide guidance on fire management to maintain and promote biodiversity values
    - A process to work with delivery partners to implement the Fire Management Strategy

  - Integration of the fire management actions for conservation land identified in the Fire Management Strategy in stewardship agreements and reserve management plans
- Introduction of a new SEPP (Strategic Conservation Planning) that will:
  - Set out development controls to avoid and minimise impacts of future development on biodiversity values in avoided land and the SCA. The SEPP requires the consent authority to be satisfied that the development is managed to avoid adverse impacts to biodiversity values prior to granting approval. This would include consideration of risks to biodiversity values relating to managing fire risk
  - Require asset protection zones (APZs) to be wholly within urban capable land. This will ensure the highest intensity bushfire risk mitigation activities occur away from habitat for the Yellow-bellied Glider. While these APZs are designed to provide a buffer zone between a bushfire hazard and buildings or other infrastructure that need to be protected, they will also act as a protective buffer for the bushland areas from the sorts of activities within the urban capable land and transport corridors that might increase fire frequency or changes to natural fire regimes

The package of measures in the Plan is expected to adequately manage the risk to the Yellow-bellied Glider from inappropriate fire regimes due to development. This is because:

- APZs for fire management are required to be located within urban capable lands which will reduce the risk of fire mitigation activities impacting habitat
- Fire management authorities will be engaged to ensure they understand the values relevant to the Yellow-bellied Glider and incorporate these values into their fire management practices. This will include specific fire management approaches for conservation areas

9.8.2 PREDATION BY CATS

Predation by cats is recognised as a potential threat to the Yellow-bellied Glider (DAWE, 2022).

Existing land use within the nominated areas and surrounding region includes residential areas and farming, which means cats are unlikely to pose a novel threat to the species in the area. However, the extent of proposed new urban development under the Plan means the threat is likely to be exacerbated.

The Plan incorporates a range of measures to manage the risks associated with cats. In summary, these include:

- A commitment (Commitment 16) to manage priority pest animals in strategic locations in the Cumberland subregion to reduce threats to land protected in the SCA. This includes a number of actions with the most relevant to the outcome for the species being:
  - The establishment of a pest animal working group to guide the implementation of pest animal control activities under the Plan
  - Preparation of a Pest Animal Control Implementation Strategy
  - A process to enter into written agreements with delivery partners to implement the pest animal control program
  - Integration of pest control actions for conservation lands into biodiversity stewardship agreements and reserve management plans
- Incorporation of development controls into DCPs for each nominated area that will:
  - Ensure that domestic animals are appropriately contained at urban/bushland interfaces
  - Require property boundaries to have appropriate fencing to contain domestic animals within the landholders' property
  - Require appropriate management and control of pest animals relevant to development sites

9.9 IMPLICATIONS FOR LONG-TERM VIABILITY OF THE SPECIES

The species' Conservation Advice (DAWE, 2022) identifies the following key issues that are likely to have the greatest influence on the long-term viability of the Yellow-bellied Glider in relation to implementation of the Plan:

- Habitat loss and fragmentation
- Indirect impacts such as:
  - Inappropriate fire regimes
  - Predation by cats

9.9.1 HABITAT LOSS AND FRAGMENTATION

The risk of residual adverse impacts to the species from habitat loss is low.

A record of the species is mapped to occur within the footprint of the OSO within GPEC. However, it is considered unlikely that individuals in this locality will be impacted under the Plan, as the Plan incorporates a species-specific commitment (Commitment 3) to avoid and minimise impacts to the Yellow-bellied Glider and its habitat within certified major transport corridors through detailed planning and design.

The Plan authorises the clearing of 974.7 ha of potential habitat (2.3 per cent of potential habitat within the Strategic Assessment Area). This habitat is considered to be more marginal than surrounding areas of habitat as:

- The areas of impacted habitat are likely to be too small and fragmented to sustain a viable population of the species
- The majority of direct impacts occur on the edges of habitat corridors and to areas that are already highly fragmented, and are likely to be degraded as a result of edge effects and high urban threat levels

The areas of potential habitat within the Strategic Assessment Area are connected to a much larger network of intact habitat to the north, west and south. In this regional context, implementation of the Plan impacts a very small proportion of the habitat available to the species.

The Plan's conservation program is likely to provide significant benefits to the species within the Strategic Assessment Area, including:

- Increased protection of 14,286.5 ha of potential habitat for the species within the SCA from development pressures through introduction of additional development controls
- Securing potential habitat for the species for conservation purposes from within the SCA. For example, 1,516.9 ha of potential habitat for the species occurs within the Georges River Koala Reserve
- A commitment (Commitment 13) to undertake ecological restoration including ecological reconstruction in conservation land across a range of vegetation types, which would contribute to the restoration of the quality and extent of habitat available for the species

Overall, habitat loss and fragmentation are not expected to adversely influence the long-term viability of the species.

9.9.2 INDIRECT IMPACTS

The potential indirect impacts associated with inappropriate fire regimes and predation by cats will be managed and mitigated through the generic management strategies in the Plan.

Indirect impacts are not expected to influence the long-term viability of the species.

9.9.3 CONCLUSION

There are large areas of potential habitat (42,576 ha) and impacts to this are relatively minor (974.7 ha) given the more substantial areas of intact habitat surrounding the Strategic Assessment Area.

While there is a record of the species within the footprint of the OSO within GPEC, a species-specific commitment (Commitment 3) to avoid impacts to the Yellow-bellied Glider and its habitat during the development of major infrastructure corridors within the nominated areas will provide protection for any individuals of the species which may occur at this site.

Potential indirect impacts are addressed through general management strategies defined in the Plan and implementation of the conservation program will protect large areas associated with potential habitat for the species.

Collectively these will ensure that the implementation of the Plan does not adversely influence the long-term viability of the Yellow-bellied Glider.

9.10 CONSISTENCY WITH THE RECOVERY PLAN

There is no adopted or made Recovery Plan for this species.

9.11 KEY THREATENING PROCESSES AND CONSISTENCY WITH THREAT ABATEMENT PLANS

Relevant Key Threatening Processes (KTPs) and any of their associated Threat Abatement Plans (TAPs) have been identified in Table 9-1 where they relate to:

- The potential direct impacts of the Plan, or
- The relevant indirect impacts

The consistency of the Plan with relevant Threat Abatement Plans is discussed in detail in Chapter 15 of the Assessment Report. The Plan is not inconsistent with any Threat Abatement Plans.

Table 9-1: Relevant Key Threatening Processes and associated Threat Abatement Plans for the Yellow-bellied Glider

RELEVANT KEY THREATENING PROCESS	ASSOCIATED THREAT ABATEMENT PLAN
Land clearance	There is no relevant TAP
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	There is no relevant TAP
Novel biota and their impact on biodiversity	There is no relevant TAP
Predation by feral cats	Threat abatement plan for predation by feral cats (DoE, 2015)

9.12 KEY STATISTICS

Table 9-2: Occurrence, avoidance and impacts of Yellow-bellied Glider habitat

	WILTON	GMAC	WSA	GPEC	TRANSPORT OUTSIDE NOMINATED AREAS	TOTAL IN NOMINATED AREAS AND TRANSPORT CORRIDORS
TOTAL HABITAT (ha)	1,636.0	2,778.4	506.7	1,983.4	124.7	7,029.2
HABITAT WITHIN EXCLUDED LANDS (ha)	297.9	860.4	63.6	1,732.3	N/A	2,954.2
HABITAT WITHOUT EXCLUDED LANDS (ha)	**1,338.1**	**1,918.0**	**443.1**	**251.1**	N/A	**3,950.3**
AVOIDANCE FOR BIODIVERSITY PURPOSE (ha)	909.4	1,292.8	131.8	71.6	N/A	2,405.7
AVOIDANCE FOR OTHER REASONS (ha)	279.3	385.3	22.5	7.5	N/A	694.6
TOTAL AVOIDANCE (ha)	**1,188.8**	**1,678.1**	**154.3**	**79.1**	N/A	**3,100.3**
DIRECT IMPACTS TO HABITAT (ha)	**149.3**	**239.9**	**288.8**	**172.0**	**124.7**	**974.7**

9.13 REFERENCES

DAWE (2022) *Conservation Advice for Petaurus australis australis (yellow-bellied glider (south-eastern))* Department of Agriculture, Water and the Environment

DoE (2015) *Threat abatement plan for predation by feral cats* Canberra Retrieved from http://www.environment.gov.au/system/files/resources/78f3dea5-c278-4273-8923-fa0de27aacfb/files/tap-predation-feral-cats-2015.pdf