Transport
for NSW

Koala Fencing – Hume Motorway, Wilton

Review of Environmental Factors

February 2024

NSW GOVERNMENT

transport.nsw.gov.au

Acknowledgement of Country

Transport for NSW acknowledges Gundangurra Tribe the traditional custodians of the land on which the Koala Fencing – Hume Motorway, Wilton is proposed.

We pay our respects to their Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

Approval and authorisation

Title	Koala Fencing – Hume Motorway, Wilton
Accepted on behalf of Transport for NSW by:	Daniel Farrugia Senior Project Manager, Infrastructure and Place
Signed	[redacted]
Date:	26/02/2024

Executive summary

The proposal

Transport for NSW (Transport) proposes to install koala exclusion fencing (koala fencing) at two locations along the Hume Motorway, referred to as Site 2 (Northern Hume) and Site 3 (Southern Hume). The fencing is proposed to exclude koalas (*Phascolarctos cinereus*) from the roadway to reduce the potential for vehicle strike. This proposal supports the NSW Government's commitment to installing koala fencing along key roads in the region to address threats to koalas.

Key features of the proposal would include:

- About 420 metres of koala fencing (in total) predominantly within the road reserve along both sides of the M31 Hume Motorway, south of Moolgun Creek Bridge (referred to as Site 2 (Northern Hume)). At the northern extent, this fencing would travel under the Moolgun Creek Bridge. At its southern extents, this fencing would tie into a future noise wall and boundary fence/or koala fence to be constructed by adjacent residential developments.
- About 1.4 kilometres of koala fencing (in total) within the road reserve along both sides of the southbound exit/entry ramps at the intersection of the M31 Hume Motorway and Picton Road (referred to as Site 3 (Southern Hume)). This fencing would tie into the existing safety barriers of the Pheasants Nest Bridge.
- One-way koala/fauna escape structures located intermittently along the fence lines, to allow any koalas/fauna to move from the road side to the habitat side of the corridor.
- Up to three metres of selective vegetation clearing on both sides of the fence to allow for the installation and maintenance of the fences and to remove overhanging branches that may allow koalas to access the road side of the fence (note that as far as practicable clearing would be limited to one metre either side of the fence).
- Gates located at about 250 metre intervals would be incorporated into the fence for use by emergency services and maintenance personnel during incidents, mitigation works and maintenance inspections / repairs.
- Tie backs at fence ends to push koalas (and other fauna) back into the habitat areas.

Construction is anticipated to commence early 2024 and take about three months to complete.

Need for the proposal

Under the *Cumberland Plain Conservation Plan* (CPCP) (DPE, 2022), the NSW Government has committed to installing koala fencing in the Wilton and Greater Macarthur growth areas, to protect koalas from the increasing urban threat of vehicle strike. In NSW, wildlife vehicle strike is regarded as a key threat to koalas (Department of Planning, Industry and Environment, 2020). A key strategy to prevent this is to discourage or exclude koalas from accessing the road corridor altogether, including through the use of koala exclusion fencing. Koala fencing is proposed to be constructed as a priority conservation action in Years 1-5 of the CPCP's implementation (i.e. 2021 to 2025). The proposal has been developed in response to the commitments in the CPCP and other related strategic plans for the region.

Proposal objectives

The objectives of the proposal are:

- Implement koala exclusion fencing as per the strategy in the CPCP
- Minimise the potential for koala vehicle strike
- Encourage the use of underpasses (under existing bridges) by koalas/fauna to safely cross road corridors.

Options considered

The options were considered for the proposal included the following:

- Option 1 – Fence installation along two sections of the Hume Motorway to facilitate safe movement of koalas along the Nepean River corridor, where habitat adjoins new development areas in the Wilton Growth Area
- Option 2 – Do nothing.

An analysis of the options was undertaken which found that the preferred option is Option 1 as it would prevent koalas crossing the motorway and therefore reduce the potential for vehicle strikes. This option would also align with relevant strategic documents, particularly the CPCP, and also meet the objectives for the proposal. The benefits of this option are considered to justify the temporary and short-term environmental impacts and cost associated with this option.

Statutory and planning framework

Under the *State Environmental Planning Policy (Transport and Infrastructure) 2021,* the proposal is categorised as environmental management works for the purpose of road infrastructure facilities, and is to be carried out by Transport as a public authority. It can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW), and development consent from council is not required.

Clause 13.6 of the *State Environmental Planning Policy (Biodiversity and Conservation) 2021* provides that the erection and maintenance of koala fences within the mapped strategic conservation planning area (within which this proposal is located) may be carried out by or on behalf of a public authority without development consent if the fence is consistent with the CPCP. This is consistent with the permissibility provided under the SEPP (Transport and Infrastructure), providing it is consistent with the CPCP.

This review of environmental factors (REF) fulfils Transport's obligation under Section 5.5 of the EP&A Act, including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

Community and stakeholder consultation

Consultation with the Aboriginal community has been undertaken following Transport's *Procedure for Aboriginal Cultural Heritage and Consultation Investigation (PACHCI) Guidelines* (2011). An archaeological survey was undertaken with representatives of the Tharawal Local Aboriginal Land Council in September 2022. No Aboriginal objects, sites or areas of potential archaeological deposit were identified within the assessment study area.

In accordance with Section 2.15 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* SEPP (Transport and Infrastructure), Subsidence Advisory NSW have been notified about the proposal. The Subsidence Advisory did not raise any issues in response to the notification.

Nearby residents and businesses would be notified of works prior to and during construction in accordance with safeguards recommended in this REF (e.g. in relation to potential noise impacts).

Environmental impacts

This REF identifies the potential environmental benefits and impacts of the proposal and outlines the mitigation measures to reduce the identified impacts. The main environmental impacts of the proposal are:

Biodiversity

A Biodiversity Assessment Report (BAR) was prepared for the proposal. The proposal would require clearing of vegetation-free maintenance zones on either side of the fence, which would consist of up to 0.61 hectares of Plant Community Type (PCT) 1395 (Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion), across three condition zones. This PCT is commensurate with Shale Sandstone Transition Forest, in the Sydney Basin Bioregion - listed as critically endangered under the BC Act, and a portion is also commensurate with Shale Sandstone Transition Forest – listed as critically endangered under the EPBC Act.

The vegetation to be removed provides potential habitat for the Cumberland Plain Land Snail *(Meridolum corneovirens*), and includes up to 0.09 ha of potential foraging habitat for Southern Myotis (*Myotis macropus*) which was assumed to be present. The proposal would not result in the removal of key breeding habitat, such as tree hollows, decorticating bark and logs for the Southern Myotis.

Construction of the proposal would produce noise and vibration which may have indirect impacts on fauna in the vicinity of the works. However, these impacts would be temporary and localised, and in the context of the existing high noise levels from the motorway, are not considered to be significant. Artificial lighting would also be required for night works, which would impact fauna behaviour (including feeding, roosting and breeding) in the vicinity temporarily. Safeguards would be implemented to minimise impacts from noise and light emissions.

The proposal would deliberately introduce an additional barrier to koala movement across the Hume Motorway at the proposal sites. As such, the proposal would potentially contribute to reduced connectivity in instances where fauna can

safely cross the existing motorway. The proposed fence alignment would tie into or travel under the existing bridges and would maintain the connectivity along the Nepean River and Allens Creek corridors (under the bridges). The proposal would reduce the incidence of vehicle-strike and mortality in the locality and facilitate the movement of fauna through more suitable corridors by channelling fauna to existing crossings under the road.

The BAR included tests of significance and found that the proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999, Biodiversity Conservation Act, 2016* or *Fisheries Management Act 1994.* A Species Impact Statement or Biodiversity Development Assessment Report is not required.

A preliminary calculation of offsets has been determined in accordance with *No Net Loss Guidelines* (Transport, 2022) using the Biodiversity Assessment Method Calculator (BAM-C). The calculation found that 22 ecosystem credits would be required for the proposal. These impacts are based on a one-metre clearing buffer from the proposed fence alignment (which represents a worst-case clearing buffer). Therefore, the preliminary offset calculations will need to be revised as part of a Biodiversity Offset Strategy for the proposal once the final clearing footprint is determined.

Noise and vibration

There are no noise sensitive receivers within 500 metres of Site 2 (Northern Hume) and therefore no noise impacts are expected during daytime hours. During the noisiest construction activity at nighttime the applicable Noise Management Level (NML) would likely be exceeded at sensitive receivers within 875 metres and with direct line of sight to the proposal area.

During the noisiest construction activity, the proposal would likely exceed the applicable NML at sensitive receivers within 200 metres of Site 3 (Southern Hume) with direct line of sight of the proposal area during daytime hours and nighttime hours. Residential receivers located at greater distances (up to 420 metres and 875 metres) would also experience exceedances of the applicable NML during nighttime however to a lesser degree.

Due to the predicated exceedances, additional safeguards will be implemented (in addition to standard safeguards) in accordance with Transport's *Construction Noise and Vibration Guideline* (2016). No vibration impacts during construction are anticipated due to the distance of receivers from the proposal area.

The proposal is not expected to cause noise or vibration impacts during operation.

Traffic, transport and access

During construction, closure of one traffic lane would be required to allow for safe site access and exit for construction workers, and to undertake the majority of works including vegetation clearing. The lane closures required would have a temporary and minor impact on traffic flow (travel times) by restricting traffic to one lane and slower speeds along a short section of the motorway. The majority of the works are proposed to be undertaken during nighttime hours, which would limit the amount of traffic impacted.

The operational proposal would not result in traffic, transport or access impacts with the exception of maintenance activities. Maintenance activities may require traffic management/lane closures to access the fences, however, would occur irregularly, have limited impacts and be short in duration.

During operation the presence of the fencing is expected to reduce the potential for vehicles striking koalas along the motorway, which would be beneficial to road users travelling through the proposal area.

Visual amenity

During construction, a temporary reduction in visual amenity would occur from the presence of construction activities, including night lighting to safely undertake the works and temporary lane closures and associated traffic management. Construction activities would be limited to the proposal area and would be visible to passing motorists and nearby receivers during nighttime hours (in which the majority of the work would be conducted), as well as standard day time construction hours (in which some of the works would be undertaken). Machinery and vehicles would also be parked in laydown areas in between shifts and contribute to visual impacts.

The presence of night lighting in particular would likely be visible to nearby receivers with line of sight to the motorway and would require management to avoid light spill as far as practicable into the surrounding environment to minimise this impact.

Operation of the proposal would introduce koala fencing as a new element along the side of the motorway, along with a vegetation-free maintenance zone on both sides of the fence. Sensitive receivers would include drivers along the motorway,

and a nearby rural residence. Overall, the visual amenity impacts of the proposal were found to be moderate-low from the road corridor (for motorists), and moderate from a nearby residence near Site 3 (Southern Hume).

Other issues

This REF also assesses impacts associated with other relevant environmental factors, including:

- Aboriginal cultural heritage
- Air quality
- Socio-economic, property and land use
- Soils and contamination
- Surface water, flooding and groundwater
- Waste and resource use
- Non-Aboriginal heritage
- Cumulative impacts.

The assessment of each of the above topics concluded the impacts during construction and operation of the proposal would generally be minor and would be managed through the implementation of safeguards and management measures outlined in Section 7.2. Residual impacts associated with the proposal are not likely to be significant.

Justification and conclusion

This REF has been prepared having regard to sections 5.5 of the EP&A Act, and Section 171 of the EP&A Regulation (refer to Appendix A), to ensure that Transport takes into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the proposal.

The proposal is considered to meet the proposal objectives, including to implement koala exclusion fencing and encourage safe habitat connectivity (and with incidental benefits to other fauna species). The proposal also improves safety by reducing the potential for fauna vehicle collision by motorists using the Hume Motorway.

Should the proposal proceed, any potential associated adverse impacts would be appropriately managed in accordance with the mitigation measures outlined in this REF. This would ensure the proposal is delivered to maximise benefit to the community and minimise any adverse impacts on the environment.

In considering the overall potential impacts outlined in this REF, the proposal is unlikely to significantly affect the environment including critical habitat or threatened species, populations, ecological communities or their habitats, and does not require the preparation of an Environmental Impact Statement.

Table of contents

Executive summary ..... **iv**

1. Introduction **1**

1.1 Proposal identification 1
1.2 Purpose of the report 3

2. Need and options considered **4**

2.1 Strategic need for the proposal 4
2.2 Limitations of existing infrastructure 8
2.3 Proposal objectives 8
2.4 Alternatives and options considered 8
2.5 Preferred option 9
2.6 Design refinements 9

3. Description of the proposal **10**

3.1 The proposal 10
3.2 Design 13
3.3 Construction activities 17
3.4 Laydown areas 19
3.5 Public utility adjustment 20
3.6 Property acquisition 20

4. Statutory and planning framework **22**

4.1 Environmental Planning and Assessment Act 1979 22
4.2 Other relevant NSW legislation 26
4.3 Commonwealth legislation 28
4.4 Confirmation of statutory position 28

5. Consultation **29**

5.1 Aboriginal community involvement 29
5.2 SEPP (Transport and Infrastructure) consultation 29
5.3 Community notifications 29

6. Environmental assessment **30**

6.1 Biodiversity 30
6.2 Noise and vibration 40
6.3 Traffic, transport and access 49
6.4 Aboriginal cultural heritage 51
6.5 Visual amenity 56
6.6 Air quality 60
6.7 Socio-economic, property and land use 62
6.8 Soils and contamination 65
6.9 Surface water, flooding and groundwater 68

6.10 Waste and resource use 72
6.11 Other issues 75

7. Environmental management 77

7.1 Environmental management plans 77
7.2 Summary of safeguards and management measures 77
7.3 Licensing and approvals 86

8. Conclusion 87

8.1 Justification 87
8.2 Objects of the EP&A Act 87
8.3 Conclusion 89

9. Certification 91

10. EP&A Regulation publication requirement 92

11. References 93

Terms and acronyms used in this REF 95

Appendix A 96

Consideration of Section 171(2) factors and matters of national environmental significance and Commonwealth land 96

Appendix B 100

Statutory consultation checklists 100

Appendix C 104

Biodiversity Assessment Report 104

Appendix D 105

Construction Noise Assessment – Koala Fencing Sites 2 and 3: Hume Motorway, Wilton 105

Appendix E 106

Aboriginal Archaeological Survey Report - Stage 2 PACHCI 106

Appendix F 107

Aboriginal heritage assessment of modified trees 107

Appendix G 108

Koala fence design drawings 108

Tables

Table 2-1: Analysis of options 9
Table 3-1: Indicative construction methodology 17
Table 3-2: Indicative quantity of materials 19
Table 4-1: Land use impacted by the proposal 23
Table 6-1 Plant community types and vegetation zones 31
Table 6-2 Summary of tests of significance for BC Act listed species/communities 37
Table 6-3 Biodiversity safeguards and management measures 38
Table 6-4: Background noise levels and applicable noise management levels for residential receivers 41
Table 6-5 Background noise levels and applicable noise management levels for active recreation 41
Table 6-6 Predicted noise levels during the noisiest construction activity at Site 2 (Northern Hume) during the day 42
Table 6-7 Predicted noise levels during the noisiest construction activity at Site 2 (Northern Hume) during the night 42
Table 6-8: Predicted noise levels during the noisiest construction activity at Site 3 (Southern Hume) during the day 42
Table 6-9: Predicted noise levels during the noisiest construction activity at Site 3 (Southern Hume) during the night 43
Table 6-10: Noise and vibration safeguards and management measures 48
Table 6-11: Transport AADT data for the Hume Motorway 49
Table 6-12: Traffic and transport safeguards and management measures 50
Table 6-13: Type and number of identified known Aboriginal sites within the study area 52
Table 6-14: Aboriginal heritage safeguards and management measures 55
Table 6-15: Visual amenity impact grading matrix 56
Table 6-16 Operational visual impact assessment 59
Table 6-17: Visual amenity safeguards and management measures 60
Table 6-18: Air quality safeguards and management measures 62
Table 6-19: Levels of sensitivity 63
Table 6-20: Levels of magnitude 63
Table 6-21: Socio-economic impact grading matrix 63
Table 6-22: Socio economic safeguards and management measures 65
Table 6-23: Soils and contamination safeguards and management measures 67
Table 6-24: Surface water safeguards and management measures 71
Table 6-25: Waste safeguards and management measures 74
Table 6-26: Other potential impacts 75
Table 6-27: Other impacts Safeguards and management measures 76
Table 7-1: Summary of safeguards and management measures 78
Table 7-2: Summary of licensing and approvals required 86
Table 8-1: Objects of the Environmental Planning and Assessment Act 1979 87
Table 10-1: EP&A Regulation publication requirement 92

Figures

Figure 1-1: Location of the proposal sites 2
Figure 2-1 CPCP Land Categories - Site 2 (Northern Hume) 6
Figure 2-2 CPCP Land Categories - Site 3 (Southern Hume) 7
Figure 3-1: Key features of the proposal – Site 2 (Northern Hume) 11
Figure 3-2: Key features of the proposal – Site 3 (Southern Hume) 12
Figure 3-3: Koala fence – typical arrangement 14
Figure 3-4: Indicative elevation - Koala fencing and gate (3.6m-wide gate detail) 15
Figure 3-5: Indicative elevation - Koala fencing and 1.2m-wide maintenance gate 15
Figure 3-6: Indicative elevation - Koala escape structure 16
Figure 3-7: Construction laydown areas (located at Site 3 (Southern Hume)) 21
Figure 4-1 Site 2 (Northern Hume) land zone 24
Figure 4-2 Site 3 (Southern Hume) land zone 25
Figure 6-1 Plant community types, habitat features Site 2 (Southern Hume) and subject land to be impacted 32
Figure 6-2 Plant community types and habitat features Site 3 (Northern Hume), and subject land to be impacted 33
Figure 6-3 Predicted construction noise impacts at Site 2 (Northern Hume) during the day 44
Figure 6-4 Predicted construction noise impacts at Site 2 (Northern Hume) during the night 45
Figure 6-5: Predicted construction noise impacts at Site 3 (Southern Hume) during the day 46
Figure 6-6 Predicted construction noise impacts at Site 3 (Southern Hume) during the night 47
Figure 6-7: Location of known Aboriginal sites 53
Figure 6-8 Location of viewpoints 57
Figure 6-9 Viewpoint 1: North facing view from the northbound lane adjacent to Site 2 (Northern Hume) (Image source: Google maps, 2023) 58
Figure 6-10 Viewpoint 2: South facing view from the southbound lane adjacent to Site 3 (Southern Hume) (Image source: Google maps, 2023) 58
Figure 6-11 Viewpoint 3: Indication of view from nearby residence towards the northbound exit ramp adjacent to Site 3 (Southern Hume) (Image source: Google maps, 2023) 58
Figure 6-12: Mapped soils of the proposal area and surrounds 66
Figure 6-13: 1% AEP Flood event mapping – Site 2 (Northern Hume) 69
Figure 6-14 1% AEP Flood event mapping – Site 3 (Southern Hume) 70

1. Introduction

1.1 Proposal identification

Transport for NSW (Transport) proposes to install koala exclusion fencing (koala fencing) at two locations along the Hume Motorway, referred to as Site 2 (Northern Hume) and Site 3 (Southern Hume). The fencing is proposed to exclude koalas (*Phascolarctos cinereus*) from the roadway to reduce the potential for vehicle strike. This proposal supports the NSW Government's commitment to address threats to koalas by installing koala fencing along key roads in the Wilton Growth Area.

Key features of the proposal would include:

- About 420 metres of koala fencing (in total) predominantly within the road reserve along both sides of the M31 Hume Motorway, south of Moolgun Creek Bridge (referred to as Site 2 (Northern Hume)). At the northern extent, this fencing would travel under the Moolgun Creek Bridge. At its southern extents, this fencing would tie into a future noise wall and boundary fence/ or koala fence to be constructed by adjacent residential developments
- About 1.4 kilometres of koala fencing (in total) within the road reserve along both sides of the southbound exit/entry ramps at the intersection of the M31 Hume Motorway and Picton Road (referred to as Site 3 (Southern Hume)). This fencing would tie into the existing safety barriers of the Pheasants Nest Bridge
- One-way koala/fauna escape structures located intermittently along the fence lines, to allow any koalas/fauna to move from the road side to the habitat side of the fence
- Up to three metres of selective vegetation clearing on both sides of the fence and bridges to allow for the installation and maintenance of the fences and to remove overhanging branches or climbing structures that may allow koalas to access the road side of the fence (note that as far as practicable clearing would be limited to one metre either side of the fence)
- Gates located at about 250 metre intervals would be incorporated into the fence for use by emergency services and maintenance personnel during incidents, mitigation works and maintenance inspections / repairs
- Tie backs at fence ends to push koalas (and other fauna) back into the habitat areas.

The proposal is located just to the west and north of the town of Wilton, within the Wollondilly Shire Council Local Government Area (LGA).

The location of the proposal is shown on Figure 1-1. Chapter 3 describes the proposal in more detail.

AECOM

N

0 250 500 m

FIGURE 1-1:
LOCATION OF THE PROPOSAL SITES

Legend

Proposal area

Watercourse

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community. Imagery © Nearmap 2023.

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by AECOM on behalf of Transport. For the purpose of these works, Transport is the proponent and determining authority under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The assessment of the environmental impacts associated with the proposal has been undertaken in the context of Section 171 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation), the factors in *Guidelines for Division 5.1 assessments* (DPE 2022), *Roads and Related Facilities EIS Guideline* (DUAP 1996) and other relevant legislation (refer Section 4).

In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that Transport examine and take into account, to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval sought from the Minister for Planning under Division 5.2 of the EP&A Act.
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in Section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report.
- The significance of any impact on nationally-listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and if offsets are required and able to be secured.
- The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Department of Climate Change, Energy, the Environment and Water for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2. Need and options considered

2.1 Strategic need for the proposal

Under the *Cumberland Plain Conservation Plan* (CPCP) (DPE, 2022), the NSW Government has committed to installing koala fencing in the Wilton and Greater Macarthur growth areas, to protect koalas from the increasing urban threat of vehicle strike. In NSW, wildlife vehicle strike is regarded as a key threat to koalas (Department of Planning, Industry and Environment, 2020). A key strategy to prevent this is to discourage or exclude koalas from accessing the road corridor altogether, including through the use of koala exclusion fencing. Koala fencing is proposed to be constructed as a priority conservation action in Years 1-5 of the CPCP's implementation (i.e. 2021 to 2025).

Advice on the CPCP from the Office of the NSW Chief Scientist and Engineer 2021

In 2021 the Office of NSW's Chief Scientist and Engineer issued advice regarding the protection of koala populations outlined in a draft of the CPCP. The advice found that the koala specific provisions of the CPCP are broadly adequate however made several recommendations that could improve outcomes for koalas. The review identified 31 principles for koala protection in the region. Principle 15 specifically recommends exclusion fencing to create separation between koalas and urban threats. This proposal forms part of the NSW Government's commitment to implement this principle.

Cumberland Plain Conservation Plan 2022

The CPCP is a strategic-level plan aimed at stemming the loss and recovering biodiversity values within the Cumberland Plain. The CPCP identifies strategically important biodiversity areas within the Cumberland subregion, with view to offsetting the biodiversity impacts of future urban development. This is proposed to be achieved through the implementation of a strategic biodiversity certification under the *Biodiversity Conservation Act 2016* (BC Act) and strategic assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The CPCP provides the biodiversity approvals required for new development in nominated areas (including the Wilton Growth Area), supports the delivery of major transport infrastructure across the region, and contains requirements for infrastructure permissible under the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (such as this proposal). Planning controls have been introduced to support the CPCP through a new chapter of the *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (refer Section 4.1.1).

The CPCP identifies important biodiversity areas that will not be certified and where development will be limited. These areas are identified as 'avoided land'. The CPCP also identifies areas suitable for development, which are mapped as certified-urban capable land or certified-major transport corridors. Development in these areas will not require further biodiversity approvals under the BC Act and EPBC Act if development is in accordance with the CPCP. The entirety of Site 2 (Northern Hume), Site 3 (Southern Hume) and associated access tracks and laydown areas are located within 'excluded land' under the CPCP (refer Figure 2-1 and Figure 2-2).

Cumberland Plain Conservation Plan Sub-plans

The CPCP contains two sub-plans which support the implementation of the CPCP: *Sub-Plan A: Conservation Program and Implementation* sits alongside *Sub-Plan B: Koalas*. Sub-Plan A outlines how the conservation program will be implemented and evaluated over the life of the CPCP. It contains a list of guiding commitments and actions, which includes the installation of koala exclusion fencing (Commitment 7). *Sub-Plan B: Koalas* describes specific conservation actions to protect and manage koalas and their habitat in south-western Sydney. This includes the installation of koala fencing at specific locations, and identification of several known roadkill hotspots in the area covered by the CPCP. The sub-plan identifies the Nepean River corridor and Allens Creek corridor as key koala habitat corridors.

Feasibility Study Report: Cumberland Plain Koala Exclusion 2022

A feasibility study was undertaken by Cardno (2022) to consider fencing alignments and fencing design options in accordance with the overarching intent of the CPCP. The feasibility study was a desktop assessment which utilised existing literature and stakeholder consultation outcomes to develop a decision-making framework which considered benefits and constraints for potential locations where exclusion fences should be aligned.

The proposed fence alignments recommended near the Wilton and Greater Macarthur growth areas generally followed the borders of the mapped 'avoided land' under the CPCP. The alignments of the proposal in this REF have been developed based on findings of the feasibility study, combined with further site surveys, environmental and planning investigations.

NSW Koala Strategy 2022

The *NSW Koala Strategy* outlines the NSW Government's commitment to improving koala safety and conservation actions (NSW Government, 2022). The strategy has four key pillars all with the aim of protecting koalas and their habitats. Pillar 3 of the strategy is to improve koala safety and health, including avoiding vehicle strike through koala fencing. The proposal aligns with this proposed action through the provision of koala fencing specifically aimed at preventing vehicle strike along the Hume Motorway.

Wilton 2040, A Plan for the Wilton Growth Area

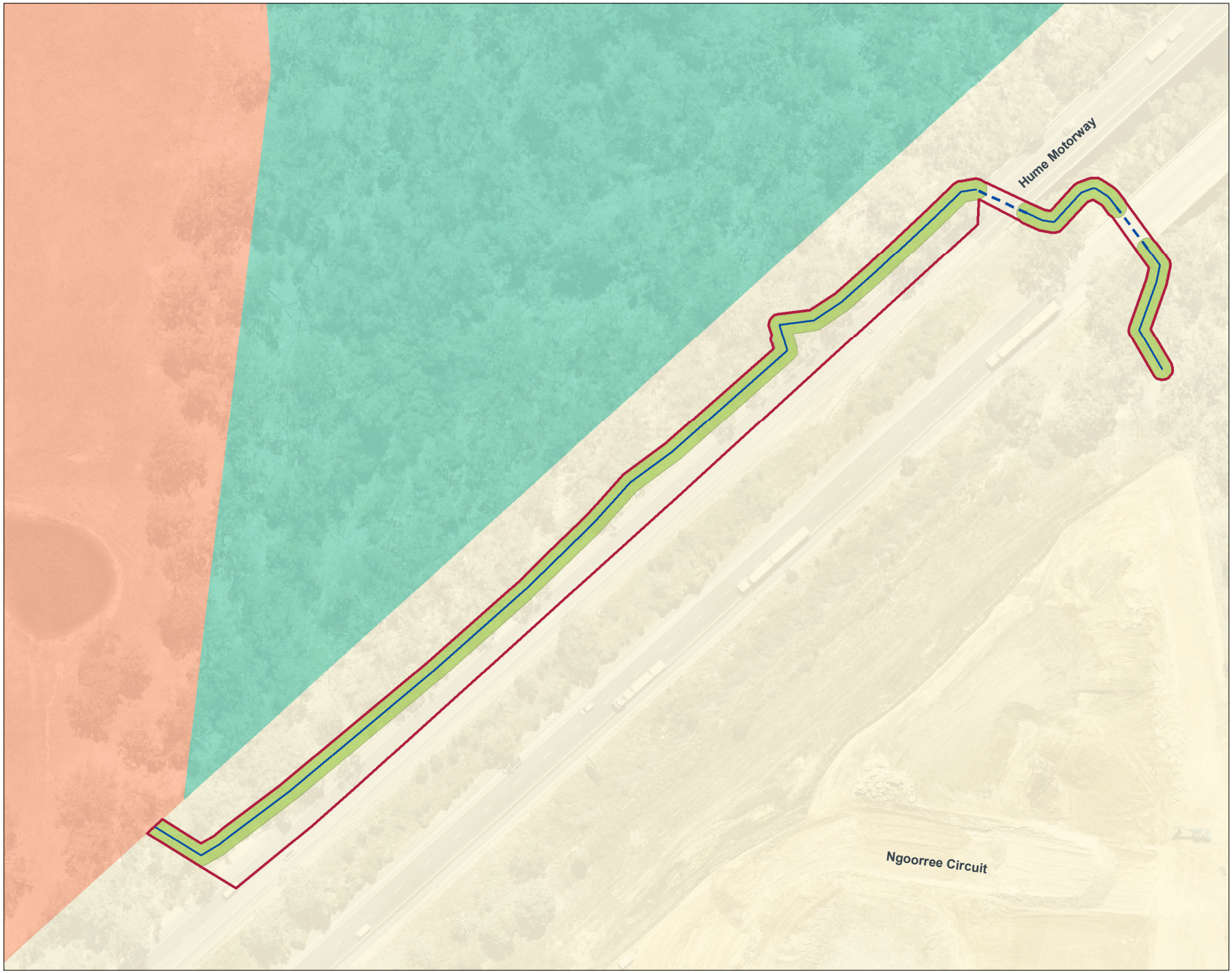
Wilton was identified as a growth area within the Western Parkland City under the *Greater Sydney Region Plan* (Greater Sydney Commission, 2018). *Wilton 2040, A Plan for the Wilton Growth Area* (Department of Planning and Environment, 2018) (Wilton 2040) was prepared as the guiding document for the transformation of the Wilton Growth Area in accordance with this plan.

One of the goals within Wilton 2040 is to protect and enhance important habitats, and specifically to protect koalas. The theme also notes the need for precinct planning to be consistent with the goals of the CPCP. There are three primary koala corridors surrounding Wilton Growth Area, including Allens Creek near Site 2 (Northern Hume). The proposal would assist in channelling koalas into the identified koala corridor adjacent to Site 2 (Northern Hume), and help to protect the koala population from vehicle strike in this area.

Wollondilly 2040

Wollondilly 2040, A Vision for the Future of Wollondilly, Local Strategic Planning Statement (Wollondilly Shire Council, 2020) (Wollondilly 2040) identifies and outlines Council's strategic planning priorities for the Wollondilly LGA. There are four main themes including infrastructure and collaboration, liveability, productivity and sustainability. The proposal is aligned with several planning priorities associated with these themes, specifically:

- *Planning Priority 4 - Creating vibrant, healthy and sustainable communities in our new town in Wilton*: A key action under this priority is the protection of native fauna and implementation of a koala conservation strategy. The proposal would help to protect native animals and koalas from vehicle strike along the motorway.
- *Planning Priority 13 - Protecting biodiversity and koala habitat corridors*: A major feature of the Wollondilly LGA is an expanding and healthy population of koalas and extensive areas of bushland that provide habitat corridors for the species' food and movement. The proposal would help to protect koalas, and biodiversity generally, by reducing vehicle strike, and by directing koalas through vegetated riparian corridors, including under existing waterway bridges to traverse the motorway.



AECOM

N

0 20 40 m

FIGURE 2-1:
CUMBERLAND PLAIN CONSERVATION PLAN LAND CATERGORIES
SITE 2 (NORTHERN HUME)

Legend

- Proposal area
- Vegetation clearing zone
- Koala fence alignment
- Koala fence alignment under bridge

CPCP Land Category

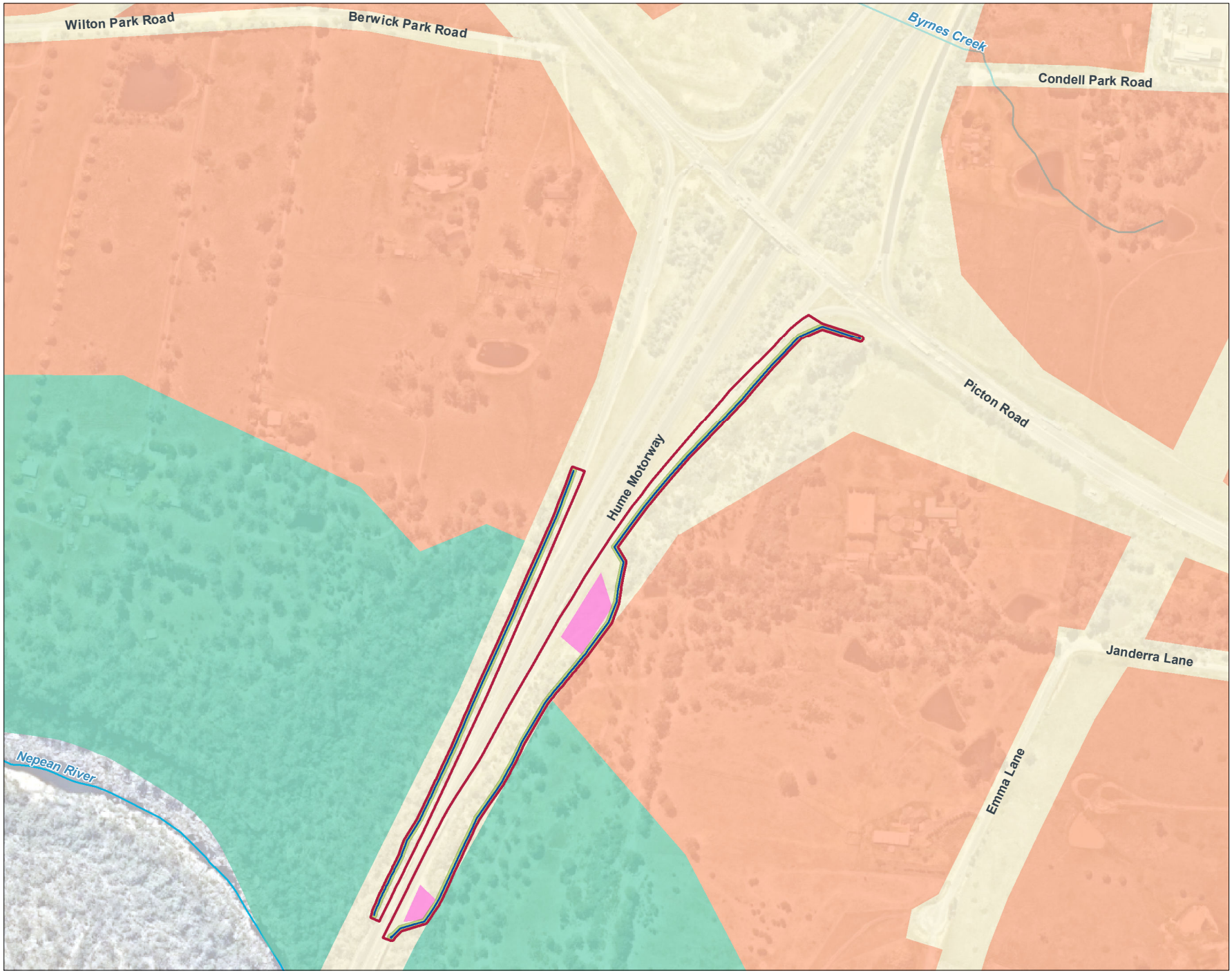
- Avoided land
- Certified - urban capable land
- Excluded land

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.



AECOM

N

0 60 120 m

FIGURE 2-2:
CUMBERLAND PLAIN CONSERVATION PLAN LAND CATERGORIES
SITE 3 (SOUTHERN HUME)

Legend

- Proposal area
- Vegetation clearing zone
- Laydown area
- Koala fence alignment
- Watercourse

CPCP Land Category

- Avoided land
- Certified - urban capable land
- Excluded land

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

2.2 Limitations of existing infrastructure

The proposal area currently does not include any koala-exclusion fencing or similar measures, resulting in the potential for harm to koalas through vehicle strike.

The existing bridges at each site do not contain any specific connectivity features for koalas/fauna to use (such as structures to climb under the bridge) and were not specifically designed for koala fencing to tie into. The bridge structures have been required to be taken into consideration in the development of the design and alignment of the fencing.

Other design and engineering constraints associated with the proposal and site locations are listed in Section 3.2.

2.3 Proposal objectives

The objectives of the proposal are as follows:

- Implement koala exclusion fencing as per the strategy in the *Cumberland Plain Conservation Plan* (CPCP)
- Minimise the potential for koala vehicle strike
- Encourage the use of underpasses (under existing bridges) by koalas/fauna to safely cross road corridors.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of preferred option

The strategic need for the proposal is described in Section 2.1, which outlines that the CPCP identifies several actions for stemming the loss of, and recovering biodiversity values within the Cumberland Plain including a commitment to install koala exclusion fencing. The *Feasibility Study Report: Cumberland Plain Koala Exclusion* (Cardno, 2022) identified fence alignment options within the Wilton growth area that aligned with the land categories (and their objectives) identified in the CPCP.

Options to meet this need were subsequently identified (refer Section 2.4.2), which included koala fencing alignments that were developed with reference to the *Feasibility Study Report: Cumberland Plain Koala Exclusion* (Cardno, 2022). Section 2.4.3 describes the analysis of options undertaken against the proposal objectives (described in Section 2.3) as well as environmental and planning considerations. A preferred option was then chosen as outlined in Section 2.5. Design refinements are described in Section 2.6.

2.4.2 Identified options

Option 1 – Fence installation along two sections of the Hume Motorway

This option would install koala fencing adjacent to two sections of the Hume Motorway, and tie into existing bridges that cross waterways (the Nepean River and Allens Creek). The alignment locations are based on the *Feasibility Study Report* (Cardno, 2022) (and CPCP) and are designed to facilitate safe movement of koalas along the Nepean River corridor, where habitat adjoins new development areas in the Wilton Growth Area.

Option 2 – Do nothing

Under a 'do-nothing' option, the existing situation along the Hume Motorway would remain the same whereby there is no koala fencing and koalas (and other wildlife) are able to access the carriageway.

2.4.3 Analysis of options

Table 2-1 below outlines the analysis of each option undertaken against the proposal objectives.

Table 2-1: Analysis of options

Objectives	Option 1	Option 2
Implement koala exclusion fencing as per the strategy in the *Cumberland Plain Conservation Plan* (CPCP)	Meets the objective: Option 1 incorporates koala fencing in line with the commitments in the CPCP and the aims of the land categories identified in the CPCP	Does not meet the objective: Option 2 does not include koala fencing and therefore does not contribute to meeting the commitments of the CPCP
Minimise the potential for koala vehicle strike	Meets objective: Option 1 would install fencing that would prevent koalas from accessing the road in proximity to the proposal	Does not meet objective: Option 2 would continue to allow koalas to access the road
Encourage the use of underpasses (under existing bridges) by koalas/fauna, to safely pass road corridors	Meets the objective: Option 1 would install fencing that would facilitate the movement of koalas under the motorway bridges to cross the road corridor, including the vegetated corridors of the Nepean River and Allens Creek	Does not meet the objective: Option 2 would not encourage koalas to cross the road corridor under bridges, with the motorway remaining a hazard to crossing koalas (and motorists)

Option 2 would continue to permit the movement of koalas (and other large fauna) across the motorway. This would be inconsistent with the objectives and commitments of the CPCP and its subplans, as well as other state and local strategies, and community sentiment generally (described in Section 2.1). This option would meet or contribute to the objectives of the proposal.

Option 1 would entail the construction of koala fencing in two locations along the Hume Motorway in areas of known koala movement. This option would result in short-term environmental impacts, and the clearing of a vegetation-free zone around the fences, which would need to be kept clear during operation also. However, once installed, the fencing would prevent koalas crossing the motorway whilst still allowing koala movement along the Nepean River and Allens Creek riparian corridors. This option would be in line with the strategic need outlined in Section 2.1, particularly the requirements of the CPCP and its relevant sub-plans. This option would also satisfy the objectives of the proposal as described above.

2.5 Preferred option

The preferred option is Option 1 as it would prevent koalas crossing the motorway and therefore reduce the potential for vehicle strike. This option would also align with the strategic documents outlined in Section 2.1, and meet the proposal objectives described in Section 2.3. The benefits of this option are considered to justify the temporary and short-term environmental impacts associated with this option. A biodiversity assessment undertaken for the preferred option (refer Section 6.1) found that the proposal is unlikely to have a significant impact on biodiversity values.

2.6 Design refinements

Throughout the development of the proposal design refinements have been made to improve the proposal design, including:

- The fencing alignment at Site 2 (Northern Hume) was adjusted to tie into a proposed noise wall and boundary fence associated with adjacent future residential development. The design was also adjusted at the northern extent to travel under the Moolgun Creek Bridge instead of tying into it, to maintain a constant fenceline/boundary to keep koalas out of the motorway corridor. The alignments for Site 2 (northern Hume) underwent further adjustments to avoid existing underground services.
- 'Floppy top' fence designs were initially considered for use as part of the fence design, however a type of 'slippery top' fence design was chosen to proceed with. This is due to the larger footprint and higher maintenance requirements of floppy top fences. The fence design chosen is described further in Section 3.2
- Emergency access gates have been added to the design at intervals along the fence lines, in consultation with the Rural Fire Service, and concrete bases added under the gates to prevent fauna digging underneath them.
- The types of koala escape mechanisms proposed have been refined based on reported performance on other koala fencing projects.

3. Description of the proposal

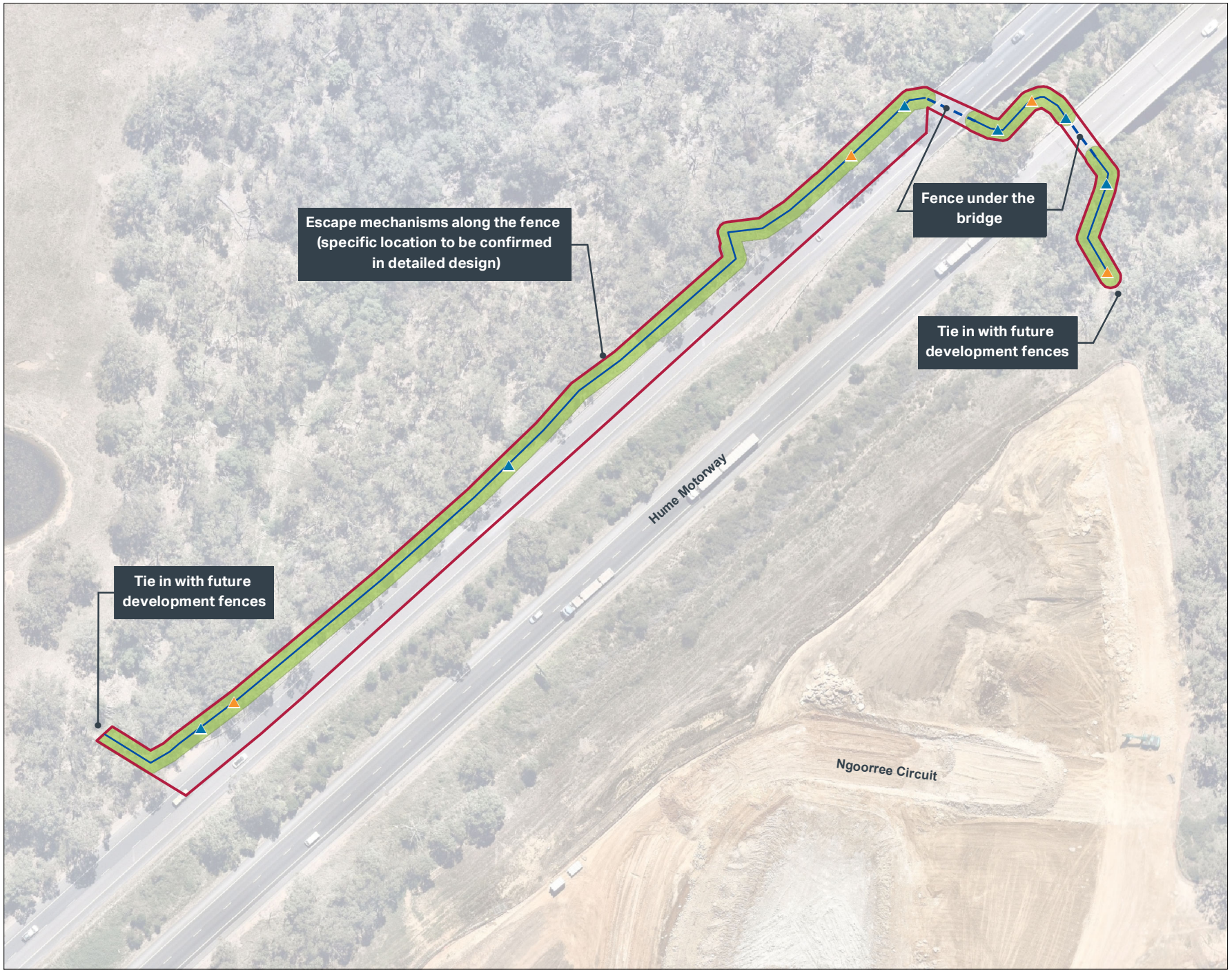
3.1 The proposal

Transport proposes to install koala fencing at two locations along the M31 Hume Motorway in Wilton, NSW. The proposal would be located about two kilometres north-west of the Wilton town centre, within the Wollondilly LGA. This fencing is part of Transport's response to the NSW Government's commitment to protect koalas from the increasing urban threat of vehicle strike.

Key features of the proposal would include:

- About 420 metres of koala fencing (in total) predominantly within the road reserve along both sides of the M31 Hume Motorway, south of Moolgun Creek Bridge (referred to as Site 2 (Northern Hume)). At the northern extent, this this fencing would travel under the Moolgun Creek Bridge. At its southern extents, this fencing would tie into a future noise wall and boundary fence/ or koala fence to be constructed by adjacent residential developments.
- About 1.4 kilometres of koala fencing (in total) within the road reserve along both sides of the southbound exit/entry ramps at the intersection of the M31 Hume Motorway and Picton Road (referred to as Site 3 (Southern Hume)). This fencing would tie into the existing safety barriers of the Pheasants Nest Bridge.
- One-way koala/fauna escape structures located intermittently along the fence lines, to allow any koalas/fauna to move from road side to the habitat side of the fence.
- Up to three metres of selective vegetation clearing on both sides of the fence to allow for the installation and maintenance of the fences and to remove overhanging branches that may allow koalas to access the road side of the fence (note that as far as practicable clearing would be limited to one metre either side of the fence).
- Gates located at about 250 metre intervals would be incorporated into the fence for use by emergency services and maintenance personnel during incidents, mitigation works and maintenance inspections / repairs
- Tie backs at fence ends to push koalas (and other fauna) back into the habitat corridor.

The key features of the proposal are shown in Figure 3-1 and Figure 3-2.



AECOM

N

0 10 20 m

FIGURE 3-1:
KEY FEATURES OF THE PROPOSAL - SITE 2 (NORTHERN HUME)

Legend

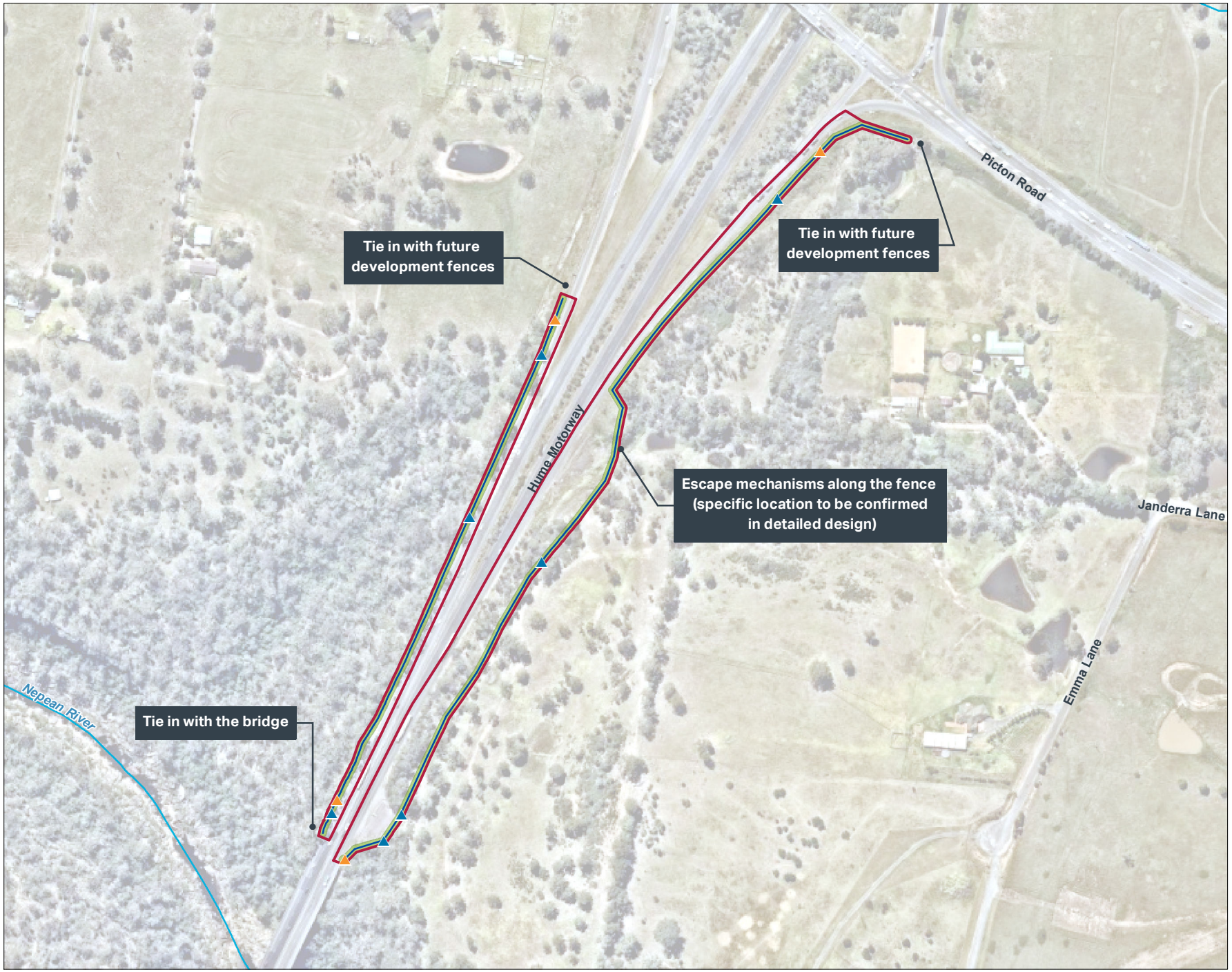
- Proposal area
- Vegetation clearing zone
- Koala fence alignment
- Koala fence alignment under bridge
- One-way escape
- Gate

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.



AECOM

N

0 50 100 m

FIGURE 3-2:
KEY FEATURES OF THE PROPOSAL - SITE 3 (SOUTHERN HUME)

Legend

- Proposal area
- Vegetation clearing zone
- Watercourse
- Koala fence alignment
- One-way escape
- Gate

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

3.2 Design

3.2.1 Design criteria

Key considerations and criteria for the design of the proposal included the following:

- Development of koala fence and gate design undertaken with reference to Transport's *R0800 Fencing Series* standard drawings and designs developed on previous exclusion fencing projects (e.g. Pacific Highway project).
- The provision of a vegetation-free zone either side of the fence to allow adequate space for construction, restrict koala movement (via overhanging branches) and allow for maintenance during operation.
- Location of the fencing (including the vegetation-free zone) within the road reserve and/or in areas that minimise impacts to vegetation.
- Design of the fencing to tie into or travel under existing bridges, thereby channelling koalas into vegetated waterway corridors under existing bridges.
- Design of the fencing to tie into existing and future planned fences and noise/boundary walls in adjacent urban development areas to avoid koala movement around the fence.
- Provision of koala/fauna escape structures located at intervals along the fence (refer Figure 3-1 and Figure 3-2 for locations of escape structures).
- Gates located at about 250 metre intervals would be incorporated into the fence for use by emergency services and maintenance personnel during incidents, mitigation works and maintenance inspections / repairs.
- Tie backs at fence ends to push koalas (and other fauna) back into the habitat corridors.

3.2.2 Engineering constraints

The following engineering constraints have been identified for the proposal:

- Road shoulders are to be kept clear and existing road safety barriers are to be avoided by a distance of at least 1.6 metres, and ideally 2.0 to 3.0 metres, to provide clearance for fence and safety barrier maintenance.
- The structural integrity of safety barriers over existing waterway bridges (that the fencing would tie into) is to be maintained (existing bridges were not designed specifically to have koala fencing tie into them).
- The integrity of the banks of nearby waterways are not to be compromised.
- Future noise walls, boundary fences and koala fences constructed by others adjacent to Site 2 (Northern Hume) (on both sides of the Hume Motorway) are to be accounted for and tied into.
- Mature trees (including those with hollows) and vegetation within the road corridor, along the fence alignment and within the vegetation free maintenance zone are to be avoided wherever practicable (may not be feasible on habitat side to prevent opportunities for koalas to climb the fence).
- Adjacent private property is to be avoided and existing property accesses (e.g. driveways) are to be maintained.
- Difficult or hazardous construction access tracks should be avoided (e.g. avoiding private property, adjacent development and steep gradients).
- Uneven ground conditions are to be avoided or levelled with machinery if necessary.
- Utilities are to be avoided.
- Fencing across notable drainage lines is to be avoided or an appropriate fence design solution is to be provided where necessary to facilitate surface runoff without blocking the drainage line and to prevent koalas to access the road from the habitat corridor.
- Other constructability constraints and accessibility constraints for maintenance activities are to be accounted for.

3.2.3 Major design features

Koala fencing and gates

The proposed koala fencing would be about 1.5 metres in height and comprise the following:

- Chain link fencing, minimum 1.5 metres in height, combined with steel sheets 0.6 metres in height secured atop the chain link fencing between 0.9m and 1.5m height, with a mesh skirt pinned into the ground to minimum depths of about 300 millimetres (deeper in softer soils)
- Fence panels of about 3.0 metres in width between each fence post
- Gates (pedestrian access only) located at about 250 metre intervals would be incorporated into the fence for use by emergency services and maintenance personnel during incidents, mitigation works and maintenance inspections / repairs. A concrete base or in-ground barrier (geo-product) would be installed under the gates to prevent fauna digging underneath the gates and traversing the fence line.
- Tie backs at fence ends to push koalas (and other fauna) back into the habitat corridor.

Indicative designs for the koala fence design and gates are shown in Figure 3-3, Figure 3-4 and Figure 3-5. The full set of design drawings are provided in Appendix G.

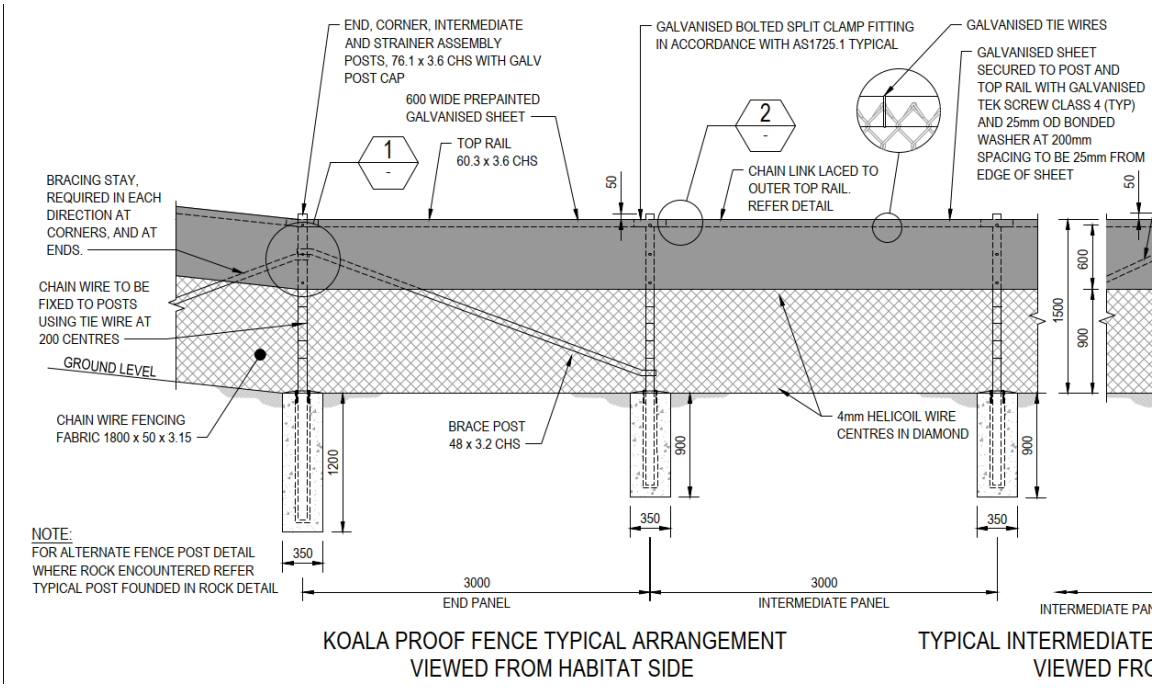


Figure 3-3: Koala fence – typical arrangement

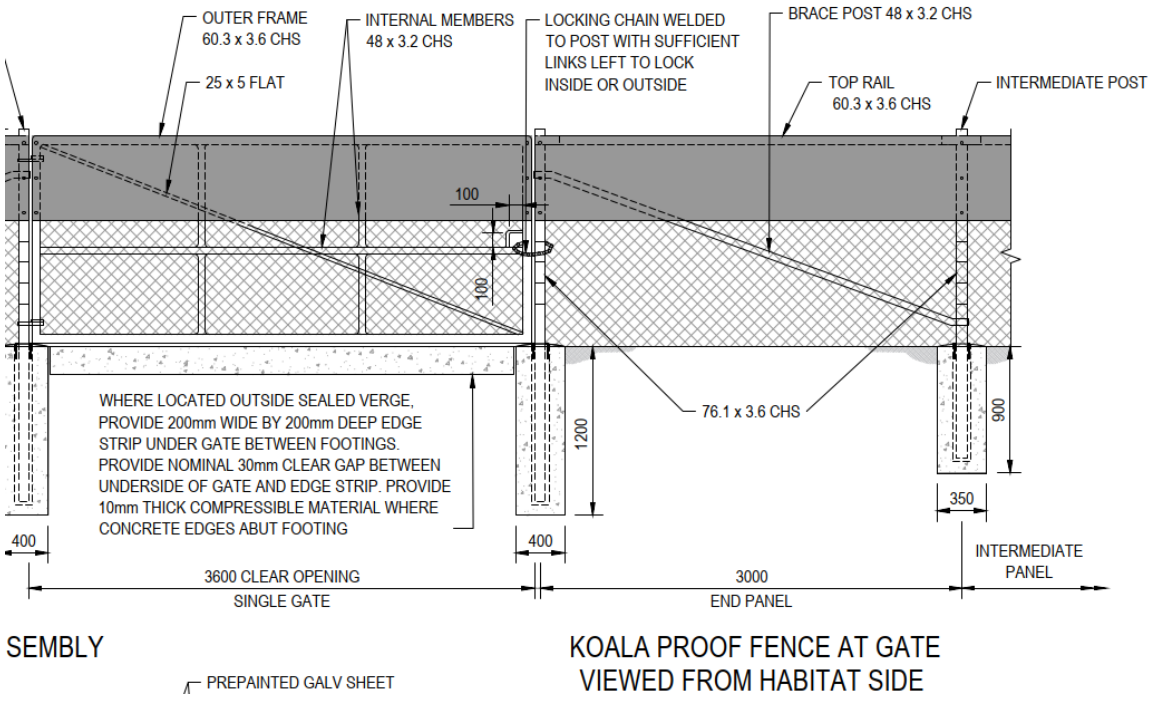


Figure 3-4: Indicative elevation - Koala fencing and gate (3.6m-wide gate detail)

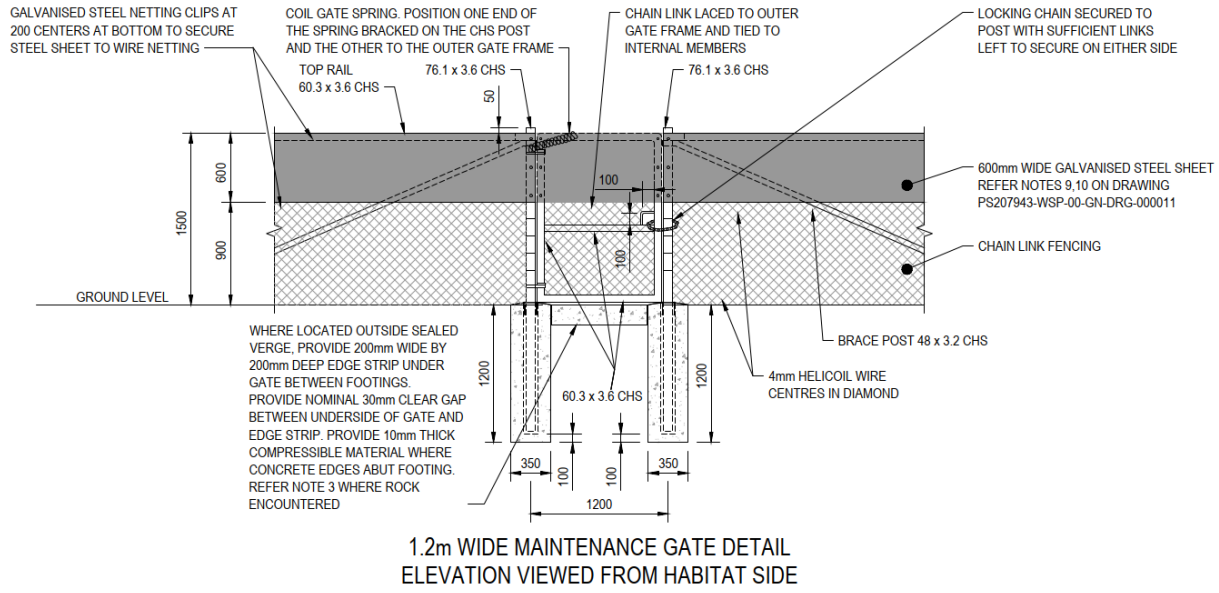


Figure 3-5: Indicative elevation - Koala fencing and 1.2m-wide maintenance gate

Koala/fauna escape structures

Koala escape structures would be installed along the fence line to allow koalas to move to the road corridor to the other side of the fence (habitat side). An escape mechanism would be included in the form of a wooden post to facilitate koalas/fauna climbing up and over the fence. The pole on the habitat side of the fence would be covered in galvanised sheeting (or similar) to prevent climbing towards the road side.

An indicative design of these escape structures is shown in Figure 3-6. These structures would be located at intervals along the fence (refer to Figure 3-1 and Figure 3-2).

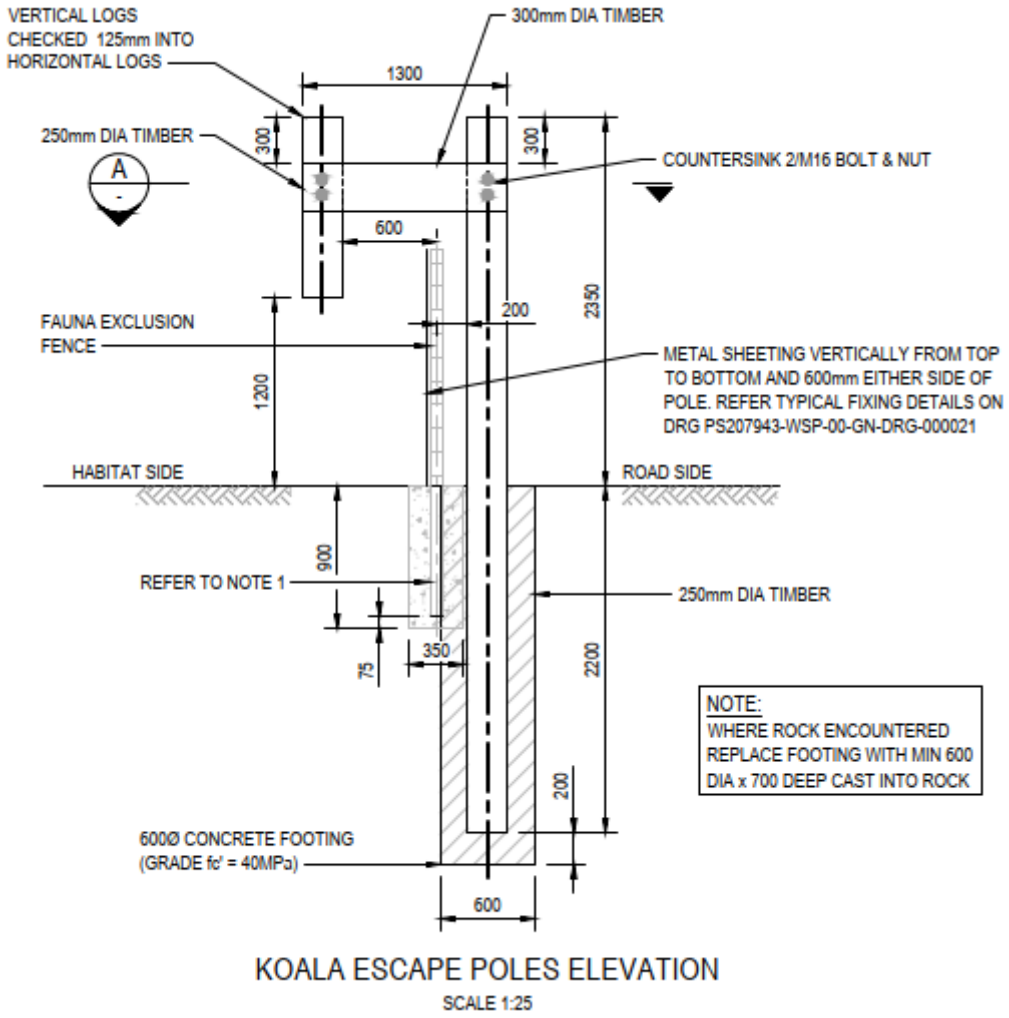


Figure 3-6: Indicative elevation - Koala escape structure

3.3 Construction activities

3.3.1 Work methodology

The indicative construction methodology for both sites is described in Table 3-1.

Table 3-1: Indicative construction methodology

Stage	Activities
Site establishment and preparatory work	• Establishment of traffic control. • Delivery of fencing components, materials and equipment to designated laydown areas/working areas within the proposal area. • Setting out of the fence alignment. • An inspection of the fence alignment by an ecologist to confirm the final route based on local ecological factors, as well as to note vegetation to be avoided/protected. • Clearing of vegetation for the fence and maintenance zone up to three metres either side of the fence (limited to one metre as far as practicable). Low overhanging branches located within three metres would be trimmed to prevent koalas accessing the road side of the fence. This represents a worst case vegetation clearance area for construction and maintenance for the purposes of this REF, and would likely be less in several sections. • Installation of erosion and sediment controls. • Trimming and levelling of the ground using a mini excavator along the proposed fence alignment.
Fencing panel and gate installation	• Excavation of fence post foundations along the alignment using a handheld or plant/ute mounted auger or jackhammer. • Positioning of the fence post and foundation concreting. • Allowing a period of one to two days for foundation concrete to dry. • Where site access is difficult, hand tools would be used and fencing materials would be transported manually to minimise impacts to vegetation. • Installation of chain link mesh, steel sheeting and gates would be carried out sequentially. • Installation of escape structures.
Finalisation and reinstatement	• Backfilling under and around new fencing as required. • Removal of erosion and sediment controls. • Reinstatement of disturbed soil.

3.3.2 Construction workforce

The construction workforce is expected to include up to eight workers for each site, though would depend on the construction activities being undertaken. Construction at both sites may be undertaken concurrently or consecutively. Final workforce numbers would be identified by the construction contractor.

3.3.3 Construction hours and duration

The majority of construction works would be carried out during the following hours:

- Sunday to Thursday 8.00pm to 5.00am.

Out of hours works are proposed primarily to reduce traffic impacts, as a single lane closure would be required for the works (refer 3.3.7 for further details).

Some works would also be undertaken during standard day time hours, defined as follows:

- Monday to Friday 7.00am to 6.00pm
- Saturday 8.00am to 1.00pm
- No day time work on Sundays or public holidays.

Construction is anticipated to commence in in early 2024 and take up to three months to complete.

3.3.4 Plant and equipment

Construction plant and equipment would only be located on site during standard construction hours. Plant and equipment used to construct the proposal would include the following:

- Mini digger or excavator
- Small trucks
- Lifting gears mounted to truck or excavator
- Light vehicles
- Ute mounted auger
- Ute mounted water cart
- Onsite concrete mixer
- Cherry picker
- Chainsaw/s and slasher
- Mulcher
- Sweeper
- Sucker truck
- Jackhammer/s
- Various other hand tools.

3.3.5 Earthworks

Minor earthwork would be required for the following activities:

- Excavation for fence post footings which would range from about 90 centimetres to 120 centimetres in depth (softer ground would require deeper footings) and 35 centimetres in width for each fence post. Footing (and pinned mesh shirt) excavations may be larger to excavate and/or break the material where rock is encountered.
- Levelling the ground surface using a mini excavator along the fence alignment. Levelling is expected to be minimal and would aim to maintain the fence bottom as level with the ground to prevent movement underneath.

3.3.6 Source and quantity of materials

The indicative materials required for the proposal are listed in Table 3-2. The quantities of resources and materials needed to construct the proposal would be relatively minor and readily available within the region. The materials would be locally sourced, where available.

Table 3-2: Indicative quantity of materials

Proposal site	Length of fence (m)	Fence steel mesh (m)	No. of posts	600 mm galvanised steel sheet	Concrete volume (m^3) for posts	Excavated soil volume (m^3)	No. of gates	Concrete footing under gates (m^3) (does not include pad)
Site 2 (Northern Hume)	356	396	137	59	14	15.5	2	0.5
Site 3 (Southern Hume)	1,500	1,650	555	248	53.5	61.5	7	1.5
Total	**1,856**	**2,046**	**692**	**307**	**67.5**	**77**	**9**	**2**

3.3.7 Traffic management and access

Construction vehicles

Construction of the proposal would require up to eight light vehicles (including traffic management) and one heavy vehicle. Construction vehicle movement would mainly be associated with the movement of workers, materials, waste, and construction plant and equipment.

Construction traffic access

Access to both sites would occur from the road corridor of the Hume Motorway and would require temporary, single lane closures. Construction vehicles and machinery would park on the road shoulder or within the designated laydown areas shown on Figure 3-7.

Traffic management measures

The single lane closures would be implemented at each site for the majority of the construction period to undertake the works (particularly for vegetation clearing) and also for site access and exit. Lane closures would be managed in accordance with a Road Occupancy Licence (ROL). Traffic management measures would be developed by the contractor with reference to the *Traffic Control at Work Sites Technical Manual* (Transport, 2022). The construction of the proposal would maintain traffic access along the Hume Motorway (including exit and entry ramps) for all construction stages. Recommended traffic, transport and access safeguards are provided in Section 6.3.

Traffic management, including temporary lane closures, would also be required to undertake maintenance activities during operation of the proposal.

3.4 Laydown areas

Two laydown areas would be established for the proposal which are located within the road corridor at Site 3 (Southern Hume) and are shown in Figure 3-7. The laydown areas would be used for the construction of both Sites 2 and 3. Temporary parking and laydown of material would also occur within the proposal area for Site 2 (Northern Hume) (e.g. along the fence alignment).

No excavation is required in relation to the establishment or use of the laydown areas, however some trimming of grass would be required. The laydown areas would include areas for laydown of materials, portable toilets and parking. Laydown areas would be enclosed with temporary fencing. Upon completion of construction, the laydown areas would be cleared of all rubbish and materials and all equipment and temporary facilities removed.

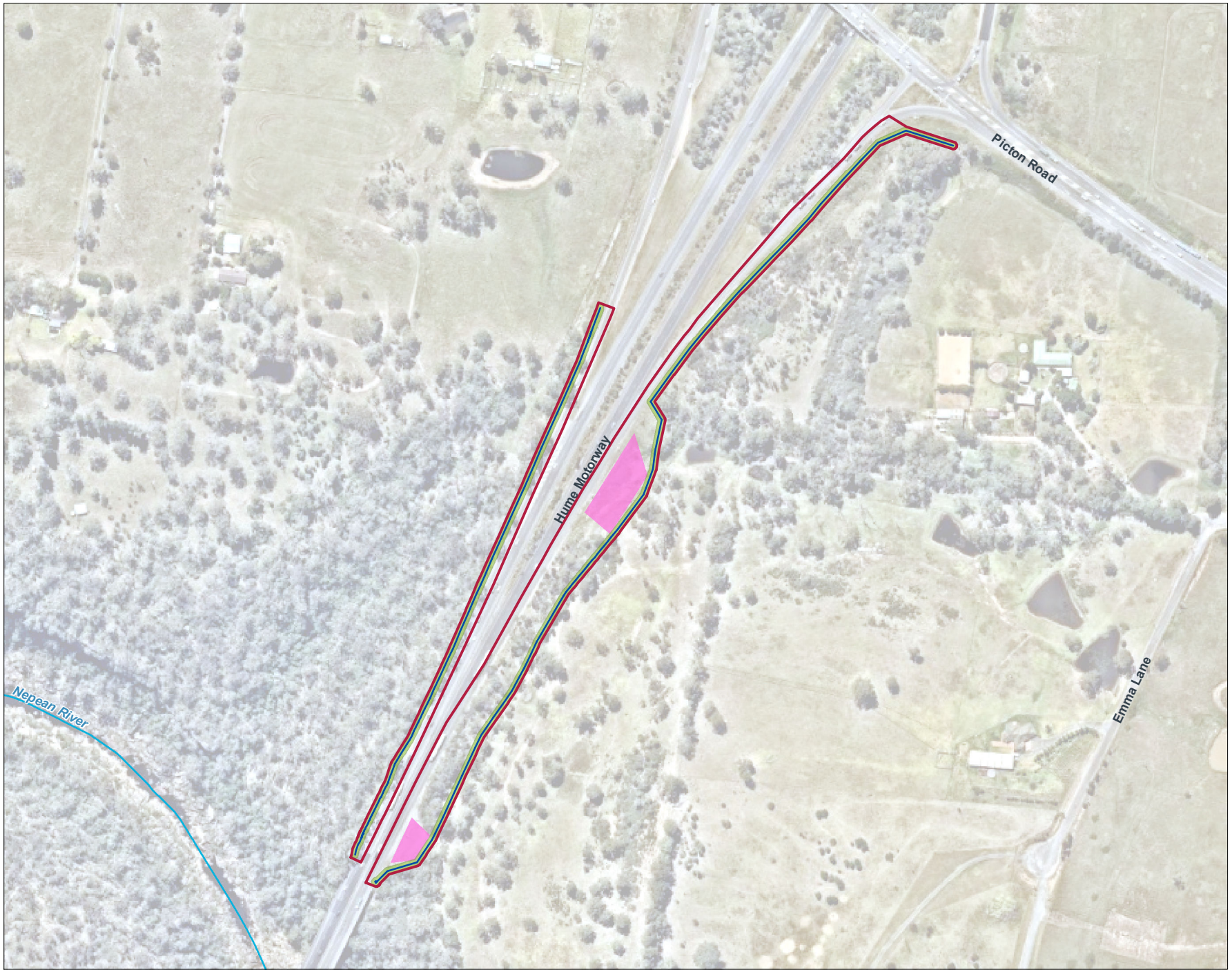
3.5 Public utility adjustment

Any utilities along the proposed fence alignment would be identified prior to the commencement of construction. The location of fence components would be adjusted if required to avoid impacts to utilities. In some case utilities would be adjusted to avoid the fence in consultation with the relevant service provider.

3.6 Property acquisition

Property acquisition is not required for the proposal.

The northern end of the fence line (on the southern side of the motorway) at Site 2 would tie into a future noise wall or koala fence to be constructed by an adjacent residential development. A landholder agreement would be required to agree upon construction and maintenance arrangements for this section of fence.



AECOM

N

0 50 100 m

FIGURE 3-7:
CONSTRUCTION LAYDOWN AREAS (LOCATED AT SITE 3 (SOUTHERN HUME))

Legend

- Proposal area
- Vegetation clearing zone
- Laydown area
- Koala fence alignment
- Watercourse

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

4. Statutory and planning framework

This chapter provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

4.1 Environmental Planning and Assessment Act 1979

4.1.1 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP (Transport and Infrastructure)) aims to facilitate the effective delivery of infrastructure across the State.

Section 2.109 of SEPP (Transport and Infrastructure) permits development on any land for the purpose of road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for environmental management works for the purpose of road infrastructure facilities and is to be carried by Transport as a public authority, it can be assessed under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW). Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* and does not require development consent or approval under:

- *State Environmental Planning Policy (Resilience and Hazards) 2021*
- *State Environmental Planning Policy (Planning Systems) 2021*
- *State Environmental Planning Policy (Precincts – Central River City) 2021*
- *State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021*
- *State Environmental Planning Policy (Precincts – Regional) 2021.*

Section 2.10 to 2.15 of SEPP (Transport and Infrastructure) contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by SEPP (Transport and Infrastructure) (where applicable), is discussed in Chapter 5 of this REF.

State Environment Planning Policy (Biodiversity and Conservation) 2021

Chapter 4 – Koala Habitat Protection 2021

Chapter 4 of the *State Environment Planning Policy (Biodiversity and Conservation) 2021* (SEPP (Biodiversity and Conservation)) aims to encourage the conservation and management of areas of native vegetation that provide habitat for koalas. The proposal is not subject to development consent, and therefore the provisions of Chapter 4 do not apply.

Chapter 13 – Strategic Conservation Planning

Chapter 13 'Strategic conservation planning' of SEPP (Biodiversity and Conservation) includes planning controls to support the CPCP. The purpose of the controls includes ensuring that development in the nominated areas is consistent with the biodiversity certification (under the BC Act) and the strategic assessment (under the EPBC Act) provided by the CPCP, and other provisions of the CPCP.

Clause 13.6 provides that the erection and maintenance of koala fences within the mapped strategic conservation planning area (within which this proposal is located) may be carried out by or on behalf of a public authority without development consent if the fence is consistent with the CPCP. This is consistent with the permissibility provided under the SEPP (Transport and Infrastructure), providing it is consistent with the CPCP.

The entirety of Site 2 (Northen Hume) and Site 3 (Southern Hume) are located within 'excluded land' (refer Figure 2-1 and Figure 2-2). Excluded land is land that has been excluded from the CPCP (and the biodiversity certification and federal strategic assessment approval which it provides). This is because this land has already been identified for urban use including business, industrial, and residential purposes, as well as other reasons. Excluded land is not subject to the avoided land considerations under Chapter 13 of this SEPP or other requirements of the CPCP.

The proposal area is not located within the Strategic Conservation Area identified under Chapter 13 of this SEPP.

State Environmental Planning Policy (Precincts – Western Parkland City) 2021

The proposal area is located on land subject to the *State Environmental Planning Policy (Precincts – Western Parkland City) 2021* (SEPP (Western Parklands City Precincts)). The proposal is located within the area subject to the *Wilton Growth Area Development Control Plan 2021* (NSW Department of Planning, Industry and Environment, 2021), the extent of which is defined as the suburb of Wilton. The Development Control Plan has seven sub-precincts, with Site 3 (Southern Hume) being within 'West Wilton' (precinct plan is under development) and the Site 2 (Northern Hume) being within the 'Wilton North' Precinct (precinct plan is in effect).

However, clause 5.12(1) of Appendix 8 (North Wilton Precinct Plan) in the SEPP (Western Parklands City Precincts) provides that the precinct plan does not restrict or prohibit development carried out by a public authority that is permitted to be carried out without consent under the SEPP (Transport and Infrastructure). Therefore, the proposal would remain permissible without consent. Further consideration of relevant land zoning provided under the SEPP (Western Parklands City Precincts) is provided below in Section 4.1.2.

4.1.2 Local Environmental Plan and land zoning

The proposal is located within the Wollondilly Shire LGA. The *Wollondilly Local Environmental Plan 2011* (LEP) applies to land in this LGA. Clause 1.8 of Appendix 8 (North Wilton Precinct Plan) of SEPP (Western Parklands City Precincts) repeals the application of the Wollondilly LEP to land which the North Wilton Precinct Plan applies. Site 2 (Northern Hume) is within land subject to the North Wilton Precinct Plan, and therefore subject to relevant provisions of Appendix 8 of SEPP (Western Parklands City Precincts).

Clause 2.7 provides that SEPP (Transport and Infrastructure) prevails over other environmental planning instruments to the extent of any inconsistency. This includes permissibility of development under the Wollondilly LEP and the need for development consent. As explained above The SEPP (Transport and Infrastructure) also prevails over SEPP (Western Parklands City Precincts). Notwithstanding, provisions relevant to the proposal have been considered below, including land use objectives which are considered in Table 4-1. The land use zones are shown on Figure 4-1 and Figure 4-2.

There are no heritage listings under the LEP that would be affected by the proposal. Aboriginal heritage and non-Aboriginal heritage is assessed in Section 6.4 and Section 6.11 respectively.

Table 4-1: Land use impacted by the proposal

Land zone (and relevant instrument)	Stated objectives of the land zone	Proposed consistency
R2 – Low Density Residential (Wollondilly LEP)	• To provide for the housing needs of the community within a low density residential environment • To enable other land uses that provide facilities or services to meet the day to day needs of residents • To support the health and well-being of the community by providing well-connected and walkable residential areas close to services and employment.	• A small portion of the northern extent of Site 2 (Northern Hume), on the southern side of the motorway, would encroach upon this land use zone. This end of the fencing would tie into future fencing planned as part of the adjoining residential development which is in line with the objectives of this zone.
SP2 – Infrastructure (Classified road) (Wollondilly LEP for Site 3 (Southern Hume), and SEPP (Western Parklands City Precincts) for Site 2 (Northern Hume))	• To provide for infrastructure and related uses • To prevent development that is not compatible with or that may detract from the provision of infrastructure	• The proposal is a related use of road infrastructure, as it provides wildlife exclusion fencing to prevent vehicle strike along the road corridor.

AECOM

N

0 25 50 m

FIGURE 4-1:

LAND ZONING - SITE 2 (NORTHERN HUME)

Legend

- Proposal area
- Vegetation clearing zone
- Koala fence alignment
- Koala fence alignment under bridge
- Watercourse

Land Use Zone

- C2 Environmental Conservation
- R2 Low Density Residential
- RU2 Rural Landscape
- SP2 Infrastructure
- UD Urban Development

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

AECOM

N

0 70 140 m

FIGURE 4-2:
LAND ZONING - SITE 2
(SOUTHERN HUME)

Legend

- Proposal area
- Vegetation clearing zone
- Koala fence alignment
- Watercourse

Land Use Zone

- C2 Environmental Conservation
- C4 Environmental Living
- E4 Environmental Living
- RU2 Rural Landscape
- SP2 Infrastructure
- UD Urban Development

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

4.2 Other relevant NSW legislation

4.2.1 Roads Act 1993

The *Roads Act 1993* sets out rights of members of the public to pass along public roads, establishes procedures for opening and closing a public road and provides for the classification of roads. It also provides for the declaration of Transport, local councils, and other public authorities as roads authorities for both classified and unclassified roads and confers certain functions on Transport and other roads authorities e.g. the function of carrying out roadwork.

Under Section 138 of the *Roads Act 1993*, consent is required from the relevant roads authority to carry out works on the Hume Motorway. The proposal would require partial (single lane) road closures to safely access and exit the proposal sites and to undertake works. A Road Occupancy Licence (ROL) would be required to undertake the proposed works.

4.2.2 Crown Lands Management Act 2016

The *Crown Land Management Act 2016* provides for the ownership and equal management of parcels of land which are identified as Crown Land under this Act. Proposals which are located on Crown Land must take into account environmental, social, cultural and economic considerations of the specific parcel of land.

The proposal is not located on Crown Land, and as such, no further considerations under this Act is required as impacts to Crown Land are not likely.

4.2.3 Aboriginal Land Rights Act 1983

The *Aboriginal land Rights Act 1983* provides for the land rights for Aboriginal Persons and for representative Aboriginal Land Councils in New South Wales. Crown Land that is not lawfully being used or occupied, not (likely) needed for residential or essential public purposes and not the subject of a registered native title claim or determination can be claimed under this Act. The proposal is not located on Crown Land and as such, does not involve land that may be subject to a land claim under this Act.

4.2.4 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* is the primary legislation dealing with Aboriginal cultural heritage in NSW. Items of Aboriginal cultural heritage significance (Aboriginal objects) or Aboriginal places (declared under part 6) are protected and regulated under the Act. Under part 6, division 2 of the Act, the Secretary of the Department of Premier and Cabinet may issue an Aboriginal heritage impact permit (AHIP) for an activity which would harm an Aboriginal object.

There are 25 Aboriginal Heritage Information Management System (AHIMS) registered sites near the proposal area. There are no AHIMS sites within the proposal area. An assessment of the potential impacts of the proposal on Aboriginal heritage was carried out and is provided in Section 6.4, which found that an AHIP is not required for the proposal.

4.2.5 Heritage Act 1997

The *Heritage Act 1977* aims to protect and preserve items of non-Aboriginal heritage significance. It provides for the protection of items of local, regional and State significance, and outlines processes for approval of development which may impact items of heritage significance.

An assessment of the potential impacts of the proposal on Aboriginal heritage was carried out and is provided in Section 6.4. No non-Aboriginal heritage items are expected to be affected by the proposal.

4.2.6 Biodiversity Conservation Act 2016

The BC Act aims to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development (ESD) (refer Section 8.2.1). The BC Act establishes a framework for assessing and offsetting biodiversity impacts from proposed development.

Under Section 2.4 of the BC Act it is an offence to damage the habitat of a threatened species or threatened ecological community, as listed in Schedule 1 and 2 of the BC Act.

Part 7 of the BC Act requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using a five-part test listed in Section 7.3 of the BC Act. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Environment Agency Head's

requirements, or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (DPIE, 2020)).

A Biodiversity Assessment Report (BAR) has been completed in accordance with the requirements of the BC Act, and the *Transport Biodiversity Assessment Guidelines* (Transport, 2022). The proposal would require the removal of a small area (0.61 hectares) of Shale Sandstone Transition Forest in the Sydney Basin Bioregion, which is a listed critically endangered ecological community under the BC Act. The BAR determined that significant impacts on listed threatened species, ecological communities and migratory species are unlikely to occur as part of the proposal. Therefore, a SIS or BDAR is not required. Offsets are required in accordance with the Biodiversity Assessment Method. Further detail is provided in Section 6.1 of this REF.

4.2.7 Fisheries Management Act 1994

The FM Act provides for the conservation, development and sharing of fishery resources of the State for the benefit of present and future generations. Certain activities that have the potential to impact aquatic habitats and species are regulated under this Act and require permits.

Allens Creek and the Nepean River are located near the proposal sites and are both designated as Key Fish Habitat. The proposal would not directly affect these waterways. Further consideration is provided in Sections 6.1, 6.8 and 6.9.

4.2.8 Protection of the Environment and Operations Act 1997

The *Protection of the Environment Operations Act 1997* aims to protect, restore and enhance the quality of the environment principally through the regulation of pollution. It does this mainly through a requirement to notify pollution incidents, and through Environment Protection Licences for certain 'scheduled' activities and non-scheduled activities with potential to pollute waters.

The proposal is not considered a scheduled activity as construction works involve the extraction or processing of less than the specified threshold of 150,000 tonnes of material, and as such an Environmental Protection Licence would not be required prior to commencing construction of the proposal.

Any pollution incident causing or threatening to materially harm the environment would need to be notified to the NSW Environment Protection Authority (EPA). This would include pollution incidents involving air, water, noise or land pollution, the disposal of waste, or material spills, leaks or escapes. This would be managed for the proposal in the form of a Construction Environmental Management Plan (CEMP).

4.2.9 Contaminated Lands Management Act 1997

The *Contaminated Lands Management Act 1997* establishes a process for investigating and remediating land where required. The Act allows the EPA to declare land as significantly contaminated land. The EPA may order a public authority to carry out actions or prepare a plan of management for significantly contaminated land. The Act imposes a duty on landowners to notify the EPA and potentially investigate and remediate land contamination if levels are above EPA guidelines.

A search of the NSW EPA contaminated land register indicated that there are no contaminated site within the vicinity of the proposal area. Refer to Section 6.8 for further details.

4.2.10 Coal Mine Subsidence Compensation Act 2017

The *Coal Mine Subsidence Compensation Act 2017* makes provision for the payment of compensation for damage caused by subsidence in connection with the extraction of coal; and for related purposes including approval for undertaking work within a mine subsidence district. The Act also provides for the assessment and management of risks associated with subsidence resulting from coal mine operations.

The proposal is located within the Wilton Mine Subsidence District. Under the Subsidence Advisory NSW Guidelines, metal and timber fencing is exempt development. The proposal would therefore not require approval under the Act.

In accordance with SEPP (Transport and Infrastructure), consultation with Subsidence Advisory NSW has been undertaken and is summarised in Section 5.2 of this REF.

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, a referral is required to the Australian Government for proposed actions that have the potential to result in a significant impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Chapter 6 and Appendix B of the REF.

Despite this, a referral is not required for proposed road activities that may affect nationally-listed threatened species, ecological communities and migratory species due to the strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

Findings - matters of national environmental significance

The assessment of the proposal's impact found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Minister for the Environment under the EPBC Act.

4.3.2 Native Title Act 1993

The *Native Title Act 1993* covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affecting native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act, a future act includes proposed public infrastructure on land or waters that affects native title rights or interest.

A search of the Native Title Tribunal Native Title Vision website was undertaken on 23 February 2023, with no Native Title holders/claimants identified.

4.4 Confirmation of statutory position

The proposal is categorised as development for the purpose of environmental management works for road infrastructure facilities and is being carried out by or on behalf of a public authority. Under Section 2.109 of SEPP (Transport and Infrastructure) the proposal is permissible without consent. The proposal is not state significant infrastructure or state significant development and would not result in a significant impact on the environment. The proposal can therefore be assessed under Division 5.1 of the EP&A Act.

Transport is the determining authority for the proposal. This REF fulfils Transport's obligation under Section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

5. Consultation

5.1 Aboriginal community involvement

Consultation with the Aboriginal community has been undertaken following Transport's Procedure for Aboriginal Cultural Heritage and Consultation Investigation (PACHCI) Guidelines (2011). In accordance with the PACHCI, the early stages of Transport projects involve consultation with Local Aboriginal Land Councils and registered Native Title holders/claimants. No Native Title holders/claimants are currently registered for the proposal area.

The proposal has been conducted in consultation with the Tharawal Local Aboriginal Land Council, who were contacted at the commencement of the Aboriginal heritage assessment undertaken for the proposal to discuss the proposed works and participate in an archaeological survey of the study area. The archaeological survey was undertaken with representatives of the Land Council in September 2022. No Aboriginal objects, sites or areas of potential archaeological deposit were identified within the assessment study area. No Aboriginal cultural features were identified as a result of archaeological survey.

The Aboriginal heritage assessment is provided in Appendix E and summarised in Section 6.4.

5.2 SEPP (Transport and Infrastructure) consultation

In accordance with Section 2.15 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021*, Subsidence Advisory NSW have been notified about the proposal. The response received from the Subsidence Advisory advised that metal and timber fences are considered exempt development by the Subsidence Advisory and that they have no further comment in regard to the proposal.

Appendix B contains a checklist that documents how SEPP (Transport and Infrastructure) consultation requirements have been considered.

5.3 Community notifications

Nearby residents and businesses will be notified prior to construction and as required during construction in accordance with safeguards recommended in this REF (refer Section 6.2 and Section 6.7).

6. Environmental assessment

6.1 Biodiversity

6.1.1 Methodology

A Biodiversity Assessment Report (BAR) was prepared for the proposal (refer Appendix C). The methodology for assessment of biodiversity included:

- A desktop review of relevant database records and previous studies to identify Commonwealth and State listed threatened species, populations and ecological communities
- Field surveys in accordance with the *Biodiversity Assessment Method* (DPIE 2020) between September and November 2022 of the biodiversity study area (refer to Figure 6-1 and Figure 6-2)
- A habitat assessment and assessment of likelihood of occurrence for threatened and migratory species and endangered populations in the study area
- An assessment of significance for threatened species and ecological communities identified during the field surveys or that are considered to have a moderate or high likelihood of occurring in the biodiversity study area
- Identification of impacts and associated mitigation measures to reduce and manage impacts.

6.1.2 Existing environment

Environmental context

The proposal area is located within the Sydney Basin bioregion and Cumberland subregion. The proposal area is adjacent to open and cleared pasture lands used for agricultural purposes, and areas of residential development. Patches of exotic vegetation are also present within the proposal area. The Hume Motorway bisects areas of core koala habitat and primary corridors within the locality, however residential and agricultural development has contributed to some fragmentation. There are extensive areas of native open forest and woodland located along the gorges of the Nepean River and Allens Creek (at the southern and northern extents of the biodiversity study area).

Plant community types and threatened ecological communities

One plant community type (PCT) was recorded within the biodiversity study area, PCT 1395: Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion. This PCT was categorised into three broad condition classes within the study area. PCT 1395 is associated with the threatened ecological community (TEC) Shale Sandstone Transition Forest in the Sydney Basin Bioregion, which is listed as critically endangered under the BC Act and EPBC Act. There are also areas of mapped exotic vegetation within the study area that cannot be attributed to any known PCT.

A summary of vegetation within the biodiversity study area is provided in Table 6-1 and Figure 6-1 and Figure 6-2.

Table 6-1 Plant community types and vegetation zones

Vegetation zone	PCT	Condition class	VI Score	TEC	Area (ha)	
					Proposal area	Biodiversity study area
1	PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Good	65.5	Critically endangered (BC Act and EPBC Act)	0.31	2.64
2		Moderate-Good	55.4	Critically endangered (BC Act)	0.20	2.30
3		Moderate	30	Critically endangered (BC Act)	0.10	1.27
-	Exotic	-			0.23	1.86
-	Cleared land	-			0.23	1.46
Total					**1.07**	**9.53**

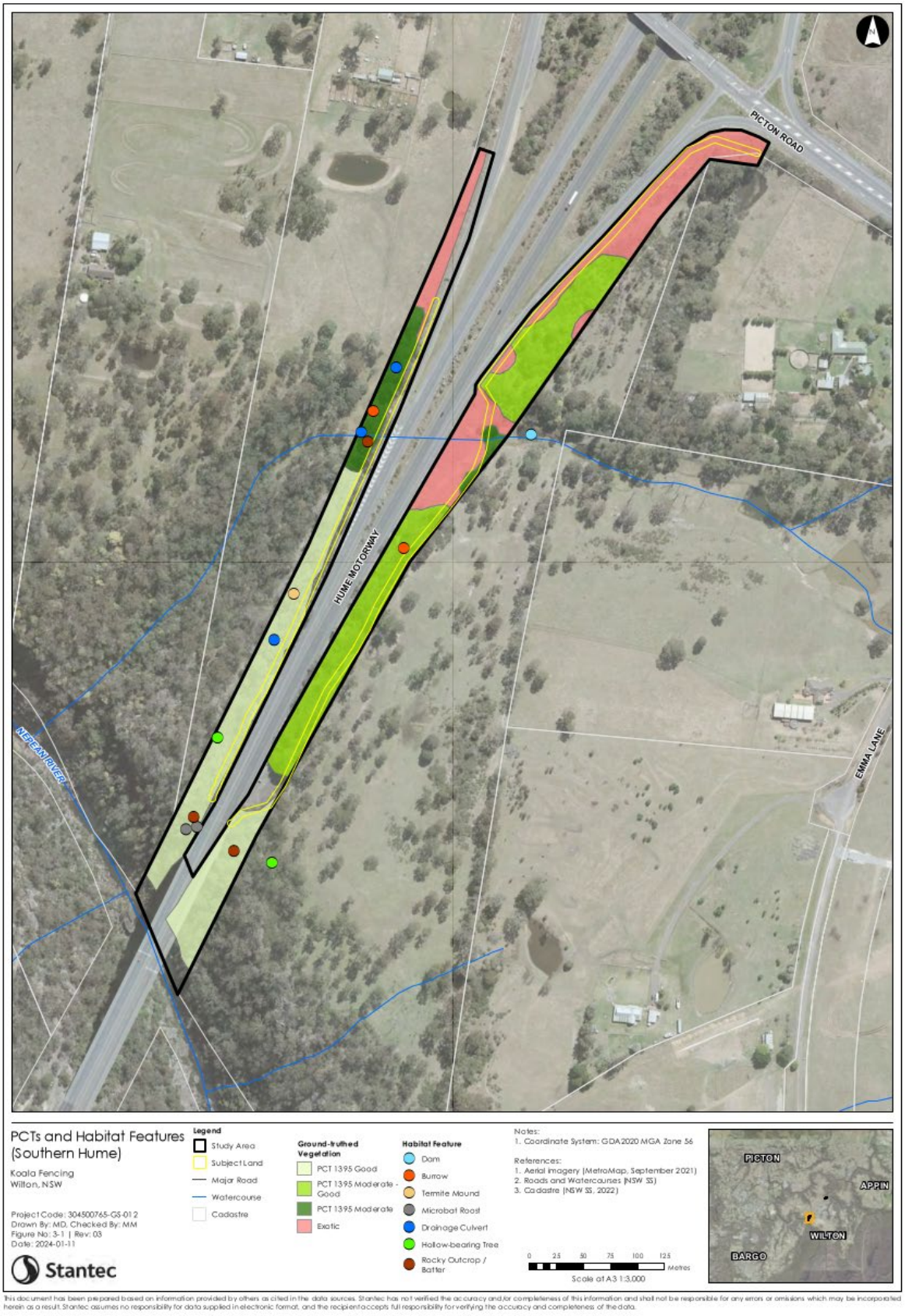


Figure 6-1 Plant community types, habitat features Site 2 (Southern Hume) and subject land to be impacted

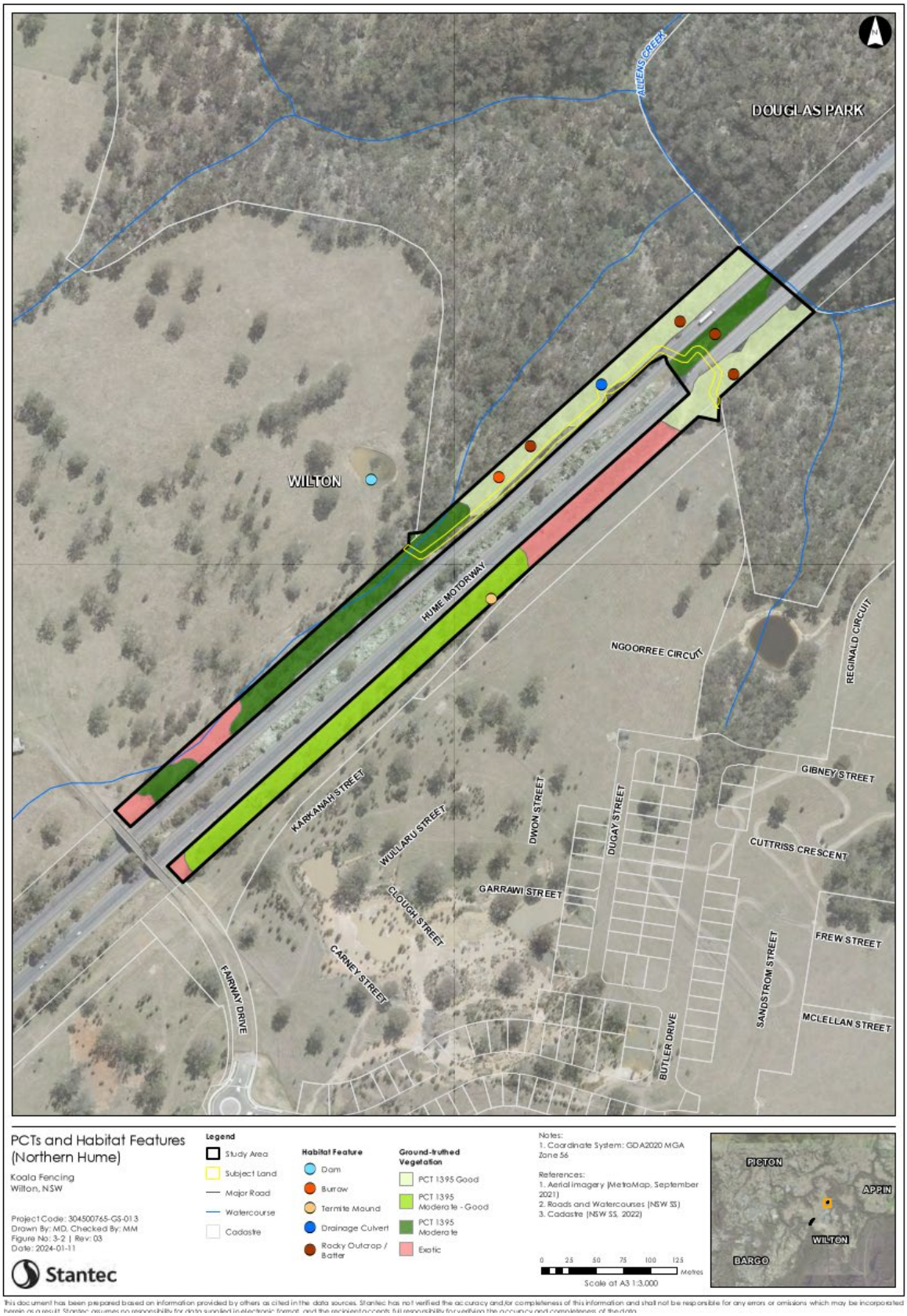


Figure 6-2 Plant community types and habitat features Site 3 (Northern Hume), and subject land to be impacted

Groundwater dependant ecosystems

There are no known groundwater dependant ecosystems (GDE) within the proposal area. The Nepean River is located 50 meters south of Site 3 (Southern Hume) is considered to have a moderate potential for aquatic GDEs. There are a number of terrestrial GDEs in proximity to the proposal area, however PCT 1395 is considered a grassy woodland and does not conform to any of the listed terrestrial GDEs identified in proximity to the proposal area (Keith, 2004). Therefore, it is unlikely that any GDEs would be directly impacted by the proposal and they have not been considered further.

Threatened species

A review of the NSW DPE BioNet Atlas, NSW DPI Fisheries Spatial Data Portal and the DAWE Protected Matters Search Tool identified 108 threatened species with the potential to occur in the study area. Species were inclusive of 42 flora, 34 birds, 19 mammals, six amphibians, three reptiles, three invertebrates and one fish.

No threatened species were observed during the field survey, however, potential habitat for some threatened species occurs within the biodiversity study area. A microbat roost site was detected under the Pheasants Next Bridge. The Southern Myotis (*Myotis macropus*) was assessed as having a possible rating of occurring and has been assumed to be present.

Due to the presence of suitable habitat in the study area, 48 species were considered to have a moderate to high likelihood of occurrence prior to survey. Refer to Appendix C of this REF for the complete list.

Wildlife connectivity corridor

The vegetated areas within the Site 2 (Northern Hume) and Site 3 (Southern Hume) proposal areas fall into the north-east and south-west extents of the Nepean River and Allens Creek koala corridors, respectively. These movement corridors represent primary corridors with a high level of connectivity for a vast number of native fauna species.

These corridors contain the largest areas of core koala habitat within the region and provide connectivity to a number of smaller areas of primary, secondary and tertiary core koala habitat. This habitat supports significant numbers of resident koalas and is considered to be vital to the persistence of the regional population. Remnant vegetation within the biodiversity study area may facilitate the movement of koalas between these corridors.

The Hume Motorway bisects areas of core koala habitat and primary corridors within the locality. Residential and agricultural development has also contributed to some fragmentation. The areas underneath Pheasants Nest Bridge and Moolgun Creek Bridge provide existing corridors for movement underneath the Hume Motorway and along the Nepean River and Allens Creek, respectively. The proposal would not obstruct the dispersal of koala, and other fauna, through existing corridors within the locality, channelling fauna to existing crossings under the Motorway.

Weeds and pests

High threat weeds identified in the biodiversity study area include:

- Crofton Weed (*Ageratina Adenop*hora)
- Cobbler's Pegs (*Bidens Pilosa*)
- Rhodes Grass (*Chloris gayana*)
- Paspalum (*Paspalum dilatatum*)
- Asparagus Fern (*Asparagus aethiopicus*)
- Lantana (*Lantana camara*)
- Blackberry complex (*Rubus fruticosus sp. agg*.)
- Fireweed (*Senecio madagascariensis*).

Aquatic ecology

No aquatic habitats exist within the proposal area. There are two Key Fish Habitats (KFH) located in proximity to the proposal area, Allens Creek 30 metres north of Site 2 (Northern Hume) and the Nepean River 50 metres south of Site 3 (Southern Hume).

6.1.3 Potential impacts

Construction

Removal of native vegetation

The proposal would require clearing of native vegetation across three vegetation condition zones for PCT 1395. Figure 6-1 and Figure 6-2 above show the subject land in which native vegetation (and vegetation condition zones) would be cleared for the proposal. The expected total area of native vegetation to be cleared is up to 0.61 hectares. The amount of native vegetation to be cleared would not represent a significant loss of native vegetation and potential habitat for threatened species. A test of significance for the critically endangered Shale Sandstone Transition Forest in the Sydney Basin Bioregion (which is associated with PCT 1395) was completed and is provided in full in Appendix C.

Establishment of the laydown areas would also require slashing/trimming of grass, however these areas are mapped as exotic vegetation and would not impact a listed ecological community (refer Figure 3-7 for laydown area locations).

Impacts to threatened fauna and habitat

No threatened flora and/or fauna species were detected within the subject land during field surveys. Direct impacts to potential habitat would be limited to a narrow band of disturbed habitat at the interface of the Hume Motorway and higher quality habitat within the locality. An abundance of higher quality foraging habitat for fauna is present in the locality. The proposal would result in the removal of up to 0.61 ha of native vegetation which provides potential habitat for the Cumberland Plain Land Snail *(Meridolum corneovirens*). Due to the availability of habitat within the immediate locality, this species would not be dependent on habitat provided by the proposal area, and thus the removal of a relatively small, linear area of refuge habitat would not significantly reduce available habitat for the species to the extent that the local population would be placed at risk of extinction. Vegetation removal (including grass trimming/slashing) would be subject to the safeguards below, which include pre-clearance surveys and clearing protocols in accordance with Transport guidelines.

The proposal would result in the removal of up to 0.09 ha of foraging habitat for the Southern Myotis (*Myotis macropus*), which was assumed to be present. Additionally, the proposal would not result in the removal of key breeding habitat, such as tree hollows, decorticating bark and logs.

Injury and mortality

The proposal has potential to cause injury and mortality to fauna during the construction phase. The risk of fauna injury and mortality impacts would be managed through the implementation of mitigation measures as outlined in Section 6.1.4.

Light, noise and vibration

The proposal would produce levels of noise and vibration at higher than existing levels at times, especially during night time hours. Noise and vibration generation as a result of the proposal would be temporary and localised to the work location at the time of work. The biodiversity study area is subject to a high degree of existing noise disturbance. It is therefore expected that any fauna utilising the biodiversity study area would be adapted to a high level of disturbance and would not be significantly impacted due to additional disturbances related to the construction phase of the proposal.

The proposal would require artificial lighting along the proposal area for night works. Artificial lighting has the potential to adversely affect fauna species in the vicinity of the works through interfering with the behaviour of nocturnal species, disturbance of roosting and foraging behaviour and reducing available habitat in general. Lighting impacts may be higher at Site 2 (Northern Hume) as there is no street lighting along the motorway, compared to Site 3 (Southern Hume) where street lighting is located. Lighting impacts would combine with noise to create disturbance in the area temporarily. Pre-clearance surveys (fauna spotting) would be undertaken prior to vegetation clearing which would limit the number of fauna impacted (as fauna would be relocated where possible), and a safeguard for controlling light spill will also be implemented (including avoiding direct lighting to the identified microbat roost site at the Pheasants Next Bridge). Further noise safeguards are provided in Section 6.2.

Operation

Edge effects on adjacent native vegetation and habitat

Clearing of native vegetation as a result of the proposal would be restricted to up to 0.61 ha of native vegetation. This clearing would be restricted to a narrow, linear patch of vegetation located in close proximity to the Hume Motorway. This would result in narrow, linear patches of vegetation remaining in places. This remaining vegetation would be exposed to increased edge effects, such as reduced protection for flora and fauna species and increased effects of environmental factors (e.g. wind, light, dust) and biological factors (exposure to predators, introduction of weed species). Vegetation within the

study area is already exposed to edge effects and anthropogenic disturbances however, and it is expected that edge effects, as a result of the proposal, would be minimal.

Wildlife connectivity and habitat fragmentation

The Hume Motorway bisects areas of core koala habitat and primary corridors within the locality. Residential and agricultural development has also contributed to some fragmentation. The proposal would deliberately introduce an additional barrier to wildlife movement across the Hume Motorway. As such, the proposal would potentially contribute to reduced connectivity, limiting available crossing locations for fauna (assuming fauna can safely cross the existing motorway). The proposed fence alignment would tie into or travel under bridges and would maintain connectivity along the Nepean River and Allens Creek corridors under the bridges. The proposal would reduce the incidence of vehicle-strike and mortality in the locality and facilitate the movement of fauna through more suitable corridors by channelling fauna to existing crossings under the road.

Injury and mortality

The proposal would reduce the rate of fauna injury and mortality along the Hume Motorway by reducing instances of roadkill. The exclusion fencing would direct fauna to pass underneath existing bridges and would provide a barrier to protect fauna from vehicle strike.

Invasion and spread of weeds and pests

Weeds were identified in the biodiversity study area during field investigations. These species can be managed using standard mitigation measures as outlined in Section 6.1.4.

Pest fauna species could use disturbed areas to increase their movement across the landscape. Given the minimal scale of the proposed clearing it is not expected that the proposal would facilitate invasive species incursion.

Conclusion on significance of impacts

Tests of significance were completed for threatened communities, populations and species listed under the BC Act and the EPBC Act that were identified as having a moderate to high potential to occur within the study area, due to the presence of nearby records and/or the presence of suitable habitat. A summary of the results of the tests of significance undertaken are provided in Table (tests of significance are provided in full in Appendix C).

Table 6-2 Summary of tests of significance for BC Act listed species/communities

Threatened species or community	Statutory listing	Likely significance impact?
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	BC Act, EPBC Act	No
Meridolum corneovirens (Cumberland Plain Land Snail)	BC Act	No
Birds (19 x species)	BC Act and/or EPBC Act	No
Petaurus norfolcensis (*Squirrel* Glider)	BC Act	No
Pteropus poliocephalus (Grey-headed Flying Fox)	BC Act, EPBC Act	No
Microbats (8 x species)	BC Act and/or EPBC Act	No
Varanus rosenbergi (Rosenberg's Goanna)	BC Act	No
Callocephalon fimbriatum (Gang-gang Cockatoo)	BC Act, EPBC Act	No
Calyptorhynchus lathami lathami (South-eastern Glossy Black Cockatoo)	BC Act, EPBC Act	No
Hirundapus caudacutus (White-throated Needletail)	EPBC Act	No
Lathamus discolor (Swift Parrot)	BC Act, EPBC Act	No
Chalinolobus dwyeri (Large-eared Pied Bat)	BC Act, EPBC Act	No
Dasyurus maculatus (Spotted-tailed Quoll)	BC Act, EPBC Act	No
Petauroides volans (Greater Glider (southern and central))	EPBC Act	No
Petaurus australis australis (Yellow-bellied Glider (south-eastern))	BC Act, EPBC Act	No
Phascolarctos cinereus (Koala)	BC Act, EPBC Act	No
Hoplocephalus bungaroides (Broad-headed Snake)	BC Act, EPBC Act	No

The BAR concluded that the proposal is not likely to significantly impact threatened species, migratory species or ecological communities or their habitats, within the meaning of the EPBC Act, BC Act or FM Act. A Species Impact Statement or Biodiversity Development Assessment Report is not required.

Offset strategy

The proposal will require the removal of up to 0.61 ha of PCT 1395. This vegetation is commensurate with Shale Sandstone Transition Forest in the Sydney Basin Bioregion - listed as critically endangered under the BC Act and a portion commensurate with Shale Sandstone Transition Forest – listed as critically endangered under the EPBC Act. The BAR determined there will be no need for species credit offsetting for impacts to Southern Myotis (*Myotis Macropus*) habitat due to not meeting the minimum thresholds.

A preliminary calculation of offsets has been determined in accordance with *No Net Loss Guidelines* (Transport, 2022) using the Biodiversity Assessment Method Calculator (BAM-C). The calculation found that 22 ecosystem credits would be required for the proposal (refer Table 7.4 in Appendix C for a breakdown of credit allocations). These impacts are based on a one-metre clearing buffer from the proposed fence alignment (which represents a worst-case clearing buffer). Therefore, the preliminary offset calculations will need to be revised as part of a Biodiversity Offset Strategy for the proposal once the final clearing footprint is determined.

6.1.4 Safeguards and management measures

Safeguards and management measures to manage potential impacts to biodiversity are provided in Table 6-3.

Table 6-3 Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features • Safeguards in this REF • Identification of the clearing boundary and identification of habitat features to be protected (e.g., by marking using flagging tape) • Map/ plans produced showing vegetation clearing boundaries, areas to be protected including sensitive areas/no go zones, protected habitat features and revegetation areas • A detailed vegetation clearing process in accordance with Transport's *Biodiversity Guidelines* (RMS, 2011) including requirements of Guide 1,2, 4 and 9 • Toolbox talks where biodiversity will be included such as vegetation clearing or works in or adjacent to sensitive locations • Identify control/mitigations measures to prevent impacts on sensitive locations or no-go zones • Procedures for unexpected threatened species finds and fauna handling • Procedures addressing relevant matters specified in the *Policy and Guidelines for Fish Habitat Conservation and Management* (Department of Primary Industries, 2013) • Protocols to manage weeds and pathogens.	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 Environment Protection; *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011); *Guidelines for Fish Habitat Conservation and Management* (Department of Primary Industries, 2013)
Biodiversity	Retained vegetation in close proximity to construction activities will not be damaged or removed.	Contractor	Construction	N/A
Biodiversity	A Biodiversity Offset Strategy in accordance with Transport's *No Net Loss Guideline* (Transport, 2022) will be developed to outline the offsetting strategies required. for biodiversity impacts. The preliminary offset calculations undertaken in this assessment will be revised as part of a Biodiversity Offset Strategy for the proposal once the final clearing footprint is determined.	Transport	Prior to construction	*No Net Loss Guideline* (Transport, 2022)

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	Native vegetation removal will be minimised. The clearing will be limited as far as practicable to approximately one metre either side of fence. An onsite ecologist will be present prior and during clearing to assist in minimizing clearing and other potential impacts to native vegetation.	Transport	Detailed design and construction	N/A
Biodiversity	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Prior to construction	*Guide 1* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
Biodiversity	Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Prior to construction	*Guide 4* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
Biodiversity	Artificial lighting will be directed down and light spill into the surrounding environment minimised, to minimise impacts to fauna in the area. Direct lighting to the identified microbat roost site at Pheasants Nest Bridge should be avoided to limit light impacts on movements in and out of the roost.	Contractor	Construction	N/A
Biodiversity	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities or fauna or flora species not assessed in the biodiversity assessment are identified in the proposal area.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011)
Biodiversity	Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	*Guide 9* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
Biodiversity	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	*Guide 2* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
Biodiversity	Weed species will be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	*Guide 6* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).

Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity	Pest species will be managed within the proposal site to prevent their spread.	Contractor	Construction	N/A
Biodiversity	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	*Guide 2* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
Biodiversity	The fencing will be regularly inspected for damage during operation, and maintenance work carried out where necessary, to maintain the function of the fence in protecting native fauna by Transport. An Asset Maintenance Plan will be established in consultation with the Department of Planning and Environment's CPCP Conservation Implementation Team	Transport	Operation	N/A

6.2 Noise and vibration

6.2.1 Methodology

A qualitative assessment of construction noise impacts was undertaken for the proposal using the Transport Construction Noise Estimator Tool (Appendix D). The methodology for the assessment included:

- Identification of the existing environment including:
  - Estimated existing background noise levels (using the Noise Estimator Tool)
  - Nearby sensitive receivers
- Estimating noise levels generated during the noisiest construction stage, using the Transport Construction Noise Estimator Tool
  - In the Noise Estimator Tool, the 'distance based (scenario)' assessment was selected (which considers a number of plant operating together during a certain construction activity), and the 'Corridor clearing' scenario was selected to represent the noisiest construction activity proposed. The machinery/plant used in the 'Corridor clearing' scenario includes an excavator, chainsaw, tub grinder/mulcher and a dump truck.
- Consideration of potential vibration impacts
- Recommending mitigation measures to minimise potential noise and vibration impacts.

6.2.2 Existing environment

The proposal area is located adjacent to the Hume Motorway in a rural environment. Sensitive receivers near the proposal area are mainly residential, with one commercial property. The major noise source in the proposal area is road traffic noise from the motorway. The following sensitive receivers have been identified in close proximity to the work, and therefore would have the highest potential to be affected (the approximate distance to each receiver is provided in brackets):

Site 2 (Northern Hume):

- Active recreation area - Bingara Gorge Golf Course, The Irons Drive, Wilton (540 metres) (note – golf course closes at 5pm)
- Residential receiver at Lot 50, Fairway Drive, Wilton (675 metres), and other residential receivers along Fairway Drive

Site 3 (Southern Hume):

- Residential receiver at 50 Janderra Lane, Wilton (140 metres)

- Residential receivers along Condell Park Road, Wilton adjacent to the proposal (165 Condell Park Road is the closest at a distance of 195 metres)
- Residential receivers along Berwick Park Road, Wilton adjacent to the proposal (30 Berwick Park Road is the closest at a distance of 240 metres)
- Residential receivers along Emma Lane, Wilton (greater than 330 metres)
- Residential receiver along Esen Place, Pheasants Nest (greater than 560 metres)
- Residential receivers along Balmoral Rise, Wilton (greater than 750 metres).

Rating Background Levels (RBL) and applicable Noise Management Levels (NMLs) determined in accordance with the Transport Construction Noise Estimator Tool are summarised in Table 6-4. The noise environment category selected for the proposal was 'R1' in the noise tool. This was selected for all areas due to the low density of receivers and the proximity to the Hume Motorway.

Table 6-4: Background noise levels and applicable noise management levels for residential receivers

Residential		
Noise Area Category		**'R1 Noise Environment'**
RBL or L_{A90}[1] Background level (dB(A))	Day	40
	Evening	35
	Night	30
$L_{Aeq(15minute)}$ NML[2] (dB(A))	Day	50
	Day (OOHW)[3]	45
	Evening	40
	Night	35

Notes:
1. L_{A90} = Background noise level
2. NML for works during standard hours = Background level plus 10 dB(A) NML, for out of hours works = Background level plus 5 dB(A)
3. NML for out of hours works = Background level plus 5 dB(A).

Table 6-5 Background noise levels and applicable noise management levels for active recreation

Active recreation		
Noise Area Category		**'R1 Noise Environment'**
$L_{Aeq(15minute)}$ NML[1] (dB(A))	Day	65
	Evening	65

Notes:
1. NML for works during standard hours = Background level plus 10 dB(A) NML, for out of hours works = Background level plus 5 dB(A).

6.2.3 Potential impacts

Construction

Noise

Site 2 (Northern Hume)

Sensitive receivers were grouped into noise catchment areas (NCA). For the NCAs, the predicted noise level and affected distance (or the distance up to which noise levels are expected to exceed the NML) is provided in Table 6-6 for potential noise impacts during the day, and Table 6-7 for potential noise impacts during the night.

Figure 6-3 and Figure 6-4 show the results of the noise assessment undertaken, including noise catchments and sensitive receivers, for daytime and night-time hours respectively.

Table 6-6 Predicted noise levels during the noisiest construction activity at Site 2 (Northern Hume) during the day

Catchment distance	Day		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1– for receivers in line of sight, at a distance up to 200m	50	60	N
Active Recreation NCA 1 – for receivers in line of sight, at a distance up to 45m	65	75	N, PC, RO

Recommended additional mitigation measures: N-Notification

Table 6-7 Predicted noise levels during the noisiest construction activity at Site 2 (Northern Hume) during the night

Catchment distance	Night		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1 – for receivers in line of sight, at a distance up to 875 m	35	40	N, R2, DR

Recommended additional mitigation measures: N-Notification, R2-Respite Period, DR-Duration Respite

During the noisiest construction activity during daytime hours, the proposal would likely exceed the applicable residential NML within 200 metres of Site 2 (Northern Hume) (with direct line of sight to the proposal area). The applicable NML for active recreation would also be exceeded within 45 metres of the proposal area. However, there are no residential receivers or active recreation receivers within these respective distances (the closest receivers are located over 500 metres from the proposal area), and therefore noise impacts would not be experienced during daytime hours. Subsequently no additional mitigation measures have been recommended during daytime for works at Site 2 (Northern Hume) outside of the standard measures described in Transport's *Construction Noise and Vibration Guideline* (2016).

During the noisiest construction activity during nighttime hours the proposal would likely exceed the applicable NML at sensitive residential receivers within 875 metres of Site 2 (Northen Hume) and with direct line of site to the proposal area. Several additional safeguards have therefore been recommended in accordance with Transport's *Construction Noise and Vibration Guideline* (2016).

Site 3 (Southern Hume)

Sensitive receivers were grouped into a noise catchment areas (NCA). For the NCAs, the predicted noise level and affected distance (or the distance up to which noise levels are expected to exceed the NML) is provided in Table 6-8 for potential noise impacts during the day, and Table 6-9 for potential noise impacts during the night. Figure 6-5 and Figure 6-6 show the results of the noise assessment undertaken, including noise catchments and sensitive receivers, for daytime and night-time hours respectively.

Note that NCA 3 (for receivers with no line of sight at a distance of 605 metres) has been included for the nighttime assessment to demonstrate that the NML wouldn't be exceeded for receivers at this distance (or further away). Within 605 metres of the proposal area, all residences are in line of sight.

Table 6-8: Predicted noise levels during the noisiest construction activity at Site 3 (Southern Hume) during the day

Catchment distance	Day		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1– in line of sight, up to 200 metres	50	60	N

Recommended additional mitigation measures: N- Notification

Table 6-9: Predicted noise levels during the noisiest construction activity at Site 3 (Southern Hume) during the night

Catchment distance	Night		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1 – for receivers in line of sight, at a distance up to 200 m	35	60	N, R2, DR
Residential NCA 2 – for receivers in line of sight, at a distance up to 420 m	35	50	N, R2, DR
Residential NCA 3 – for receivers with no line of sight, at a distance up to 605 m	35	35	N
Residential NCA 4 – for receivers in line of sight, at a distance up to 875	35	40	N, R2, DR

Recommended additional mitigation measures: N- Notification, R2 – Respite Period, DR – Duration Respite

During the noisiest construction activity during daytime hours the proposal would likely exceed the applicable NML at sensitive receivers within 200 metres of Site 3 (Southern Hume) and with direct line of sight of the proposal area. Due to the predicated exceedance, an additional safeguard (notification) has been recommended in accordance with Transport's *Construction Noise and Vibration Guideline* (2016).

During the noisiest construction activity during nighttime hours the proposal would likely exceed the applicable NML at sensitive residential receivers within 200 metres with direct line of site to the proposal area. Residential receivers at further distances (420 metres and 875 metres) from the proposal would experience lower NML exceedances. Several additional safeguards have therefore been recommended in accordance with Transport's *Construction Noise and Vibration Guideline* (2016).

Worst case noise levels

It is possible that multiple pieces of noisy equipment (such as chainsaws) are used at the same time in close proximity to each other, which could exceed the overall noise level predicted using the Noise Estimator Tool. In these cases, it is possible that predicted noise levels may increase by up to 3 dB(A). However, it should be noted that the predicted construction noise levels at each receiver are considered to be reasonable worst-case 15-minute impacts. As a result, the proposal noise levels are likely to be lower than those stated in this assessment for substantial periods of time.

In summary, it is unlikely that an increase in the number of receivers affected by a 3 dB(A) increase would occur, and the implementation of standard and additional noise mitigation measures would ensure that the potential for adverse noise impacts at sensitive receivers is minimised.

Vibration

A jackhammer is proposed to be used in the proposal which has a minimum working distance of one metre to prevent cosmetic damage to buildings from vibration. There are no buildings or receivers within one metre of the proposal area, therefore there would not be any vibration impacts from the proposal and minimum working distances would not be applicable.

Operation

The proposal would not have noise or vibration impacts whilst operational. Maintenance activities (periodic fence inspections by light vehicle and/or small truck, and minor repair work) would be undertaken during daytime hours and would not increase the overall noise levels from the motorway. The chain link fence with top panelling is not expected to noticeably reduce noise emissions to surrounding receivers.

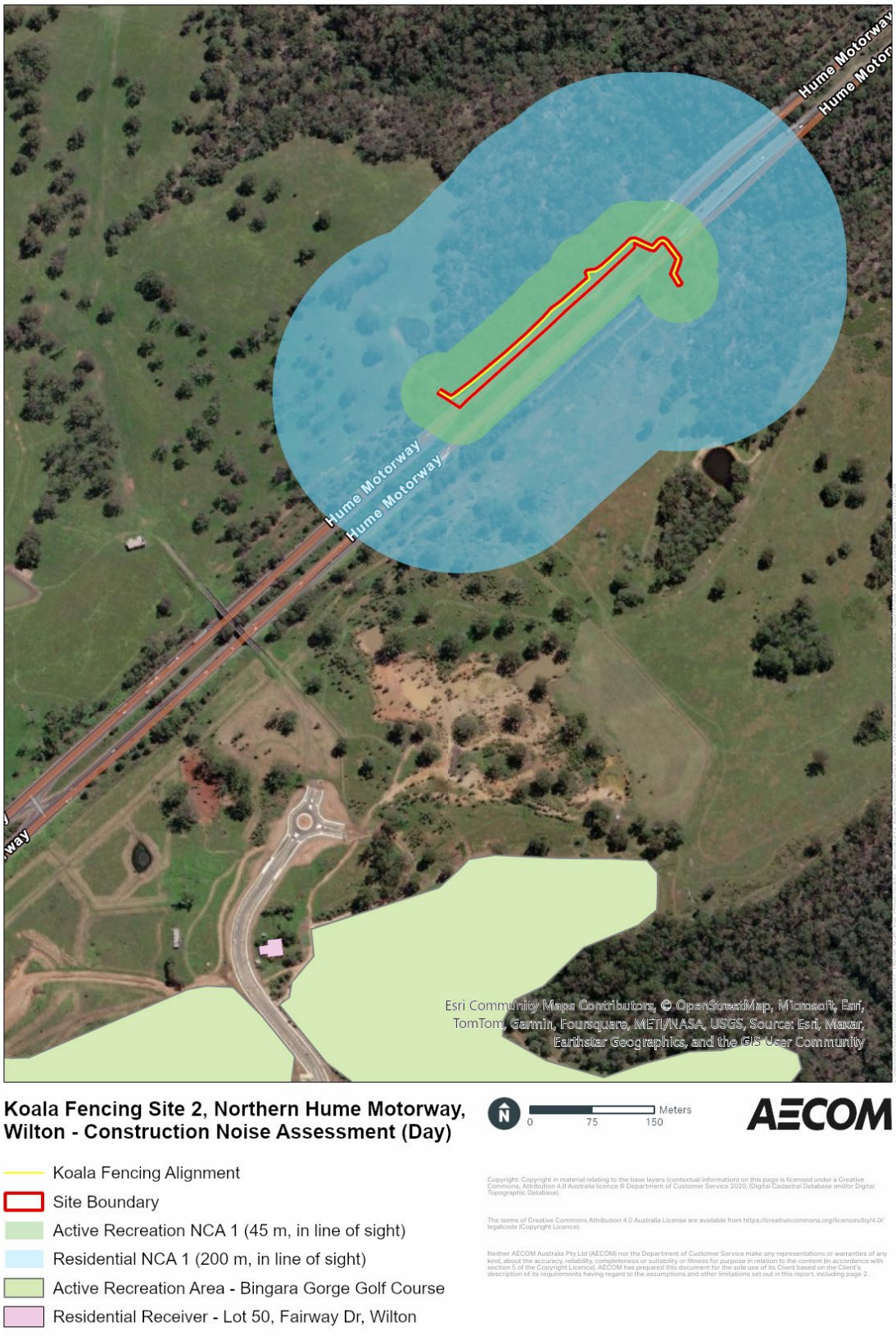


Figure 6-3 Predicted construction noise impacts at Site 2 (Northern Hume) during the day

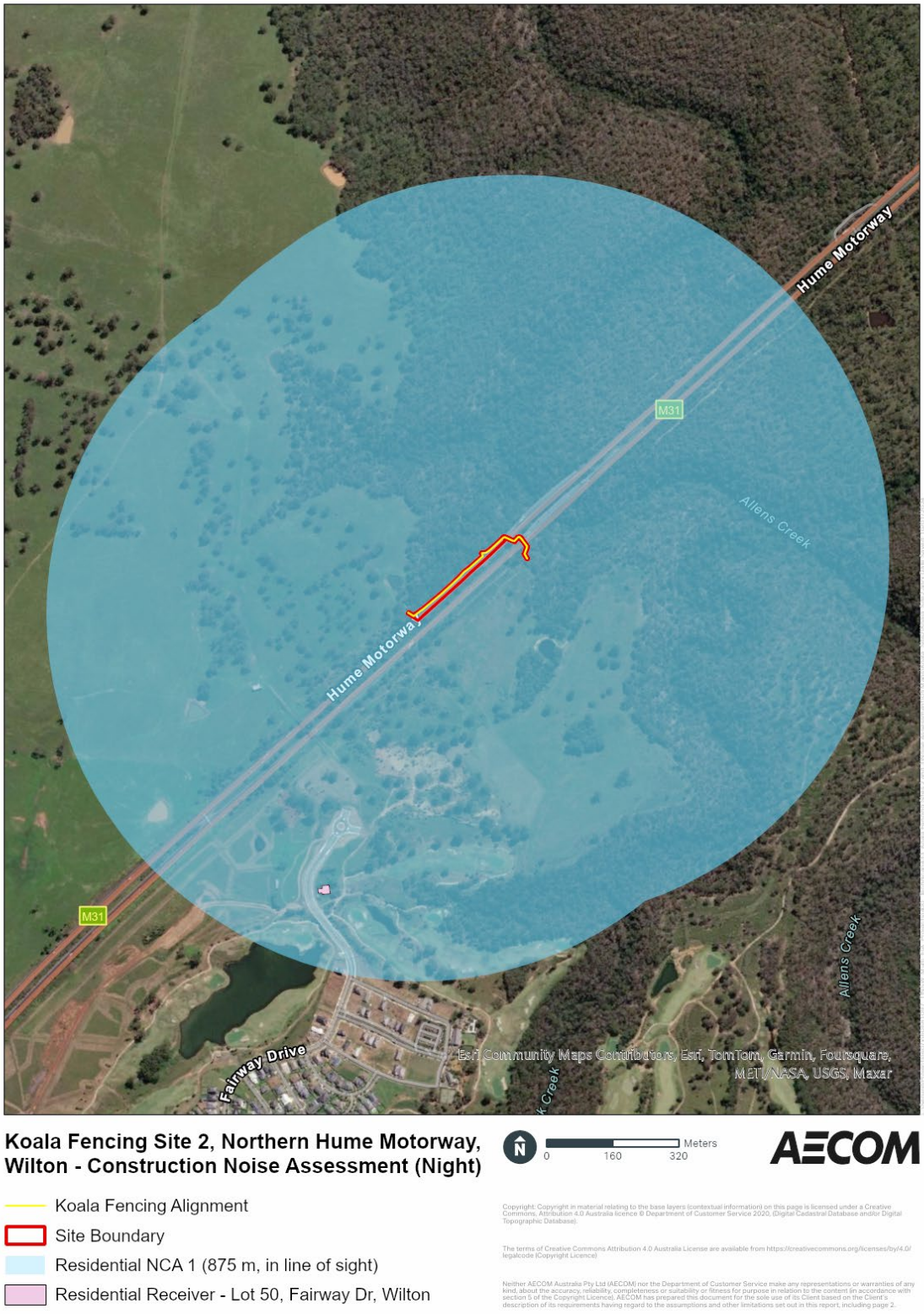


Figure 6-4 Predicted construction noise impacts at Site 2 (Northern Hume) during the night

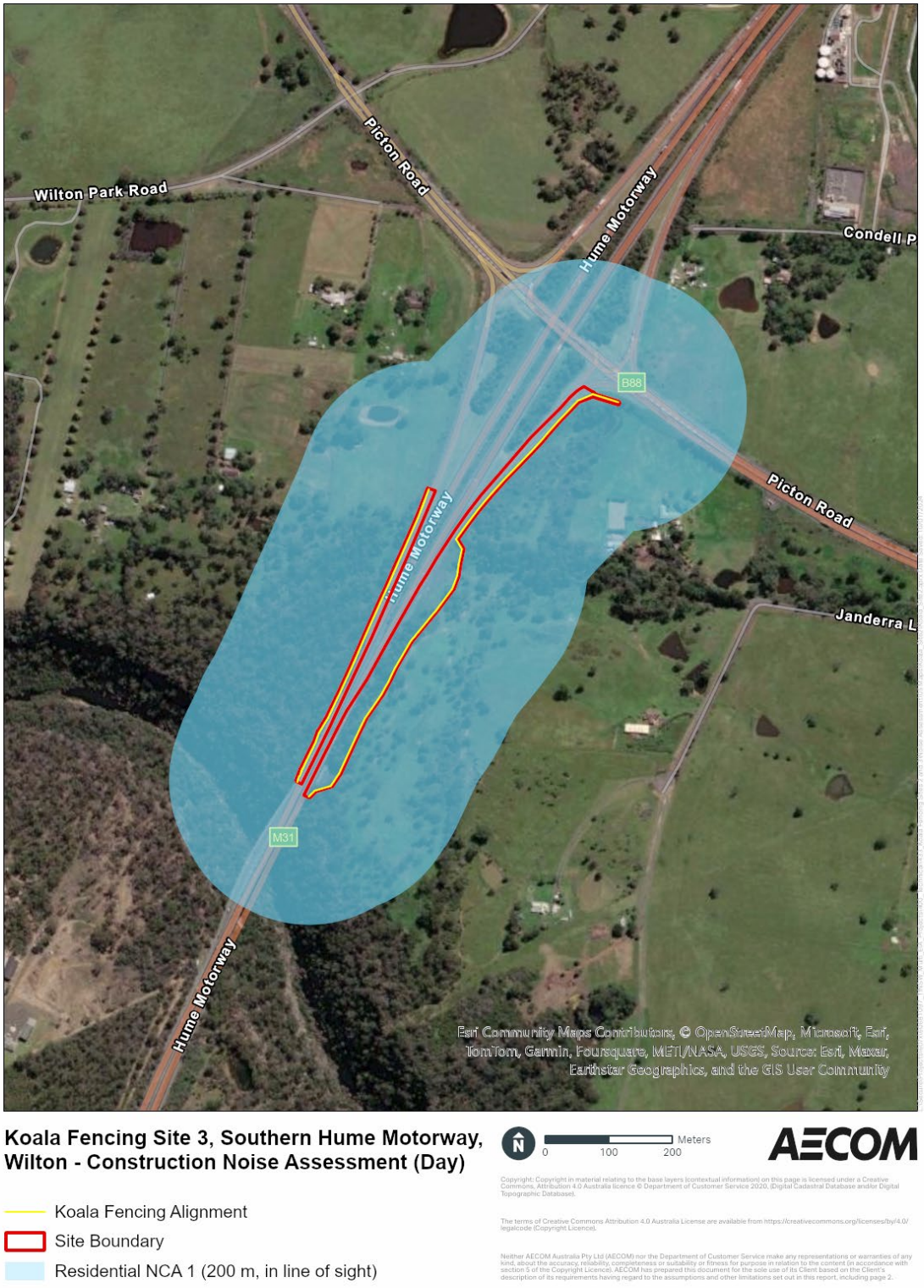
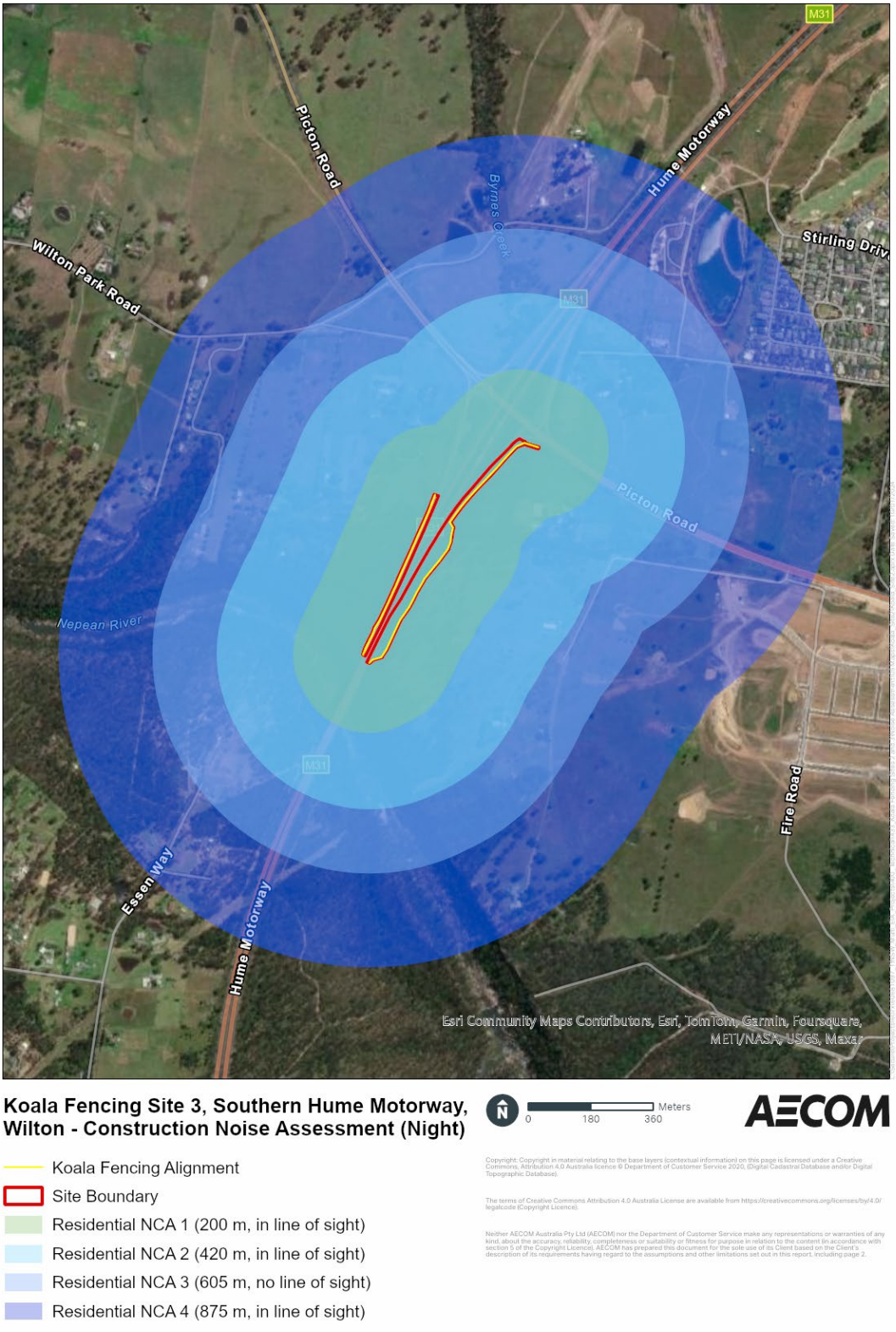


Figure 6-5: Predicted construction noise impacts at Site 3 (Southern Hume) during the day



Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence).

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Figure 6-6 Predicted construction noise impacts at Site 3 (Southern Hume) during the night

6.2.4 Safeguards and management measures

Safeguards and management measures to manage potential noise and vibration impacts are provided in Table 6-10.

Table 6-10: Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction noise	A Construction Noise Management Plan (NMP) will be prepared and implemented as part of the CEMP. The NMP will generally follow the approach in the Environment Protection Authority's *Interim Construction Noise Guidelines* (DECCW, 2009) and *Construction Noise and Vibration Guideline* (CNVG), and include: • All potential high noise generating activities associated with the activity • A map indicating the locations of sensitive receivers including residential properties • A quantitative noise assessment in accordance with the Environment Protection Authority's *Interim Construction Noise Guidelines* (DECCW, 2009) and *Construction Noise and Vibration Guideline* (CNVG) • Feasible and reasonable mitigation measures to be implemented, taking into account the CNVG. • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures. • A process for assessing the performance of the implemented mitigation measures • An outline of a monitoring program • A process for documenting and resolving issues and complaints	Contractor	Pre-construction	Environment Protection Authority's *Interim Construction Noise Guidelines* (DECCW, 2009) and *Construction Noise and Vibration Guideline* (CNVG).
Construction noise	An Out of Hours Works procedure will be prepared as part of the Construction Noise Management Plan and will include: • Undertaking an out-of-hours noise and vibration assessments (OOHWA) for the proposed works / activities and identification of mitigation measures in accordance with Transport for NSW's *Construction Noise and Vibration Guideline*. The OOHWA will be based on construction planning developed by the construction contractor.	Contractor	Pre-construction	Transport for NSW's *Construction Noise and Vibration Guideline*
Construction noise	The noisiest works (chain sawing and mulching) cannot be carried out past midnight where there are sensitive receivers predicted to exceed the NML (less noisy equipment such as electric chainsaws can be used past midnight).	Contractor	Construction	N/A
Construction noise	Noise curtains are to be used for mulching during out of hours work where sensitive receivers are predicted to exceed the NML.	Contractor	Construction	N/A

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction noise	No more than five night shifts per week will be permitted during construction.	Contractor	Construction	N/A
Construction noise	Notification (N): Letterbox drops will be delivered for receivers within an 875 metre radius of the proposal area at both Sites 2 and 3. Notifications will detail work activities, dates, hours, impacts, mitigation measures, and contact details. Notifications will be sent a minimum of seven calendar days prior to the start of work.	Transport / Contractor	Pre-construction	CNVG
Noise impacts	Relevant standard mitigation measures from the *Construction Noise and Vibration Guideline* (Transport, 2016) provided in Appendix D will be implemented.	Transport / contractor	Pre-construction, construction and operation	CNVG

6.3 Traffic, transport and access

6.3.1 Methodology

The assessment methodology for impacts on traffic, transport and access included the following tasks:

- Desktop review of traffic and transport conditions on the Hume Motorway
- Qualitative, high-level assessment of traffic and transport impacts in the vicinity of the proposal area during construction and operation
- Identification of measures to avoid, minimise and manage impacts on traffic, transport and access.

6.3.2 Existing environment

Traffic

The Hume Motorway is a key strategic road and freight route which links Sydney, regional NSW and Melbourne. Picton Road intersects the Hume Motorway between Site 2 (Northern Hume) and Site 3 (Southern Hume) and is a key link between Picton, the Hume Motorway and Wollongong.

Transport has a permanent traffic volume counter located about ten kilometres south of Site 3 (Southern Hume) on the Hume Motorway. The station provides historical AADT data, which is presented in Table 6-11.

Table 6-11: Transport AADT data for the Hume Motorway

Station ID	Station location	Two way traffic volumes (vehicles/day)					
		2018	2019	2020	2021	2022	2023
BRGSTC	20 m east of Avon Dam Road, Bargo, NSW	35,372	35,548	31,275	29,056	37,265	37,621

Public and active transport

Regional public buses utilise the Hume Motorway daily. There are no formal facilities for public and active transport within the proposal area.

6.3.3 Potential impacts

Construction

During construction, closure of one traffic lane would be required to allow for safe site access and exit and to undertake the majority of construction works, including vegetation clearing. The lane closures required would have a temporary and minor impact on traffic flow (travel times) by restricting traffic to one lane and slower speeds along a short section of the

motorway. The majority of the works are proposed to be undertaken during night time hours, which would limit the amount of traffic impacted.

Construction of the proposal would require up to eight light vehicles (including traffic management vehicles) and one heavy vehicle at each site. Construction vehicle movement would mainly be associated with the movement of workers, materials, waste, and construction plant and equipment. Construction vehicle volumes for the proposal would be negligible in the context of existing motorway traffic.

Construction parking would occur within the proposed laydown areas and road shoulders. There are no public parking areas near the proposal area which would be impacted. The proposal would result in minor, temporary and localised traffic impacts in these sections of the Hume Motorway. Construction would occur on one site before moving to the next site which would also limit overall impacts between the two sites.

An accredited traffic control contractor would be engaged to undertake the lane closure in accordance with a ROL to be obtained under the *Roads Act 1993*. The permissible construction hours and days of the week would be stipulated in the ROL. All works carried out within the vicinity of traffic, including loading and unloading of plant and equipment, and permissible construction hours would comply with requirements set out in the conditions given in Section 138 of the *Roads Act 1993*.

Operation

The operational proposal would not result in traffic, transport or access impacts with the exception of maintenance activities. Maintenance activities may require traffic management/lane closures to safely access the fences in some areas, however, would occur irregularly, have limited impacts and be short in duration. There would be access gates in the koala fencing to allow access through the fence lines for emergency services and maintenance personnel during incidents, mitigation works and maintenance inspections / repairs.

During operation the presence of the fencing is expected to reduce the potential for vehicles striking koalas along the motorway, which would be beneficial to motorists travelling through the proposal area.

6.3.4 Safeguards and management measures

Safeguards and management measures to manage potential impacts to traffic and transport are provided in Table 6-12:.

Table 6-12: Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction traffic and transport impacts	A Traffic Guidance Scheme (TGS) and Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TGS and TMP will be prepared in accordance with the Transport *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport, 2008). The TGS will include: • measures to maintain access to local roads and properties • site-specific traffic control measures (including signage) to manage and regulate traffic movement • requirements and methods to notify the local community of impacts on the local road network • access to construction sites including entry and exit locations • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic	Contractor	Detailed design, pre-construction, construction	Section 4.8 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Reference
	• monitoring, review and amendment mechanisms.			
Construction traffic and transport impacts	Traffic management measures will be developed with reference to the *Traffic Control at Work Sites Technical Manual* (Transport, 2022).	Contractor	Pre-construction, construction	*Traffic Control at Work Sites Technical Manual* (Transport, 2022)
Construction traffic and transport impacts	A Road Occupancy Licence (ROL) will be obtained for the traffic lane closures required prior to works commencing, and ROL conditions adhered to.	Transport / Contractor	Pre-construction, construction	*Roads Act 1993*

6.4 Aboriginal cultural heritage

An Aboriginal Archaeological Survey Report has been prepared by Kelleher Nightingale Consulting Pty Ltd to assess the potential impacts of the proposal. A summary of this assessment is presented in this section, with the full report provided in Appendix E.

6.4.1 Methodology

The Aboriginal Archaeological Survey Report for the proposal has been prepared in accordance with Stage 2 of Transport's *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (Transport, 2011). The Archaeological Survey Report has also been prepared with reference to the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW, 2010).

The Archaeological Survey Report involved the following methodology:

- Identification of a study area and desktop research, including:
  - Searches of relevant heritage registers, databases and lists for Aboriginal sites, including a search of the Aboriginal Heritage Information Management System (AHIMS) database
  - Review of previous archaeological investigations for the study area, review of landscape context and regional character, and development of site predictions
- Archaeological site survey of the study area in November 2022
- Assessment of potential impacts to Aboriginal archaeological sites, objects or areas of archaeological potential
- Identification of safeguards and management measures to manage potential Aboriginal cultural heritage impact.

6.4.2 Existing environment

Database searches

A search of the AHIMS database was carried out on 4 November 2022 to identify registered (known) Aboriginal sites or declared Aboriginal places within or adjacent to the study area.

The search resulted in the identification of 25 known Aboriginal sites, as listed on Table 6-13 and Figure 6-7.

Table 6-13: Type and number of identified known Aboriginal sites within the study area

Site context	Site feature	Number of sites
Open[1]	Artefact	9
	Artefact; Potential Archaeological Deposits (PAD)	3
	Modified tree (scarred or carved)	4
	PAD	5
	PAD; stone arrangement	1
Closed[2]	Art (pigment or engraved)	2
	Habitat structure; PAD	1

1: Open sites are generally associated with sites other than rock shelters, such as grinding grooves and isolated artefacts such as Scarred Trees
2: Closed sites are generally associated with rock shelters, including potential archaeological deposits within the shelter, rock art or shell middens

Other sources of information including heritage registers and lists were also searched for known Aboriginal heritage. These included:

- Wollondilly LEP
- State Heritage Register and State Heritage Inventory
- Section 170 Heritage and Conservation Registers
- Commonwealth Heritage List
- National Heritage List
- Australian Heritage Database & Australian Heritage Places Inventory
- Register of the National Estate (non-statutory archive).

One local heritage item 'Aboriginal shelter sites (Wilton Park)' (Wollondilly LEP, listing number I285) immediately borders Site 2 (Northern Hume), on the south-western side of the Hume Motorway at Allens Creek. The item is recorded as comprising a number of Aboriginal shelter sites located within deeply incised gullies carrying Allens Creek and Stringy Bark Creek. The item is not located within the proposal area.

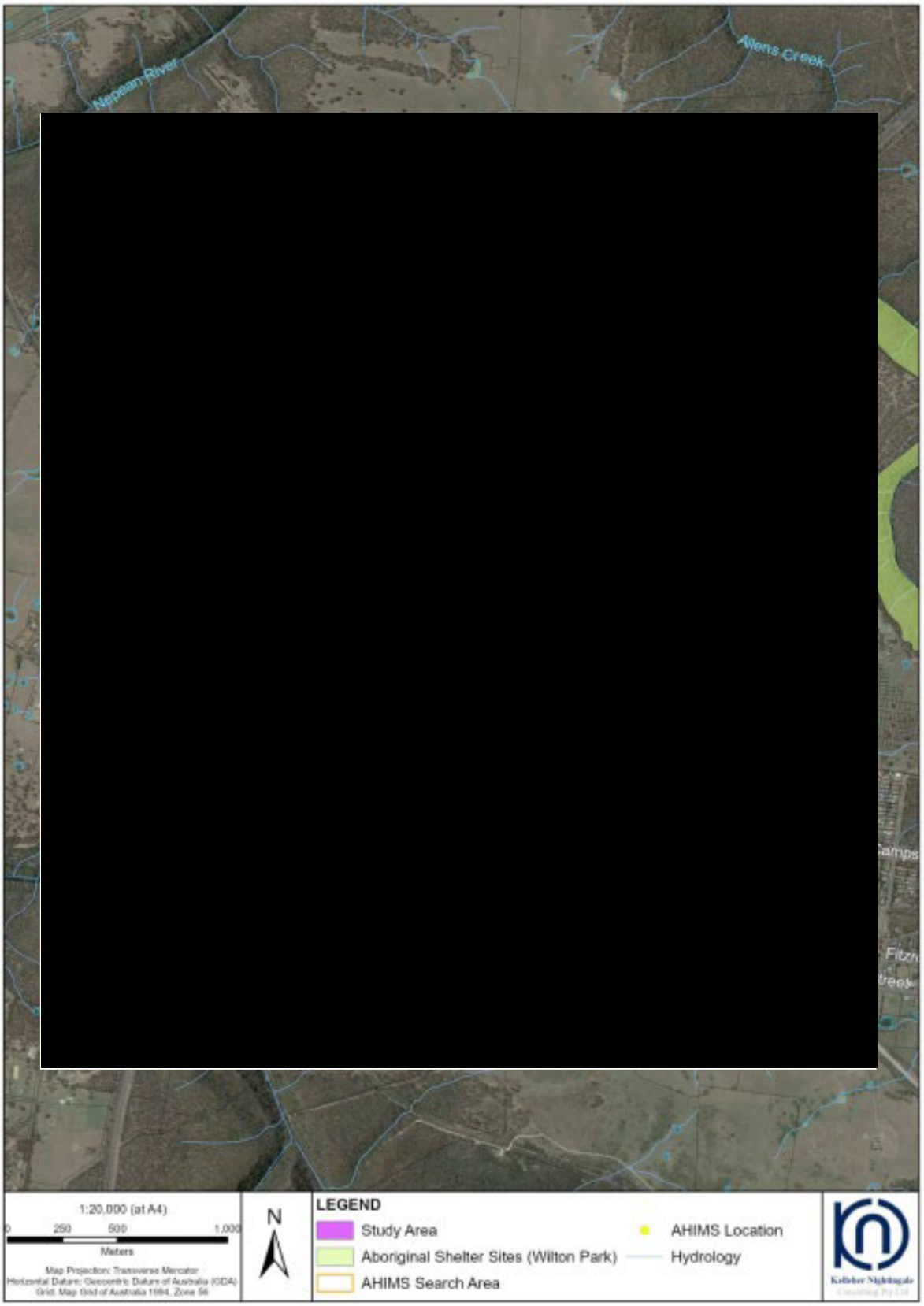


Figure 6-7: Location of known Aboriginal sites

No Aboriginal archaeological sites or Aboriginal heritage items were recorded on these databases within the study area.

The AHIMS searches indicate that previously recorded sites in the immediate area surrounding Site 2 (Northern Hume) are predominantly low-density open context artefact sites, rockshelter sites with art and a culturally modified (scarred) tree.

Previous archaeological investigations have suggested that these sites represent the movement of Aboriginal people across the plateau and more permanent occupation areas bordering the Nepean River and its drainage creek systems. These areas would have been extensively exploited by Aboriginal people for their resources.

Landscape context

The study area is located on the southern end of the Cumberland Plain, which is a region of the Sydney Basin characterised by low lying, gently undulating low hills and plains atop the Wianamatta Group of Triassic Period sedimentary shales. The study area is chiefly characterised by gentle crests and slopes present across the plateau. These slopes descend to steep, vegetated gorges containing Allens Creek in the north and the Nepean River in the south. The underlying bedrock geology of the study area comprises Ashfield Shale of the Wianamatta Group and Hawkesbury Sandstone

Soils across the study area derive from Blacktown, Hawkesbury and Lucas Heights soils, as shown in Figure 6-12. Blacktown soils have the potential to conserve archaeological deposits intact where disturbance levels are low. Where steeper landforms are present, preservation of archaeological deposits is less likely, especially where combined with landscape disturbance. Hawkesbury soils are archaeologically sensitive due to the occurrence of outcropping blocks and weathered scarps of sandstone, which provide overhangs with a suitable environment for rock shelter sites and platforms suitable for engravings or grinding grooves. Lucas Heights soils are present within the southern portion of the study area bordering the Nepean River. These soils are considered to have some archaeological potential due to its age and slow accumulation of soil matrix.

Within the study area, predominant land use disturbance is the result of infrastructure development, specifically the construction and maintenance of the Hume Motorway corridor, as well as adjacent agricultural activities. However, pockets of remnant native vegetation are present within proximity to Allens Creek and the Nepean River. Native vegetation within the study area consists of Shale/Sandstone Transition Forest, as well as Cumberland Plain Shale Woodland. Remnant native vegetation demonstrates that the area contains a diverse range of native flora which was likely to have provided past Aboriginal people with a range of raw materials and food sources.

Archaeological predictions

Various resources that would have been valued by Aboriginal people are present within region, including native plant and animal species, sources of fresh water and rock shelters suitable for use as campsites. Preservation of archaeological deposit in open contexts (i.e. artefact scatters and isolated finds) occurs sporadically across the plateau. However, the study area comprises a highly disturbed road corridor and former pasture paddocks. Within this context Aboriginal objects are unlikely to survive in situ and the archaeological potential of such sites is generally low.

Archaeological survey results

The archaeological survey did not identify any Aboriginal archaeological objects, sites or potential archaeological deposits within the study area. The survey found that the proposal area exhibited substantial ground disturbance and has low potential for intact archaeological deposits due to motorway construction, vegetation removal, water related infrastructure and utilities installation.

However, several sites were identified within proximity to the proposal area, by background research, AHIMS records and the archaeological field survey. These sites comprised a culturally modified (scarred) tree, a rockshelter site with art, isolated surface artefacts and an area of PAD. Open context sites were identified across the flat plateau; the rockshelter site was identified on the steep slope of the Allens Creek gorge.

A further two modified trees were identified near Site 2 (Northern Hume) during site visits for the proposal. These trees are located adjacent to the north-bound carriage way of the motorway. A visual assessment and detailed assessment of these trees by An Aboriginal heritage specialist determined that they contain contemporary features and are not Aboriginal heritage items for the purposes of the *National Parks and Wildlife Act 1974* (refer Appendix F for further information). Further, these trees would not be impacted by the proposal.

6.4.3 Potential impacts

Construction

No Aboriginal archaeological sites, Aboriginal objects or areas of archaeological potential were identified within the proposal area. Based on the limited ground disturbance required for the proposal (e.g. fence post excavations) and low archaeological potential of the proposal area, it is unlikely that construction of the proposal would impact on Aboriginal archaeological objects, sites or deposits. A safeguard is recommended for unexpected finds of potential Aboriginal heritage.

Operation

As no Aboriginal archaeological sites, Aboriginal objects or areas of archaeological potential were identified within the proposal area, and maintenance activities would not disturb previously undisturbed land, it is unlikely that operation of the proposal would impact on any Aboriginal cultural heritage items.

A Stage 3 PACHCI assessment is not required at this stage as no impact to Aboriginal heritage has been identified.

6.4.4 Safeguards and management measures

Safeguards and management measures to manage potential impacts to Aboriginal cultural heritage are provided in Table 6-14.

Table 6-14: Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Aboriginal cultural heritage	The *Standard Management Procedure – Unexpected Heritage Items* (Transport, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*
Aboriginal cultural heritage	Should future design extend into areas not assessed as part of the current Stage 2 PACHCI assessment, additional assessment in accordance with the Stage 2 requirements of the Transport PACHCI (Transport, 2011) and the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW, 2010) would be required.	Transport	Detailed design / Pre-construction	PACHCI (Transport, 2011)
Contemporary modified trees	The two modified trees identified near Site 2 (Northern Hume) are not to be impacted (refer Appendix F).	Contractor	Construction	Appendix F of this REF

6.5 Visual amenity

This section assesses and describes the impacts of the proposal on visual amenity within and surrounding the proposal area.

6.5.1 Methodology

A visual amenity impact assessment was undertaken with reference to the *Guideline for Landscape Character and Visual Impact Assessment* (Transport, 2020). According to the guideline, activities requiring a Project REF that are small in scale require a visual impact assessment only (in accordance with chapter 6 of the guideline). Keys steps undertaken for the visual amenity impact assessment therefore included a qualitative, high-level assessment for the construction stage of the proposal, and the following tasks for the operational stage of the proposal:

- Identification of existing viewpoints and their sensitivity to change
- Determination of the magnitude of change for each viewpoint
- Assessment of visual impact
- Identification of measures to avoid, minimise and manage impacts on visual amenity (for both construction and operation stages).

Assessment of the visual impact of the proposal is completed with the *Guideline for Landscape Character and Visual Impact Assessment* grading matrix, presented in Table 6-15. Sensitivity relates to the ability of a view to accept a change without adverse impact on its quality. Magnitude relates to the degree of change affecting a view.

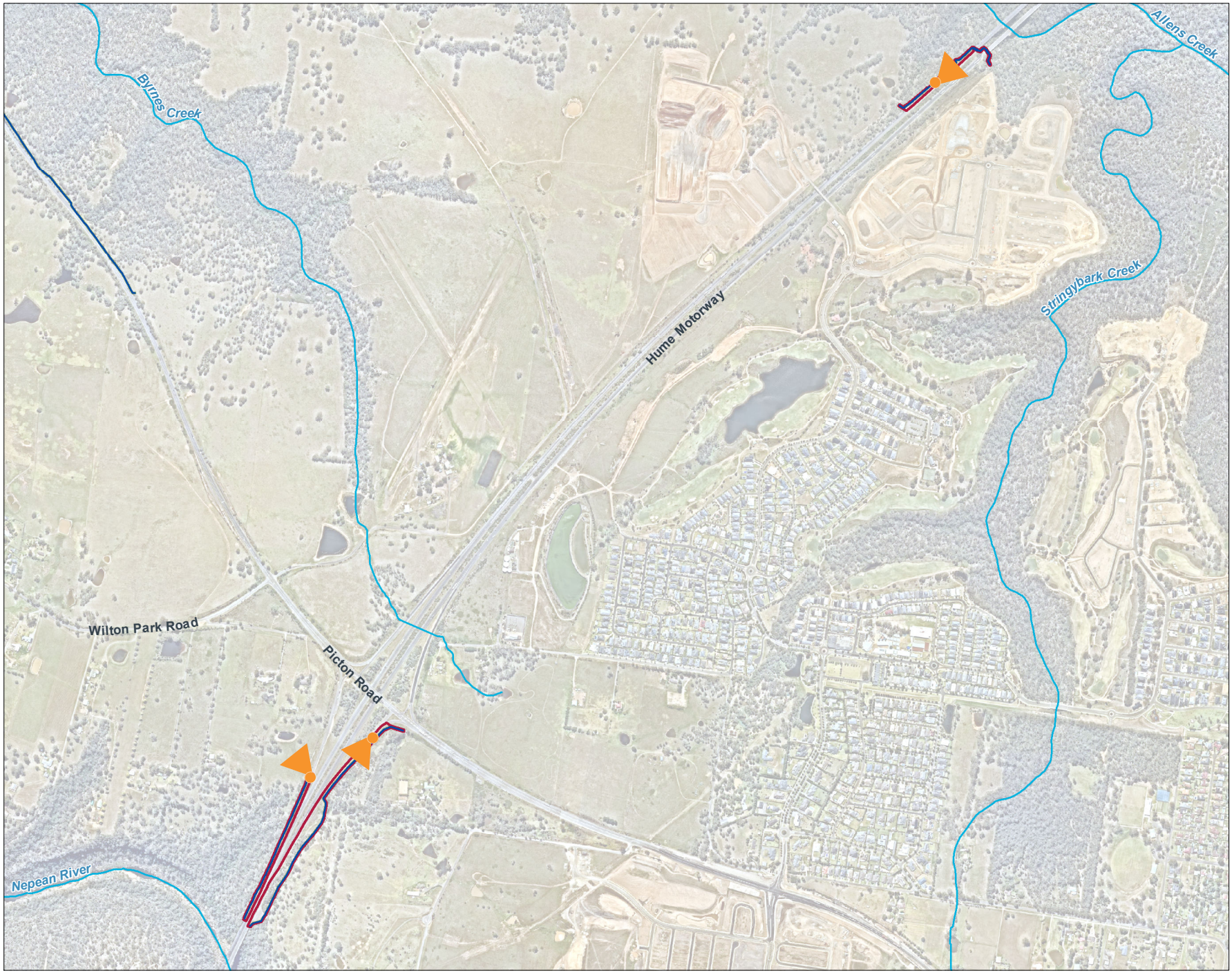
Table 6-15: Visual amenity impact grading matrix

Sensitivity		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
	High	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.5.2 Existing environment

The proposal is predominantly located within the road corridor of the Hume Motorway. Views of the proposal area are predominantly limited to views from the road corridor (i.e. of passing motorists) due to the rural surrounding landscape and limited number of residences or other buildings, as well as vegetation along the motorway and road cuttings. A residential dwelling located about 60 metres north-east of Site 3 (Southern Hume) may have line of sight to the proposal area due to sparse vegetation in this area, however this is limited by the boundary fence around the dwelling.

Three representative viewpoints have been selected to represent the change in views due to the proposal as shown on Figure 6-8. The view of the three viewpoints are shown on Figure 6-9, Figure 6-10 and Figure 6-11 respectively.



AECOM

N

0 200 400 m

FIGURE 6-8: LOCATION OF VIEWPOINTS

Legend

- Proposal area
- Vegetation clearing zone
- Koala fence alignment
- Koala fence alignment under bridge
- Watercourse
- Viewpoint

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

Figure 6-9 Viewpoint 1: North facing view from the northbound lane adjacent to Site 2 (Northern Hume) (Image source: Google maps, 2023)

Figure 6-10 Viewpoint 2: South facing view from the southbound lane adjacent to Site 3 (Southern Hume) (Image source: Google maps, 2023)

Figure 6-11 Viewpoint 3: Indication of view from nearby residence towards the northbound exit ramp adjacent to Site 3 (Southern Hume) (Image source: Google maps, 2023)

6.5.3 Potential impacts

Construction

During construction, a temporary reduction in visual amenity would occur from the presence of construction activities, including night lighting to safely undertake the works and temporary lane closures and associated traffic management. The construction activities would be limited to the proposal area and would be visible to passing motorists and nearby receivers during nighttime hours (in which the majority of the work would be conducted), as well as standard day time construction hours (in which some of the works would be undertaken). Machinery and vehicles would also be parked in laydown areas when not in use (in between shifts) and contribute to visual impacts.

The presence of night lighting would likely be visible to nearby receivers with line of sight to the motorway, which would increase the existing light emissions from the motorway corridor. This would be more apparent at Site 2 (Northern Hume) as there is no existing street lighting along the motorway at this location, however there are no sensitive receivers in the immediate vicinity, with the closest receiver located about 670 metres from the proposal area. Sensitive receivers are located in closer proximity to Site 3 (Southern Hume) at distances of about 115 metres, however the existing street lighting along the motorway corridor in this location would negate some of the degree of change experienced. Lighting would require management to avoid light spill as far as practicable into the surrounding environment to minimise these impacts. The visual compatibility of the remainder of construction activities with the road corridor is likely to be of low impact. This is based on the small scale of construction activities proposed, the temporary transient views of the construction activities for most receivers (i.e. passing motorists), and the nature of the corridor as a major infrastructure corridor which is also subject to periodic maintenance/construction activities.

Operation

An assessment of the visual sensitivity and magnitude of change at three visual receiver locations was undertaken for the operational phase of the proposal. The results of this assessment are provided in Table 6-16.

Table 6-16 Operational visual impact assessment

Viewpoints	Anticipated change	Sensitivity to change	Magnitude of change	Rating
Viewpoint 1: North facing view from the northbound lane adjacent to Site 2 (Northern Hume)	The proposal would remove vegetation and introduce koala fencing as a new element along the side of the motorway.	The sensitivity is considered to be moderate as although views from motorists would be fleeting as they travel past, a large number of motorists would experience these views, which consist of mature trees and vegetation within a rural/undeveloped landscape.	The magnitude of the change would be low. A cleared maintenance zone would be required on both sides of the fence and the fence would limit views to the surrounding landscape which would have some visual impact. However the fence would be a minor addition to the existing motorway infrastructure corridor, and the fencing would only be seen briefly by motorists passing at high speeds.	Moderate-low
Viewpoint 2: South facing view from the southbound lane adjacent to Site 3 (Southern Hume)	The proposal would remove vegetation and introduce koala fencing as a new element along the side of the motorway.	The sensitivity is considered to be moderate as although views from motorists would be fleeting as they travel past, a large number of motorists would experience these views, which consist of mature trees and vegetation within a rural/undeveloped landscape.	The magnitude of the change would be low. A cleared maintenance zone would be required on both sides of the fence and the fence would limit views to the surrounding landscape which would have some visual impact. However the fence would be a minor addition in the context of the existing motorway infrastructure corridor, and the fencing would only be seen briefly by motorists passing at high speeds.	Moderate-low
Viewpoint 3: View from nearby residence towards Site 3	The proposal would remove vegetation and introduce koala fencing as a new element along the	Residents with visibility of the proposal would have a moderate sensitivity due to the permanence of the view, however the view is	The magnitude of the change would be moderate. The fence colour would be 'steel galvanised' and is likely to be a noticeable addition to a permanent view from	Moderate

Viewpoints	Anticipated change	Sensitivity to change	Magnitude of change	Rating
(Southern Hume)	side of the motorway.	limited by the existing fence around the residence, distance of the fence, and looks towards an existing motorway corridor.	the residence, as would the cleared maintenance zone required on both sides of the fence. However there would be some screening of the koala fence from existing vegetation between the proposed fence location and the residence, and the koala fence would provide some screening of the view to the motorway.	

Overall, the change to visual amenity of the proposal area is considered moderate-low from the road corridor, and moderate from the nearby residence near Site 3 (Southern Hume). Safeguards have been recommended to minimise visual impacts.

6.5.4 Safeguards and management measures

Safeguards and management measures to manage potential visual amenity impacts are provided in Table 6-17.

Table 6-17: Visual amenity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Visual amenity impacts during construction	Construction plant, equipment and materials will not remain onsite any longer than is necessary during and after work is completed	Contractor	Construction	N/A
Visual amenity impacts during construction	Artificial lighting will be directed down and light spill into adjoining properties and the surrounding environment minimised where possible, especially where residential receivers have line of sight to the proposal area.	Contractor	Construction	N/A

6.6 Air quality

6.6.1 Methodology

A qualitative assessment was undertaken to assess the impact of the proposal on local air quality. This was considered an appropriate level of assessment due to the small scale of the proposal and activities proposed and the low number of nearby sensitive receivers. The assessment involved a desktop review of:

- The existing land use and climatic environment based on local meteorological data
- Review of available background air quality monitoring data, and search of the National Pollutant Inventory (NPI) for existing sources of air pollution
- Identification of potential sensitive receivers
- Potential air pollutants generated during the construction phase of the proposal based on standard construction practices
- Potential air pollutants generated during the operational phase of the proposal based on maintenance activities proposed.

6.6.2 Existing environment

Landscape and land use

The proposal is located on the southern end of the Cumberland Plain, characterised by low lying, gently undulating low hills and plains. The proposal area is surrounded by predominately rural and agricultural land uses, as well as the road corridor of the Hume Motorway.

Air quality

The existing air quality of the proposal area is influenced by vehicle emissions associated with the Hume Motorway, and agricultural activities. A search of the NPI identified that the closest registered existing air pollution source is the Tower Power Station owned and operated by EDL Energy, which is located about three kilometres east of Site 2 (Northern Hume).

The Bargo weather station is the closest air quality monitoring station to the proposal area. It is located about 11 kilometres south-west of Site 3 (Southern Hume), and has collected air quality data over the last 30 years. The average air quality of the area for ozone (O_3) and particle matter (particles less than 2.5 and 10 micrometres diameter, $PM_{2.5}$ and PM_{10} respectively) have been 'Good' (DPE, 2023).

Sensitive receivers

Sensitive receivers in the vicinity (within 150 metres) of the proposal area include:

- Road users on the Hume Motorway
- Site 3 (Southern Hume):
  - Residential receivers along Berwick Park Road, Wilton adjacent to the proposal (30 Berwick Park Road is the closest at a distance of 115 metres)
  - Residential receiver at 50 Janderra Lane, Wilton (150 metres)

There are no residential receivers within 150 metres of Site 2 (Northern Hume).

6.6.3 Potential impacts

Construction

Potential localised air quality impacts associated with construction of the proposal include dust generation and exhaust emissions from vehicles and machinery. Short-term dust emissions could result from construction activities such as vegetation clearing, excavation and vehicle movement. Airborne dust generated has the potential to result in minor temporary impacts for nearby sensitive receivers, although this is expected to be negligible due to the small scale of the construction activities involved and lack of nearby sensitive receivers. The low number of vehicles and machinery required at any one time would also limit the potential for exhaust emissions to impact the local air quality.

As a result of the limited duration and intensity of the construction activities, and through implementation of standard construction management measures, it is anticipated that dust generation or exhaust emissions would result in negligible to minor impacts to air quality.

Operation

There are no anticipated discernible long-term changes to air quality as a result of the proposal. Minor inspection and maintenance activities for the fence line would involve light vehicle/s and equipment however is not expected to contribute any noticeable air emissions to the local environment.

6.6.4 Safeguards and management measures

Safeguards and management measures to manage potential impacts to air quality are provided in Table 6-18.

Table 6-18: Air quality safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Air quality	Measures (such as watering or covering exposed areas) will be implemented to minimise or prevent air pollution and dust emissions where required.	Construction contractor	Construction	N/A
Air quality	Vehicle loads containing loose materials will be covered.	Construction contractor	Construction	N/A
Air quality	During extreme weather events (such as high winds) where dust generation cannot be effectively minimised, dust generating works will cease until adequate controls can be implemented or until adverse weather conditions subside.	Construction contractor	Construction	N/A
Air quality	Vehicles and machinery will be regularly serviced and maintained in an efficient condition to minimise potential emissions.	Construction contractor	Construction	N/A
Air quality	All emission controls used on vehicles and construction equipment will comply with standards listed in Schedule 4 of the *Protection of the Environment Operations (Clean Air) Regulation 2010*.	Construction contractor	Construction	Schedule 4 of the *Protection of the Environment Operations (Clean Air) Regulation 2010*.

6.7 Socio-economic, property and land use

6.7.1 Methodology

The socio-economic assessment was prepared in accordance with the *Environmental impact assessment practice note: socio-economic assessment: EIA-N05* (Transport, 2020) (Practice Note). Property and land use impacts were considered as part of the assessment.

Based on review of the Practice Note it was determined that the 'basic' level of assessment would be the most appropriate. This is defined as applying to "*…projects of few, short duration or localised impacts or where impacts can be appropriately managed by notifications and consultation*." The proposal is likely to affect residents nearby the proposal alignment and those who utilise the Hume Motorway and the off-ramp to Picton Road.

The methodology for the assessment included:

- Identification of the existing socio-economic environment of the study area, including
  - Data on population, demographics, local business and industry, employment, income and dwelling characteristics in the study area (defined below)
  - Access, connectivity, existing social infrastructure and community features
  - Key community issues from previous community consultation
  - Desktop review of property and land uses within and adjacent to proposal area
- Identification and assessment of the potential socio-economic impacts of the construction and operation of the proposal
- Recommendation of measures to avoid, minimise and manage potential impacts on the socio-economic environment.

Study area

The study area for this socio-economic assessment is 'Wilton (NSW)' suburb. This study area was selected as it would provide representation of a local community, in particular nearby landholders and users, residents and businesses. The proposal is anticipated to impact (both positively and negatively) the local area.

Criteria

The significance of likely impacts has been assessed based on the sensitivity and magnitude of the impacts. These terms are defined as follows:

- Sensitivity – the qualities of the receptor which influences its vulnerability to change and capacity to adapt
- Magnitude – the scale, duration, intensity and scope of the overall proposal including how it will be constructed and operated.

The levels of sensitivity and magnitude are defined in Table 6-19: and Table 6-20: respectively.

Table 6-19: Levels of sensitivity

Sensitivity	Definition
Negligible	No vulnerability and able to absorb or adapt to change.
Low	Minimal areas of vulnerabilities and a high ability to absorb or adapt to change.
Moderate	A number of vulnerabilities but retains some ability to absorb or adapt to change.
High	Multiple vulnerabilities and/or very little capacity to absorb or adapt to change.

Table 6-20: Levels of magnitude

Magnitude	Definition
Negligible	No discernible positive or negative changes caused by the impact. Change from the baseline remains within the range commonly experienced by receptors.
Low	A discernible change from baseline conditions. Tendency is that the impact is to a small proportion of receptors over a limited geographical area and mainly in the vicinity of the project. The impact may be short term or some impacts may extend over the life of the proposal.
Moderate	A clearly noticeable difference from baseline conditions. Tendency is that the impact is to a small to large proportion of receptors and may be over an area beyond the vicinity of the project. Duration may be short term to medium or some impacts may extend over the life of the project.
High	A change that dominates over existing baseline conditions. The change is widespread or persists over many years or is effectively permanent.

The socio-economic assessment applied the impact grading matrix presented in the Practice Note to assess the level of significance for potential negative impacts only, as shown in Table 6-21. Where a beneficial impact is identified, magnitude and sensitivity were not selected, and instead given a 'beneficial' qualitative rating.

Table 6-21: Socio-economic impact grading matrix

		Magnitude			
		High	**Moderate**	**Low**	**Negligible**
Sensitivity	**High**	High	High-moderate	Moderate	Negligible
	Moderate	High-moderate	Moderate	Moderate-low	Negligible
	Low	Moderate	Moderate-low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

6.7.2 Existing environment

According to 2021 census data from the Australian Bureau of Statistics (ABS), the Wilton suburb had a population of 3,767 residents. The three most popular modes to travel to work include: car (as the driver) (49.8 per cent), car (as the passenger) (2.0 per cent) and truck (1.9 per cent).

Notably, the proposal is located in the Wilton Grown Area which is subject to strategies to increase the housing availability and consequently the population of Wilton. Currently, there are two proposed adjacent residential developments to the north and south of Site 2 (Northern Hume), which are being built at the time of production of this REF.

The proposal is located in the Wollondilly Shire LGA. The existing land use zone within the proposal area is SP2 Infrastructure (refer Section 4 for further information on land zoning).

6.7.3 Potential impacts

Construction

The proposal area is predominantly located within the motorway corridor and would not require property acquisition. However, the northern end of the fence line on the southern side of the motorway at Site 2 would tie into a future noise wall or koala fence to be constructed by an adjacent residential development. Property agreements would be required with the landholder to agree upon construction arrangements within this property.

Construction of the proposal is anticipated to generate work for up to 10 employees which would have a beneficial impact on employment in the region. Additionally, increased expenditure at local businesses through purchases made by construction workers, and indirect employment and expenditure through the provision of goods and services required for construction, would also be beneficial to the community.

Construction would generate noise and air quality emissions and affect the visual environment. Noise impacts are assessed in Section 6.2 and show that residential receivers within 200 meters of Site 3 (Southern Hume) would experience high exceedances of applicable noise management levels. Noise and air quality impacts would be short term and temporary and managed with mitigation measures, refer to Sections 6.2, 6.3, 6.5 and 6.6.

The impact of construction of the proposal to access and connectivity would be low. Disruption to the road network (e.g. people travelling to work in the region) and public transport (e.g. regional buses) would be minimal and limited to temporary lane closures and speed restrictions for short stretches of the motorway adjacent to the proposal area. Road users would still have access to the road network during construction.

Operation

The majority of the proposal would be located within the road reserve of the Hume Motorway. The northern end of the fence line at Site 2 that would tie into a future noise wall or koala fence in adjacent property would not require permanent property acquisition, however a property agreement would be required for ongoing maintenance arrangements with the landholder.

Gates along the fence would provide emergency access to adjacent properties. The fencing along the motorway would also not affect land use in the surrounding area.

Small maintenance crews would be required periodically, which would have a negligible impact on employment and income in the region. Maintenance activities required for the proposal would not have an impact on population or demography.

The proposal would have a minor beneficial impact on local businesses (e.g. local vendors, trucking and freight companies) during operation, as the proposal would result in a safer roadway for those using the motorway and the off ramp to Picton Road.

As a new fixture in the landscape, the proposal would have a moderate-low to moderate impact on local visual amenity (refer Section 6.5.

The koala fencing would have a positive impact on roads (e.g. people travelling to work in the region) and public transport (e.g. regional buses) as it would reduce koalas/wildlife entering the motorway and reduce the risk of a collision. Similarly, by protecting native fauna the proposal would also have a beneficial impact to environmental values of the local communities in the area.

6.7.4 Safeguards and management measures

Safeguards and management measures to manage potential socio-economic impacts are provided in Table 6-22:. Other safeguards and management measures to address socio-economic impacts are identified in Sections 6.2, 6.3 and 6.5.

Table 6-22: Socio economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Community notification	Transport will notify nearby residents and businesses at least seven days prior to construction of the proposal. Notifications will detail work activities, dates, hours, impacts, mitigation measures and contact details. Notifications will be sent a minimum of seven calendar days prior to the start of work.	Transport	Pre-construction / construction	N/A

6.8 Soils and contamination

6.8.1 Methodology

A desktop assessment of soils and contamination was undertaken, which included the following tasks:

- Review of existing acid sulfate and salinity conditions mapped in the proposal area using the NSW Government *Central Resource for Sharing and Enabling Environmental Data in NSW* (SEED) (2023)
- Review of existing contamination sources recorded in the Wollondilly LGA using the NSW EPA contaminated land record
- Review of the Aboriginal Archaeological Survey Report for information on existing soils environments (refer to Appendix E)
- Assessment of potential soil and contamination risks during construction and operation of the proposal
- Identification of measures to avoid, minimise and manage impacts on soils and contamination.

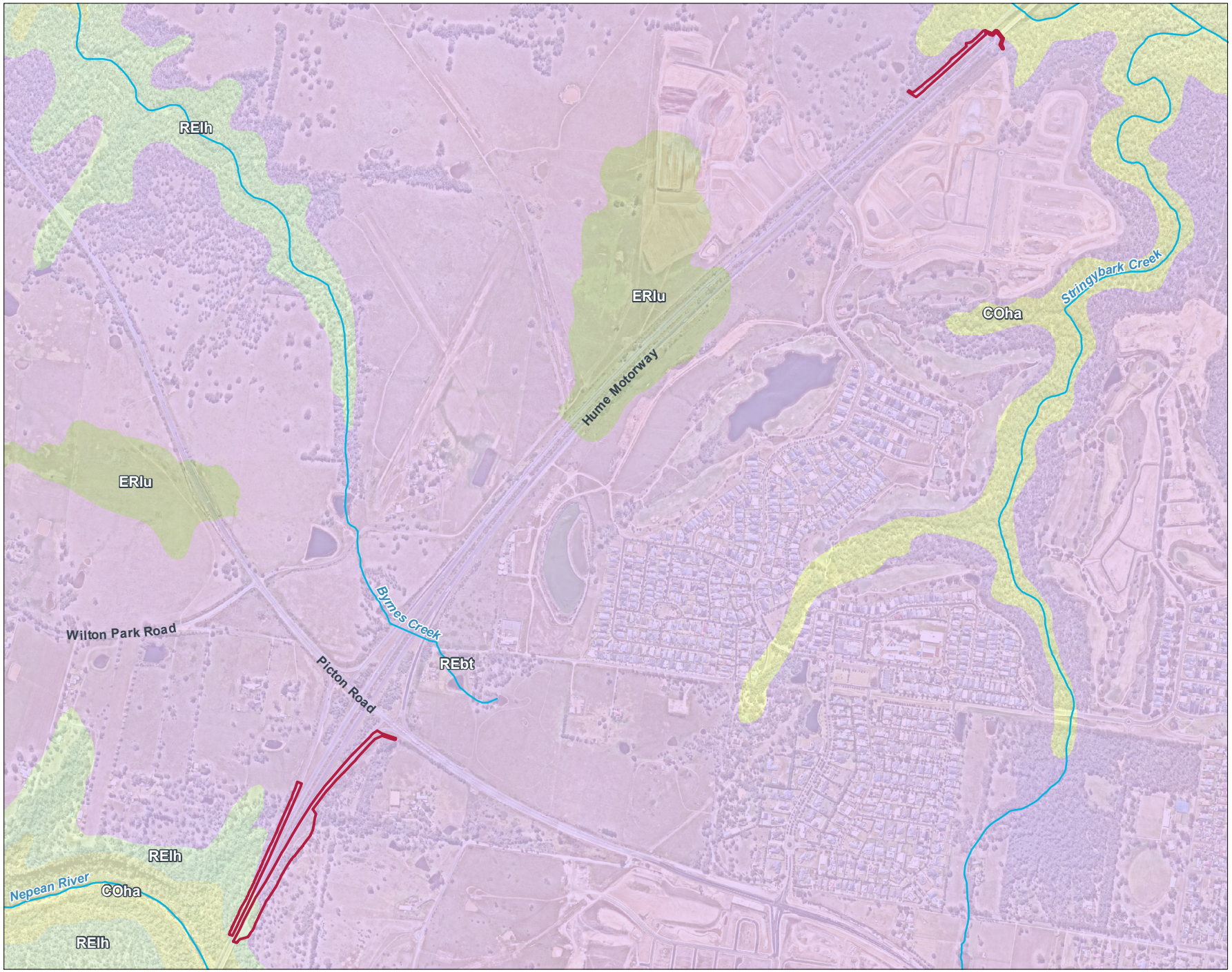
6.8.2 Existing environment

The desktop review identified that the proposal area is not located on soils mapped as having acid sulfate or salinity risk.

A search of the NSW EPA contaminated land register on 24 March 2023 did not identify any recorded contaminated sites in the vicinity of the proposal area.

Soils in and surrounding the proposal area are shown on Figure 6-12. Soils within and surrounding the proposal area derive from Blacktown, Hawkesbury and Lucas Heights soils. Blacktown soils are present across the majority of the proposal area and consist of shallow to moderately deep hard setting red, brown and yellow podzolic soils with low soil fertility. They are subject to minor to moderate erosion where surface vegetation is not maintained.

As noted in Section 1.1 the proposal area is within the Wilton Mine Subsidence District. Under the Subsidence Advisory NSW Guidelines, metal and timber fencing is exempt development, and the proposal would therefore not require approval under the EP&A Act.



AECOM

N

0 200 400 m

FIGURE 6-12:
SOIL LANDSCAPES

Legend

- Proposal area
- Watercourse

Soil Landscapes

- Hawkesbury
- Luddenham
- Blacktown
- Lucas Heights

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

6.8.3 Potential impacts

Construction

Contamination

There is no known significant contamination present within the proposal area, however being adjacent to the motorway corridor there is a low risk that contamination could be encountered as a result of contaminated runoff or leaks/spills from the motorway. If unexpected contaminated material is uncovered during excavation, or accidental spills or leaks occur during construction, safeguards would be implemented to minimise human health hazards and prevent the spread of contaminants into the surrounding environment.

Soils

Construction of the proposal would involve vegetation clearing (up to three metres on each side of the fence), and excavation for fence posts and installation of gates and escape mechanisms. If not adequately managed, these works could result in erosion and subsequent sedimentation off site, which may result in an increase in sediment loads entering nearby water bodies or drainage lines. This risk would be heightened when working in close proximity of drainage lines, waterways, downward sloping surfaces, and also during high wind conditions and rainfall events. These risks have implications for other environmental factors, including biodiversity, water quality and air quality. For example, where sediment loads in waterways are increased, existing water quality conditions would be altered which may negatively impact aquatic flora and fauna. The cleared corridor along the fence line would be stabilised by replacing disturbed soil and vehicle compaction. With the implementation of the safeguards listed in Table 6-23:, the impacts associated with soil disturbance, erosion and sedimentation in the proposal area are expected to be low.

Operation

It is not anticipated that the operation of the proposal would have a significant impact on soils or pose a risk of contamination. Maintenance would include inspections of the fence line to monitor the condition of the fence, remove new vegetation growth and to check for erosion along the maintenance zone. Some minor soil management (e.g. replenishment or compaction) may be required along the vegetation-free maintenance zone and around posts due to minor erosion, including rill erosion. Monitoring and maintenance would generally require a light vehicle and minimal equipment so the risk of introducing contamination through accidental spills or leaks would be low.

6.8.4 Safeguards and management measures

The safeguards listed in Table 6-23 are recommended to address the potential impacts identified above. Other safeguards and management measures to address soil-related impacts are identified in Section 6.9.

Table 6-23: Soils and contamination safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Unexpected contaminated soils	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport Senior Manager Environment and Sustainability and/or EPA.	Contractor	Detailed design / pre-construction, construction	Section 4.2 of QA *G36 Environment Protection*
Accidental spill	A site-specific emergency spill plan will be developed and include spill-management measures in accordance with the Transport *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport EPA officers).	Contractor	Detailed design / pre-construction, construction	Section 4.3 of QA *G36 Environment Protection*

6.9 Surface water, flooding and groundwater

This section assesses and describes the impacts of the proposal on surface water and groundwater within and surrounding the proposal area.

6.9.1 Methodology

The assessment methodology for impacts on surface water and groundwater included the following key tasks:

- Desktop review of the proposal's location in relation to water catchments, watercourses s and drainage lines
- Qualitative desktop assessment of potential impacts on surface water and groundwater during construction and operation
- Identification of measures to avoid, minimise and manage impacts on surface water and groundwater.

6.9.2 Existing environment

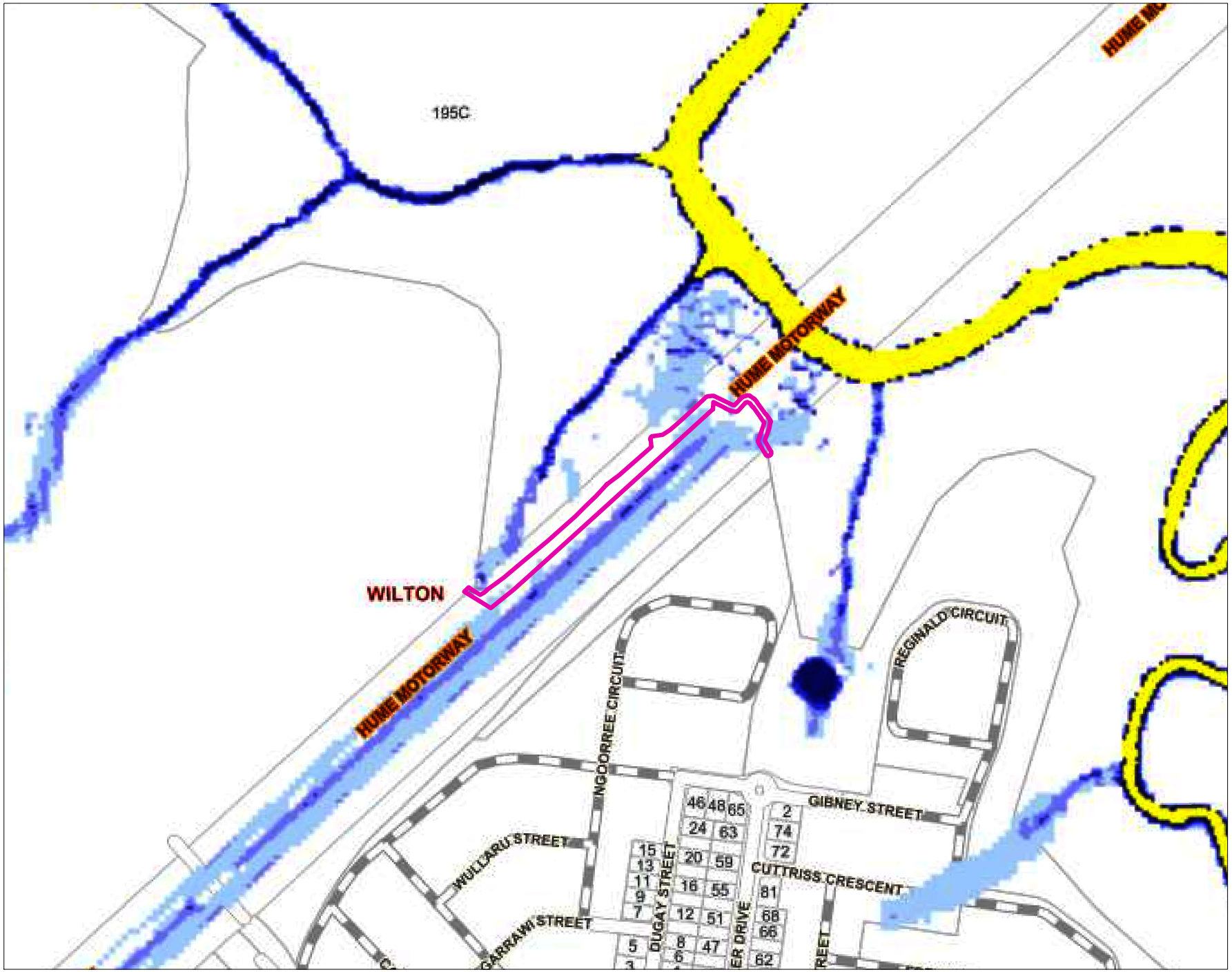
The proposal area is located within the Hawkesbury-Nepean Catchment. The main watercourses near the proposal area are shown on Figure 6-1 and Figure 6-2 and include the Nepean River (located about 50 metres south of Site 3 (Southern Hume), and Allens Creek, a tributary of the Nepean River (located about 30 metres north of Site 3 (Southern Hume). Ephemeral drainage lines off Allens Creek and the Nepean River intercept with the proposal area.

The major water use within the catchment is for the agricultural industry (DPE, 2023). Water within the catchment is heavily controlled by five major water supply dams which retain river flows. Key water management challenges in the broader catchment include intensive urban and industrial development, and competing needs for water. Water management issues within the region include:

- Poor water quality from pollution, algae and weed growth
- Urban and agricultural development eroding river banks
- Maintaining sufficient environmental flows.

The Wollondilly LEP flood maps (Wollondilly Shire Council, 2023) indicates the extent of a 1% Annual Exceedance Probability (AEP) flood event. The flood map shows that small areas of Site 2 (Northern Hume) and Site 3 (Southern Hume) would be subject to flooding (where drainage lines are present) in a 1% AEP event, as shown on Figure 6-13 and Figure 6-14.

The shallow excavations for the proposal (i.e. up to 1.2 metres deep) are not expected to intercept groundwater, and groundwater would not be used for construction purposes. Groundwater dependent ecosystems are also not expected to be present (refer Section 6.1). Therefore, groundwater it is not assessed further.



AECOM

N

0 60 120 m

FIGURE 6-13: 1% AEP FLOOD EVENT MAPPING - SITE 2 (NORTHERN HUME)

Legend

Proposal area

1% AEP Flood Depth

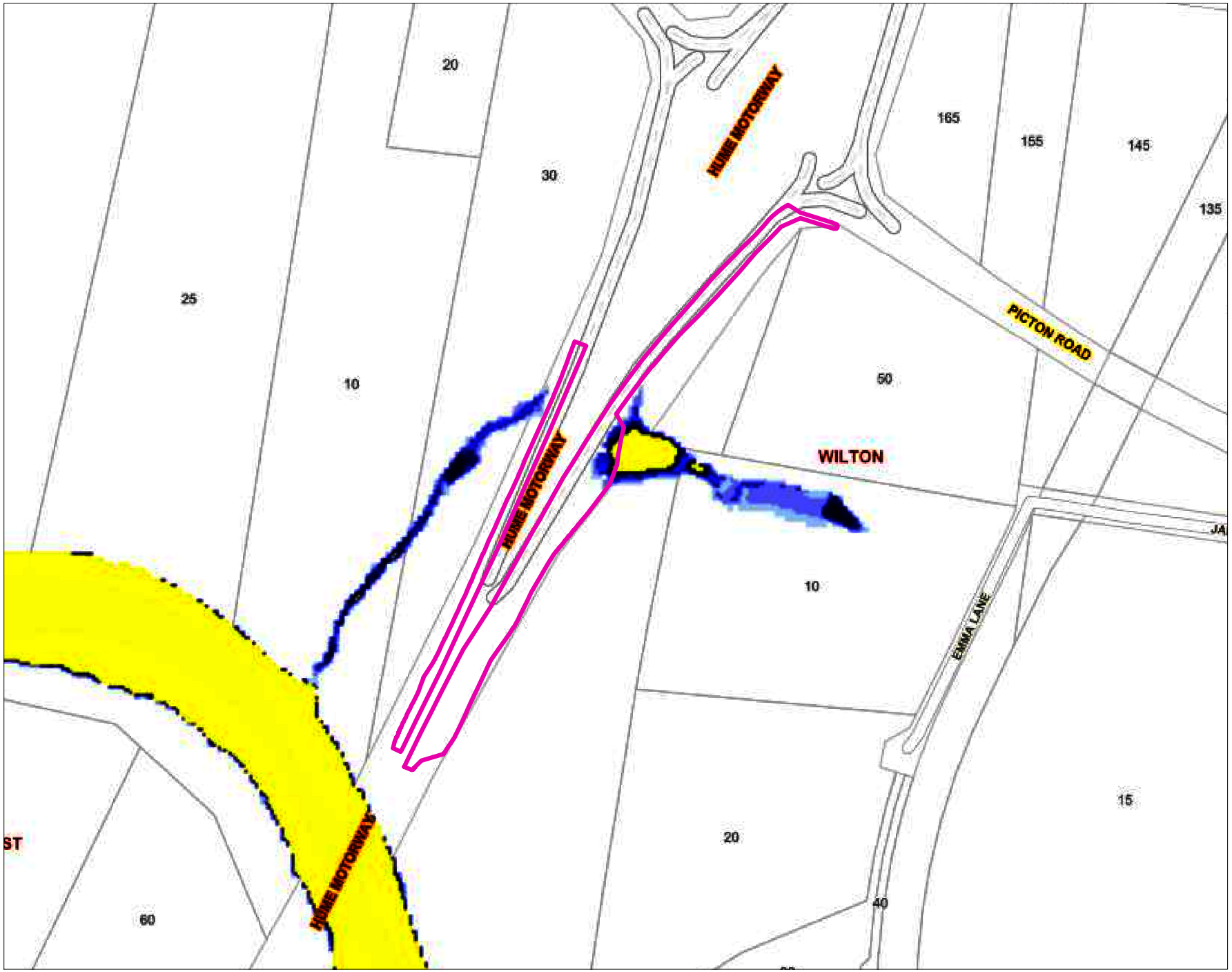
- <= 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.



AECOM

N

0 70 140 m

FIGURE 6-14: 1% AEP FLOOD EVENT MAPPING - SITE 3 (SOUTHERN HUME)

Legend

Proposal area

1% AEP Flood Depth

- <= 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

Copyright: Copyright in material relating to the base layers (contextual information) on this page is licensed under a Creative Commons, Attribution 4.0 Australia licence © Department of Customer Service 2020, (Digital Cadastral Database and/or Digital Topographic Database).

The terms of Creative Commons Attribution 4.0 Australia License are available from https://creativecommons.org/licenses/by/4.0/legalcode (Copyright Licence)

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

Source: Imagery © Nearmap 2023.

6.9.3 Potential impacts

Construction

Construction of the proposal has the potential to affect surface water quality in nearby watercourses should contaminated runoff or construction waste/materials escape from the site. Impacts may include:

- Contamination of nearby watercourses/adjacent drainage lines from accidental spills of fuels, oils or other chemicals from construction vehicles or equipment
- Sedimentation of nearby watercourses/adjacent drainage lines from excavated and disturbed areas, particularly during rainfall events.

Accidental spills and leaks would be managed by using vehicles and equipment that are well maintained, and having spill kits available onsite to deploy if necessary to contain and capture contamination. Temporary sediment and erosion controls would be installed where required (e.g. near drainage lines) to prevent sediment moving offsite. Construction of the proposal would not be conducted during heavy rain conditions. Soils along the cleared alignment would be stabilised where required by soil replenishment and compaction with vehicles if necessary. Potential impacts on surface water quality during construction are expected to be negligible with the implementation of safeguards.

The drainage lines in the vicinity of Sites 2 and 3 are subject to flooding during the 1% AEP flood event but may also experience flooding during lesser events. This is also the case for a portion of the northern laydown area in Site 3 (Southern Hume). Mitigation measures would be required to monitor for significant rain event forecasts in the region and avoid storing materials, particularly contaminating materials on site, to avoid flood-related impacts.

Operation

There are no anticipated discernible long-term impacts on surface water as a result of the proposal. Where required, an alternative fence panel design would be installed so that adequate drainage of drainage lines/overland flows from the proposal area would occur. Drainage lines crossing both sites are susceptible to flooding in large flood events (i.e. 1% AEP flood event) and may also experience some degree of flooding in smaller events. The fence would be periodically inspected for signs of erosion and any fence repairs required (especially after heavy rain events), and vegetation would also be removed from within the maintenance zone when required. Soil would be replenished and compacted where necessary, and is not expected to result in significant sedimentation of nearby watercourses/drainage lines. Vehicles and equipment required during maintenance would be minimal and spill kits will be carried within vehicles to prevent any accidental spills or leaks from contaminating nearby watercourses/drainage lines.

6.9.4 Safeguards and management measures

Safeguards and management measures to manage potential impacts to surface water and groundwater are provided in Table 6-24. Other safeguards and management measures to address surface water impacts are identified in Section 6.8.

Table 6-24: Surface water safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Soil and water	Soil and water management and mitigation measures will be prepared and implemented as part of the CEMP. The measures will identify reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Contractor	Detailed design / pre-construction	Section 2.1 of QA *G38 Soil and Water Management*
Soil and water	A site-specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP. The Plan will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms), including upstream events that could cause flooding, and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Detailed design / pre-construction	Section 2.2 of *QA G38 Soil and Water Management*

Impact	Environmental safeguards	Responsibility	Timing	Reference
Accidental leaks and spills	Fuels, oils and other chemicals would not be stored on site.	Contractor	Construction	N/A
Refuelling	Refuelling would occur off site within an appropriately bunded area and outside of waterlogged conditions.	Contractor	Construction	N/A
Spills	If an incident occurs (e.g. a spill), the Transport EMF-EM-PR-0001 *Environmental Incident Procedure* (Transport, 2021) would be followed and the relevant Transport Contract Manager and Environment Manager would be notified as soon as practicable.	Contractor	Construction	EMF-EM-PR-0001 *Environmental Incident Procedure* (Transport, 2021)
Spills	An emergency spill kit would be kept on site during the works. All staff would be made aware of the location of the spill kit and trained in its use.	Contractor	Construction	N/A
Erosion	Disturbed surfaces would be compacted and stabilised, particularly in anticipation of a rain event to reduce the potential for erosion.	Contractor	Construction	N/A
Drainage lines	Weather forecasts for the region will be monitored prior to working near drainage lines, to prevent works being undertaken during conditions which may cause wet-weather flows (including flash floods). Laydown areas would be managed to avoid storing materials (particularly potentially contaminating materials) in low lying areas or near drainage lines, to avoid material escaping from the site during large flood events.	Transport and contractor	Pre-construction, construction	N/A
Flooding	Fences will be periodically inspected for maintenance required, especially after large rain events to maintain the fence in a functional condition.	Transport	Operation	N/A

6.10 Waste and resource use

This section provides an assessment of potential waste generated by the proposal.

6.10.1 Methodology

A high-level assessment of potential resource use and waste management has been carried out for the proposal. The assessment considered the impact associated with:

- Resource use and management of materials during construction
- Waste generation, management and disposal during construction
- Waste generation, management and disposal during operation.

The basis of the assessment was to consider waste management within the context of the waste management hierarchy (waste avoidance, reuse, recycling and disposal), consistent with the NSW *Waste Avoidance and Resource Recovery Act 2001*, and the NSW EPA's *Waste Classification Guidelines* (2014).

6.10.2 Existing environment

Existing waste streams within the proposal area are limited to roadside litter from passing traffic and other waste material generated periodically by road maintenance activities. Waste generated by road maintenance activities is removed by staff undertaking the maintenance and disposed of into waste bins at depots according to the waste type classification (e.g. general waste, recyclable waste, hazardous waste).

6.10.3 Potential impacts

Construction

Construction of the proposal would require the use of resources including fencing wire mesh, metal posts and panelling, timber and fuel and oils for vehicles and machinery. The construction of the proposal would result in some increased demand on local and regional resources, however, the development of the proposal would not result in resources becoming scarce or short supply in the region.

Where waste materials generated by the proposal cannot be reused on site or removed offsite to be re-used on other projects, disposal would be required. Any disposal of waste would be undertaken in accordance with the *Waste Classification Guidelines* (EPA, 2014) and to a suitably licensed waste facility. Most of the waste generated would either be recycled or disposed of offsite as general solid waste. Green waste would be generated from vegetation removal. Vegetation would either be mulched directly into a truck and removed offsite to a licensed facility, or otherwise stockpiled as mulch onsite for several days in accordance with a mulch management plan. Any suspected contaminated waste, harmful materials or classifiable special wastes (e.g. asbestos) would be classified and managed according to waste type, and managed in accordance with the *Contaminated Land Management Act 1997* and other relevant legislation where applicable.

Waste generated during construction has the potential to affect the local environment if not managed appropriately. Potential impacts include:

- Contamination of soils and/or contaminated runoff entering the receiving environment from accidental leaks/spillages of fuel, oils or fluids from construction vehicles and machinery
- Litter from poor waste capture and storage, or transport of staff and materials
- Spread of weeds or pathogens from mis-managed green waste
- Contamination of the receiving environment (e.g. soils and water quality) from mis-identified or mis-managed unexpected contamination encountered.

Construction waste management would be subject to the safeguards described below in Section 6.10.4.

Operation

Materials required to maintain and repair the operational fence would be minimal, and may include fencing repair materials, and soil replacement/removal around fence posts affected by water or vehicle movement. Vegetation removal/trimming would also be required to maintain the cleared maintenance zone on each side of the fence, which would result in green waste. Minor volumes of green waste would be spread onsite if possible or otherwise removed and disposed offsite at a licensed facility.

Waste management and minimisation during operation would be consistent with the approach used above for construction waste, to avoid/minimise impacts, classify waste in accordance with the *Waste Classification Guidelines* (EPA, 2014), and dispose of to a suitably licensed waste facility as a last resort.

6.10.4 Safeguards and management measures

Safeguards proposed to address the potential waste related impacts are provided in Table 6-25:. Note that safeguards relating to management of soils (including contaminated soil) and water/runoff are provided in Sections 6.8.4 and 6.9.4.

Table 6-25: Waste safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Impacts from construction waste	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: • Measures to avoid and minimise waste associated with the proposal • Classification of wastes and management options (re-use, recycle, stockpile, disposal) in accordance with *the Waste Classification Guidelines* (EPA, 2014) and NSW legislative requirements • Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting. The WMP will align with the *Environmental Procedure – Management of Wastes on Transport for NSW Land* (Transport, 2014) and relevant Transport Waste fact sheets.	Contractor	Detailed design / pre-construction and construction	Section 4.2 of *QA G36 Environment Protection;* *Waste Classification Guidelines* (EPA, 2014); *Environmental Procedure – Management of Wastes on Transport for NSW Land* (Transport, 2014) and relevant Transport Waste fact sheets.
Vegetation waste	If vegetation is to be mulched and transported off site for beneficial reuse, it is to be assessed for the presence of weeds, pest, and other disease, and a Mulch Management Plan prepared in accordance with the Transport Technical Procedure: *Mulch Management*.	Contractor	Construction, pre-construction	Transport for NSW Technical Procedure: Mulch Management
Unexpected finds	If unexpected asbestos is encountered during construction works, works are to cease and a licensed asbestos removalist is to be contacted to safely remove asbestos from the work area. Works can recommence when a clearance certificate is obtained. If unexpected finds of other contamination or unknown contamination is encountered, works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary controls or further actions identified and implemented in consultation with the Transport for NSW Senior Manager Environment and Sustainability.	Contractor, Transport	Construction	N/A
Impacts from operational waste	Reuse and recycle materials where feasible during operation to minimise the amount of material sent to waste management/disposal facilities.	Transport	Operation	N/A

6.11 Other issues

6.11.1 Existing environment and potential impacts

Other minor issues are addressed in Table 6-26.

Table 6-26: Other potential impacts

Environmental factor	Existing environment	Potential impact
Non-Aboriginal heritage	Database searches did not identify any local, State or Commonwealth listed non-Aboriginal heritage items within 250 metres of the proposal area. The proposed fence alignments are located along the sides of the Hume Motorway and are bordered by predominantly rural/ agricultural land that has been subject to historic clearing and disturbance. Previous disturbance from motorway construction and agricultural activities indicate that the archaeological potential for undiscovered heritage items is likely to be low for the majority of the proposal area. Portions of the proposed fence alignments on the northern side of the motorway at both Site 2 (Northern Hume) and Site 3 (Southern Hume) are more densely vegetated heading towards Allens Creek and the Nepean Rover respectively, which indicate that these areas may be less disturbed and archaeological potential may therefore be higher.	Given that no local, State or Commonwealth non-Aboriginal heritage listed items are recorded within 250 metres of the proposal area, and the proposal involves minimal excavation (e.g. shallow and narrow excavations for fence posts) along predominantly disturbed land, it is not anticipated that construction of the proposal would have an impact on non-Aboriginal heritage. Operation of the proposal would involve maintenance of the fence line and involve minimal ground disturbance which would not impact previously undisturbed land otherwise, impacts to non-Aboriginal heritage are not expected during operation. If unexpected heritage finds are encountered during construction a standard Transport procedure for unexpected finds would be followed.
Cumulative impacts	Other projects identified in the surrounding area that may have a cumulative impact with the proposal include: • Picton Road upgrade project • Numerous developments in Bingara Gorge about 500 metres from the proposal area • Wilton North suburb directly adjacent to the proposal area (Site 2 (Northern Hume)) • Other koala fencing projects in the region by Transport and DPE	Construction of the proposal would produce impacts to biodiversity, noise, traffic, visual amenity and air quality which could combine with construction impacts from the Picton Road upgrade and nearby residential developments to create cumulative impacts. With the exception of biodiversity, impacts from the proposal would be temporary and localised, and is unlikely to cause a significant cumulative impact. During operation, the proposal would have a beneficial cumulative impact in combination with the broader program of koala fencing in the region (e.g. along Picton Road in Wilton, and along the Main Southern Railway in Razorback and Douglas Park), by preventing koalas from entering the road and rail corridors. At Site 2 (Northern Hume), the proposal would also tie into adjacent residential development fencing proposed. Biodiversity impacts due to the maintenance zone required would combine with other vegetation losses in the area, however, would be small in scale. There is not expected to be any other cumulative impacts during operation due to the limited scale and frequency of maintenance activities required for the proposal.

6.11.2 Safeguards and management measures

Table 6-27: Other impacts Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Unexpected find of non-Aboriginal heritage	The *Standard Management Procedure – Unexpected Heritage Items* (Transport, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*
Cumulative construction impacts	The CEMP would be revised to consider potential cumulative impacts from surrounding development activities as they become known. This would include a process to review and update mitigation measures as new works in the surrounding area begin or if complaints are received.	Transport, contractor	Pre-construction and construction	

7. Environmental management

This chapter describes how the proposal will be managed to reduce potential environmental impacts during detailed design, construction and operation. A framework for managing potential impacts is provided. A summary of site-specific environmental safeguards is provided and the licence and/or approval requirements required prior to construction are listed.

7.1 Environmental management plans

Safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport Environment and Sustainability Officer, prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements.

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
Biodiversity					
B1	Biodiversity	A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to: • Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features • Safeguards in this REF • Identification of the clearing boundary and identification of habitat features to be protected (e.g., by marking using flagging tape) • Map/ plans produced showing vegetation clearing boundaries, areas to be protected including sensitive areas/no go zones, protected habitat features and revegetation areas • A detailed vegetation clearing process in accordance with Transport's *Biodiversity Guidelines* (RMS, 2011) including requirements of Guide 1,2, 4 and 9 • Toolbox talks where biodiversity will be included such as vegetation clearing or works in or adjacent to sensitive locations • Identify control/mitigations measures to prevent impacts on sensitive locations or no-go zones • Procedures for unexpected threatened species finds and fauna handling • Procedures addressing relevant matters specified in the *Policy and Guidelines for Fish Habitat Conservation and Management* (Department of Primary Industries, 2013) • Protocols to manage weeds and pathogens.	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 Environment Protection *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011); *Guidelines for Fish Habitat Conservation and Management* (Department of Primary Industries, 2013)
B2	Biodiversity	Retained vegetation in close proximity to construction activities will not be damaged or removed.	Contractor	Construction	N/A
B3	Biodiversity	A Biodiversity Offset Strategy in accordance with Transport's *No Net Loss Guideline* (Transport, 2022) will be developed to outline the offsetting strategies required. for biodiversity impacts. The preliminary offset calculations undertaken in this assessment will be revised as part of a Biodiversity Offset Strategy for the proposal once the final clearing footprint is determined.	Transport	Prior to construction	*No Net Loss Guideline* (Transport, 2022)

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
B4	Biodiversity	Native vegetation removal will be minimised. The clearing will be limited as far as practicable to approximately one metre either side of fence. An onsite ecologist will be present prior and during clearing to assist in minimizing clearing and other potential impacts to native vegetation.	Transport	Detailed design and construction	N/A
B5	Biodiversity	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Prior to construction	*Guide 1* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
B6	Biodiversity	Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Prior to construction	*Guide 4* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
B7	Biodiversity	Artificial lighting will be directed down and light spill into the surrounding environment minimised to minimise impacts to fauna in the area. Direct lighting to the identified microbat roost site at Pheasants Nest Bridge should be avoided to limit light impacts on movements in and out of the roost	Contractor	Construction	N/A
B8	Biodiversity	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities or fauna or flora species not assessed in the biodiversity assessment are identified in the proposal area.	Contractor	Construction	*Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011)
B9	Biodiversity	Fauna will be managed in accordance with *Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	*Guide 9* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).
B10	Biodiversity	Pest species will be managed within the proposal site to prevent their spread.	Contractor	Construction	N/A
B11	Biodiversity	Pathogens will be managed in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).	Contractor	Construction	*Guide 2* of the *Biodiversity Guidelines: Protecting and managing*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					biodiversity on RTA projects (RTA 2011).
B12	Biodiversity	The fencing will be regularly inspected for damage during operation, and maintenance work carried out where necessary, to maintain the function of the fence in protecting native fauna by Transport. An Asset Maintenance Plan will be established in consultation with the Department of Planning and Environment's CPCP Conservation Implementation Team	Transport	Operation	N/A
Noise and vibration					
NV1	Construction noise	A Construction Noise Management Plan (NMP) will be prepared and implemented as part of the CEMP. The NMP will generally follow the approach in the Environment Protection Authority Interim Construction Noise Guidelines (DECCW, 2009) and Construction Noise and Vibration Guideline (CNVG), and include: • All potential high noise generating activities associated with the activity • A map indicating the locations of sensitive receivers including residential properties • A quantitative noise assessment in accordance with the Environment Protection Authority Interim Construction Noise Guidelines (DECCW, 2009) and Construction Noise and Vibration Guideline (CNVG) • Feasible and reasonable mitigation measures to be implemented, taking into account the CNVG. • Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures. • A process for assessing the performance of the implemented mitigation measures • An outline of a monitoring program • A process for documenting and resolving issues and complaints	Contractor	Pre-construction	
NV2	Construction noise	An Out of Hours Works procedure will be prepared as part of the Construction Noise Management Plan and will include: Undertaking a out-of-hours noise and vibration assessments (OOHWA) for the proposed works / activities and identification of mitigation measures in accordance with Transport for NSW's Construction Noise and Vibration Guideline. The OOHWA will be based on construction planning developed by the construction contractor.	Contractor	Pre-construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NV3	Construction noise	An Out of Hours Works procedure will be prepared as part of the Construction Noise Management Plan and will include: Undertaking a out-of-hours noise and vibration assessments (OOHWA) for the proposed works / activities and identification of mitigation measures in accordance with Transport for NSW's Construction Noise and Vibration Guideline. The OOHWA will be based on construction planning developed by the construction contractor.	Contractor	Pre-construction	
NV4	Construction noise	Noise curtains are to be used for mulching during out of hours work where sensitive receivers are predicted to exceed the NML.	Contractor	Construction	
NV5	Construction noise	No more than five night shifts per week will be permitted during construction.	Contractor	Construction	
NV6	Construction noise	Notification (N): Letterbox drops will be delivered for receivers within an 875 metre radius of the proposal area at both Sites 2 and 3. Notifications will detail work activities, dates, hours, impacts, mitigation measures, and contact details. Notifications will be sent a minimum of seven calendar days prior to the start of work.	Transport / Contractor	Pre-construction	CNVG
NV7	Noise impacts	Relevant standard mitigation measures from the *Construction Noise and Vibration Guideline* (Transport, 2016) provided in Appendix D will be implemented.	Transport / contractor	Pre-construction, construction and operation	CNVG
Traffic and transport					
TT1	Construction traffic and transport impacts	A Traffic Guidance Scheme (TGS) and Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TGS and TMP will be prepared in accordance with the Transport *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport, 2008). The TGS will include: • measures to maintain access to local roads and properties • site-specific traffic control measures (including signage) to manage and regulate traffic movement • requirements and methods to notify the local community of impacts on the local road network • access to construction sites including entry and exit locations • a response plan for any construction traffic incident • consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic	Contractor	Detailed design, pre-construction, construction	Section 4.8 of QA *G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		• monitoring, review and amendment mechanisms.			
TT2	Construction traffic and transport impacts	Traffic management measures will be developed with reference to the *Traffic Control at Work Sites Technical Manual* (Transport, 2022).	Contractor	Pre-construction, construction	*Traffic Control at Work Sites Technical Manual* (Transport, 2022)
TT3	Construction traffic and transport impacts	A Road Occupancy Licence (ROL) will be obtained for the traffic lane closures required prior to works commencing, and ROL conditions adhered to.	Transport / Contractor	Pre-construction, construction	*Roads Act 1993*
Aboriginal cultural heritage					
AH1	Aboriginal cultural heritage	The *Standard Management Procedure – Unexpected Heritage Items* (Transport, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*
AH2	Aboriginal cultural heritage	Should future design extend into areas not assessed as part of the current Stage 2 PACHCI assessment, additional assessment in accordance with the Stage 2 requirements of the Transport PACHCI (Transport, 2011) and the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW, 2010) would be required.	Transport	Detailed design / Pre-construction	PACHCI (Transport, 2011)
AH3	Contemporary modified trees	The two modified trees that were identified near Site 2 (Northern Hume) are not to be impacted (refer Appendix F).	Contractor	Construction	Appendix F of this REF
Visual amenity					
VA1	Visual amenity impacts during construction	Construction plant, equipment and materials will not remain onsite any longer than is necessary during and after work is completed	Contractor	Construction	N/A
VA2	Visual amenity impacts during construction	Artificial lighting will be directed down and light spill into adjoining properties and the surrounding environment minimised where possible, especially where residential receivers have line of sight to the proposal area.	Contractor	Construction	N/A
Air quality					
AQ1	Air quality	Measures (such as watering or covering exposed areas) will be implemented to minimise or prevent air pollution and dust emissions where required.	Construction contractor	Construction	N/A
AQ2	Air quality	Vehicle loads containing loose materials will be covered.	Construction contractor	Construction	N/A

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
AQ3	Air quality	During extreme weather events (such as high winds) where dust generation cannot be effectively minimised, dust generating works will cease until adequate controls can be implemented or until adverse weather conditions subside.	Construction contractor	Construction	N/A
AQ4	Air quality	Vehicles and machinery will be regularly serviced and maintained in an efficient condition to minimise potential emissions.	Construction contractor	Construction	N/A
AQ5	Air quality	All emission controls used on vehicles and construction equipment will comply with standards listed in Schedule 4 of the *Protection of the Environment Operations (Clean Air) Regulation 2010*.	Construction contractor	Construction	Schedule 4 of the *Protection of the Environment Operations (Clean Air) Regulation 2010*.
Socio-economic, property and land use					
SE1	Community notification	Transport will notify nearby residents and businesses at least seven days prior to construction of the proposal. Notifications will detail work activities, dates, hours, impacts, mitigation measures and contact details. Notifications will be sent a minimum of seven calendar days prior to the start of work.	Transport	Pre-construction / construction	N/A
Soils and contamination					
SC1	Unexpected contaminated soils	If contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport Senior Manager Environment and Sustainability and/or EPA.	Contractor	Detailed design / pre-construction, construction	Section 4.2 of QA *G36 Environment Protection*
SC2	Accidental spill	A site-specific emergency spill plan will be developed and include spill-management measures in accordance with the Transport *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport EPA officers).	Contractor	Detailed design / pre-construction, construction	Section 4.3 of QA *G36 Environment Protection*
Surface water, flooding and groundwater					
SW1	Soil and water	Soil and water management and mitigation measures will be prepared and implemented as part of the CEMP. The measures will identify reasonably foreseeable risks relating to soil erosion and water pollution and describe how these risks will be addressed during construction.	Contractor	Detailed design / pre-construction	Section 2.1 of QA *G38 Soil and Water Management*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
SW2	Soil and water	A site-specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP. The Plan will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms), including upstream events that could cause flooding, and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Detailed design / pre-construction	Section 2.2 of *QA G38 Soil and Water Management*
SW3	Accidental leaks and spills	Fuels, oils and other chemicals would not be stored on site.	Contractor	Construction	N/A
SW4	Refuelling	Refuelling would occur off site within an appropriately bunded area and outside of waterlogged conditions.	Contractor	Construction	N/A
SW5	Spills	If an incident occurs (e.g. a spill), the Transport *EMF-EM-PR-0001 Environmental Incident Procedure* (Transport, 2021) would be followed and the relevant Transport Contract Manager and Environment Manager would be notified as soon as practicable.	Contractor	Construction	EMF-EM-PR-0001 *Environmental Incident Procedure* (Transport, 2021)
SW6	Spills	An emergency spill kit would be kept on site during the works. All staff would be made aware of the location of the spill kit and trained in its use.	Contractor	Construction	N/A
SW7	Erosion	Disturbed surfaces would be compacted and stabilised, particularly in anticipation of a rain event to reduce the potential for erosion.	Contractor	Construction	N/A
SW8	Flooding	Fences will be periodically inspected for maintenance required, especially after large rain events to maintain the fence in a functional condition.	Transport	Operation	N/A
Waste and resource use					
WR1	Impacts from construction waste	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to: • Measures to avoid and minimise waste associated with the proposal • Classification of wastes and management options (re-use, recycle, stockpile, disposal) in accordance with *the Waste Classification Guidelines* (EPA, 2014) and NSW legislative requirements • Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions • Procedures for storage, transport and disposal • Monitoring, record keeping and reporting. The WMP will align with the *Environmental Procedure – Management of Wastes on Transport for NSW Land* (Transport, 2014) and relevant Transport Waste fact sheets.	Contractor	Detailed design / pre-construction and construction	Section 4.2 of *QA G36 Environment Protection* *Waste Classification Guidelines* (EPA, 2014); *Environmental Procedure – Management of Wastes on Transport for NSW Land* (Transport, 2014) and relevant Transport Waste fact sheets.

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
WR2	Vegetation waste	If vegetation is to be mulched and transported off site for beneficial reuse, it is to be assessed for the presence of weeds, pest, and other disease, and a Mulch Management Plan prepared in accordance with the Transport Technical Procedure: *Mulch Management*.	Contractor	Construction, pre-construction	Transport for NSW Technical Procedure: Mulch Management
WR3	Unexpected finds	If unexpected asbestos is encountered during construction works, works are to cease and a licensed asbestos removalist is to be contacted to safely remove asbestos from the work area. Works can recommence when a clearance certificate is obtained. If unexpected finds of other contamination or unknown contamination is encountered, works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary controls or further actions identified and implemented in consultation with the Transport for NSW Senior Manager Environment and Sustainability.	Contractor, Transport	Construction	N/A
WR4	Impacts from operational waste	Reuse and recycle materials where feasible during operation to minimise the amount of material sent to waste management/disposal facilities.	Transport	Operation	N/A
Other impacts					
OI1	Unexpected find of non-Aboriginal heritage	The *Standard Management Procedure – Unexpected Heritage Items* (Transport, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*
OI2	Cumulative construction impacts	The CEMP would be revised to consider potential cumulative impacts from surrounding development activities as they become known. This would include a process to review and update mitigation measures as new works in the surrounding area begin or if complaints are received.	Transport, contractor	Pre-construction and construction	N/A

7.3 Licensing and approvals

Table 7-2 summarises the licences and approvals required for the proposal.

Table 7-2: Summary of licensing and approvals required

Instrument	Requirement	Timing
Road Occupancy Licence	Approval to temporarily close lanes on the Hume Motorway during construction of the proposal.	Prior to start of the activity.
REF	REF to be determined by Transport in accordance with EP&A Act.	Prior to start of the activity.
Landholder agreement	Landholder agreement would be required for the northern end of the fence at Site 2 which would tie-in to adjacent development.	Prior to start of the activity.

8. Conclusion

8.1 Justification

8.1.1 Social factors

As outlined in Section 6.7, the proposal would have some negative social impacts as a result of the disturbance and change that would occur during construction. The combined effect of traffic delays, construction noise, dust and visual impacts would result in a general loss of amenity for residents, motorists, workers and others who live or travel through the area. There would be some positive impacts associated with employment and expenditure required for construction.

Once operational, the proposal would provide improved safety for motorists and koalas , and is expected to have a positive impact for the local communities.

8.1.2 Biophysical factors

Construction of the proposal would require the removal of up to 0.61 hectares of native vegetation. Assessments of significance concluded that the proposal is unlikely to have a significant impact on biodiversity matters, with mitigation measures to be implemented for koalas to minimise the impact on the local population.

Operation of the proposal would protect koalas and improve road safety. The proposal is consistent with the objectives of the CPCP. Other environmental factors are addressed throughout Section 6.

8.1.3 Economic factors

The proposal would be constructed within the existing road corridor. No property acquisition would be required for the proposal. As described in Section 6.7, construction of the proposal is anticipated to generate work for up to 10 employees which would have a beneficial impact on employment in the region. Additionally, increased expenditure at local businesses, and indirect employment and expenditure through the provision of goods and services required for construction, would also be beneficial to the community.

Locally, the proposal would improve road safety. This would impact positively for road users within the proposal area and surrounding suburbs. The long-term benefits for road transportation are considered to outweigh the short-term inconvenience on the local community during construction of the proposal.

8.1.4 Public interest

The public interest is best served through the equitable distribution of resources, and investment in public infrastructure that fulfils the need of the majority. The proposal represents an investment in infrastructure that would minimise the long-term negative impacts on the koala population. The proposal would improve road safety and protection of koalas.

There are a number of Commonwealth and State strategic plans that specifically address protecting koalas and their habitats. The proposal is consistent with these plans including the CPCP.

8.2 Objects of the EP&A Act

Table 8-1: provides a summary of this REF against the objectives of the EP&A Act.

Table 8-1: Objects of the Environmental Planning and Assessment Act 1979

Instrument	Requirement
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	The proposal would protect the local koala population within the Wollondilly LGA. Protection of the local koala population is a key conservation goals under Wilton 2040, CPCP and *Wollondilly 2040*.

Instrument	Requirement
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	Ecologically sustainable development is considered in Section 8.2.1 below and Chapter 6 of this REF has considered relevant economic, environment and social considerations in decision making about environmental planning and assessment.
1.3I To promote the orderly and economic use and development of land.	The proposal has considered anticipated growth within the area and where appropriate included consideration of it in the design.
1.3(d) To promote the delivery and maintenance of affordable housing.	The CPCP provides for the delivery of affordable housing with the Wilton Growth Area, while protecting biodiversity values, including the Southern Sydney Koala population. Koala-exclusion fencing is a commitment under the CPCP.
1.3I To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal aims to safeguard the endangered koala species by implementing exclusion fencing that would reduce koalas entering the motorway corridor, in order to reduce vehicle strikes..
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	An assessment of impacts to Aboriginal heritage has been undertaken in accordance with the requirements of PACHCI (refer to Section 6.4). Non-Aboriginal heritage is assessed in Section 6.11. No impacts to built and cultural heritage (including Aboriginal cultural heritage) are anticipated as a result of the proposal.
1.3(g) To promote good design and amenity of the built environment.	Not relevant to the project.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the project.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the project.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	This objective was not met as this REF would not be publicly available.

8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures. Environmental impacts have been minimised where possible, and further scope to minimise vegetation clearance required during construction has been incorporated into the recommended safeguards (a conservative worst case vegetation clearance footprint was considered in this REF). The proposal would result in the removal of a small area of threatened listed ecological community, which is not likely to have a significant impact. Biodiversity offsets are also proposed in accordance with offset requirements (refer Section 6.1).

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations.

While the proposal would have some temporary adverse impacts, they are not considered to be of a nature or extent that would result in disadvantage to any specific section of the community or to future generations.

Conservation of biological diversity and ecological integrity

This principle states: "the diversity of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, must be maintained and improved to ensure their survival".

The principle of conservation of biological diversity and ecological integrity requires the maintenance and improvement of genes, species, populations and communities, as well as the ecosystems and habitats to which they belong, to ensure their survival. A thorough assessment of the existing local environment was undertaken to identify and manage any potential impacts of the proposal on local biodiversity (refer to Section 6.1).

Operation of the proposal would provide the protection of koala (and potentially other fauna species), by reducing the incidence of vehicle strike.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources that may be affected by the carrying out of a project, including air, water, land and living things.

This REF has examined the environmental consequences of the proposal and identified mitigation measures to manage the potential for adverse impacts. The requirement to implement these mitigation measures would result in an economic cost to DPE/Transport and would increase the capital and operating costs of the proposal. The costs of the generation and management of waste and pollution would be captured in any waste disposal charges for construction activities. This signifies that environmental resources have been given appropriate valuation.

The proposal has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the proposal is being developed with an environmental objective in mind.

8.3 Conclusion

The proposed installation of koala fencing along the Hume Motorway is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration of impacts on threatened species and ecological communities and their habitats, and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal, as described in the REF, best meets the project objectives but would result in some impacts on biodiversity, traffic and transport, the noise environment and visual amenity. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also reduce koala vehicle strike in the proposal area and improve road safety. On balance, the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared nor approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance nor the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999 (*Commonwealth). A referral to the Australian Department of Climate Change, Energy, the Environment and Water is not required.

9. Certification

This review of environmental factors provides a true and fair review of the proposal in relation to its potential effects on the environment. It addresses to the fullest extent possible all matters affecting or likely to affect the environment as a result of the proposal.

Name:	Dylan Drysdale
Position:	Principal Environmental Scientist
Company name:	AECOM
Date:	23/02/2024

I certify that I have reviewed and endorsed the contents of this REF and, to the best of my knowledge, it is in accordance with the EP&A Act, the EP&A Regulation and the Guidelines approved under Section 170 of the EP&A Regulation, and the information is neither false nor misleading. I accept it on behalf of Transport for NSW.

Name:	Daniel Farrugia
Position:	Senior Project Manager, Eastern Sydney Project Office
Transport region/program:	Infrastructure and Place, Transport for NSW
Date:	26/02/2024

10. EP&A Regulation publication requirement

Table 10-1: EP&A Regulation publication requirement

Requirement	Yes/No
Does this REF need to be published under Section 171(4) of the EP&A Regulation?	Yes

11. References

Bureau of Meteorology, 2023. Climate statistics for Australian locations for Campbelltown (Mount Annan) (Station ID: 068257); Commenced: 2006 – present; Latitude: 34.06° S; Longitude: 150.77° E.

Bureau of Meteorology, 2023. Climate statistics for Australian locations for Douglas Park (St. Marys Towers) (Station ID: 68200); Commenced: 1974 – present; Latitude: 34.21° S; Longitude: 150.71° E.

Department of Environment and Climate Change (DECC), 2009. Interim Construction Noise Guideline.

Department of Planning and Environment, 2018. Wilton 2040 - a Plan for the Wilton Growth Area.

Department of Planning and Environment, 2022. The Cumberland Plain Conservation Plan.

Department of Planning and Environment, 2023. Air quality data services, Bargo. Accessed at : www.dpie.nsw.gov.au/air-quality/air-quality-data-services/data-download-facility 22/02/2023 in March 2023.

Department of Planning and Environment, 2023. Hawksbury-Nepean. Accessed at: https://www.industry.nsw.gov.au/water/basins-catchments/snapshots/hawksbury-nepean in May 2023.

Department of Planning, Industry and Environment, 2020. Biodiversity Assessment Method.

Department of Planning, Industry and Environment, 2020. How to keep koalas off the road, koala vehicle strike fact sheet 2.

Department of Primary Industries, 2013. Policy and guidelines for fish habitat conservation and management.

Greater Sydney Commission, 2018. Greater Sydney Region Plan: A Metropolis of Three Cities.

Heritage NSW, 2010. Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales.

Keith D. A., 2004. Ocean Shores to Desert Dunes: The native vegetation of New South Wales and the ACT.

NSW Department of Planning and Environment, 2021. Wilton Growth Area Development Plan 2021.

NSW Department of Planning and Environment, 2022. Guidelines for Division 5.1 assessments.

NSW Department of Urban Affairs and Planning (DUAP), 1996. Roads and Related Facilities EIS Guideline.

NSW Environment Protection Authority, 2014. Waste Classification Guidelines: Parts 1 and 2.

NSW Environment Protection Authority, 2023. Contaminated land record of notices, accessed at: https://app.epa.nsw.gov.au/prclmapp/searchregister.aspx in March 2023.

Office of the Chief Scientist and Engineer, Department of Planning and Industry, 2021. Advice regarding the protection of koala populations associated with the Cumberland Plain Conservation Plan.

Planning Industry and Environment, 2023. eSpade, accessed at https://www.environment.nsw.gov.au/eSpade2WebApp in March 2023.

Queensland Government, 2022. Koala-Sensitive Design Guideline, accessed at https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=0CAIQw7AJahcKEwi4-fO0n_n-AhUAAAAAHQAAAAAQAw&url=https%3A%2F%2Fenvironment.des.qld.gov.au%2F__data%2Fassets%2Fpdf_file%2F0025%2F102859%2Fkoala-sensitive-design-guideline.pdf&psig=AOvVaw2ep9lQmK8RP85lH4aCyPu1&ust=1684306125095983 in May 2023.

Roads and Maritime, 2011. Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects.

Roads and Maritime, 2011. Procedure for Aboriginal Cultural Heritage and Consultation Investigation.

Roads and Maritime, 2016. Construction Noise and Vibration Guideline.

Transport for NSW, 2011. Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI).

Transport for NSW, 2020. Environment impact assessment practice note EIA-N04 – Guideline for landscape character and visual impact assessment

Transport for NSW, 2020. Environmental impact assessment practice note: socio-economic assessment: EIA-N05.

Transport for NSW, 2021. EMF-EM-PR-0001 Environmental Incident Procedure.

Transport for NSW, 2022. Traffic Control at Work Sites Technical Manual.

Transport for NSW, 2022. Transport Biodiversity Assessment Guidelines.

Transport for NSW, 2023. Traffic Volume Viewer, accessed at https://roads-waterways.transport.nsw.gov.au/about/corporate-publications/statistics/traffic-volumes/aadt-map/index.html#/?z=6 in March 2023.

Wollondilly Shire Council, 2020. Wollondilly 2040: Local Strategic Planning Statement.

Wollondilly Shire Council, 2023. DA Tracker, accessed at: https://tracking.wollondilly.nsw.gov.au in May 2023.

Wollondilly Shire Council, 2023. Wollondilly Flood Map, accessed at: https://www.yoursay.wollondilly.nsw.gov.au/wollondilly-shire-wide-flood-study/maps/wollondilly-flood-map in May 2023.

Terms and acronyms used in this REF

Term / Acronym	Description
AADT	Average Daily Traffic Count
AEP	Annual Exceedance Probability
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal heritage impact permit
BAR	Biodiversity Assessment Report
BC Act	*Biodiversity Conservation Act 2016 (NSW)*
BDAR	Biodiversity Development Assessment Report
CEMP	Construction environmental management plan
CPCP	The Cumberland Plain Conservation Plan
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW).* Provides the legislative framework for land use planning and development assessment in NSW
EP&A Regulation	*Environmental Planning and Assessment Regulation 2021*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*. Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	*Fisheries Management Act 1994 (NSW)*
LEP	Local Environment Plan
LGA	Local Government Area
NCA	Noise Catchment Area
NML	Noise Management Level
NSW	New South Wales
PACHCI	Procedure for Aboriginal Cultural Heritage and Consultation Investigation
PCT	Plant community type
QA Specifications	Specifications developed by Transport for use with road work and bridge work contracts let by Transport.
RBL	Rating Background Level
REF	Review of Environmental Factors
SA2	Statistical Area Level 2
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP (Western Parklands City)	State Environmental Planning Policy (Precincts – Western Parklands City) 2021
SEPP (Transport and Infrastructure)	State Environmental Planning Policy (Transport and Infrastructure) 2021
Transport	Transport for NSW

Appendix A

Consideration of Section 171(2) factors and matters of national environmental significance and Commonwealth land

Section 171(2) Factors

In addition to the requirements of the *Guideline for Division 5.1 assessments* (DPE 2022) and the *Roads and Related Facilities EIS Guideline* (DUAP 1996) as detailed in the REF, the following factors, listed in Section 171(2) of the *Environmental Planning and Assessment Regulation 2021*, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor		Impact
a	Any environmental impact on a community?	The construction of the proposal would cause short-term environmental impacts on the community primarily from construction traffic, noise and visual amenity impacts. These impacts would be required to be minimised with the implementation of the safeguards and management measures described in this REF. The operational proposal would have minimal impacts during operation, however, would have minor long-term impacts on the community, including biodiversity impacts and visual amenity. The proposal would also have long term and positive community impact as it would contribute towards the protection of koalas from vehicle collision.
b	Any transformation of a locality?	No, the proposal would not result in the transformation of the locality.
c	Any environmental impact on the ecosystems of the locality?	The proposal would require a vegetation-free maintenance zone (which would be limited to approximately one metre on both sides of the fence). The vegetation-free zone would directly impact the ecosystem of the locality, however these impacts would not be significant (refer Section 6.1). Other indirect impacts to ecosystems of the locality would also occur during construction (e.g. noise, lighting and air emissions), which would not be significant (refer Sections 6.2 and 6.6).
d	Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality?	The proposal would have visual amenity impacts during construction from the presence of the construction sites and use of night lighting. Once installed the proposal would not result in significant reduction in any of these aspects to the locality.
e	Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	No, the proposal would not affect a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance, given its distance from such items.
f	Any impact on the habitat of protected fauna (within the meaning of the *Biodiversity Conservation Act 2016*?	The proposal would involve clearing vegetation up to three metres on either side of the koala fence (limited to one metre as far as practicable) to allow for a maintenance zone and prevent koalas from climbing over the fence. The total amount of native vegetation to be cleared would be up to 0.61 ha. The amount of native vegetation to be cleared would not represent a significant loss of potential habitat for threatened species.
g	Any endangering of any species of animal, plant, or other form of life, whether living on land, in water or in the air?	No, the proposal is not anticipated to endanger any biodiversity. It would provide infrastructure for protecting koalas from vehicle strike.
h	Any long-term effects on the environment?	The proposal is anticipated to have a long-term beneficial effect by reducing death and injury of koalas due to vehicle strike.

Factor		Impact
i	Any degradation of the quality of the environment?	Construction activities would have short term and temporary impacts. These include noise emissions, potential impacts to air quality from dust generation and traffic impacts. Safeguards and management measures are in place to minimise potential impacts.
j	Any risk to the safety of the environment?	The proposal is designed to increase the safety of koalas, as well as motorists. The proposal would not pose a risk to the safety of the environment otherwise.
k	Any reduction in the range of beneficial uses of the environment?	The proposal would not result in the reduction in the range of beneficial uses of the environment. The fencing would be installed within the motorway corridor which would not interfere with the function of the motorway.
l	Any pollution of the environment?	The proposal would have short term pollution impacts such as generation of noise and air quality emissions, however potential impacts would be minimised with the implementation of the safeguards provided in this REF.
m	Any environmental problems associated with the disposal of waste?	Waste that would be generated by the proposal are typical and their disposal would not cause environmental problems.
n	Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply?	Resources required for the proposal are readily available and are not in short supply.
o	Any cumulative environmental effect with other existing or likely future activities?	During construction, the proposal would produce impacts to biodiversity, noise, traffic, visual amenity, water quality, and air quality which could combine with nearby construction of the residential developments. The proposal would have long term beneficial impacts with other projects in the area aimed at protecting koala populations.
p	Any impact on coastal processes and coastal hazards, including those under projected climate change conditions?	The proposal is not located in a coastal zone and would not affect coastal processes or hazards, including those predicted under climate change.
q	Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1,	Review of applicable local strategic planning statements, regional strategic plans or district strategic plans is provided in Chapter 2. The proposal is considered to be consistent with these documents.
r	Other relevant environmental factors.	Relevant environmental factors have been considered in Chapter 6 of this REF.

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Department of Climate Change, Energy, the Environment and Water.

A referral is not required for proposed actions that may affect nationally-listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor		Impact
a	Any impact on a World Heritage property?	The proposal would not impact on a World Heritage property.
b	Any impact on a National Heritage place?	The proposal would not impact on a National Heritage place.
c	Any impact on a wetland of international importance?	The proposal would not impact on a wetland of international importance.
d	Any impact on a listed threatened species or communities?	The proposal would require the removal of up to 0.61 ha of threatened ecological community and potential habitat for threatened species (refer Section 6.1 for detail). The proposal would have a long term and beneficial impact on the koala, an endangered species. The proposal is aimed at reducing vehicle strike, a key threat to the koala population.
e	Any impacts on listed migratory species?	The proposal would result in the removal of a limited area of potential habitat however would not significantly impact migratory species.
f	Any impact on a Commonwealth marine area?	The proposal would not impact on a Commonwealth marine area.
g	Does the proposal involve a nuclear action (including uranium mining)?	The proposal would not include a nuclear action (including uranium mining.
h	Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	The proposal would not impact on the environment of Commonwealth land.

Appendix B

Statutory consultation checklists

Transport and Infrastructure SEPP

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	N/A	Section 2.110
Bus Depots	Does the project propose a bus depot?	No	N/A	Section 2.110
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	N/A	Section 2.110

Development within the Coastal Zone

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	N/A	Section 2.14

Note: See interactive map at ***Planning Portal NSW spatial viewer - find a property***. Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program.

Council related infrastructure or services

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	N/A	Section 2.10
Traffic	Are the works likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No	N/A	Section 2.10
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	N/A	Section 2.10
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No	N/A	Section 2.10

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No	N/A	Section 2.10
Road & footpath excavation	Will the works involve more than *minor* or *inconsequential* excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	N/A	Section 2.10

Local heritage items

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential?	No	N/A	Section 2.11

Flood liable land

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Flood liable land	Are the works located on flood liable land? If so, will the works change flood patterns to more than a *minor* extent?	No	N/A	Section 2.12
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance?	No	N/A	Section 2.13

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: The Management of Flood Liable Land published by the New South Wales Government.

Public authorities other than councils

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	No	N/A	Section 2.15
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	N/A	Section 2.15
Navigable waters	Do the works include a fixed or floating structure in or over navigable waters?	No	N/A	Section 2.15
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	N/A	Section 2.15
Artificial light	Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	N/A	Section 2.15
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility Buffer Map referred to in Section 5.15 of Lockhart LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.	No	N/A	Section 2.15
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	Yes	Mine Subsidence Board	Section 2.15
Western Parkland City	Are the works within a Western City operational area specified in the Western Parkland City Authority Act 2018, Schedule 2 with a capital investment value of $30 million or more? *The proposal is within the Western Parkland City however has a capital investment value of less than $30 million.*	No	Western Parkland City Authority	Section 2.15

Appendix C

Biodiversity Assessment Report

Koala Fencing – Hume Highway, Wilton

Biodiversity Assessment Report

Transport for NSW

Author:	Senior Environmental Specialist (Biodiversity)
Date:	08/06/2023
Version:	2.0
Division:	Safety, Environment and Regulation

Version	Date	Revision description
1.0	03/02/2021	New Resource 4 template created to reflect: • *Biodiversity Conservation Act 2016*, Biodiversity Conservation Regulation 2017, Biodiversity Conservation (Savings and Transitional) Regulation 2017, Biodiversity Conservation Amendment (Controlled Actions) Regulation 2019, and minor amendments to the *Environmental Planning and Assessment Act 1979* • Establishment of Transport for NSW (TfNSW)
2.0	07/05/2021	Template updated to provide further detail on certain components of the Biodiversity Assessment Method 2020

Koala Fencing – Hume Highway, Wilton

Biodiversity Assessment Report

Transport for NSW | January 2024

Prepared by Stantec Australia, Pty Ltd

Copyright: The concepts and information contained in this document are the property of Transport for NSW. Use or copying of this document in whole or in part without the written permission of Transport for NSW constitutes an infringement of copyright.

Document controls

Approval and authorisation

Title	Koala Fencing – Hume Highway, Wilton Biodiversity Assessment Report
Accepted on behalf of Transport for NSW by:	
Signed:	
Dated:	

Document status

Document status	Description	Date	Prepared by	Reviewed by
V0	Draft for internal review	20/11/2022	Annabelle McTaggart Dane Fogliada	Christopher Wellington
V1	Draft for client review	05/12/2022	Annabelle McTaggart Dane Fogliada	Christopher Wellington
V2	Updates following client comment and confirmation of fencing alignments	05/05/2023	Annabelle McTaggart Dane Fogliada	Kevin Roberts
V3	Final Draft	29/05/2023	Dane Fogliada	David Wassman
V4	Final – Updates from detailed design	12/01/2024	Dane Fogliada	Catriona Sutherland

Contents

Executive summary i

Glossary iv

1 Introduction 1
1.1 Proposal background 1
1.2 The proposal 1
1.2.1 Key terms 2
1.3 Legislative context 6
1.3.1 NSW Environment Planning and Assessment Act 1979 6
1.3.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 6
1.3.3 NSW Biodiversity Conservation Act 2016 7
1.3.4 NSW Fisheries Management Act 1974 7
1.3.5 NSW Biosecurity Act 2015 7
1.3.6 State Environmental Planning Policy (Biodiversity and Conservation) 2021 8

2 Methods 9
2.1 Personnel 9
2.2 Background research 9
2.3 Vegetation assessment 10
2.3.1 Vegetation mapping 10
2.3.2 Vegetation survey and classification 11
2.4 Threatened species assessment 17
2.4.1 Habitat assessment 17
2.4.2 Targeted flora surveys 18
2.4.3 Targeted fauna surveys 19
2.5 Aquatic surveys 29
2.6 Limitations 29

3 Existing environment 30
3.1 Landscape features 30
3.2 Habitat features 32
3.3 Plant community types and vegetation zones 32
3.3.1 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395 36
3.3.2 Other vegetation 39
3.4 Threatened ecological communities 40
3.5 Groundwater dependent ecosystems 44
3.6 Threatened species 46
3.6.1 Likelihood of occurrence results 46
3.6.2 Candidate species 50
3.7 Aquatic results 59
3.8 Areas of outstanding biodiversity value 61
3.9 Wildlife connectivity corridors 61
3.10 Matters of national environmental significance 62
3.10.1 Threatened ecological communities 64
3.10.2 Migratory species 65

4 Avoidance and minimisation 67

5 Impact assessment 69
5.1 Construction direct impacts 69
5.1.1 Removal of native vegetation 69
5.1.2 Removal of threatened fauna habitat 70

5.1.3 Injury and mortality 71
5.2 Indirect and operational impacts 71
5.2.1 Edge effects on adjacent native vegetation and habitat 71
5.2.2 Wildlife connectivity and habitat fragmentation 71
5.2.3 Injury and mortality 72
5.2.4 Invasion and spread of weeds 72
5.2.5 Invasion and spread of pests 73
5.2.6 Invasion and spread of pathogens and disease 73
5.2.7 Noise, light, dust and vibration 73
5.3 Cumulative impacts 74
5.4 Assessments of significance 75

6 Mitigation 77

7 Offset strategy 82
7.1 Quantification of offset or revegetation requirements 82
7.2 Preliminary offset calculations 83
7.3 Biodiversity offset strategy 84

8 Conclusion 85

References 86

Appendix A – BioNet Search Results (10km locality)

Appendix B – PMST Search Results

Appendix C – Habitat Assessment Table

Appendix D – Species recorded

Appendix E - Assessments of Significance

List of tables

Table 2-1: Personnel

Table 2-2: Reviewed sources

Table 2-3: Vegetation survey campaign details

Table 2-4: Criteria for assessing vegetation in low condition

Table 2-5: Plot data collected

Table 2-6: Minimum number of plots required and completed per vegetation zone

Table 2-7: Targeted threatened flora survey details

Table 2-8: Summary of environmental conditions during targted flora surveys

Table 2-9: Targeted threatened fauna survey details

Table 2-10: Summary of environmental conditions during targeted fauna surveys

Table 3-1: Landscape features

Table 3-2: Plant community types and vegetation zones

Table 3-3: Floristic and structural summary of PCT 1395 within the study area

Table 3-4: Final determination description review for Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act

Table 3-5: Threatened species with a moderate or high likelihood of occurrence prior to survey

Table 3-6: Threatened species surveys results

Table 3-7: MNES and their applicability to the subject land
Table 3-8: Review of key diagnostic characteristics for Shale Sandstone Transition Forest of the Sydney Basin Bioregion - listed as critically endangered under the EPBC Act
Table 4-1: Consistency with Transport for NSW principles to avoid and minimise impacts on biodiversity
Table 5-1: Summary of direct impacts on native vegetation
Table 5-2: High threat exotic species within the study area
Table 5-3: Present and future project/proposals
Table 5-4: Summary of BC Act significance assessments findings
Table 5-5: Summary of EPBC Act significance assessments findings
Table 6-1: Mitigation measures
Table 7-1: Offset thresholds (TfNSW No Net Loss Guidelines (TfNSW, 2022)
Table 7-2: Assessment of vegetation impacts against thresholds
Table 7-3: Assessment of threatened species habitat loss against thresholds
Table 7-4: Preliminary Ecosystem Credit offset obligations

List of figures

Figure 1-1: Proposal context
Figure 1-2: The proposal (Southern Hume)
Figure 1-3: The proposal (Northern Hume)
Figure 2-1: The proposal (Northern Hume)
Figure 2-2: Vegetation plot-based survey locations (Southern Hume)
Figure 2-3: Vegetation plot-based survey locations (Northern Hume)
Figure 2-4: Threatened species survey locations (Southern Hume)
Figure 2-5: Threatened species survey locations (Northern Hume)
Figure 3-1: Plant community types and habitat features (Southern Hume)
Figure 3-2: Plant community types and habitat features (Northern Hume)
Figure 3-3: Threatened ecological communities (Southern Hume)
Figure 3-4: Threatened ecological communities (Northern Hume)
Figure 3-5: Recorded threatened species
Figure 3-6: Recorded threatened species
Figure 3-7: Aquatic results
Figure 3-8: Identified Koala corridors (study area location represented by red arrows) (DPIE 2019c)

Executive summary

Transport for New South Wales (Transport for NSW) proposes to establish Koala (Phascolarctos cinereus) exclusion fencing at two locations adjacent to the Hume Highway at Wilton (the proposal). The two sites are located between Pheasants Nest Bridge and Moolgun Creek Bridge, along the Hume Highway. Stantec Australia Pty Ltd on behalf of the proponent, Transport for NSW, have prepared a Biodiversity Assessment Report (BAR) to identify and assess the potential biodiversity impacts associated with the construction of the proposal.

The Department of Planning and Environment (DPE) developed the Cumberland Plain Conservation Plan (CPCP) (DPE, 2022a) with the goal of providing strategic conservation planning to meet the future needs of this community while protecting threatened plants and animals in the long term. 'Sub-Plan B: Koalas' supports the implementation of this plan by outlining a conservation program to protect and conserve the Cumberland Plain Koalas. The NSW government has committed to constructing koala exclusion fencing in the Wilton and Greater Macarthur growth areas to protect koalas from increasing urban threats such as vehicle strike. A number of priority koala exclusion fencing locations under the CPCP are on Transport for NSW land. Transport for NSW will lead the installation of fencing at these sites funded by the DPE under the upfront funding for implementation of the CPCP. This proposal forms part of the broader Koala Fencing project under the CPCP and fencing at the two sites will join up to future fencing delivered by DPE.

The proposal would reduce the incidence of vehicle-strike and mortality in the locality; however fencing would also increase the barrier effect of the Hume Motorway and further fragment the landscape. The proposal would avoid complete fragmentation of the landscape and facilitate the movement of fauna through more suitable corridors by channelling fauna to existing crossings under the Hume Highway.

A desktop assessment was conducted with reference to a variety of NSW and Commonwealth databases, mapping resources, legislation and assessment guidelines. The desktop assessment identified the potential presence of several listed threatened species, populations and Threatened Ecological Community (TECs), known or considered likely to occur in the locality. The desktop assessment also identified several native Plant Community Types (PCTs) which could be present within the Subject Land. The findings of the desktop assessment were used to inform the scope of the field surveys.

Field surveys were conducted over 8 campaigns (21 September 2022, 12 October 2022 – 14 October 2022, 31 October 2022 and 07 November 2022 – 09 November 2022) by suitably qualified ecologists. These surveys comprised a complete walk-through survey of the entire study area, the completion of six BAM vegetation plots and dedicated targeted surveys for the following groups:

- Threatened flora survey transects for the study area in its entirety;
- Diurnal birds - dedicated morning surveys in areas of suitable habitat from within the study area;
- Amphibians- active opportunistic surveys of suitable habitat nearby to the study area;
- Koala (Phascolarctos cinereus) - spot assessment technique was deployed across habitat containing suitable feed trees within the study area;
- Nocturnal fauna - spotlighting and call playback surveys within areas of potential habitat of the study area;
- Microbats - Anabat express units were deployed in areas identified as potential microbat habitat and day and night roost searches were conducted in all suitable breeding locations within the study area; and
- All groups - opportunistic surveys were conducted for all fauna groups during all phases of works.

The following vegetation types are present within the study area and subject land:

Veg. zone	Plant community type (PCT)	Condition class	Vegetation integrity score (VIS score)	Threatened ecological community	Area (ha)	
					Subject land	Study area
1	PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Good	65.5	Critically endangered (BC Act and EPBC Act)	0.31	2.64
2		Moderate - Good	55.4	Critically endangered (BC Act)	0.20	2.30
3		Moderate	30	Critically endangered (BC Act)	0.10	1.27
-	Exotic	-	-	-	0.23	1.86
-	Cleared land	-	-	-	0.23	1.46
Total					1.07	9.53

PCT 1395 was found to conform to the State listed TEC 'Shale Sandstone Transition Forest in the Sydney Basin Bioregion' – listed as critically endangered under the BC Act. No other State listed TECs occurred within the study area.

A small portion of PCT 1395 (good condition) found within the subject land is commensurate with the Commonwealth listed TEC 'Shale Sandstone Transition Forest of the Sydney Basin Bioregion' – listed as critically endangered under the EPBC.

No threatened flora and/or fauna species were detected within the subject land during field surveys. Southern Myotis (*Myotis macropus*) received a 'possible' call detection following acoustic surveys. Due to survey constraints, this species has been assumed present and considered for impact offsetting. Approximately 0.09 ha of suitable habitat for the species would be removed as part of the proposal.

The proposal would require clearing of native vegetation across three vegetation zones across PCT 1395. The expected total area of native vegetation to be cleared is 0.61 ha.

Tests of significance have been completed for 39 listed entities under the BC Act. Based on the removal of habitat from within the subject land, the proposal is unlikely to have a significant impact on any listed entity.

Assessments of Significance have been completed for 11 listed entities under the EPBC Act. Based on the removal of habitat from within the subject land, the proposal is unlikely to have a significant impact on any Matters of National Significance as defined by the EPBC Act.

Mitigation measures are proposed where impacts cannot be avoided, and the implementation of these measures will reduce adverse impacts on ecological values within the subject land.

Impacts to biodiversity values within the subject land have been assessed against Transport for NSW offset guideline documents to determine if biodiversity offsetting would be required as part of the proposal. For works involving the clearing of a critically endangered ecological communities (CEEC), the transport biodiversity offset threshold applies to any clearing of a CEEC in 'moderate to good' condition. The proposal will require the removal of 0.61 ha of PCT 1395 in a moderate to good condition. A preliminary offset calculation of 22 Ecosystem Credits have been assigned to impacts of the proposal and

offsetting would be in accordance with Transport for NSW offsetting guidelines. The proposal would also remove approximately 0.09 ha of suitable foraging habitat for the Southern Myotis (*Myotis macropus*). This impact does not meet the minimum offsetting thresholds of the 'No Net Loss Guidelines' (TfNSW, 2022). Therefore, no species credit offsets have been accrued as part of the proposal.

Glossary

Definitions	
Accredited person or assessor	Means as person accredited under section 6.10 (of the BC Act) to prepare reports in accordance with the BAM.
Biodiversity Assessment Method	The Biodiversity Assessment Method is established under section 6.7 of the BC Act. The BAM is established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values.
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020a).
Biodiversity Assessment Method Calculator	Biodiversity Assessment Method Calculator (BAM-C) – the online computer program that provides decision support to assessors and proponents by applying the BAM and referred to as the BAM-C. The BAM-C contains biodiversity data from the BioNet Vegetation Classification and the Threatened Biodiversity Data Collection that the assessor is required to use in a BAM assessment. The BAM-C applies the equations used in the BAM, including those to determine the number and class of biodiversity credits required to offset the impacts of a development, or created at a biodiversity stewardship site. It is published by the Department (DPIE 2020a).
BioNet Atlas	The DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020a).
BioNet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. The BioNet Vegetation Classification is published by the Department and available at www.environment.nsw.gov.au/research/Visclassification.htm (DPIE 2020a).
Construction footprint	The area to be directly impacted by the proposal during construction activities. See also definition for subject land.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat, and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020a).
Ecosystem credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for ecosystem credits. This is analogous with the definition of 'predicted species'.

Definitions	
Ecosystem credits	A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020a).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (DPIE 2020a).
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020a).
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: • The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area. • The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area. • The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year (OEH 2018).
Matter of national environmental significance	A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth).
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a).
Mitigation	Action to reduce the severity of an impact.
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary, (a) trees (including any sapling or shrub or any scrub), (b) understorey plants, (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act). Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.

Definitions	
Patch size	An area of native vegetation that: • occurs on the development site or biodiversity stewardship site • includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).
PlantNET	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Spatial datasets	Spatial databases required to prepare a BDAR • BioNet NSW (Mitchell) Landscapes – Version 3.1 • NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7 • NSW soil profiles • hydrogeological landscapes • acid sulfate soils risk • digital cadastral database • Vegetation Information Systems maps • Geological sites of NSW.
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of 'candidate species'.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a).
Species polygon	An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a).
Subject land	Land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship proposal. It excludes the landscape assessment area which surrounds the subject land (ie the area of land in the 1500 m buffer zone around the subject land or 500m buffer zone for linear proposals). In the case of a biodiversity certification proposal, subject land includes the biodiversity certification assessment area (DPIE 2020a). See also definition for construction footprint.
Study area	The area directly affected by the proposal (subject land or construction footprint) and any additional areas likely to be affected by the proposal, either directly or indirectly.
Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a).

Definitions	
	Part of the BioNet database, published by EESG and accessible from the BioNet website at www.bionet.nsw.gov.au.
Vegetation integrity (score)	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a).
Vegetation zone	A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a).

Abbreviations	
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offset Scheme
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CPCP	Cumberland Plain Conservation Plan
DIWA	Directory of Important Wetlands in Australia
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EEC	Endangered ecological community
EP&A Act	*Environment Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Fisheries NSW Policy and Guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	*Fisheries Management Act 1994* (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
KFH	Key Fish Habitat
LGA	Local Government Area
MNES	Matters of national environmental significance

Abbreviations	
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SAII	Serious and Irreversible Impacts
SEPP	State Environmental Planning Policy
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)
TfNSW	Transport for NSW

1 Introduction

1.1 Proposal background

Transport for New South Wales (Transport for NSW) proposes to establish Koala (Phascolarctos cinereus) exclusion fencing at two locations adjacent to the Hume Highway at Wilton (the proposal), located within the local government area (LGA) of Wollondilly Shire Council. The two sites are located between Pheasants Nest Bridge and Moolgun Creek Bridge, along the Hume Highway shown in Figure 1.1. Stantec Australia Pty Ltd, on behalf of the proponent, Transport for NSW, have prepared a Biodiversity Assessment Report (BAR) to identify and assess the potential biodiversity impacts associated with the construction of the proposal.

The Department of Planning and Environment (DPE) developed the Cumberland Plain Conservation Plan (CPCP) (DPE, 2022a) with the goal of providing strategic conservation planning to meet the future needs of this community while protecting threatened plants and animals in the long term. 'Sub-Plan B: Koalas' supports the implementation of this plan by outlining a conservation program to protect and conserve the Cumberland Plain Koalas.

The installation of Koala exclusion fencing for the Cumberland Plain region is a key element of 'Sub-Plan B: Koalas' under the CPCP. This is in accordance with advice provided by the Office of the NSW Chief Scientist and Engineer in 2021, which identified the provision of effective Koala exclusion fencing and fauna passage across roads as central to reducing mortality and enhancing the long-term survival of Koalas in the Cumberland Plain region. A number of priority koala exclusion fencing locations under the CPCP are on Transport for NSW land. Transport for NSW will lead the installation of fencing at these sites funded by the DPE under the upfront funding for implementation of the CPCP. This proposal forms part of the broader Koala Fencing project under the CPCP and fencing at the two sites will join up to future fencing delivered by DPE. Fencing is used to reduce the rate of vehicle strike by preventing wildlife from entering the roadway and funnelling wildlife towards safer crossing locations (Rytwinski et al., 2016). Fencing would increase the barrier effect of a road and therefore crossing structures or zones are required to maintain landscape connectivity. The proposal will facilitate the movement of fauna through more suitable corridors by channelling fauna to existing crossings under the Hume Highway.

1.2 The proposal

The proposal is to establish approximately 1800 m of Koala fencing at two sites between Pheasants Nest Bridge and Moolgun Creek Bridge, Wilton. Fencing installed as a part of the proposal will join up to future fencing delivered by DPE. Key features of the proposal are shown in Figure 1 2 and Figure 1 3 and would include:

- Installation of approximately 1400 m of Koala fencing, with the south-western fence ends tied to Pheasants Nest Bridge over the Nepean River (Southern Hume);
- Installation of approximately 400 m of Koala fencing, with the north-eastern fence ends tied to Moolgun Creek Bridge over Allens Creek (Northern Hume);
- The removal of vegetation to 3m to either side of the fence alignment, resulting in the removal of 0.61 ha of mapped PCT 1395; and
- The removal of existing fences (if applicable) as part of the establishment of the Koala fencing.

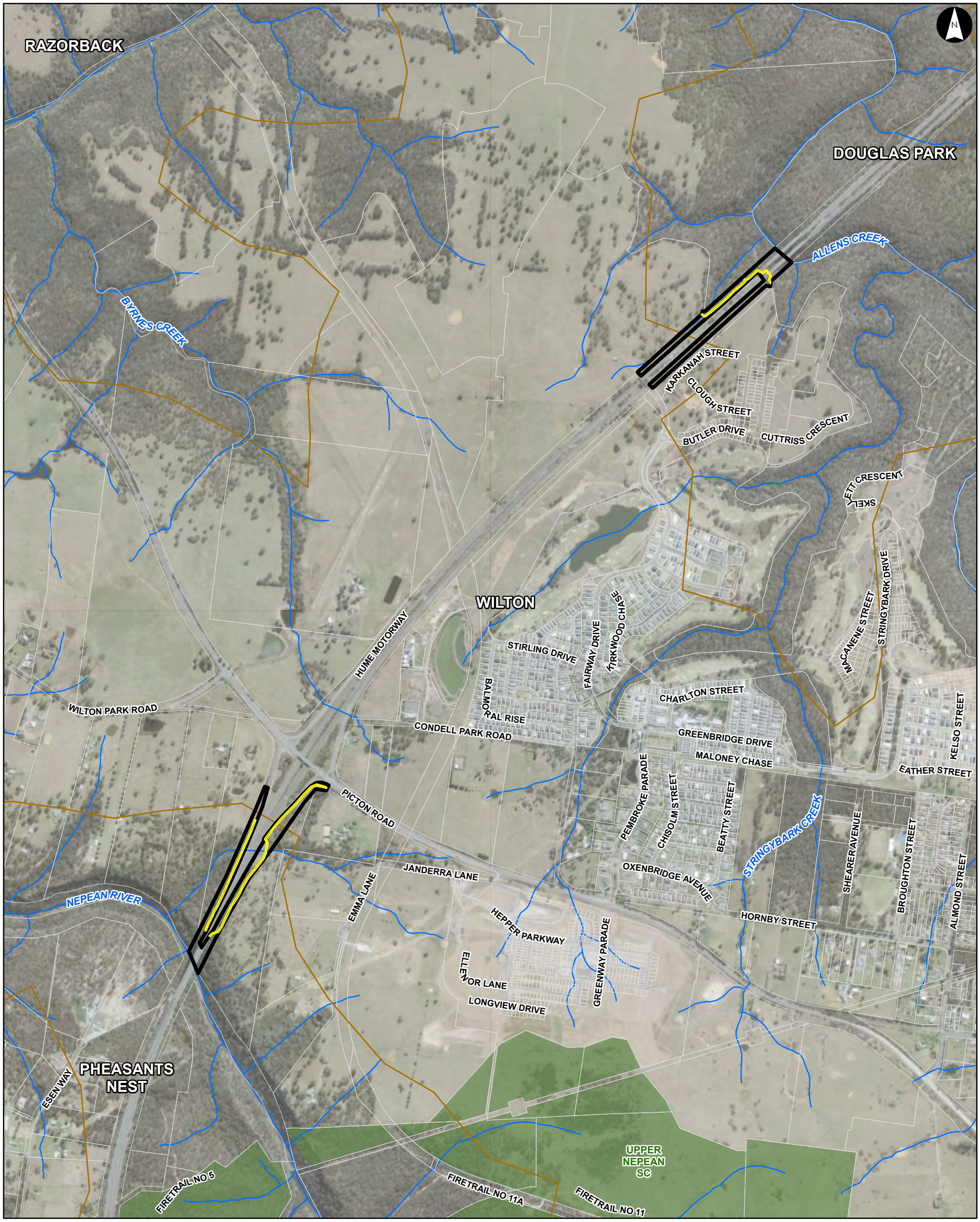
The proposed fenceline would be tied to Pheasants Nest and Moolgun Creek Bridges to provide fauna crossing opportunities, in accordance with the Draft Wildlife Connectivity Guidelines (RTA, 2011).

In accordance with the DPE Koala Vehicle Strike Fact sheet 2 (DPE 2020), fencing will be well-maintained, having no gaps or holes, trees or shrubs within 3m, overhanging vegetation or built-up debris. The fence would be 1.5m in height.

1.2.1 Key terms

The following key terms are used in this report:

- Biodiversity Assessment Report (BAR) – this report;
- The proposal – refers to the installation of approximately 1500 m of Koala fencing at two locations along the Hume Highway, Wilton;
- Subject land – the construction footprint or boundary used to calculate direct impacts of the proposal. For the purposes of this assessment, the subject land has been defined as 3m either side of the fence alignment;
- Study area – the land to which on-ground biodiversity studies were undertaken as part of this report. This includes the subject land;
- Locality – land within 10 km of the Study Area used for desktop analysis of potential biodiversity values; and
- Bioregion – The Interim Biogeographic Regionalisation for Australia (IBRA) region and subregion in which the subject land is located. The subject land is located in the Sydney Basin bioregion and Cumberland subregion.



Proposal Context

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-005
Drawn By: MD, Checked By: MM
Figure No: 1-1 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Mitchell Landscape
- NPWS Reserve
- Cadastre

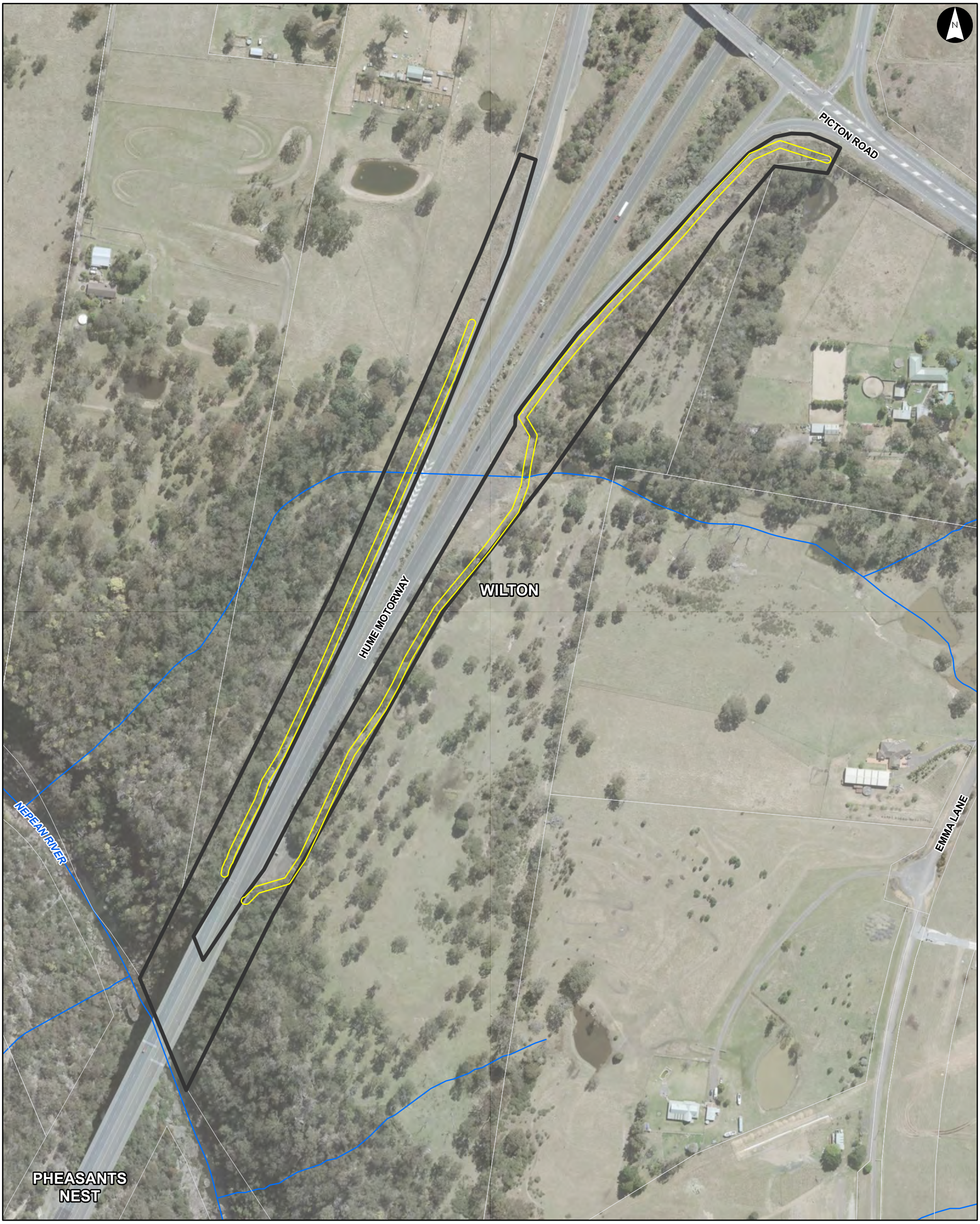
Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2023)
4. Mitchell Landscape (OEH, 2019)

0 150 300 450 600 750 Metres

Scale at A3 1:15,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



The Proposal (Southern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-006
Drawn By: MD, Checked By: MM
Figure No: 1-2 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Watercourse
- Cadastre

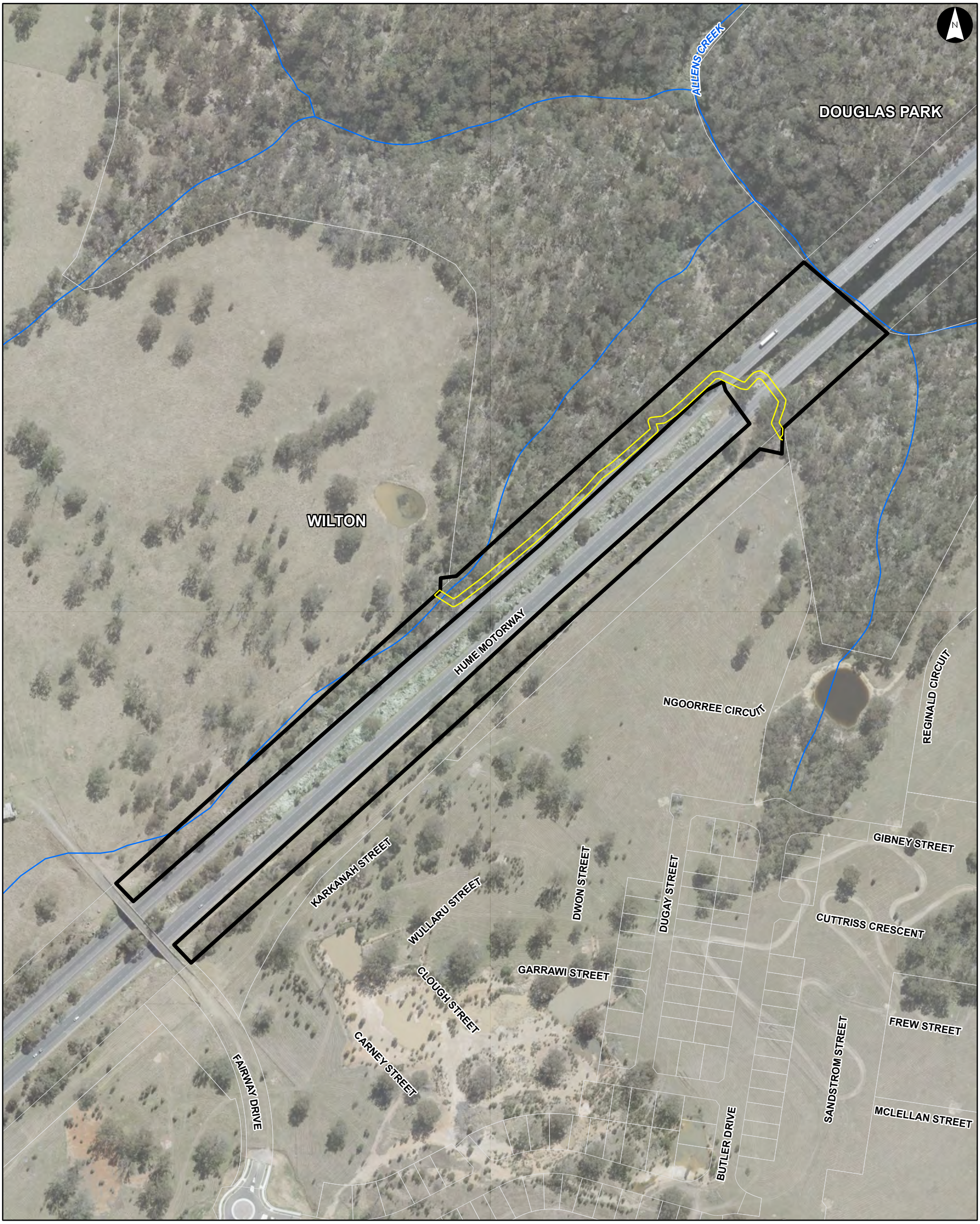
Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2023)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



The Proposal (Northern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-007
Drawn By: MMD, Checked By: MM
Figure No: 1-3 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2023)

0 25 50 75 100 125
Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

1.3 Legislative context

1.3.1 NSW Environment Planning and Assessment Act 1979

A Review of Environmental Factors (REF) is prepared to satisfy Transport for NSW duties under s.5.5 of the Environment Planning and Assessment Act 1979 (EP&A Act) to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and s.5.5 in making decisions on the likely significance of any environmental impacts. This BAR forms part of the REF being prepared for the establishment of Koala fencing at two sites along the Hume Highway, Wilton, and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

1.3.2 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) requires approval of the Commonwealth Minister for Environment (formerly the Minister of Sustainability, Environment, Water, Population and Communities) for actions that may have a significant impact on Matters of National Environmental Significance (MNES). The EPBC Act is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) and lists threatened species, ecological communities and other MNES. Any proposed action that is expected to have an impact on MNES must be referred to the Minister for assessment under the EPBC Act or assessed under the accredited process between the Commonwealth and the State of NSW.

Of the nine types of MNES, two are potentially relevant to the proposal:

- Listed threatened species and ecological communities; and
- Migratory species

13 threatened ecological communities (TECs), 66 threatened species and 16 migratory species were predicted to occur within 10km of the subject land.

In September 2015, a "strategic assessment" approval was granted by the Federal Minister in accordance with the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The approval applies to Transport for NSW road activities being assessed under Division 5.1 of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. "Fauna fencing" is included as an applicable activity under the broad group of utilities and fencing and therefore the strategic assessment approval is applicable to the proposal.

As a result, TfNSW road proposals assessed via an REF:

- Must address and consider potential impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- Do not require referral to the Department of Climate Change, Energy, and the Environment and Water (DCCEEW) for these matters, even if the activity is likely to have a significant impact
- Must use the Biodiversity Assessment Method (BAM) to calculate credits that would offset significant impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species.

To assist with this, assessments impact significance are required for all relevant biodiversity values in accordance with the Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999 (DoE 2013).

This BAR has determined that significant impacts on listed threatened species, ecological communities and migratory species is unlikely to occur as part of the proposal. Therefore, a referral for a controlled action is not required.

1.3.3 NSW Biodiversity Conservation Act 2016

The NSW Biodiversity Conservation Act 2016 (BC Act) establishes mechanisms for:

- The management and protection of listed threatened species of native flora and fauna (excluding fish and marine vegetation) and TECs;
- The listing of threatened species, TECs and key threatening processes;
- The development and implementation of recovery and threat abatement plans;
- The declaration of areas of outstanding biodiversity value (AOBV);
- The consideration and assessment of threatened species impacts in development assessment process; and
- Biodiversity Offsets Scheme (BOS), including the Biodiversity Values Map and method to identify serious and irreversible impacts (SAII).

The BC Act establishes a regulatory framework for assessing and offsetting biodiversity impacts on proposed developments. Where development consent is granted, the authority may impose as a condition of consent an obligation to retire a number and type of biodiversity credits determined under the Biodiversity Assessment Method (BAM).

Part 7 of the BC Act requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using a five-part test listed in Section 7.3 of the BC Act. Where a significant impact is likely to occur, a species impact statement (SIS) must be prepared in accordance with the Environment Agency Head's requirements, or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the BAM (DPIE 2020a).

This BAR has determined that significant impacts on listed threatened species, ecological communities and migratory species are unlikely to occur as part of the proposal. Therefore, a SIS or BDAR is not required.

1.3.4 NSW Fisheries Management Act 1974

The NSW Fisheries Management Act 1994 (FM Act) provides for the conservation, protection and management of fisheries, aquatic systems and habitats in NSW. Similar to the BC Act, the FM Act lists threatened species, populations and ecological communities of fish and marine vegetation. Part 7A of the FM Act requires that significance assessments are undertaken in accordance with Division 12 of the FM Act.

Consideration of likely occurrence of threatened fish in the waterways in proximity to the subject land is provided in Section 3.6.

1.3.5 NSW Biosecurity Act 2015

The NSW Biosecurity Act 2015 came into effect on 1 July 2017, effectively replacing the Noxious Weeds Act 1993, and 13 other Acts, with a single Act. Under the Noxious Weeds Act all landowners have a responsibility to control noxious weeds on their property. Under the Biosecurity Act, the same responsibility will apply and will be known as a General Biosecurity Duty.

The General Biosecurity Duty states "Any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised." The general biosecurity duty applies to all weeds listed in Schedule 3 of the Biosecurity Act.

Details of exotic species and primary weeds recorded within the subject land are provided in Section 3.2.2.

1.3.6 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity SEPP 2021) came into effect on 01 March 2022 and includes provisions for Koala habitat protection that aim to:

- Help reverse the decline of Koala populations by ensuring Koala habitat is properly considered during the development assessment process; and
- Provide a process for councils to strategically manage Koala habitat through the development of Koala plans of management.

As per Schedule 2 of Biodiversity SEPP 2021, the SEPP applies to Wollondilly LGA, and therefore the subject land. Consideration has been given to potential Koala habitat as a part of this BAR.

Chapter 13 of the Biodiversity SEPP 2021 makes reference to the Cumberland Plain Conservation Plan (CPCP), in particular provides development controls on koala fences and fauna crossings. The proposal is within the Wilton Growth area of the CPCP; however the subject land is entirely within the road corridor which is classified as 'excluded land.' Therefore, the proposal will not impact any land mapped as Certified – Urban Capable Land and/or Avoided Land under the CPCP. Development controls or compliance recommendations detailed in the CPCP do not apply to the proposal.

2 Methods

2.1 Personnel

This Biodiversity Assessment Report (BAR) was prepared by the following personnel, outlined in Table 2-1.

Table 2-1: Personnel

Name	Role	Qualifications
Kevin Roberts	• Technical review	• B Sc (Hons) • M Sc (Environment) • Executive Masters (Public Administration) • BAM Accredited Assessor (BAAS1707)
David Wassman	• Project manager	• B Sc (EnvSc) • CEnvP
Christopher Wellington	• Report review	• PhD Candidate • B Sc (Ecology)
Dane Fogliada	• Report writing • Field ecologist • Figure preparation	• B Sc (Environment) • Certificate II (Conservation Land Management) • BAM Accredited Assessor (BAAS23010)
Annabelle McTaggart	• Report writing • Field ecologist • Figure preparation	• B Sc (Conservation Biology)

2.2 Background research

A review of information and data was completed in August 2022 to gain an understanding of biodiversity values within the study area and broader study locality. Reviewed sources are outlined in Table 2-2.

A search radius of 10 km around the study area was used to collect and review information on the presence or likelihood of occurrence of:

- Threatened terrestrial and aquatic species and their habitat;
- Threatened ecological communities;
- Important habitat for migratory species; and
- Areas of outstanding biodiversity value.

Table 2-2: Reviewed Sources

Source	Date Accessed	Search Area
NSW DPE BioNet Species sightings http://www.bionet.nsw.gov.au/	22/08/2022	10 km
NSW DPI Fisheries Spatial Data Portal: https://www.dpi.nsw.gov.au/about-us/science-and-research/spatial-data-portal	22/08/2022	10 km

Source	Date Accessed	Search Area
SEED datasets including Biodiversity Values Map and available native vegetation community mapping (VIS 4207) (https://www.seed.nsw.gov.au/)	24/08/2022	10 km
The DAWE's Protected Matters Search Tool: https://pmst.awe.gov.au/	22/08/2022	10 km
The Commonwealth Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE): http://www.bom.gov.au/water/groundwater/gde/map.shtml	24/08/2022	10 km
National Flying-fox monitoring viewer: http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf	24/08/2022	10 km
Threatened biodiversity profile search. Profiles for NSW listed species (https://www.environment.nsw.gov.au/threatenedspeciesapp/) and nationally listed species at (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)	22/08/2022	N/A
Current and preliminary BC Act and EPBC Act listings	22/08/2022	N/A

2.3 Vegetation assessment

Vegetation survey and assessment was completed in accordance with Chapter 4 of the Biodiversity Assessment Method (DPIE 2020a). Table 2-3 outlines the survey timing and methodology of the vegetation assessment.

Table 2-3: Vegetation Survey Campaign Details

Date	Survey method	Personnel*
21 September 2022	Vegetation mapping	DF, AM
12 October 2022	BAM plots	DF, AM
13 October 2022	BAM plots	DF, AM

*DF= Dane Fogliada, AM=Annabelle McTaggart

2.3.1 Vegetation mapping

Prior to surveys, a review of existing vegetation mapping relevant to the study area was undertaken. Western Cumberland subregion (VIS 4207) mapping was used with reference to the updated State Vegetation Type Mapping (SVTM) for consistency.

On-ground vegetation mapping was completed by meanders through the study area to verify PCTs, as described in the BioNet Vegetation Classification, and their extents. Rapid data points were collected with the following:

- Structure and species composition;
- Characteristic floristics at each vegetation strata; and

- Landscape characteristics.

All native vegetation was assigned to a PCT and categorised into broad condition classes (vegetation zones) to inform the required plot-based survey effort. Vegetation classification was finalised following vegetation mapping (see section 2.3.2).

Where disturbed areas were recorded, native vegetation was defined in accordance with s1.6 of the BC Act and Part 5A 60B of the NSW Local Land Services Act 2013 (LLS Act). Allocation of an area to native vegetation was based on the following definitions:

- Native Vegetation: In accordance with s1.6 of the BC Act and Part 5A 60B of the NSW Local Land Services Act 2013 (LLS Act), native vegetation means any of the following types of plants native to New South Wales: (a) trees (including any sapling or shrub or any scrub), (b) understorey plants, (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland; and
- Plant: In accordance with the LLS Act, a plant is native to NSW if it was established in NSW before European settlement. The regulations may authorise conclusive presumptions to be made of the species of plants native to NSW by adopting any relevant classification in an official database of plants that is publicly accessible. In accordance with the BC Act, a plant means any plant whether vascular or non-vascular and in any stage of biological development and includes fungi and lichens but does not include marine vegetation.

All areas that did not meet the definition of native vegetation were categorised as exotic or cleared land.

2.3.2 Vegetation survey and classification

Vegetation identification of PCTs and TECs, assessment of vegetation zones and plot-based surveys were undertaken in accordance with Chapter 4 of the BAM (DPIE 2020a).

Plant community types (PCTs) and TECs were identified by analysing the assemblage of species, vegetation structure and landscape characteristics and comparing these features with the description of the most likely PCTs as per the BioNet Vegetation Classification and the Threatened Species Scientific Committee final determinations of TECs. Potential EPBC listed TECs were assessed against individual key diagnostic characteristics and condition thresholds, as per the Commonwealth listing/conservation advice, to determine whether PCTs in the Study Area were commensurate with Commonwealth listed TECs.

2.3.2.1 Vegetation zones

A vegetation zone is defined as a relatively homogenous area of native vegetation that is the same PCT and broad condition type. Areas of similar condition were grouped into broad condition types based on structural condition and levels of disturbance and exotic cover. Stratification of vegetation was undertaken to identify areas of low condition vegetation as per Table 2-4.

Table 2-4: Criteria for assessing vegetation in low condition

Cat.	Vegetation formation	Criteria
A	Rainforest Wet-sclerophyll Forest	Native tree cover <25 % of the tree cover benchmark for the PCT
		AND

Cat.	Vegetation formation	Criteria
	Dry-sclerophyll Forest Grassy Woodland Semi-arid Woodland Forested Wetland	Less than 50% of ground cover vegetation consists of either: • species listed in the BioNet Vegetation Classification PCT profile for medium to high classification confidence PCTs, **or** • any native species for very low to low classification confidence PCTs, **OR** Greater than 90% of ground cover vegetation is cleared.
B	Arid Shrubland Heathland Or any PCT from category A where the tree cover benchmark is <10 %	Native shrub cover <50 % of the shrub cover benchmark for the PCT
		AND
		Less than 50% of ground cover vegetation consists of either: • species listed in the BioNet Vegetation Classification PCT profile for medium to high classification confidence PCTs, **or** • any native species for very low to low classification confidence PCTs, **OR** Greater than 90% of ground cover vegetation is cleared.
C	Freshwater Wetland Saline Wetland Grassland Alpine Complex Or any PCT from category B where the shrub cover benchmark is <10 %	Less than 50% of ground cover vegetation consists of either: • species listed in the BioNet Vegetation Classification PCT profile for medium to high classification confidence PCTs, **or** • any native species for very low to low classification confidence PCTs, **OR** Greater than 90% of ground cover vegetation is cleared.

2.3.2.2 Plot-based vegetation survey

Plot-based floristics and vegetation integrity surveys were completed in accordance with Section 4.3 of the BAM (DPIE, 2020a). Each plot-based survey was comprised of a 20 m x 50 m plot, established to collect qualitative data for vegetation integrity scores, and nested sub-plots consisting of a 20 m x 20 m plot and five evenly spaced 1 m x 1 m quadrats, as illustrated in Figure 2 1

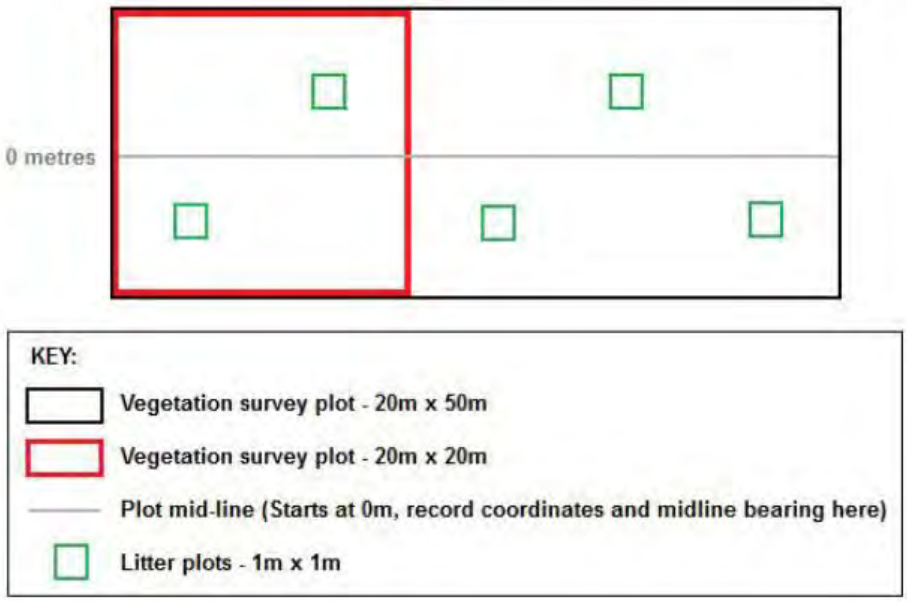


Figure 2-1: The proposal (Northern Hume)

Data collected in each plot is detailed in Table 2-5. Full floristic data is provided in Appendix D.

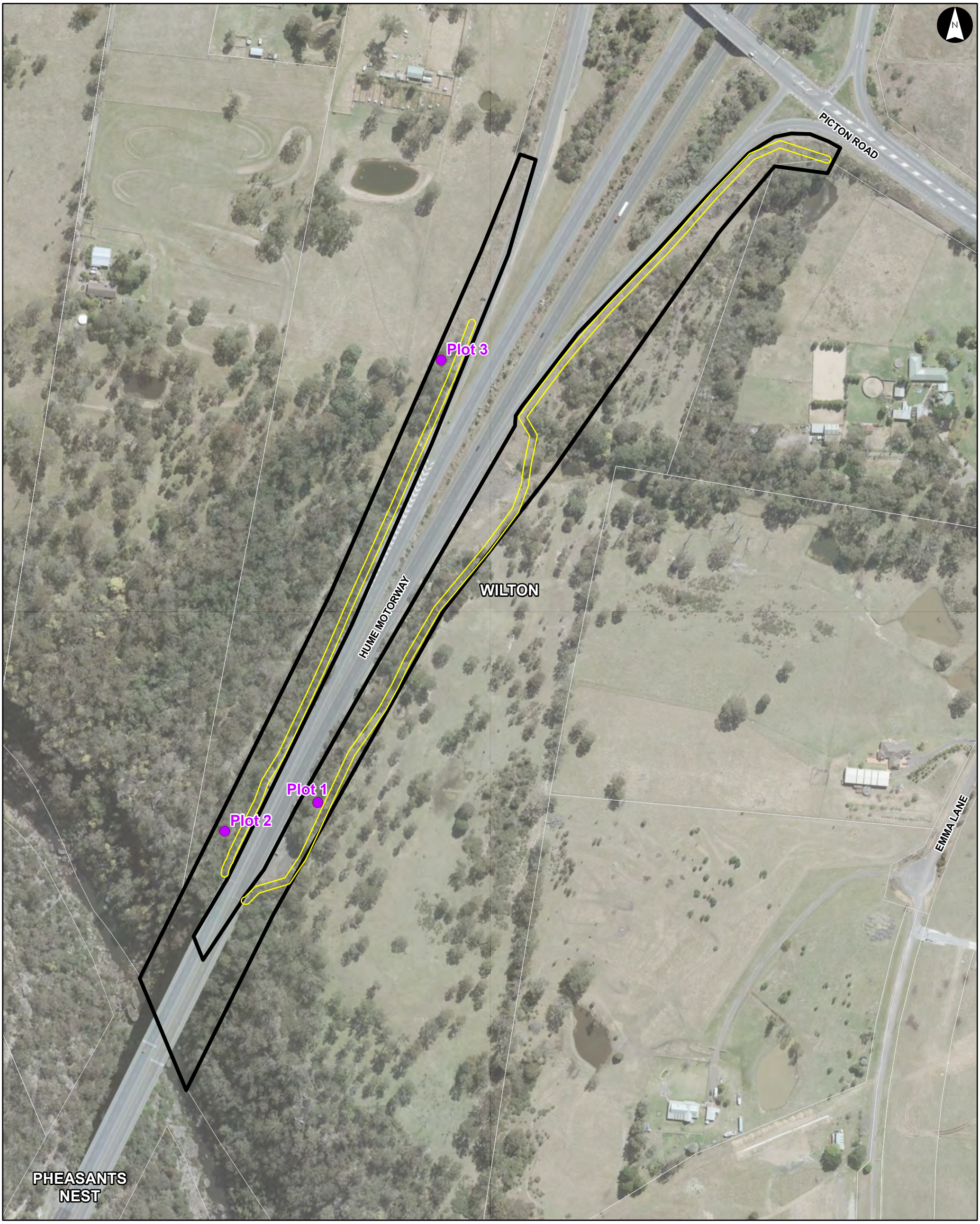
Table 2-5: Plot data collected

Attribute	Qualitative data collected
Location	Geographic coordinates (easting and northing – MGA 2020 Zone 56) collected using ArcGIS field application Collector
Native and exotic species richness and cover percentage	Plot: 20 x 20 m All plant species were recorded and cover percentage of each species was estimated. The growth form, native/exotic, high threat weed (HTW) status for each species was determined.
Number of hollow-bearing trees (HBTs)	Plot: 20 x 50 m The number of living and dead trees with hollows were recorded. A hollow was only recorded if: • The entrance could be seen; • The estimated entrance width was at least 5 cm; • The hollow appeared to have depth; • The hollow was at least 1 m above the ground; and • The centre of the tree was located within the plot. Information regarding hollow size, angle of hollow, tree species and tree diameter at breast height (dbh) and height from the ground were also collected.
Tree stem size diversity and number of large trees	Plot: 20 x 50 m Tree stem size diversity was recorded by measuring the dbh of living trees within the plot. For multi-stemmed living trees, only the largest stem was measured. The number of large trees were tallied where dbh was greater than a specified dbh of large trees as defined for each PCT in the Vegetation Classification.
Evidence of regeneration	Plot 20 m x 50 m Presence/absence of overstorey species present within the plot that are regenerating (saplings with a dbh ≤ 5 cm).
Total length of fallen logs	Plot: 20 m x 50 m A cumulative total distance of logs found within the plot. A log is defined as having a minimum diameter of 0.1 m and a length of at least 0.5 m.

The minimum number of plots required per vegetation zone was determined in accordance with Table 3 of the BAM (DPIE, 2020a). Table 2-6 details the number of plots completed for each vegetation zone and the associated plot identified. The location of each plot is illustrated in Figure 2 2 and Figure 2 3.

Table 2-6: Minimum number of plots required and completed per vegetation zone

Vegetation zone	PCT_condition	Vegetation zone area (ha) – study area	No. plots required	No. plots completed (plot IDs)
1	1395_good	2.64	2	2 (Plot 2 and 5)
2	1395_moderate_good	2.30	2	2 (Plot 1 and 4)
3	1395_moderate	1.74	1	2 (Plot 3 and 6)



Vegetation Plot Surveys (Southern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-008
Drawn By: MD, Checked By: MM
Figure No: 2-2 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- BAM Plot
- Major Road
- Cadastre

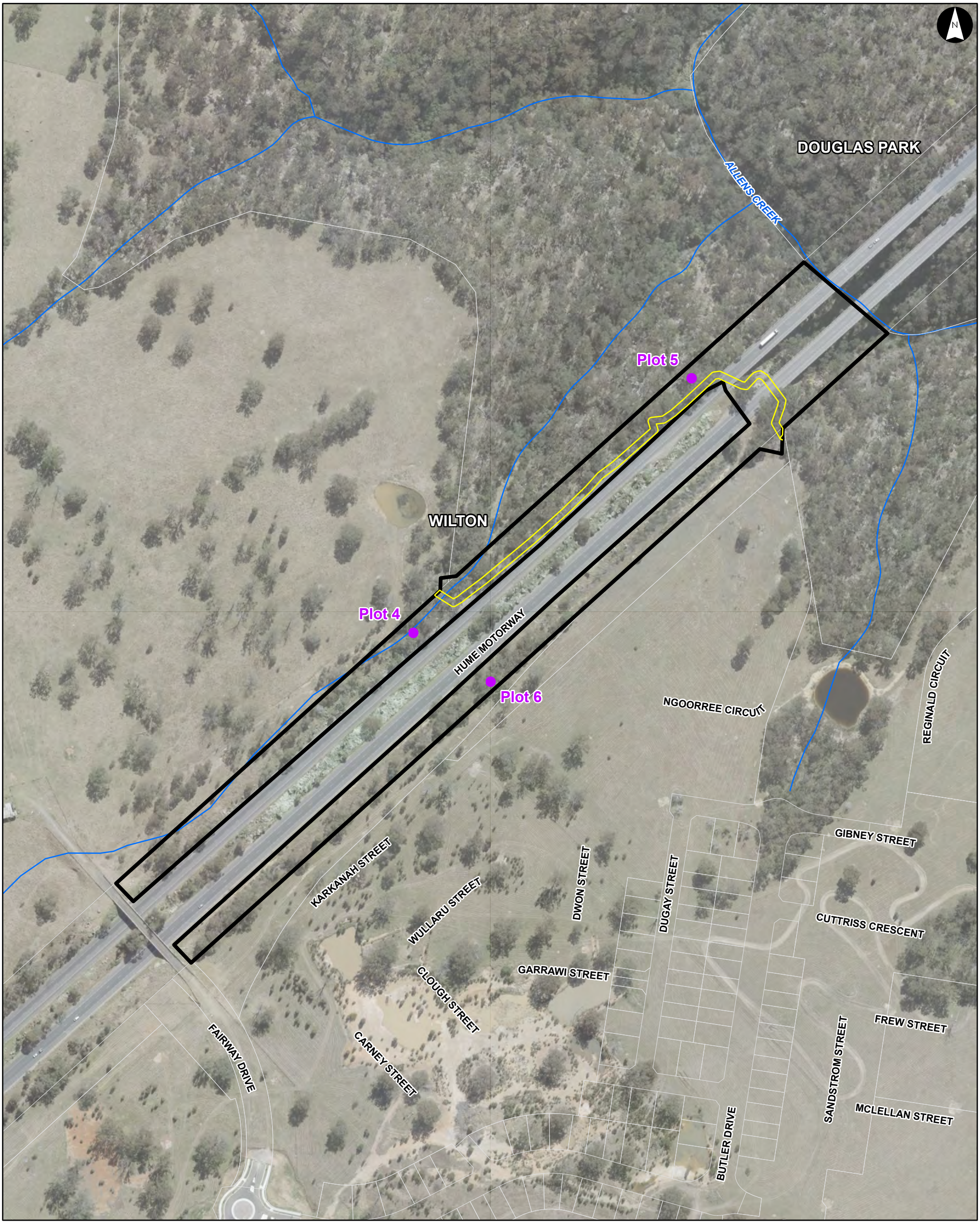
Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2023)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.



Vegetation Plot Surveys (Northern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-009
Drawn By: MD, Checked By: MM
Figure No: 2-3 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- BAM Plot
- Major Road
- Watercourse
- Cadastre

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2023)

0 25 50 75 100 125
Metres
Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

2.4 Threatened species assessment

Field surveys were completed between September and November 2022 (Table 2 8 and Table 2 10). The aims of the surveys were to ground-truth the results of the background research and habitat assessment, with particular consideration given to species of conservation concern likely to occur. This included habitat transects conducted to map important habitat features and evidence of fauna activity. Features collected included hollow-bearing trees (HBTs), stags, burrows, aquatic habitat, culverts, and signs of fauna activity (such as feeding evidence, claw marks, scats).

Threatened flora (see section 2.4.2) and fauna (see section 2.4.3) surveys were conducted in accordance with the BAM to determine presence within the study area. The species considered for targeted surveys were those considered likely to occur in the study area based on the likelihood of occurrence assessment (Appendix C).

There are three classes of threatened species under the BAM:

- Ecosystem credit species (ECS), or predicted species, are species where presence can generally be predicted by vegetation and/or landscape surrogates, or that have a low probability of detections during targeted surveys. No targeted surveys were completed for these species and if suitable habitat occurred, ECS were assumed present;
- Species credit species (SCS), or candidate species, are species for which vegetation and/or landscape surrogates cannot reliably predict their presence or components of their habitat. Targeted surveys are required to determine their presence; and
- Dual credit species (species that have species credit and ecosystem credit components) were surveyed for the SCS component (e.g., breeding habitat) during the required survey period identified in the TBDC, if habitat occurred in the subject land.

Where SCS could not be surveyed in accordance with the required seasonal timing or relevant guidelines, an assessment of habitat suitability was undertaken based on habitat constraints, records within the locality and previous survey effort, where relevant. SCS that cannot be surveyed during the required survey period are required to be assumed as present. However, all targeted species were able to be surveyed sufficiently and no species have been assumed present within the subject land.

Incidental detection and recording of fauna species identified outside of specified surveys have been collected to confirm presence as part of this assessment.

2.4.1 Habitat assessment

A habitat assessment was completed to assess the likelihood of occurrence of each threatened or migratory species, threatened population or ecological community identified with the potential to occur within the study area. All threatened biodiversity identified by literature and database searches were considered. In assessing the likelihood of occurrence for each species, consideration was given to the vegetation mapped within the subject land, the currency and location of nearby records, the presence of key habitat features and known populations in the area. The likelihood of occurrence criteria is detailed in Appendix C.

Species were considered ‘likely to occur’ (i.e., moderate to high likelihood of occurrence) where:

- The geographic distribution of the species is known or predicted to include the IBRA subregion in which the project is located, and
- The species is associated with the PCTs identified within the subject land, and
- A species inhabits the assessment area and is dependent on identified suitable habitat (i.e., for breeding or important life cycle periods such as winter flowering resources), and

- Has been recorded recently (previous 10 years) in the locality, and
- Is known or likely to maintain resident populations in the locality, and
- The proposal footprint contains habitat features or components associated with the species, or
- Past or current surveys undertaken in the proposal footprint indicate the species is present.

The habitat assessment formed the basis for targeted surveys and was reviewed following the completion of surveys and the confirmation of habitat features in the study area (Appendix C).

A test of significance (under the BC Act or FM Act) and/or an assessment of significance (under the EPBC Act) for species considered 'likely to occur' by the habitat assessment has been completed (Appendix E).

2.4.2 Targeted flora surveys

Threatened flora surveys were conducted in accordance with the parallel transect method outlined in the 'Surveying Threatened Plants and Their Habitats: NSW Survey Guide for the Biodiversity Assessment Method' (DPIE 2020d). All flora species considered to have at least a moderate likelihood of occurrence were considered for targeted surveys.

Given the condition of suitable habitat within the subject land, the parallel transect method (DPIE 2020d) would comprehensively determine presence/absence of target species. The guidelines suggest parallel field traverses with a spacing of 5m being appropriate for surveying herbs and forbs in dense vegetation. The timing of surveys adhered to the survey season requirements, as detailed in the TBDC, for all of the targeted flora species (Table 2-7). Table 2-8 outlines the dates, survey method and environmental conditions for the threatened flora surveys.

Table 2-7: Targeted threatened flora survey details

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Acacia bynoeana	Bynoe's Wattle	All year	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
Epacris purpurascens var. purpurascens	-	September - October	PCT 1395 – 0617 ha	• Flora transects	Surveys completed
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	August - November	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
Melaleuca deanei	Deane's Paperbark	All year	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
Persoonia bargoensis	Bargo Geebung	All year	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
Persoonia hirsuta	Hairy Geebung	All year	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Pimelea curviflora var. curviflora	-	October - March	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
Pomaderris brunnea	Brown Pomaderris	August - October	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed

Table 2-8: Summary of environmental conditions during targeted flora surveys

Surveys undertaken	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
Threatened flora transects	12/10/2022	9.1	20.9	0	Significant rain event 09/10/2022 with approximately 58.4 mm of rainfall
Threatened flora transects	13/10/2022	12.0	21.5	0	
Threatened flora transects	14/10/2022	14.7	23.2	0.4	

Data as per Bureau of Meteorology (BoM) nearest meteorological station (Station 068257 Campbelltown (Mount Annan) at http://www.bom.gov.au/climate/dwo/202210/html/IDCJDW2157.202210.shtml

2.4.3 Targeted fauna surveys

Threatened fauna surveys were conducted in accordance with species-specific guidelines as specified below:

- Department of Environment and Conservation (2004) Threatened biodiversity survey and assessment. Guidelines for developments and activities (working draft);
- Department of Planning and Environment (2022) 'Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide';
- OEH (2018), 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method;
- Commonwealth of Australia (2011b) Survey Guidelines for Australia's Threatened Mammals, Commonwealth of Australia;
- Commonwealth of Australia (2011c) Survey Guidelines for Australia's Threatened Reptiles; and
- TBDC specific habitat constraints and survey requirements.

Table 2-9 outlines the dates, survey method and survey effort completed for the threatened fauna surveys. Survey locations for threatened fauna are illustrated in Figure 2-4 and Figure 2-5.

Table 2-9: Targeted threatened fauna survey details

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Birds					
Anthochaera phrygia	Regent Honeyeater	All year	PCT 1395 – 0.61 ha	• Diurnal bird surveys • Mapped important habitat	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022 Not within mapped important habitat
Burhinus grallarius	Bush Stone-curlew	All year	PCT 1395 – 0.61 ha	• Diurnal bird surveys • Call playback	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022
Callocephalon fimbriatum	Gang-gang Cockatoo	October - January	PCT 1395 – 0.61 ha	• Diurnal bird surveys • Hollow-bearing trees with suitable sized hollows for breeding	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022 No suitable breeding hollows (>9cm) within the subject land
Calyptorhynchus lathami	Glossy Black-Cockatoo	January - September	PCT 1395 – 0.61 ha	• Diurnal bird surveys • Hollow-bearing trees with suitable sized hollows for breeding	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022 No suitable breeding hollows within the subject land
Haliaeetus leucogaster	White-bellied Sea-Eagle	July - December	PCT 1395 – 0.61 ha	• Diurnal bird surveys	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Hieraaetus morphnoides	Little Eagle	August - October	PCT 1395 – 0.61 ha	• Diurnal bird surveys	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022
Lathamus discolor	Swift Parrot	All year	PCT 1395 – 0.61 ha	• Diurnal bird surveys • Mapped important habitat	Not within mapped important habitat
Lophoictinia isura	Square-tailed Kite	September - January	PCT 1395 – 0.61 ha	• Diurnal bird surveys	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022
Ninox connivens	Barking Owl	May - December	PCT 1395 – 0.61 ha	• Nocturnal bird surveys • Hollow-bearing trees with suitable sized hollows for breeding	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022No suitable breeding hollows within the subject land
Ninox strenua	Powerful Owl	May - August	PCT 1395 – 0.61 ha	• Nocturnal bird surveys • Hollow-bearing trees with suitable sized hollows for breeding	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022No suitable breeding hollows within the subject land

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Tyto novaehollandiae	Masked Owl	May - August	PCT 1395 – 0.61 ha	• Nocturnal bird surveys • Hollow-bearing trees with suitable sized hollows for breeding	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022No suitable breeding hollows within the subject land
Reptiles					
Hoplocephalus bungaroides	Broad-headed Snake	All year	PCT 1395 – 0.61 ha	• Reptile search in all areas of suitable habitat	Seven hand searches of sheltering sites complete: 21/09/2022 12/10/2022 13/10/2022 14/10/2022
Mammals					
Cercartetus nanus	Eastern Pygmy-possum	October - March	PCT 1395 – 0.61 ha	• Spotlighting transects • Stag watching	Two repeat spotlighting transects: 12/10/2022 13/10/2022
Chalinolobus dwyeri	Large-eared Pied Bat	November - January	PCT 1395 – 0.61 ha	• Diurnal and nocturnal roost search • Acoustic survey (ANABAT)	Roost searches: 12/10/2022 13/10/2022 Four recording nights of acoustic survey: 31/10/2022 07/11/2022 08/11/2022 09/11/2022
Miniopterus australis	Little Bent-winged Bat	December - February	PCT 1395 – 0.61 ha	• Microbat trapping • Caves or tunnels as breeding habitat	No suitable breeding habitat within the subject land

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Miniopterus orianae oceanensis	Large Bent-winged Bat	December - February	PCT 1395 – 0.61 ha	• Microbat trapping • Caves or tunnels as breeding habitat	No suitable breeding habitat within the subject land
Myotis macropus	Southern Myotis	October - March	PCT 1395 – 0.61 ha	• Diurnal and nocturnal roost search • Acoustic survey (ANABAT)	Roost searches: 12/10/2022 13/10/2022 Four recording nights of acoustic survey: 31/10/2022 07/11/2022 08/11/2022 09/11/2022
Petauroides volans	Greater Glider	All year	PCT 1395 – 0.61 ha	• Spotlighting transects • Stag watching	Two repeat spotlighting transects: 12/10/2022 13/10/2022
Petaurus norfolcensis	Squirrel Glider	All year	PCT 1395 – 0.61 ha	• Spotlighting transects • Stag watching	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022
Phascolarctos cinereus	Koala	All year	PCT 1395 – 0.61 ha	• Koala SAT • Spotlighting transects • Call playback	12 SAT surveys complete: 21/09/2022 12/10/2022 13/10/2022 14/10/2022
Pteropus poliocephalus	Grey-headed Flying-fox	All year	PCT 1395 – 0.61 ha	• Spotlighting transects	No camp within the study area.
Gastropods					

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Meridolum corneovirens	Cumberland Plain Land Snail	All year	PCT 1395 – 0.61 ha	• Gastropod survey	Targeted searches at all Koala feed trees in conjunction with 12 Koala SAT surveys: 21/09/2022 12/10/2022 13/10/2022 14/10/2022
Amphibians					
Heleioporus australiacus	Giant Burrowing Frog	September - April	PCT 1395 – 0.61 ha	• Aural/visual surveys and/or Tadpole searches • Flowing ephemeral streams within the study area	No suitable habitat within the subject land
Litoria littlejohni	Littlejohn's Tree Frog	July - November	PCT 1395 – 0.61 ha	• Aural/visual surveys and/or Tadpole searches • Dams or pools within the study area	No suitable habitat within the subject land
Mixophyes balbus	Stuttering Frog	September - March	PCT 1395 – 0.61 ha	• Aural/visual surveys • Flowing ephemeral streams within the study area	No suitable habitat within the subject land

Table 2-10 outlines the dates, survey method and environmental conditions for the threatened fauna surveys.

Table 2-10: Targeted threatened fauna survey details

Surveys undertaken (number of surveys)	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
• Gastropod surveys (3) • Koala SAT (3) • Diurnal bird surveys (2) • Reptile searches (1)	21/09/2022	9.6	19.9	0	-

Surveys undertaken (number of surveys)	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
• Gastropod surveys (3) • Koala SAT (3) • Microbat roost search (1) • Reptile searches (2) • Nocturnal surveys (1 Call Playback Survey, Spotlighting transects)	12/10/2022	9.1	20.9	0	Significant rain event 09/10/2022 with approximately 58.4 mm of rainfall
• Gastropod surveys (3) • Koala SAT (3) • Microbat roost searches (2) • Reptile searches (2) • Nocturnal surveys (1 Call Playback Survey, Spotlighting transects)	13/10/2022	12.0	21.5	0	
• Gastropod surveys (3) • Koala SAT (3) • Diurnal bird surveys (2) • Reptile searches (2)	14/10/2022	14.7	23.2	0.4	
• Microbat survey (ANABAT)	31/10/2022	11.9	27.3	0	-
• Microbat survey (ANABAT)	07/11/2022	11.2	25.4	0	-
• Microbat survey (ANABAT)	08/11/2022	12.0	24.7	0	-
• Microbat survey (ANABAT)	09/11/2022	9.4	25.2	0	-
Data as per Bureau of Meteorology (BoM) nearest meteorological station (Station 068257 Campbelltown (Mount Annan) at http://www.bom.gov.au/climate/dwo/202210/html/IDCJDW2157.202210.shtml					

Survey methods are detailed further below.

2.4.3.1 Diurnal bird surveys

Four diurnal bird surveys were completed in accordance with the 'Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Draft' (DEC 2004). One diurnal survey consisted of an area search of approximately 1 ha for at least 20 minutes, whilst actively listening and looking for bird species. Diurnal bird surveys were completed at dawn to optimise detection.

2.4.3.2 Koala Spot Assessment Technique

Koala surveys were conducted in accordance with 'Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide' (DPE, 2022b). A Spot Assessment Technique (SAT) survey was used to determine the presence of Koalas within the study area. The SAT requires the surveyor to identify suitable habitat for Koalas and identify at

least 30 Koala feed trees (if applicable) within a set grid over the study area. Searches for Koala use, such as scat, are then be undertaken at each identified tree. Given the small size of the study area, all Koala feed trees were identified and a scat search was undertaken at each feed tree. Koalas were also targeted during spotlighting transects of the study area.

2.4.3.3 Microbat surveys

Microchiropteran bat (microbat) surveys were conducted in accordance with 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method' (OEH 2018b). Ultrasonic echolocation detectors (ANABATs) were used in areas of appropriate habitat and flyways to help capture the calls of microbat species. These devices are able to detect and record high frequency calls which can then be analysed to identify species presence. Data was analysed by Dr Anna McConville (ECHO Ecology and Surveying). A diurnal and nocturnal roost search was also conducted to attempt to visually detect any microbat species using appropriate habitat within the study area.

2.4.3.4 Nocturnal surveys

Nocturnal surveys were completed in accordance with the 'Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities draft' (DEC 2004).

Spotlighting transects were conducted on foot throughout the study area. Each spotlighting transect was traversed for at least one hour using a 12V 100W spotlight.

Stag watching occurred at suitable HBTs within the study area and included the visual inspection of a hollow 30 minutes prior to sunset and 1 hour following sunset to detect any fauna using the hollow.

Calls of nocturnal species were broadcasted in areas of suitable habitat and visibility by using a 10W amplifier speaker. At each call playback location, an initial listening period of 10 minutes was undertaken followed by a spotlight search for 10 minutes to detect any fauna in the immediate vicinity. The calls for each target species were played intermittently, in accordance with timings specified within the relevant guidelines. Following the broadcast of calls, a further 10 minutes of active listening and spotlighting was conducted.

2.4.3.5 Reptile Surveys

Targeted surveys for Broad-headed Snake (Hoplocephalus bungaroides) were conducted by searches of suitable sheltering sites (rocks and crevices). Appropriate sheltering sites were searched with torches during both diurnal and nocturnal surveys.

2.4.3.6 Gastropod Surveys

Targeted searches for Cumberland Plain Land Snail (Meridolum corneovirens) were undertaken throughout the study area in areas of suitable habitat. Searches for live snails or empty shells were conducted at the base of trees and beneath rocks and debris. These were undertaken in conjunction with Koala SAT surveys. Searches were also undertaken opportunistically throughout the survey period.

PICTON ROAD

HUME MOTORWAY

WILTON

NEPEAN RIVER

EMMA LANE

PHEASANTS NEST

Threatened Species Survey (Southern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-010
Drawn By: MD, Checked By: MM
Figure No: 2-4 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Threatened Species Survey

- Bird Survey
- Call Playback
- Reptile
- Roost Search
- Spot Assessment Technique
- Stag Watch

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Threatened Species Survey (Northern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-011
Drawn By: MD, Checked By: MM
Figure No: 2-5 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Threatened Species Survey

- Bird Survey
- Call Playback
- Reptile
- Roost Search
- Spot Assessment Technique

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

2.5 Aquatic surveys

A desktop aquatic assessment was conducted to determine the habitat value of each waterway within the study area. Habitat values include key fish habitat, sensitivity and waterways identified by the threatened species distribution mapping in accordance with NSW DPI (Fisheries) document Policy and Guidelines for fish habitat conservation and management (2013 update). Field-based aquatic assessments were not completed due to proximity of aquatic habitat to the subject land and safety concerns reaching each waterway edge.

2.6 Limitations

The methodology presented here provides a limitation on describing the biodiversity values of the study area. The biodiversity values recorded from the surveys should not be seen as a complete/comprehensive inventory. The surveys would have sampled the study area at a point in time (snapshot). A period of several seasons or years is often required to identify all species in an area. Given the short period of time spent on site, the detection of certain species may be affected by:

- Seasonal migration (particularly migratory birds);
- Seasonal flowering periods (some species are cryptic and are unlikely to be detected outside of the known flowering period);
- Seasonal availability of food, such as blossoms for some fauna;
- Weather conditions during the survey period (some species may go through cycles of activity related to specific weather conditions, for example some microbats, reptiles and frogs can be inactive during cold weather);
- Species lifecycle (cycles of activity related to breeding); and
- Accessibility of watercourses within the study area (considered to be unfeasible and unnecessary due to the location and low impact nature of the Project).

The vegetation extent within the study area has been mapped as accurately as possible, although some boundary errors may still exist. Vegetation has been assigned to the most likely PCT described in the BioNet Vegetation Classification database. In many cases there are no sharp boundaries defining the transition between PCTs and communities are naturally variable. The vegetation within the study area have been mapped as best as possible based on observations during the site inspection and based on aerial imagery. It is likely that the boundaries of PCTs and vegetation zones will change with time and in response to long-term variation in environmental conditions such as rainfall, surface drainage patterns and anthropogenic disturbance.

This report was developed based on available data and the environmental condition of the study area at the time of the site inspection and development of this report. Environmental conditions, including the presence of threatened species, can vary with time. These potential limitations have been addressed by applying the precautionary principle in cases where the survey methodology may have given a false negative result (e.g., a species that could reasonably be expected to occur, based on previous records and available habitat, was not observed). All species (including threatened species) have been assessed on the basis of the presence of their habitat and the likely significance of that habitat to a viable local population.

3 Existing environment

The study area is located within the Cumberland IBRA Sub-region of the Sydney Basin IBRA region. This region is important for biodiversity, supporting several endemic flora and fauna species found only on the Cumberland Plain. Annual rainfall in the area exceeds 800 mm (BoM 2022).

The study area falls within the Hawkesbury Nepean Catchment and the Blacktown soil landscape, which is characterised by gently undulating rises on Wianamatta Group shale. Soils from the Blacktown soil landscape is derived from Ashfield Shale (Hazleton and Tille, 1990). The land consists of gently undulating land, sloping down to the Nepean River and Allens Creek at the southern and northern extents, respectively. The grade of the land becomes increasingly steep within the gullies. Soil within these areas is comprised of the Hawkesbury soil landscape and rock outcrops are prevalent.

At the southern extent of the Southern Hume site, the Pheasants Nest Bridge crosses the Nepean River, a 7th order watercourse. At the northern extent of the Northern Hume site, Moolgun Creek Bridge crosses Allens Creek, a 4th order stream. There are extensive areas of native open forest and woodland located along the gorges of the Nepean River and Allens Creek. This vegetation extends along lower order tributaries within the locality.

The proposal is located along the road reserves of the Hume Motorway, in two sections between Pheasants Nest Bridge and Moolgun Creek Bridge. Within this area, the Hume Motorway consists of 4 lanes of dual carriageway traffic with a speed limit of 110km/hr. Other land use zoning adjacent to the study include RU2 – Rural Landscape, R2 – Low Density Residential and C2 – Environmental Conservation mapped within the Wollondilly Local Environmental Plan (2011) and SP2 – Infrastructure and UD – Urban Development within the State Environmental Planning Policy (Precincts—Western Parkland City) 2021.

3.1 Landscape features

Table 3-1 identifies the relevant landscape features as required under Section 3.1 of the BAM. Figure 1 1 illustrates the landscape features on a Location Map.

Table 3-1: Landscape Features

Landscape features	Site Particular
Interim Biogeographic Regionalisation for Australia (IBRA) bioregions and subregions	Sydney Basin bioregion and Cumberland subregion
NSW landscape regions (Mitchell landscapes)	There are two mapped NSW landscape regions within the study area: • Upper Nepean Gorges; and • Picton- Razorback Hills The Upper Nepean Gorges was selected as the NSW landscape for analysis in the BAM-C.
Cleared areas	Patches of exotic vegetation are present within the study area. The study area occurs adjacent to open and cleared pasture lands, used for agricultural purposes, and areas of residential development, notably Bingara Gorge.

Landscape features	Site Particular
Rivers and streams	Several unnamed ephemeral drainage lines occur within the study area. These drainage lines discharge into the Nepean River, at the southern extent of the Southern Hume site, and Allens Creek, at the northern extent of the Northern Hume site. Two perennial waterways occur at the boundaries of the study area. At the southern extent of the Southern Hume site, the Pheasants Nest Bridge crosses the Nepean River, a 7th order watercourse. At the northern extent of the Northern Hume site, Moolgun Creek Bridge crosses Allens Creek, a 4th order stream.
Wetlands	There are no mapped or observed wetlands in the study area.
Connectivity features	The Hume Motorway bisects areas of core Koala habitat and primary corridors within the locality. Residential and agricultural development has also contributed to some fragmentation. Parts of extensive areas of native open forest and woodland, located along the gorges of the Nepean River and Allens Creek, form the southern and northern extents of the study area. The vegetated areas within the Southern Hume and Northern Hume sites fall into the north-east and south-west extents of the Nepean and Allens Koala corridors, respectively. These Koala movement corridors represent primary corridors with a high level of connectivity of core Koala habitat and are identified as being critical for the long-term viability of the regional Koala population in south-western Sydney (DPIE 2019c). The Nepean Koala corridor consists of over 1740ha of core Koala habitat and the Allens Koala corridor consists of over 1235ha of core Koala habitat. These corridors contain the largest areas of core Koala habitat within the region and provide connectivity to a number of smaller areas of primary, secondary and tertiary core Koala habitat. This habitat supports significant numbers of resident Koalas and is considered to be vital to the persistence of the regional population.
Areas of Geological Significance and Soil Hazard Features	There are no areas of geological significance and soil hazard features present within the study area.
Areas of outstanding biodiversity value	There are four declared areas of outstanding biodiversity value (AOBV) in NSW: • Gould's Petrel • Little Penguin population in Sydney's North Harbour • Mitchell's Rainforest Snail in Stotts Island Nature Reserve • Wollemi Pine. None of these areas occur within or nearby to the study area.

3.2 Habitat features

The study area extends to the Nepean River at Pheasants Nest Bridge and Allens Creek at Moolgun Creek Bridge. Beyond the abutments of these bridges, the grade of the land becomes increasingly steep within the gullies. As such, the study area includes cliffside habitat features, such as crevices and caves, which may provide suitable habitat for threatened species within the locality.

There are extensive areas of native open forest and woodland located along the gorges of the Nepean River and Allens Creek. High-quality aquatic habitat is also present within the Nepean River and Allens Creek (see section 3.7). As the fence ends will be tied to Pheasants Nest Bridge and Moolgun Creek Bridge, the subject land does not extend into the habitat provided within the gullies of the Nepean River and Allens Creek. Habitat within the subject land is restricted to patches of remnant vegetation, including, one small hollow-bearing tree, decorticating bark and woody debris.

A microbat roost site with guano was detected under the Pheasants Nest Bridge. Microbat surveys using acoustic detectors (ANABAT) were undertaken to determine the likely species occupying this roost site. Call analysis of collected call sequences was not able to confidently identify any known species. It should be noted that Southern Myotis (*Myotis macropus*) received a 'possible' rating and could not be confidently identified due to missing pulses in the call recording. As the roost is located behind tall fencing, appropriate flyways to conduct harp trapping, in accordance with the BAM guidelines, are not present and confirmation of the species is not possible. *Myotis macropus* may be present within transport structures at any time of the year (TfNSW 2021). Other threatened microbat species often recorded in transport structures (Bent-winged Bats) are not known to breed in these structures, however may roost in transport structures outside of their breeding period (from March to October). Based on the timing of the microbat surveys (October and November) and the possible recorded call sequence, it is assumed that Southern Myotis (*Myotis macropus*) are present within the study area.

Photo 3-1: Microbat roost (orange arrow) and guano (red arrow) under the Pheasants Nest Bridge

The study area also includes rocky batters and ephemeral drainage lines. Due to the abundance of intact vegetation within the locality, particularly within the Nepean and Allens corridors, it is considered unlikely that fauna within the locality would be dependent on any habitat provided by vegetation within the subject land. Habitat within the subject land may provide potential foraging habitat for a number of species, however it is likely to be used on a transitionary basis.

3.3 Plant community types and vegetation zones

Vegetation within the study area is comprised of one PCT being PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland

Plain, Sydney Basin Bioregion, in three broad condition classes. Where PCTs have been delineated into vegetation zones through broad condition categories, classification has been determined through the final VIS score for a vegetation zone. In accordance with Section 9.2.1 of the BAM and TfNSW guidelines the following classification rules for low condition zones have been applied:

- VI Score <15, where the PCT is representative of an EEC or a CEEC
- VI Score <17, where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or represents a vulnerable ecological community
- VI Score <20, where the PCT does not represent a TEC and is not associated with threatened species habitat.

Vegetation zones classified 'moderate to good' condition are any that obtain a VI Score above the listed thresholds. There are also areas of mapped exotic vegetation within the study area that cannot be attributed to any known PCT.

A summary of vegetation detected within the study area is provided in Table 3 2 and illustrated in Figure 3-1 and Figure 3-2.

Table 3-2: Plant community types and vegetation zones

Veg. zone	Plant community type (PCT)	Condition class	Vegetation integrity score (VIS score)	Threatened ecological community	Area (ha)	
					Subject land	Study area
1	PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Good	65.5	Critically endangered (BC Act and EPBC Act)	0.31	2.64
2		Moderate-Good	55.4	Critically endangered (BC Act)	0.20	2.30
3		Moderate	30	Critically endangered (BC Act)	0.10	1.27
-	Exotic	-	-	-	0.23	1.86
-	Cleared land	-	-	-	0.23	1.46
Total					1.07	9.53

PICTON ROAD

HUME MOTORWAY

NEPEAN RIVER

EMMA LANE

PCTs and Habitat Features (Southern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-012
Drawn By: MD, Checked By: MM
Figure No: 3-1 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Ground-truthed Vegetation

- PCT 1395 Good
- PCT 1395 Moderate - Good
- PCT 1395 Moderate
- Exotic

Habitat Feature

- Dam
- Burrow
- Termite Mound
- Microbat Roost
- Drainage Culvert
- Hollow-bearing Tree
- Rocky Outcrop / Batter

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

PCTs and Habitat Features (Northern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-013
Drawn By: MD, Checked By: MM
Figure No: 3-2 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Habitat Feature

- Dam
- Burrow
- Termite Mound
- Drainage Culvert
- Rocky Outcrop / Batter

Ground-truthed Vegetation

- PCT 1395 Good
- PCT 1395 Moderate - Good
- PCT 1395 Moderate
- Exotic

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.3.1 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395

Vegetation formation: Grassy woodland

Vegetation class: Coastal Valley Grassy Woodlands

PCT ID: 1395

Conservation status: Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act (see Section 3.3 for determination test). Shale Sandstone Transition Forest of the Sydney Basin Bioregion – listed as critically endangered under the EPBC Act (see Section 3.10 for determination and condition tests).

Estimate of percent cleared: 80 %

Vegetation zones (condition) and plots:

- Zone 1 (Good) – Plots 2, 5
- Zone 2 (Moderate-Good) – Plots 1, 4
- Zone 3 (Moderate) – Plots 3, 6

Description:

Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395) is a grassy woodland occurring on transitional shale-sandstone soils around the edge of the Cumberland Plain. The community is associated with elevations up to 350 metres above sea level (ASL).

Plant Community Type (PCT) 1395 was the only native vegetation community detected within the study area. This PCT is located on elevations of 120 metres to 190 metres ASL and occupies approximately 6.20 ha within the study area.

Based on the descriptions in the BioNet Vegetation Classification, PCT 1395 typically has a canopy dominated by Narrow-leaved Ironbark (Eucalyptus crebra), Red Ironbark (Eucalyptus fibrosa), Grey Gum (Eucalyptus punctata) and Black She-oak (Allocasuarina littoralis). The midstorey is characteristic of Narrow-leaved Geebung (Persoonia linearis), Native Blackthorn (Bursaria spinosa) and Rough Guinea Flower (Hibbertia aspera). The ground layer mostly consists of Kangaroo Grass (Themeda australis), Many-flowered Mat-rush (Lomandra multiflora), Kidney Weed (Dichondra repens) and Weeping Grass (Microlaena stipoides). Other species can also occur in each stratum.

The canopy of PCT 1395 within the study area was characterised by the presence of Grey Gum (Eucalyptus punctata) and Red Ironbark (Eucalyptus fibrosa) with occurrences of Black She-oak (Allocasuarina littoralis). The regular occurrence of Black She-oak (Allocasuarina littoralis) differentiated the vegetation community from other similar occurring PCTs. Native Blackthorn (Bursaria spinosa) and Tick Bush (Kunzea ambigua) were frequently detected as well as exotic shrub species such as Lantana (Lantana camara). The groundcover remained similar across the PCT and zone with slight variations of exotic coverage due to edge effects and disturbances. Table 3 3 summarises some of the typical species detected within the study area.

Plant Community Type (PCT) 1395 occurred in three broad condition categories within the study area:

- Good (vegetation zone 1) – this condition class is characteristic of a reduced exotic coverage and exhibits a broad native diversity in all stratums. This vegetation zone is generally found away from the roadside and closer to each bridge as ‘edge effects’ from the Hume Highway are not as prevalent in this zone;
- Moderate-Good (vegetation zone 2) – this condition class has an increased level of exotic coverage and is marginally impacted by ‘edge effects’ from the Hume Highway. This vegetation zone still exhibits a diverse range of tree sizes and native floristic coverage; and

- Moderate (vegetation zone 3) – this condition class has a high abundance of exotic species and coverage due to an increase in 'edge effects' from the Hume Highway. Generally, this zone did not have a diverse native ground coverage.

Table 3-3:Floristic and structural summary of PCT 1395 within the study area

Growth form	Typical species
Trees	Grey Gum (*Eucalyptus punctata*), Red Ironbark (*Eucalyptus fibrosa*), Black She-oak (*Allocasuarina littoralis*), Red Bloodwood (*Corymbia gummifera*)
Shrubs	Native Blackthorn (*Bursaria spinosa*), Tick Bush (*Kunzea ambigua*), Narrow-leaved Geebung (*Persoonia linearis*)
Grass and grass-like	Kangaroo Grass (*Themeda australis*), Blady Grass (*Imperata cylindrica*), Weeping Grass (*Microlaena stipoides*), Three-awn Speargrass (*Aristida vagans*)
Forb	Kidney Weed (*Dichondra repens*), Pomax (*Pomax umbellata*), Yellow-flowered Wood Sorrel (*Oxalis perrenans*)
Fern	Common Maidenhair (*Adiantum aethiopicum*), Rock Fern (*Cheilanthes austrotenuifolia*)
Other	Twinning Glycine (*Glycine tabacina*), Native Passionfruit (*Passiflora herbertiana*), Dusky Coral Pea (*Kennedia rubicunda*)
Exotic	Spear Thistle (*Cirsium vulgare*), Scarlet Pimpernell (*Anagallis arvensis*), Ribwort (*Plantago lanceolata*)
High Threat Exotic	Cobbler's Pegs (*Bidens pilosa*), Lantana (*Lantana camara*), Blackberry (*Rubus fruticosus*), Fireweed (*Senecio madagascariensis*)

Photo 3-2: Plot 5 showing vegetation zone 1 (PCT 1395 - good)

Photo 3-3: Plot 6 showing vegetation zone 2 (PCT 1395 – moderate-good)

Photo 3-4: Plot 4 showing vegetation zone 3 (PCT 1395 - moderate)

3.3.2 Other vegetation

3.3.2.1 Exotic

There are areas of vegetation mapped within the study area that do not conform to any known native PCT due to exotic species abundance. A total of 28 exotic species were recorded in the study area (see Appendix D for full floristics list). Eight of the exotic species recorded within the study area have a listing at National, State and/or local level (see Section 5.2.4) as:

- Weed of National Significance (WoNS): the national weed strategy (Invasive Plants and Animal Committee (IPAC), 2017) recognises WoNS as species that are a current or future threat to Australia, which require coordinated and strategic management to prevent, eradicate contain and/or minimise their economic, environmental and/or social impacts;
- High threat weeds (HTWs): are exotic species listed considered in the BAM and listed under the BC Act. High threatened weeds (HTW) are plants not native to Australia that, if not controlled, will invade and outcompete native species (NSW DPIE, 2020a). These exotic plants are required to be managed and controlled; or
- Priority weeds (PWs): are exotic species recognised as part of the NSW Biosecurity Act 2015 as requiring specific management. The management of PWs is identified in the weed strategy for each Local Land Service (LLS) region. The Wollondilly LGA is part of the Greater Sydney LLS region.

Photo 3-5: Exotic vegetation within the study area

3.3.2.2 Cleared land

Cleared land within the study area included all hardstand areas, including the existing Hume Highway and associated infrastructure. Cleared land often consisted of an absent canopy and middle strata with occurrences of exotic/native species. The ground layer was consistent with being a mix of native and exotic species, however not constituting as native grassland areas due to the presence of exotic species (>50 % coverage). Historic and ongoing clearing, maintenance and disturbance has assisted in the reduction in biodiversity values in these areas.

Photo 3-6: Cleared land (hardstand) within the study area

3.4 Threatened ecological communities

Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395) is associated with the TEC: Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act. The identified PCT 1395 within the study area was assessed against the listing descriptions of the TEC in Table 3 4.

Table 3-4: Final determination description review for Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act

Characteristics	Final determination reference	Characteristics of PCT 1395 within the subject land
Location	*Paragraph 2:* Shale Sandstone Transition Forest occurs or has occurred in the Bankstown, Baulkham Hills, Blue Mountains, Campbelltown, Hawkesbury, Liverpool, Parramatta, Penrith, and Wollondilly Local Government Areas (LGA).	Meets final determination reference. The subject land is within the Wollondilly LGA.
Soil and landscape	*Paragraph 1:* Occurs on areas transitional between the clay soils derived from Wianamatta Shale and the sandy soils derived from Hawkesbury Sandstone on the margins of the Cumberland Plain. All sites are within the Sydney Basin Bioregion.	Meets final determination reference. Subject land is within the Sydney Basin Bioregion and Cumberland subregion. Based on derived Hawkesbury Sandstone.
	Paragraph 9: Shale Sandstone Transition Forest generally occurs on soils derived from a shallow shale or clay material overlying sandstone, or where shale-derived materials has washed down over sandstone-derived substrate. Such sites are generally close to the geological boundary between the Wianamatta Shale and the Hawkesbury Sandstone.	Meets final determination reference. Subject land occurs on a boundary between the Wianamatta Shale and Hawkesbury Sandstone.
Floristic composition	*Paragraph 4:* Shale Sandstone Transition Forest is characterised by the assemblage of species listed in the final determination.	Meets final determination reference. Of the 105 species listed in the final determination, 28 were recorded in PCT 1395.

Characteristics	Final determination reference	Characteristics of PCT 1395 within the subject land
	Paragraph 6: Shale Sandstone Transition Forest has an understorey which may be either grassy and herbaceous or of a shrubby nature. In areas that have not been burnt for an extended period of time the understorey may be dense.	Meets final determination reference. Vegetation varies from an open grassland and shrubby understory within the subject land.
Characteristic tree species	*Paragraph 5:* Characteristic tree species in Shale Sandstone Transition Forest are; Eu*calyptus punctata, Eucalyptus resinifera*, one of the stringybarks (*Eucalyptus globoidea, Eucalyptus eugenioides, Eucalyptus sparsifolia, Eucalyptus agglomerata*). One or more ironbarks (*Eucalyptus fibrosa, Eucalyptus crebra, Eucalyptus paniculata, Eucalyptus beyeriana*) may be locally important.	Meets final determination reference. Dominant tree species within the subject land include *Eucalyptus punctata* and *Eucalytpus fibrosa*.
Disturbance	*Paragraph 14:* A large proportion of the area where Shale Sandstone Transition Fore occurred in the past has been cleared for agriculture and urban development. Remnants are small and scattered. Identified threats include clearing, physical damage from recreational activities, rubbish dumping, grazing, mowing and weed invasion.	Meets final determination reference. Land adjacent to the subject land has been historically cleared for agricultural/farming practices.

PICTON ROAD
HUME MOTORWAY
WILTON
NEPEAN RIVER
EMMA LANE
PHEASANTS NEST

Threatened Ecological Communities (Southern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-014
Drawn By: MD, Checked By: MM
Figure No: 3-3 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Threatened Ecological Community (EPBC Act) - Ground-truthed

- Shale Sandstone Transition Forest of the Sydney Basin Bioregion - CE

Threatened Ecological Community (BC Act) - Ground-truthed

- Shale Sandstone Transition Forest in the Sydney Basin Bioregion - CE

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery supplied by MetroMap (September, 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Threatened Ecological Communities (Northern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-015
Drawn By: MD, Checked By: MM
Figure No: 3-4 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Threatened Ecological Community (EPBC Act) - Grouth-truthed

- Shale Sandstone Transition Forest of the Sydney Basin Bioregion - CE

Threatened Ecological Community (BC Act) - Grouth-truthed

- Shale Sandstone Transition Forest in the Sydney Basin Bioregion - CE

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.5 Groundwater dependent ecosystems

The level of groundwater dependence of PCTs in the subject land has been determined using the Atlas of Groundwater Dependent Ecosystems (GDE) (BoM, 2021). The Atlas of Groundwater Dependent Ecosystems provides broad-scale mapping of potential GDEs and has been used with contemporary, location-specific data collected as part of this BAR to determine the presence of GDEs. PCT characteristics, including vegetation class based on the Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT (Keith, 2004), were used to determine and categorise GDEs in the study area.

The Nepean River is considered a moderate potential aquatic GDE that occurs within proximity to the subject land.

There are a number of terrestrial GDEs identified in proximity to the subject land including:

- Sandstone riparian scrub forest – moderate potential terrestrial GDE;
- Hinterland sandstone gully forest – high potential terrestrial GDE; and
- Cumberland River Flat Forest – high potential terrestrial GDE.

Plant Community Type (PCT) 1395 is considered a grassy woodland and does not conform to any of the listed terrestrial GDEs identified in proximity to the subject land (Keith, 2004). Therefore, it is unlikely that any GDEs would be directly impacted by the proposal. GDEs in proximity to the subject land are illustrated in Figure 3 5.

Groundwater Dependant Ecosystems

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-016
Drawn By: MD, Checked By: MM
Figure No: 2-3 | Rev: 03
Date: 2024-01-11

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre
- Terrestrial Groundwater Dependant Ecosystems

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)
4. Groundwater dependant ecosystems (DPE, 2021)

0 150 300 450 600 750 Metres

Scale at A3 1:15,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.6 Threatened species

3.6.1 Likelihood of occurrence results

A broad diversity of threatened species have been recorded within the more intact vegetation along the valleys of the Nepean River and Allens Creek. A review of the NSW DPE BioNet Atlas, NSW DPI Fisheries Spatial Data Portal and the DAWE Protected Matters Search Tool identified 108 threatened species with the potential to occur in the study area. Species were inclusive of 42 flora, 34 birds, 19 mammals, six amphibians, three reptiles, three invertebrates and one fish.

Migratory species listed under the EPBC Act are discussed in section 3.10.2

No threatened species were observed during the field survey (possible Southern Myotis (Myotis macropus) detected and assumed present), however, potential habitat for some threatened species occurs within the study area. An assessment of the likelihood of occurrence of all threatened species, based on habitat within the study area, was carried out to determine the potential for these species to occur within the study area. The rationale behind the assessment is attached in Appendix C.

Due to the presence of suitable habitat in the study area, 48 species were considered to have a moderate to high likelihood of occurrence prior to survey. These species are outlined in Table 3 5. Following targeted surveys, 39 species were considered to have a moderate to high likelihood within the study area (Appendix C). Assessments of significance were completed for for these species and are provided in Appendix E.

Table 3-5: Threatened species with a moderate or high likelihood of occurrence prior to survey

Scientific Name	Common Name	BC Act	EPBC Act	Source	Credit type	Likelihood of Occurrence prior to survey
Flora						
Acacia bynoeana	Bynoe's Wattle	E	V	47 (BioNet) BAM-C	Species	Moderate
Epacris purpurascens var. purpurascens	-	V	-	286 (BioNet) BAM-C	Species	Moderate
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	551 (BioNet) BAM-C	Species	Moderate
Melaleuca deanei	Deane's Paperbark	V	V	43 (BioNet) BAM-C	Species	Moderate
Persoonia bargoensis	Bargo Geebung	E	V	623 (BioNet) BAM-C	Species	Moderate
Persoonia hirsuta	Hairy Geebung	E	E	8 (BioNet) BAM-C	Species	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Credit type	Likelihood of Occurrence prior to survey
Pimelea curviflora var. curviflora	-	V	V	2 (BioNet) BAM-C	Species	Moderate
Pomaderris brunnea	Brown Pomaderris	E	V	16 (BioNet) BAM-C	Species	Moderate
Birds						
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	43 (BioNet)	Ecosystem	Moderate
Burhinus grallarius	Bush Stone-curlew	E	-	2 (BioNet) BAM-C	Species	Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	15 (BioNet), PMST BAM-C	Dual	Moderate
Calyptorhynchus lathami lathami	Glossy Black-Cockatoo	V	V	45 (BioNet), PMST BAM-C	Dual	Moderate
Chthonicola sagittata	Speckled Warbler	V	-	4 (BioNet)	Ecosystem	Moderate
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	22 (BioNet)	Ecosystem	Moderate
Daphoenositta chrysoptera	Varied Sittella	V	-	46 (BioNet)	Ecosystem	Moderate
Glossopsitta pusilla	Little Lorikeet	V	-	62 (BioNet)	Ecosystem	Moderate
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	7 (BioNet) BAM-C	Dual	Moderate
Hieraaetus morphnoides	Little Eagle	V	-	17 (BioNet) BAM-C	Dual	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Credit type	Likelihood of Occurrence prior to survey
Hirundapus caudacutus	White-throated Needletail	-	V,C,J,K	6 (BioNet), PMST	Ecosystem	Moderate
Lathamus discolor	Swift Parrot	E	CE	5 (BioNet), PMST BAM-C	Dual	Moderate
Lophoictinia isura	Square-tailed Kite	V	-	9 (BioNet) BAM-C	Dual	Moderate
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	10 (BioNet)	Ecosystem	Moderate
Neophema pulchella	Turquoise Parrot	V	-	4 (BioNet)	Ecosystem	Moderate
Ninox connivens	Barking Owl	V	-	2 (BioNet) BAM-C	Dual	Moderate
Ninox strenua	Powerful Owl	V	-	31 (BioNet) BAM-C	Dual	Moderate
Petroica boodang	Scarlet Robin	V	-	25 (BioNet)	Ecosystem	Moderate
Petroica phoenicea	Flame Robin	V	-	2 (BioNet)	Ecosystem	Moderate
Stagonopleura guttata	Diamond Firetail	V	-	12 (BioNet)	Ecosystem	Moderate
Tyto novaehollandiae	Masked Owl	V	-	3 (BioNet) BAM-C	Dual	Moderate
Invertebrates						
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	47 (BioNet) BAM-C	Species	Moderate
Fish						

Scientific Name	Common Name	BC Act	EPBC Act	Source	Credit type	Likelihood of Occurrence prior to survey
Macquaria australasica	Macquarie Perch	E	E	PMST	NA	Moderate*
Mammals						
Cercartetus nanus	Eastern Pygmy-possum	V	-	31 (BioNet) BAM-C	Species	Moderate
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	28 (BioNet), PMST BAM-C	Species	Moderate
Dasyurus maculatus	Spotted-tailed Quoll	V	E	10 (BioNet), PMST	Ecosystem	Moderate
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	9 (BioNet)	Ecosystem	Moderate
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	27 (BioNet)	Ecosystem	Moderate
Miniopterus australis	Little Bent-winged Bat	V	-	12 (BioNet) BAM-C	Dual	Moderate
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	32 (BioNet) BAM-C	Dual	Moderate
Myotis macropus	Southern Myotis	V	-	194 (BioNet) BAM-C	Species	Moderate/Possible detection/ Assumed present
Petauroides volans	Greater Glider (southern and central)	-	E	15 (BioNet), PMST BAM-C	Species	Moderate
Petaurus australis	Yellow-bellied Glider (south-eastern)	V	V	3 (BioNet), PMST	Ecosystem	Moderate
Petaurus norfolcensis	Squirrel Glider	V	-	8 (BioNet) BAM-C	Species	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Credit type	Likelihood of Occurrence prior to survey
Phascolarctos cinereus	Koala	E	E	1192 (BioNet), PMST BAM-C	Species	High
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	99 (BioNet), PMST BAM-C	Dual	Moderate
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	5 (BioNet)	Ecosystem	Moderate
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	19 (BioNet)	Ecosystem	Moderate
Reptiles						
Hoplocephalus bungaroides	Broad-headed Snake	E	V	28 (BioNet), PMST BAM-C	Dual	Moderate
Varanus rosenbergi	Rosenberg's Goanna	V	-	4 (BioNet)	Ecosystem	Moderate

V = vulnerable; E = endangered; CE = critically endangered

*Moderate likelihood of occurrence within the study area but unlikely within the subject land.

3.6.2 Candidate species

Species credit species and dual credit species are species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features. These species are considered to be 'candidate species' and require targeted survey, habitat assessment or expert report to confirm presence/absence from the subject land. Without targeted survey in accordance with the relevant survey guidelines or an expert report, these species are assumed to be present and must be considered in the impact assessment. Table 3 6 identifies all species credit species and dual credit species considered as part of this assessment and the results of targeted surveys.

Table 3-6: Threatened species surveys results

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Flora					

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Acacia bynoeana (Bynoe's Wattle)	E	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Epacris purpurascens var. purpurascens	V	-	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Grevillea parviflora subsp. parviflora (Small-flower Grevillea)	V	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Melaleuca deanei (Deane's Paperbark)	V	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Persoonia bargoensis (Bargo Geebung)	E	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Persoonia hirsuta (Hairy Geebung)	E	E	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Pimelea curviflora var. curviflora	V	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Pomaderris brunnea (Brown Pomaderris)	E	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Birds					
Anthochaera phrygia (Regent Honeyeater	CE	CE	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. The study area does not occur within mapped important habitat for the species. This species has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.
Burhinus grallarius (Bush Stone-curlew)	E	-	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.
Callocephalon fimbriatum (Gang-gang Cockatoo)	V	E	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Calyptorhynchus lathami (Glossy Black-Cockatoo)	V	V	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.
Haliaeetus leucogaster (White-bellied Sea-Eagle)	V	-	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.
Hieraaetus morphnoides (Little Eagle)	V	-	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.
Lathamus discolor (Swift Parrot)	E	CE	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. The study area does not occur within mapped important habitat for the species. This species has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Lophoictinia isura (Square-tailed Kite)	V	-	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.
Ninox connivens (Barking Owl)	V	-	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it. No suitable breeding hollows occur within the study area.
Ninox strenua (Powerful Owl)	V	-	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it. No suitable breeding hollows occur within the study area.

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Tyto novaehollandiae (Masked Owl)	V	-	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it. No suitable breeding hollows occur within the study area.
Reptiles					
Hoplocephalus bungaroides (Broad-headed Snake)	E	V	Not recorded	Yes	Dual Credit species This species is associated with PCT 1395, however was not detected during targeted surveys. It has the potential to use habitat within the study area on a transitionary basis but would not be dependent on it.
Mammals					
Cercartetus nanus (Eastern Pygmy-possum)	V	-	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Chalinolobus dwyeri (Large-eared Pied Bat)	V	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Miniopterus australis (Little Bent-winged Bat)	V	-	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. No suitable breeding habitat occurs within the study area.
Miniopterus orianae oceanensis (Large Bent-winged Bat)	V	-	Not recorded	Yes (Outside of survey period, however no available habitat occurs within the subject land)	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. No suitable breeding habitat occurs within the study area.
Myotis macropus (Southern Myotis)	V	-	Possible recording	Yes	Species Credit species. This species is associated with PCT 1395. This species received a 'possible' result following call analysis. This species has been assumed present and an appropriate species polygon has been applied 'PCTs that are within 200m of mapped waterbodies' (OEH, 2018b). Approximately 0.09 ha of suitable habitat would be removed.
Petauroides volans (Greater Glider)	-	E	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? [1]	Results
Petaurus norfolcensis (Squirrel Glider)	V	-	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Phascolarctos cinereus (Koala)	E	E	Not recorded	Yes	Dual Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys. Suitable habitat occurs within the study area.
Pteropus poliocephalus (Grey-headed Flying-fox)	V	V	Not recorded	Yes	Dual Credit species. No breeding camps occur within the study area.
Gastropods					
Meridolum corneovirens (Cumberland Plain Land Snail)	E	-	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
Amphibians					
Heleioporus australiacus (Giant Burrowing Frog)	V	V	Not recorded	Yes	Species credit species. No suitable habitat is present within the study area.
Litoria littlejohni (Littlejohn's Tree Frog)	V	V	Not recorded	Yes	Species credit species. No suitable habitat is present within the study area.
Mixophyes balbus (Stuttering Frog)	E	V	Not recorded	Yes	Species credit species. No suitable habitat is present within the study area.

Note: 1. As identified in Section 2.4 of this BAR.

PICTON ROAD
HUME MOTORWAY
WILTON
NEPEAN RIVER
EMMA LANE
PHEASANTS NEST

Threatened Species (Southern Hume)

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-018
Drawn By: MD, Checked By: MM
Figure No: 3-6 | Rev: 03
Date: 2024-01-12

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

Species Credit Species

- Southern Myotis (Possible)
- Southern Myotis

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)

0 25 50 75 100 125 Metres

Scale at A3 1:3,000

This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.7 Aquatic results

Two perennial waterways occur at the boundaries of the study area. At the southern extent of the Southern Hume site, the Pheasants Nest Bridge crosses the Nepean River, a 7th order watercourse. At the northern extent of the Northern Hume site, Moolgun Creek Bridge crosses Allens Creek, a 4th order stream. Several unnamed ephemeral creek/drainage lines also occur within the study area. These drainage lines and watercourses discharge into the Nepean River and Allens Creek and were not flowing at the time of surveys.

Both the Nepean River and Allens Creek are mapped as Key Fish Habitat (KFH) within the Hawkesbury-Nepean catchment. Both the Nepean River and Allens Creek are identified as habitat for Macquarie Perch (Macquaria australasica), listed as endangered under the FM Act and EPBC Act, within the Fisheries NSW Spatial Data Portal threatened species distribution mapping. The potential distribution for this species occurs outside the subject land and the proposal would not directly impact available habitat for the species. Aquatic results are shown in Figure 3 7.

Due to the nature and extent of the proposal, an assessment of significance for potential threatened aquatic species has not been completed as part of this BAR.

RAZORBACK
DOUGLAS PARK
KARKANAH STREET
BUTLER DRIVE
FAIRWAY DRIVE
KIRKWOOD CHASE
WILTON
HUME MOTORWAY
STIRLING DRIVE
MACANENE STREET
STRINGYBARK DRIVE
CHARLTON STREET
WILTON PARK ROAD
CONDELL PARK ROAD
GREENBRIDGE DRIVE
KELSO STREET
PICTON ROAD
PEMBROKE PARADE
CHISOLM STREET
BEATTY STREET
SHEARER AVENUE
BROUGHTON STREET
ALMOND STREET
JANDERRA LANE
EMMA LANE
HEPPER PARKWAY
HORNBY STREET
GREENWAY PARADE
LONGVIEW DRIVE
PHEASANTS NEST
ESEN WAY
FIRETRAIL NO 11A

Aquatic Habitat

Koala Fencing
Wilton, NSW

Project Code: 304500765-GS-017
Drawn By: MD, Checked By: MM
Figure No: 3-6 | Rev: 03
Date: 2024-01-12

Stantec

Legend

- Study Area
- Subject Land
- Major Road
- Macquarie Perch Indicative Distribution
- Cadastre
- Wollondilly Key Fish Habitat

Stream Order

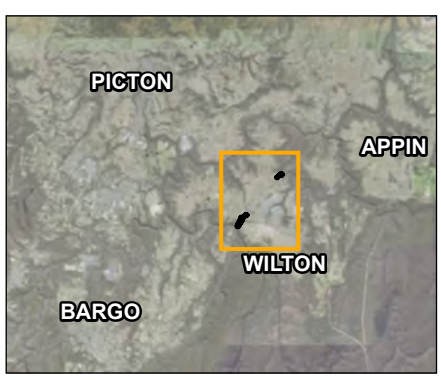
- 1, 2
- 3
- 4
- 6
- 7

Notes:
1. Coordinate System: GDA2020 MGA Zone 56

References:
1. Aerial imagery (MetroMap, September 2021)
2. Roads and Watercourses (NSW SS)
3. Cadastre (NSW SS, 2022)
4. Macquarie perch indicative distribution, Stream order and Key fish habitat (DPI)

0 150 300 450 600 750 Metres

Scale at A3 1:15,000



This document has been prepared based on information provided by others as cited in the data sources. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

3.8 Areas of outstanding biodiversity value

There are four declared areas of outstanding biodiversity value (AOBV) in NSW:

- Gould's Petrel
- Little Penguin population in Sydney's North Harbour
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve
- Wollemi Pine.

No AOBV occur within the study area. The closest AOBV to the study area is the Little Penguin population in Sydney's North Harbour, located approximately 70km north-east of the study area.

3.9 Wildlife connectivity corridors

The vegetated areas within the Southern Hume and Northern Hume sites fall into the north-east and southwest extents of the Nepean and Allens Koala corridors, respectively. These movement corridors represent primary corridors with a high level of connectivity for a vast number of native fauna species that frequent the locality.

The Nepean Koala corridor consists of over 1740 ha of core Koala habitat and the Allens Koala corridor consists of over 1235 ha of core Koala habitat. These corridors contain the largest areas of core Koala habitat within the region and provide connectivity to a number of smaller areas of primary, secondary and tertiary core Koala habitat (DPIE 2019c). This habitat supports significant numbers of resident Koalas and is considered to be vital to the persistence of the regional population. Remnant vegetation within the study area may facilitate the movement of Koalas between these corridors.

The Hume Motorway bisects areas of core Koala habitat and primary corridors within the locality. Residential and agricultural development has also contributed to some fragmentation. The areas underneath Pheasants Nest Bridge and Moolgun Creek Bridge provide existing corridors for movement underneath the Hume Motorway and along the Nepean River and Allens Creek, respectively. The proposal will facilitate the dispersal of Koala, and other fauna, through existing corridors within the locality, channelling fauna to existing crossings under the Motorway.

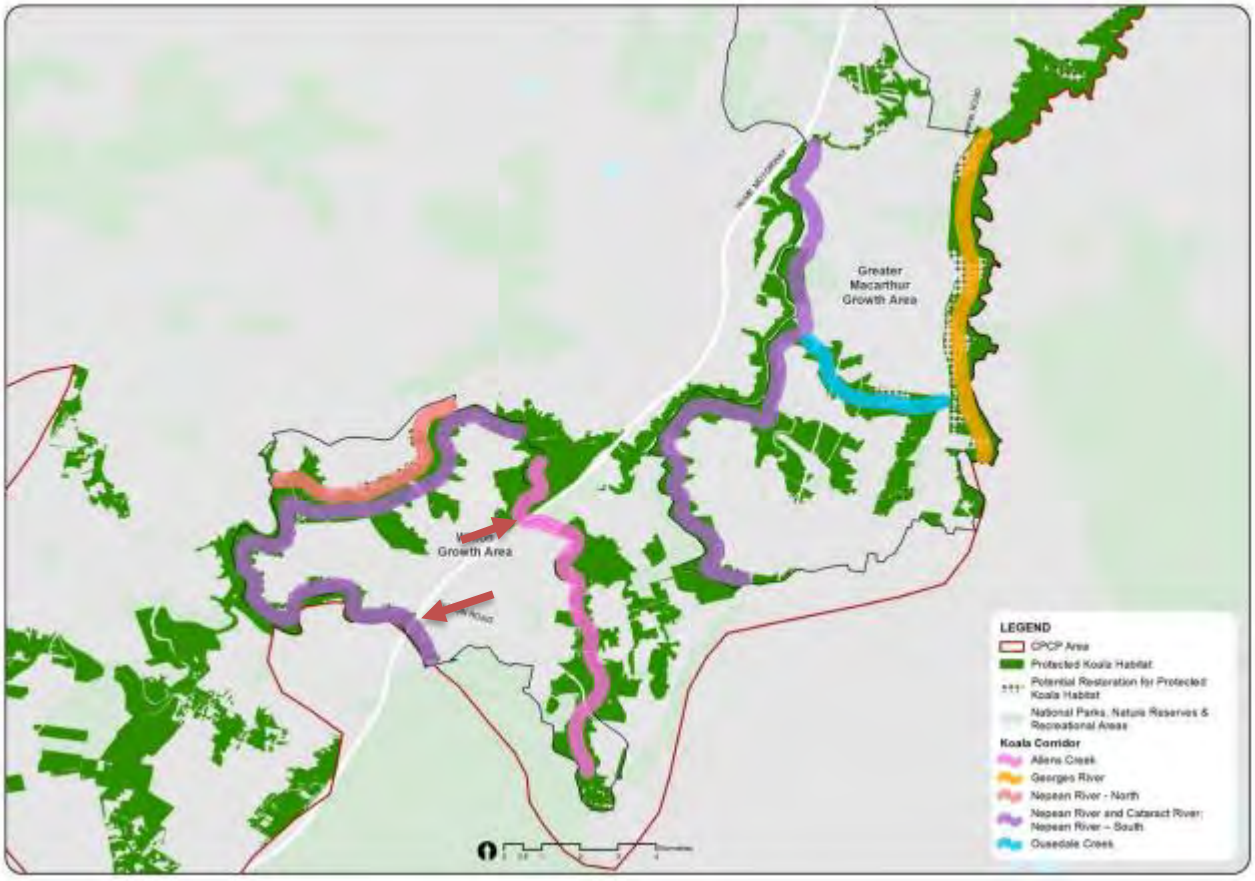


Figure 3-8: Identified Koala corridors (study area location represented by red arrows) (DPIE 2019c)

3.10 Matters of national environmental significance

There are nine types of Matters of National Environmental Significance (MNES) listed under the EPBC Act. Actions that have, or are likely to have, a significant impact on these MNES would require approval from the Australian Government Minister for the Environment (Commonwealth Minister). Of the nine types of MNES, two are potentially relevant to the proposal:

- Listed threatened species and ecological communities; and
- Migratory species

Threatened species and ecological communities listed under the EPBC Act are considered as MNES and are considered in the below sections.

Table 3 7 summarises MNES and their applicability to the subject land as per the Protected Matters Search Tool (PMST) (see Appendix B).

Table 3-7: MNES and their applicability to the subject land

MNES	PMST predicted	Applicability to subject land
World Heritage Places	None	NA
National Heritage Places	None	NA
Wetlands of International Importance	None	NA

<table>
<tr><th>MNES</th><th>PMST predicted</th><th>Applicability to subject land</th></tr>
<tr><td>Great Barrier Reef Marine Park</td><td>None</td><td>NA</td></tr>
<tr><td>Commonwealth Marine Area</td><td>None</td><td>NA</td></tr>
<tr><td>Threatened Ecological Communities (TECs)</td><td>A total of 13 TECs are predicted as likely or may occur within 10km of the subject land, including:
• Four endangered TECs; and
• Nine critically endangered TECs</td><td>Further assessment is presented in Section 3.4</td></tr>
<tr><td>Threatened Species</td><td>A total of 66 threatened species were predicted to occur within 10km of the subject land as per table below.
<table>
<tr><th>Group</th><th colspan="3">Number of species predicted</th></tr>
<tr><th></th><th>Vulnerable</th><th>Endangered</th><th>Critically endangered</th></tr>
<tr><td>Birds</td><td>4</td><td>4</td><td>4</td></tr>
<tr><td>Fish</td><td>-</td><td>1</td><td>-</td></tr>
<tr><td>Frogs</td><td>3</td><td>2</td><td>-</td></tr>
<tr><td>Mammals</td><td>7</td><td>3</td><td>-</td></tr>
<tr><td>Plants</td><td>21</td><td>12</td><td>2</td></tr>
<tr><td>Reptiles</td><td>2</td><td>-</td><td>-</td></tr>
<tr><td>Insects</td><td>-</td><td>1</td><td>-</td></tr>
</table></td><td>Further assessment is presented in Section 3.6</td></tr>
<tr><td>Migratory Species</td><td>A total of 16 migratory species were predicted to occur within 10km of the subject land.</td><td>Further assessment is presented in Section3.10</td></tr>
<tr><td colspan="3">Other matters</td></tr>
<tr><td>Commonwealth Lands</td><td>A total of 11 Commonwealth land parcels were predicted to occur within 10km of the subject land.</td><td>Listed Commonwealth lands do not occur within the subject land</td></tr>
<tr><td>Commonwealth Heritage Places</td><td>None</td><td>NA</td></tr>
<tr><td>Listed Marine Species</td><td>A total of 22 Listed Marine Species were predicted to occur within 10km of the subject land.</td><td>Further assessment of threatened species was undertaken as shown in Appendix B.</td></tr>
<tr><td>Whales and Other Cetaceans</td><td>None</td><td>NA</td></tr>
<tr><td>Critical Habitats</td><td>None</td><td>NA</td></tr>
<tr><td>Commonwealth Reserves Terrestrial</td><td>None</td><td>NA</td></tr>
<tr><td>Australian Marine Parks</td><td>None</td><td>NA</td></tr>
<tr><td>Habitat Critical to the Survival of Marine Turtles</td><td>None</td><td>NA</td></tr>
</table>

3.10.1 Threatened ecological communities

Plant Community Type (PCT) 1395 is associated with Shale Sandstone Transition Forest of the Sydney Basin Bioregion - listed as critically endangered under the EPBC Act. The identified PCT 1395 within the study area was assessed against the key diagnostic characteristics of the TEC in Table 3 7.

Table 3-8: Review of key diagnostic characteristics for Shale Sandstone Transition Forest of the Sydney Basin Bioregion - listed as critically endangered under the EPBC Act

Key diagnostic characteristic	Characteristics of PCT 1395 within the subject land
Limited to the Sydney Basin Bioregion (IBRA v7)	Meets key diagnostic characteristic. The subject land is located within the Sydney Basin Bioregion.
Occurs at the transition between shales and sandstones of the Wianamatta and Hawkesbury Groups, including the transitional Mittagong Formation.	Meets key diagnostic characteristic. Subject land based on derived Hawkesbury Sandstone.
Occurs as forest or woodland and may have a primarily shrubby or primarily grassy understorey, or be a mixture.	Meets key diagnostic characteristic. Vegetation varies from an open grassland and shrubby understory within the study area.
The canopy is a mix of native tree species typically including two or more of the following: *Eucalyptus punctata* (grey gum), *E. crebra* (narrow-leaved ironbark), *E. fibrosa* subsp. *fibrosa* (broad-leaved ironbark), *E. tereticornis* subsp. *tereticornis* (forest red gum), *E. resinifera* subsp. *resinifera* (red mahogany), *E. eugenioides* (or *E. globoidea* depending on local species present and degree of sandstone influence) and *Angophora bakeri* (narrow-leaved apple).	Meets key diagnostic characteristic. Dominant tree species within the subject land include *Eucalyptus punctata* and *Eucalytpus fibrosa*.
Where present the mid layer of the understorey varies in structure and floristics. Where present, the small tree layer is likely to be dominated by Eucalypt species and *Allocasuarina littoralis* (black she-oak). Where shrubs are present, the mid layer is likely to be dominated by *Bursaria spinosa* (blackthorn) in areas with low sandstone influence, with other common species including *Leucopogon juniperinus, Kunzea ambigua* (tick bush), *Persoonia linearis* (narrow-leaved geebung), *Ozothamnus diosmifolius* (rice flower, sago bush, white dogwood) and *Hibbertia aspera* (rough guinea flower)	Meets key diagnostic characteristic. Shrubs within the subject land include *Bursaria spinosa* (blackthorn), *Leucopogon juniperinus, Kunzea ambigua* (tick bush) and *Persoonia linearis* (narrow-leaved geebung).

Key diagnostic characteristic	Characteristics of PCT 1395 within the subject land
Where present, the ground layer of the understorey is typically diverse and dominated by grasses and herbs including: *Aristida vagans* (three-awned spear grass), *Austrostipa pubescens* (spear grass), *Cheilanthes sieberi* subsp. *sieberi* (poison rock fern), *Dichondra repens* (kidney weed), *Echinopogon ovatus* (forest hedgehog grass), *Entolasia marginata* (bordered panic), *Entolasia stricta* (wiry panic*), Lepidosperma laterale* (saw sedge),*Lomandra multiflora, Microlaena stipoides* var. *stipoides* (weeping grass), *Oxalis perennans* (wood-sorrel), *Pimelea linifolia* subsp. *linifolia*, *Pomax umbellata, Phyllanthus hirtellus, Pratia purpurascens* (white root), *Solanum prinophyllum* (forest nightshade) and *Themeda triandra* syn. *T. australis* (kangaroo grass). The ground layer may also contain small shrubs, including *Hibbertia aspera* (rough guinea flower).	Meets key diagnostic characteristic. Grasses and herbs within the subject land include *Aristida vagans* (three-awned spear grass), *Dichondra repens* (kidney weed), *Entolasia marginata* (bordered panic), *Entolasia stricta* (wiry panic*), Lepidosperma laterale* (saw sedge),*Lomandra multiflora, Microlaena stipoides* var. *stipoides* (weeping grass), *Oxalis perennans* (wood-sorrel), *Pimelea linifolia* subsp. *linifolia*, *Pomax umbellata, Pratia purpurascens* (white root), *Solanum prinophyllum* (forest nightshade) and *Themeda triandra* syn. *T. australis* (kangaroo grass).

Based on the diagnostic characteristics of the vegetation within the subject land, the Shale Sandstone Transition Forest of the Sydney Basin Bioregion ecological community is deemed to occur. In order to be considered a MNES under the EPBC Act, areas of the ecological community must meet:

- Key diagnostic characteristics (in Section 1.5.2; (DoE, 2014)
- At least the minimum condition thresholds for moderate quality (i.e., for Category A, in Section 1.5.2; (DoE, 2014).

It is intended that the condition thresholds are designed to identify the best patches for national protection. The vegetation within the study area forms part of a much larger tract of native vegetation >0.5 ha, however portions of the subject land demonstrate significant reduction in ecological integrity due to exotic flora coverage. In order to be representative of the EPBC Act listed TEC, the patch must demonstrate >30% native perennial understorey vegetation coverage. Patches of PCT 1395 within the subject land identified as being in a 'good' condition meet this minimum requirement and should be considered a MNES. Therefore, approximately 0.31 ha of Shale Sandstone Transition Forest of the Sydney Basin Bioregion - listed as critically endangered under the EPBC Act TEC occurs within the subject land. The extent of its distribution within the study area is illustrated in Figure 3 3 and Figure 3 4.

An assessment of significance for this TEC is provided in Appendix E.

3.10.2 Migratory species

Migratory species are those animals that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations. Listed migratory species may include any native species identified in an international agreement approved by the Minister. All listed migratory species are MNES under the EPBC Act. An action will require approval if the action has, will have, or is likely to have, a significant impact on a listed migratory species.

The PMST indicated 16 migratory bird species have either been previously recorded or are predicted to occur within the study locality. A habitat assessment was carried out to determine the potential for these species to occur within the study area (Appendix C). One migratory species, the White-throated Needletail (Hirundapus caudacutus) was considered

to have a moderate likelihood of occurrence. This species is also listed as vulnerable under the EPBC Act. An assessment of significance for this species is provided in Appendix E.

4 Avoidance and minimisation

Under the Transport for NSW Biodiversity Policy (TfNSW 2022), the management of biodiversity should aim to: Avoid and minimise impacts

1. Avoid and minimise impacts first;
2. Mitigate impacts where avoidance is not possible; and
3. Offset where residual impacts cannot be avoided, in accordance with TfNSW guidelines.

Table 4 1 outlines how the proposal will avoid and minimise direct impacts to native vegetation and habitat in accordance with Transport for NSW policies.

Table 4-1: Consistency with Transport for NSW principles to avoid and minimise impacts on biodiversity

Transport for NSW principles (TfNSW, 2022)	Proposal consistency
Location of the proposal	
Locating the proposal in areas where there are no biodiversity values.	The proposal is limited in its scope to be positioned in a way that would avoid all biodiversity values within the subject land. Efforts have been made to position the alignment along existing fence lines or areas of disturbance, where possible.
Locating the proposal in areas where the native vegetation or threatened species habitat is in the lowest condition.	
Locating the proposal in areas that avoid habitat for threatened species that may be at risk of a significant impact or native vegetation that is part of a critically endangered ecological community (CEEC) or an endangered ecological community (EEC).	PCT 1395 detected within the subject land is consistent with the TEC 'Shale Sandstone Transition Forest in the Sydney Basin Bioregion' – listed as critically endangered under the BC Act and 0.31 ha of this land is consistent with the EPBC Act listed TEC Shale Sandstone Transition Forest of the Sydney Basin Bioregion. Measures to minimise direct impacts to this community have been implemented, however cannot be totally avoided as part of the proposal.
Locating the proposal such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained.	Sections of fencing delivered under the proposal would join to future fencing delivered by DPE to reduce the incidence of vehicle strike in the locality. As such, the proposal would contribute to reduced connectivity (assuming fauna can safely cross the existing motorway). The proposed fence alignment would tie onto bridges to maintain connectivity along the Nepean River and Allen's Creek corridors.
Design refinement of the proposal	
Reducing the clearing footprint of the proposal.	The clearing footprint has been reduced as far as practicable and is impacting primarily upon existing fence lines and disturbed areas.
Locating ancillary facilities in areas where there are no biodiversity values.	The use of ancillary facilities would be limited for the proposal. If ancillary facilities are necessary for the development of the proposal, they would be located in existing cleared land and avoid any mapped native vegetation.
Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the lowest condition.	

Transport for NSW principles (TfNSW, 2022)	Proposal consistency
Locating ancillary facilities in areas that avoid habitat for threatened species and vegetation in high threat status categories (e.g. endangered or critically endangered)	
Alternatives	
An analysis of alternative routes, technologies, locations and sites that would avoid or minimise impacts on biodiversity values and justification for selecting the location and methods of the proposal	The general location of the proposal has been determined in accordance with corridors identified as priorities for protection under the CPCP. The proposal aims to mitigate impacts on the southern Sydney Koala population through the installation of Koala exclusion fencing. Currently the Hume Motorway forms a barrier to the movement of fauna in the locality. The installation of exclusion fencing would limit the occurrences of vehicle-strike, whilst redirecting individuals to existing corridors. As such, the proposal has been located to provide benefits to biodiversity.

5 Impact assessment

This section assesses potential impacts biodiversity in the subject land as a result of the construction and operation of the proposal. The main components of the proposal with potential to impact biodiversity are summarised below:

- Construction:
- Installation of approximately 1400 m of Koala fencing, with the south-western fence ends tied to Pheasants Nest Bridge over the Nepean River (Southern Hume);
- Installation of approximately 400 m of Koala fencing, with the north-eastern fence ends tied to Moolgun Creek Bridge over Allens Creek (Northern Hume);
- The removal of vegetation to 3m to either side of the fence alignment, resulting in the removal of 0.61 ha of mapped PCT 1395; and
- The removal of existing fences (if applicable) as part of the establishment of the Koala fencing.
- Operation:
    - Barrier effect of fencing; and
    - Maintenance of fencing.

Potential impacts of the proposal are listed below. Further detail is provided in section 5.1 and 5.2.

- Construction impacts:
    - Removal of native vegetation
    - Removal of threatened fauna species habitat and habitat features
    - Injury and mortality of fauna
- Operation/indirect impacts:
    - Wildlife connectivity and habitat fragmentation
    - Edge effects on adjacent native vegetation and habitat
    - Injury and mortality
    - Invasion and spread of weeds
    - Invasion and spread of pests
    - Invasion and spread of pathogens and disease
    - Noise, light, dust and vibration

The project is entirely within ‘excluded land’ and will not impact any land mapped as Certified – Urban Capable Land and/or Avoided Land under the CPCP.

5.1 Construction direct impacts

5.1.1 Removal of native vegetation

The proposal would require clearing of native vegetation across three vegetation zones across PCT 1395, as summarised in Table 5 1. Where possible, the fence line would follow existing areas of fence line and disturbed areas. Vegetation would be cleared up to 3m either side of the proposed alignment. The expected total area of native vegetation to be cleared is 0.61ha (Table 5 1). This vegetation is commensurate with the TEC Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act and a portion commensurate with Shale Sandstone Transition Forest – listed as critically endangered under the EPBC Act (0.31 ha).

The total amount of native vegetation to be cleared would be 0.61 ha, which represents 9.1 % of native vegetation in the study area. The amount of native vegetation to be cleared is negligible and would not represent a significant loss of native vegetation and potential habitat for threatened species.

Table 5-1: Summary of direct impacts on native vegetation

Veg zone	PCT	Broad condition class	TEC	Area to be impacted (ha)
1	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (PCT 1395)	Good	Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act Shale Sandstone Transition Forest of the Sydney Basin Bioregion – listed as critically endangered under the EPBC Act	0.31
2		Moderate-Good	Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act	0.20
3		Moderate		0.10
			Total	0.61

5.1.2 Removal of threatened fauna habitat

The proposal would result in the removal of 0.61 ha of native vegetation which may provide potential habitat for the Cumberland Plain Land Snail (*Meridolum corneovirens*). Table 5 1 outlines the condition of this habitat. This species was not detected during the field surveys; thus it was not included for impact offsetting requirements. Nonetheless, due to the availability of habitat within the immediate locality, this species would not be dependent on habitat provided by the subject land, and thus the removal of a relatively small, linear area of refuge habitat would not significantly reduce available habitat for the species to the extent that the local population would be placed at risk of extinction. Appropriate mitigation and management measures, such as the retention of habitat features (i.e., leaf litter, logs) on site, will be implemented to minimise the removal of habitat for the Cumberland Plain Land Snail. An AoS for this species is provided in Appendix E.

Direct impacts to habitat would be limited to a narrow band of disturbed habitat at the interface of the Hume Motorway and higher quality habitat within the locality. An abundance of higher quality foraging habitat for nectivorous birds and arboreal mammals is present in the locality. Additionally, the proposal would not result in the removal of key breeding habitat, such as tree hollows, decorticating bark and logs.

The microbat roost site detected under Pheasants Nest Bridge would not be removed or impacted by the proposal. The Southern Myotis (*Myotis macropus*) was given a ‘possible’ rating of occurring, and has been assumed present. A species polygon has been created in accordance with the BAM including impacted areas within 200m of the Nepean River at the Southern Hume site (OEH, 2018b). Approximately 0.09 ha of suitable habitat would be impacted as part of the proposal.

The removal of habitat resources is unlikely to have a significant impact on native fauna, as there is an abundance of similar or better conditioned habitat across the study locality of which the study area only forms a small proportion. Mobile threatened fauna have been afforded a moderate to high likelihood of occurrence due to their potential to use habitat within the study area on a transitionary basis.

As such, the proposal is unlikely to significantly impact mobile threatened species and disturbances to potential habitat would largely be temporary. The details of the AoS, which assess impacts on threatened species with the potential to occur in the study area, are provided in Appendix E.

5.1.3 Injury and mortality

The proposal has potential to cause injury and mortality to fauna during the construction phase. Risks to fauna are associated with vegetation clearing and the mobilisation of plant. It is expected that mobile fauna would relocate to undisturbed areas during construction activities, however less mobile fauna may be directly impacted during these activities. Fauna injury and mortality impacts would be managed through the implementation of mitigation measures, outlined in section 6.

5.2 Indirect and operational impacts

Indirect impacts occur when the proposal or activities relating to the construction, operation and general change in land-use patterns of the proposal affect native vegetation, threatened ecological communities, threatened species and their habitats beyond the subject land (direct impact area).

5.2.1 Edge effects on adjacent native vegetation and habitat

Edge effects occur at the boundary of vegetated areas due to changes in level of protection and exposure to disturbance factors. Generally, edges of vegetation have reduced protection for flora and fauna species and increased effects of environmental (e.g., wind, artificial light, dust) and biological (e.g., more exposure to predators, increased weed colonization and increased competition with exotic species) factors when compared with conditions found further into a vegetation patch.

Clearing of native vegetation as a result of the proposal would be restricted to 0.61 ha of native vegetation. This clearing would be restricted to a narrow, linear patch of vegetation located in close proximity to the Hume Motorway. As a result, vegetation within the study area is already exposed to edge effects and anthropogenic disturbances. It is expected that edge effects, as a result of the proposal, would be minimal.

5.2.2 Wildlife connectivity and habitat fragmentation

The Hume Motorway bisects areas of core Koala habitat and primary corridors within the locality. Residential and agricultural development has also contributed to some fragmentation. The proposal would deliberately introduce an additional barrier to wildlife movement across the Hume Motorway. Sections of fencing delivered under the proposal would join to future fencing delivered by DPE to reduce the incidence of vehicle strike in the locality. As such, the proposal would potentially contribute to reduced connectivity, limiting available crossing locations for fauna (assuming fauna can safely cross the existing motorway). The proposed fence alignment would tie onto bridges to maintain connectivity along the Nepean River and Allen's Creek corridors. The proposal would reduce the incidence of vehicle-strike and mortality in the locality and facilitate the movement of fauna through more suitable corridors by channelling fauna to existing crossings under the road.

The areas underneath Pheasants Nest Bridge and Moolgun Creek Bridge provide existing corridors for movement underneath the Hume Motorway and along the Nepean River and Allens Creek, respectively (Photos 5-1 and 5-2). These areas fall within the north-east and south-west extents of the Nepean and Allens Koala corridors, respectively. These Koala movement corridors represent primary corridors with a high level of connectivity of core

Koala habitat and are identified as being critical for the long-term viability of the regional Koala population in south-western Sydney (DPIE 2019c). These corridors contain the largest areas of core Koala habitat within the region and provide connectivity to a number of smaller areas of primary, secondary and tertiary core Koala habitat. Other fauna species moving through the area are also likely to use these corridors as they provide suitable woodland habitat within an otherwise unsuitable area of grassland habitat and connect large areas of intact native vegetation. Remnant vegetation within the study area may facilitate the movement of fauna between these corridors.

Additional fence lengths delivered under the CPCP will further reduce wildlife connectivity throughout the locality, however will reduce mortality and facilitate the movement of fauna through more suitable corridors by channelling fauna to existing crossings under the road.

Photo 5-1:Existing crossing under Pheasants Nest Bridge

Photo 5-2: Existing crossing under Moolgun Creek Bridge

5.2.3 Injury and mortality

The proposal would reduce the rate of fauna injury and mortality along the Hume Motorway by reducing instances of roadkill. The exclusion fencing would direct fauna to existing underpasses and wildlife corridors and provide a barrier to protect fauna from urban threats.

Exclusion fencing has the potential to contribute to mortality of fauna as they attempt to escape threats, such as bushfires or predators. These potential negative impacts would be mitigated through fence design and retention of existing corridors.

5.2.4 Invasion and spread of weeds

The introduction and spread of weeds has the potential to occur during the construction phase of the proposal. This can occur by the spread of opportunistic exotic vegetation from adjacent private properties or new species can be introduced via equipment, plant and footwear. Weed cross-contamination and spread can be avoided and minimised by implementing weed management as per the Biodiversity Guidelines (RTA 2011).

High threat exotic species identified in the study area are provided in Table 5 2.

Table 5-2: High threat exotic species within the study area

Scientific Name	Common Name	Extent of Infestation
Ageratina adenophora	Crofton Weed	Few individuals in Northern Hume
Bidens pilosa	Cobbler's Pegs	Scattered individuals throughout the study area
Chloris gayana	Rhodes Grass	Abundant throughout the study area, particularly along the roadside
Paspalum dilatatum	Paspalum	Infestation in the south-western portion of the study area
Asparagus aethiopicus	Asparagus Fern	Few individuals in the south-eastern portion of the study area
Lantana camara	Lantana	Scattered juveniles in Northern Hume
Rubus fruticosus sp. agg.	Blackberry complex	Small patches present in the western portions of Southern Hume and Northern Hume
Senecio madagascariensis	Fireweed	Scattered individuals throughout the study area

5.2.5 Invasion and spread of pests

Pest fauna species could use disturbed areas to increase their movement across the landscape. Edges provide opportunities for invasive pest animals to move into newly accessible areas. Given the minimal scale of the proposed clearing it is not expected that the proposal would facilitate invasive species incursion.

5.2.6 Invasion and spread of pathogens and disease

Any foreign equipment or materials brought onto the construction site also has potential to introduce diseases such as Phytophthora (Phytophthora cinnamomi), Myrtle Rust (Puccinia psidii) and Chytrid Fungus (Batrachochytrium dendrobatidis). The risk of spread of pathogens and disease can be avoided and minimised by implementing a cleaning and decontamination protocol for equipment, machinery and PPE (section 6).

5.2.7 Noise, light, dust and vibration

The proposed works may produce levels of noise and vibration at higher than ambient levels. Noise and vibration generation as a result of the proposal would be temporary and localised to the work location at the time of work. The study area is subject to a high degree of existing noise disturbance and therefore it is expected that any fauna utilising the study area would be adapted to a high level of disturbance and will not be significantly impacted due to additional disturbances related to the construction phase of the proposal.

Increased noise levels may deter fauna species from the immediate area for the duration of works. This is not considered to be a substantial impact on fauna in the study area and it is expected that fauna would return once this disturbance is removed.

Increased dust levels can reduce photosynthesis in flora and respiratory capability in fauna. It is expected the proposal would cause minimal dust generation which is unlikely to result in significant impacts to flora or fauna.

Night works are not proposed hence, no light impacts are anticipated.

5.3 Cumulative impacts

The proposal would result in the removal of up to 0.61 ha of vegetation within PCT 1395. The proposed works have the potential to have cumulative environmental effects with other existing or likely future activities. However, the negative effects of this proposal would be negligible due to the nature and extent of the works. Potential impacts on biodiversity would be minimised through the safeguards detailed in Section 6.

The proposal is located within the Wollondilly Shire Council LGA. Projects identified within the Wollondilly Shire Council LGA that could create cumulative impacts with the proposal have been detailed in Table 5 3.

Table 5-3: Present and future project/proposals

Project/proposal	Biodiversity value impacted	Construction impacts	Operational impacts
Wilton Priority Growth Area (DPE, 2022a)	Native vegetation communities within the locality, including up to 16.50 hectares of Shale Sandstone Transition Forest in the Sydney Basin Bioregion. Known threatened flora populations. Threatened fauna habitat and connectivity.	Impacts related to the development of up to 1,720ha of certified-urban capable land including removal of native vegetation and habitat, threatened fauna habitat, injury and mortality of fauna and fragmentation. Potential indirect effects on invasion of weeds, pests and pathogens and increased noise, light, dust and vibration.	Likely increase traffic in the locality. Reduced connectivity and increased exposure of urban threats to fauna, such as roads, fences and domestic animals. Invasion of weeds, pests and pathogens and increased noise and light.
Picton Road Upgrade	Impacts to native vegetation and potential habitat in close proximity to the Hume Highway sites. The REF for this project is not yet complete (early 2023) so exact impacts cannot be calculated.	Potential impacts related to construction may include removal of native vegetation, removal of threatened fauna species habitat and habitat features and injury and mortality of fauna.	Likely increase traffic in the locality. Invasion of weeds, pests and pathogens and increased noise and light.
Future exclusion fencing and Koala crossings delivered under Sub Plan-B of the CPCP	Minor impacts to native vegetation. Reduced vehicle-strike and subsequent fauna injury and mortality. Reduced fauna connectivity due to introduction of fauna exclusion fencing.	Potential impacts related to construction may include removal of native vegetation, removal of threatened fauna species habitat and habitat features and injury and mortality of fauna.	Fauna connectivity would be facilitated through suitable crossings at each bridge location. Reduced incidence of vehicle-strike and mortality in the locality and facilitation of fauna movement through more suitable corridors.

5.4 Assessments of significance

Assessments of significance (AoS) have been completed for each threatened species, population or ecological community that has been recorded in the study area, is assumed present, or has a moderate to high likelihood of occurrence. All AoS completed are provided in Appendix E.

For the purposes of assessment under the BC Act, species that share broadly similar life history characteristics, particularly in terms of movement, and habitat requirements have been grouped together.

Assessments of significance for species, populations and ecological communities listed under the BC Act and EPBC Act have been assessed against:

- Threatened biodiversity listed under the BC Act: Threatened Species Test of Significance Guidelines (OEH, 2018);
- Matters of national environmental significance listed under the EPBC Act: Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE, 2013); and
- Referral guidelines for species listed under the EPBC Act.

The results of these significance assessments have been summarised in Table 5 4 and Table 5 5.

Table 5-4: Summary of EPBC Act significance assessments findings

	Significance assessment question*					
Threatened species, or communities	**a**	**b**	**c**	**d**	**e**	**Likely significant impact?**
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	X	N	N	N	N	No
Meridolum corneovirens (Cumberland Plain Land Snail)	N	X	N	N	N	No
Birds	N	X	N	N	N	No
Arboreal and/or hollow dependent mammals	N	X	N	N	N	No
Dasyurus maculatus (Spotted-Tail Quoll)	N	X	N	N	N	No
Pteropus poliocephalus (Grey-headed Flying Fox)	N	X	N	N	N	No
Microbats	N	X	N	N	N	No
Reptiles	N	X	N	N	N	No

Notes: Y = Yes (negative impact), N = No (no or positive impact), X = yes/no answer not applicable, ? = unknown impact.
* Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018)

Table 5-5: Summary of EPBC Act significance assessments findings

Threatened species, or communities	**Important population***	**Likely significant impact?**
Shale Sandstone Transition Forest	X	N

Threatened species, or communities	Important population*	Likely significant impact?
Callocephalon fimbriatum (Gang-gang Cockatoo)	N	N
Calyptorhynchus lathami lathami (South-eastern Glossy Black-Cockatoo)	N	N
Hirundapus caudacutus (White-throated Needletail)	N	N
Lathamus discolor (Swift Parrot)	N	N
Chalinolobus dwyeri (Large-eared Pied Bat)	N	N
Dasyurus maculatus (Spotted-tailed Quoll)	N	N
Petauroides volans (Greater Glider (southern and central))	N	N
Petaurus australis australis (Yellow-bellied Glider (south-eastern))	N	N
Phascolarctos cinereus (Koala)	Y+	N
Pteropus poliocephalus (Grey-headed Flying-fox)	Y+	N
Hoplocephalus bungaroides (Broad-headed Snake)	N	N

Notes: Y = Yes (negative impact), N = No (no or positive impact), X = not applicable, ? = unknown impact.
* Significant Impact Guidelines 1.1 (DoE 2013)
+ Individuals of an important population may utilise habitat within the study area on a transitional basis. See Appendix E for further information.

6 Mitigation

Table 6-1 details measures to avoid, minimise or mitigate proposal impacts. Where applicable, these should be included in any Construction Environmental Management Plan (CEMP) or any associated sub-plans prior to construction.

Table 6-1: Mitigation measures

Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated	Responsibility
All project impacts	Retained vegetation in close proximity to construction activities will not be damaged or removed.	Construction	Effective	None	Contractor
	A Biodiversity Offset Strategy in accordance with TfNSW 'No Net Loss Guideline' (TfNSW, 2022) would be developed to outline the offsetting strategies for biodiversity impacts that exceed TfNSW offset thresholds.	Prior to construction	Effective	Biodiversity impacts would be offset as outlined in the strategy.	TfNSW
Removal of native vegetation	Native vegetation removal will be minimised through detailed design and installation. The clearing would be limited as far as practicable (reduced to approximately 1m either side of fence alignment). An onsite ecologist is recommended during fence installation to assist in minimizing potential impacts to native vegetation.	Detailed design During construction	Effective	0.61 ha of native vegetation to be removed within the 3m buffer area along the fence alignment. This area is likely to be reduced to a 1m buffer area during installation.	TfNSW
	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to construction	Effective		Contractor
	Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective		Contractor
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		Contractor

Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated	Responsibility
Removal of threatened fauna habitat	Threatened fauna habitat removal will be minimised through detailed design.	Detailed design	Effective	Removal of habitat features that cannot be avoided. This may include leaf litter and woody debris. Any habitat features will be relocated within the study area. The alignment of the fence will avoid direct impacts to hollow-bearing trees. Removal of 0.09 ha of Southern Myotis foraging habitat would result.	TfNSW
	Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None	Contractor
	Habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	0.61 ha of native vegetation to be removed. Habitat features that cannot be avoided will be retained within the study area.	Contractor
	Habitat will be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	Habitat features that cannot be avoided, such as woody debris, will be retained within the study area.	Contractor
	The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	None	Contractor

Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated	Responsibility
	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	None	Contractor
Removal of threatened flora	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	None	Contractor
	The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	None	Contractor
Fragmentation of identified habitat corridors	Fencing design should be consistent with the *Draft Wildlife Connectivity Guidelines for Road Projects* (RTA 2011).	Detailed design	Effective	None	TfNSW
	Connectivity of identified wildlife corridors will be maintained through detailed design.	Detailed design	Effective	None	TfNSW
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None	Contractor
Injury and mortality of fauna	Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None	Contractor
Invasion and spread of weeds	Weed species will be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None	Contractor
Invasion and spread of pests	Pest species will be managed within the proposal site.	During construction	Effective	None	Contractor

Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated	Responsibility
Invasion and spread of weeds, pests and diseases	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None	Contractor
Noise, light, dust and vibration	Shading and artificial light impacts will be minimised through detailed design. No night works are anticipated as part of the proposal.	Detailed design	Effective	None	Contractor

7 Offset strategy

Impacts to biodiversity values within the subject land have been assessed against the provisions of biodiversity offsets, conservation measures and/or tree and hollow replacement in accordance with TfNSW offset guideline documents 'No Net Loss Guidelines' (TfNSW, 2022) and 'Tree and Hollow Replacement Guidelines' (TfNSW, 2022). The below subsections outline any biodiversity offset requirements in accordance with these guidelines.

7.1 Quantification of offset or revegetation requirements

The proposal will require the removal of 0.61 ha of PCT 1395. This vegetation is commensurate with Shale Sandstone Transition Forest in the Sydney Basin Bioregion - listed as critically endangered under the BC Act and a portion commensurate with Shale Sandstone Transition Forest – listed as critically endangered under the EPBC Act. Table 7 1 outlines the minimum offset thresholds for all TfNSW projects and an assessment of threshold application to this proposal has been determined in Table 7 2 and Table 7 3.

Table 7-1: Offset thresholds (TfNSW No Net Loss Guidelines (TfNSW, 2022)

Impact	Threshold
Works involving clearing of a CEEC	Where there is any clearing of an CEEC in 'moderate to good' condition
Works involving clearing of an EEC	Where clearing of an EEC ≥ 2 ha in 'moderate to good' condition
Works involving clearing of VEC	Where clearing of VEC ≥ 5 ha in 'moderate to good' condition
Works involving clearing of any habitat for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type)	Where clearing ≥ 1 ha in 'moderate to good' condition
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is ≥10 or where clearing of habitat is ≥ 1 ha
Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat
Any residual biodiversity impact that doesn't require offsets in accordance with the No Net Loss Guideline is to be assessed against the requirements of the Tree and Hollow Replacement Guideline.	Any clearing of hollows and/or trees ≥5cm DBH

Table 7-2: Assessment of vegetation impacts against thresholds

Vegetation Zone	Plant Community Type (PCT)	Condition	Threatened Ecological Community (TEC)	VIS Score	Impact Area (ha)	Threshold triggered?
1	PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Good	Critically endangered (BC Act and EPBC Act)	65.5	0.31	**Yes** 'Where there is any clearing of a CEEC in 'moderate to good' condition'
2		Moderate-Good	Critically endangered (BC Act)	55.4	0.20	**Yes** 'Where there is any clearing of a CEEC in 'moderate to good' condition'

Vegetation Zone	Plant Community Type (PCT)	Condition	Threatened Ecological Community (TEC)	VIS Score	Impact Area (ha)	Threshold triggered?
3		Moderate	Critically endangered (BC Act)	30	0.10	**Yes** 'Where there is any clearing of a CEEC in 'moderate to good' condition'

The assessment in Table 7 2 has determined there would be a need for ecosystem offsetting from vegetation clearance related to the proposal.

The proposal would involve the removal of Southern Myotis (*Myotis Macropus*) habitat from the subject land. A species polygon has been created in accordance with the BAM including impacted areas within 200m of the Nepean River at the Southern Hume site (OEH, 2018b).

Table 7-3: Assessment of threatened species habitat loss against thresholds

Species Name	EPBC Act	BC Act	Vegetation Zone	Impact Area (ha)	Threshold triggered?
Myotis macropus (Southern Myotis)	-	Vulnerable	1	0.08	**No** 'Clearing area is not ≥ 1 ha in 'moderate to good' condition'
			2	0.01	**No** 'Clearing area is not ≥ 1 ha in 'moderate to good' condition'

The assessment it Table 7-3 has determined there will be no need for species credit offsetting for impacts to Southern Myotis (*Myotis Macropus*) habitat due to not meeting the minimum thresholds

7.2 Preliminary offset calculations

A preliminary calculation of offsets for each of the triggering impact identified in Table 7 2 has been determined in accordance with TfNSW 'No Net Loss Guidelines' (TfNSW, 2022) using the BAM-C. Ecosystem credits requiring offsetting have been included in Table 7 4. These impacts are based on a 3m clearing buffer from the proposed fence alignment and clearing would be reduced (to approximately 1m buffer) during fence installation. Therefore, current offset calculations will need to be revised once the final clearing footprint is determined.

Table 7-4: Preliminary Ecosystem Credit offset obligations

Plant Community Type (PCT)	EPBC Act	BC Act	VIS Score	BRW	HBT	Impact Area (ha)	Ecosystem credits
PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	Shale Sandstone Transition Forest of the Sydney Basin Bioregion – listed as critically endangered under the EPBC Act	Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act Critically endangered (BC Act)	65.5	2.5	No	0.31	13
			55.4	2.5	No	0.20	7
			30	2.5	No	0.10	2
						Total	22

7.3 Biodiversity offset strategy

There are three main options available to meet the biodiversity offset obligations of the proposal that have triggered the thresholds of TfNSW guidelines (TfNSW, 2022). These include:

- Make a payment into the Biodiversity Conservation Fund (BCF)
- Purchase and retire biodiversity credits including purchasing from the Transport Biobank
- Arrange for Biodiversity Conservation Actions to be undertaken (subject to DPE approval requirements).

As the Biodiversity Offset Scheme has not been triggered and the requirements for offsetting have been triggered from TfNSW guidelines, conservation measures may also be applied. A Biodiversity Offset Strategy would be developed as part of this proposal. Specifically, this would involve a review of the final clearing footprint once the project has been completed to determine if offsets are required.

It is not anticipated that there is a requirement to remove hollow-bearing trees and/or trees (≥5cm DBH) in areas of non-native vegetation and cleared land. The removal of vegetation and offsetting has been accurately calculated using the 'No Net Loss Guidelines' (TfNSW, 2022) and offsetting under the 'Tree and Hollow Replacement Guidelines' (TfNSW, 2022) is not required. Therefore, there is no requirement to prepare a Tree and Hollow Replacement Plan for the proposal.

8 Conclusion

This BAR was undertaken to assess potential biodiversity impacts of the proposal which would include the removal of 0.61 ha of potential habitat for threatened species within the subject land.

Native vegetation within the study area was consistent to one naturally occurring PCT 1395. PCT 1395 was found to conform to the State listed TEC 'Shale Sandstone Transition Forest in the Sydney Basin Bioregion' – listed as critically endangered under the BC Act. No other State listed TECs occurred within the study area. A small portion of PCT 1395 (good condition) found within the subject land is commensurate with the Commonwealth listed TEC 'Shale Sandstone Transition Forest of the Sydney Basin Bioregion' – listed as critically endangered under the EPBC.

No threatened flora and/or fauna species were detected within the subject land during field surveys. Southern Myotis (*Myotis macropus*) received a 'possible' call detection following acoustic surveys. This species has been assumed present and considered for impact offsetting. The proposal would result in the removal of 0.09 ha of Southern Myotis foraging habitat.

The proposal will require clearing of native vegetation across three vegetation zones across PCT 1395. The expected total area of native vegetation to be cleared is 0.61 ha.

Tests of significance and Assessments of Significance have been completed for all species that were considered to have at least a moderate likelihood of occurring within the subject land. Based on the removal of habitat from within the subject land, the proposal is unlikely to have a significant impact on any BC Act or EPBC Act listed entity.

Mitigation measures are proposed where impacts cannot be avoided, and the implementation of these measures will reduce adverse impacts on ecological values within the subject land.

For works involving the clearing of a critically endangered ecological community (CEEC), the transport biodiversity offset threshold applies to any clearing of a CEEC in 'moderate to good' condition. The proposal will result in the clearing of 0.61 ha of Shale Sandstone Transition Forest in good condition. Offsetting requirements would be in accordance with TfNSW guidelines.

The proposal would result in impacts to 0.09 ha of foraging habitat for the Southern Myotis (*Myotis macropus*) however did not meet the minimum offsetting thresholds of the 'No Net Loss Guidelines' (TfNSW, 2022). Therefore, no species credit offsets have been accrued as part of the proposal.

The proposal will reduce the incidence of vehicle-strike and mortality in the locality and facilitate the movement of fauna through more suitable corridors by channelling fauna to existing crossings under the Hume Highway.

References

Bureau of Meteorology (2022) Groundwater Dependent Ecosystems Atlas. Available from: http://www.bom.gov.au/water/groundwater/gde/

Commonwealth of Australia (2011b) Survey Guidelines for Australia's Threatened Mammals, Commonwealth of Australia. Available on the DAWE website http://www.environment.gov.au/system/files/resources/b1c6b237-12d9-4071-a26e-ee816caa2b39/files/survey-guidelines-mammals.pdf

Commonwealth of Australia (2011c) Survey Guidelines for Australia's Threatened Reptiles. Available on the DAWE website: http://www.environment.gov.au/system/files/resources/eba674a5-b220-4ef1-9f3a-b9ff3f08a959/files/survey-guidelines-reptiles.pdf

Department of the Environment (DoE) (2013a), Matters of National Environmental Significance Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Available from: https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Department of Environment and Conservation (2004) Threatened biodiversity survey and assessment. Guidelines for developments and activities (working draft). Available on the EES website. https://www.environment.nsw.gov.au/research-and-publications/publications-search/threatened-biodiversity-survey-and-assessment

DPE (2020) How to keep koalas off the road: Koala Vehicle Strike Fact sheet 2. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/koala-vehicle-strike-fact-sheet-2-how-to-keep-koalas-off-roads-200230.pdf

DPE (2022a) The Cumberland Plain Conservation Plan. Available at: https://www.planning.nsw.gov.au/Policy-and-Legislation/Strategic-conservation-planning/Cumberland-Plain-Conservation-Plan/Final-report.

DPE (2022b) Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide. Available at https://www.environment.nsw.gov.au/research-and-publications/publications-search/Koala-phascolarctos-cinereus-biodiversity-assessment-method-survey-guide.

DPI (2012), Risk Assessment Guidelines for Groundwater Dependent Ecosystems. Available on the EPI website http://www.water.nsw.gov.au/__data/assets/pdf_file/0005/547682/gde_risk_assessment_guidelines_volume_1_final_accessible.pdf

DPIE (2019a), Biodiversity Assessment Operational Manual Stage 1. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-operational-manual-stage-1-180276.pdf

DPIE (2019b), Biodiversity Assessment Operational Manual Stage 2. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-operational-manual-stage-2-190512.pdf.

DPIE (2019c), Conserving Koalas in the Wollondilly and Campbelltown Local Government Areas. Available at: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/conserving-Koalas-wollondilly-campbelltown-local-government-areas-190573.pdf

DPIE (2020a), Biodiversity Assessment Method. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-2020-200438.pdf

DPIE (2020b), Biodiversity Assessment Method 2020 Operational Manual Stage 1. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-operational-manual-stage-2-190512.pdf.

DPIE (2020c), NSW Survey Guide for Threatened Frogs. A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method. Available here:

https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/nsw-survey-guide-for-threatened-frogs-200440.pdf

DPIE (2020d), Surveying threatened plants and their habitats. NSW survey guide for the Biodiversity Assessment Method. Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/surveying-threatened-plants-and-habitats-nsw-survey-guide-biodiversity-assessment-method-200146.pdf

Hazelton P.A. and Tille P.J. (1990) *Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheets* map and report, Soil Conservation Service of NSW, Sydney.

Keith D. A. (2004) Ocean Shores to Desert Dunes: The native vegetation of New South Wales and the ACT. Department of Environment and Conservation, Sydney.

OEH (2018), 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method. Available on the DPIE website at: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/species-credit-threatened-bats-survey-guide-180466.pdf

RTA (2011), Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects. Roads and Traffic Authority, NSW. Available on the RMS website at: https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/biodiversity_guidelines.pdf

Rytwinski, T., Soanes, K. , Jochen, A. G. J. , Fahrig, L. , Findlay, S. , Houlahan, J. , van der Ree, R. , and van der Grift, E. (2016) How effective is road mitigation at reducing road-kill? A meta-analysis. PLoS ONE 11(11): e0166941.

TfNSW (2021), Microbat Management Guidelines. Available from: https://roads-waterways.transport.nsw.gov.au/documents/about/environment/microbat-management-guidelines.pdf

TfNSW (2022), Biodiversity Policy. Available on the TfNSW website at: https://www.transport.nsw.gov.au/system/files/media/documents/2022/biodiversity-policy-NSW-government.pdf

TfNSW. (2022). No Net Loss Guidelines. Transport for NSW.

TfNSW. (2022). Tree and Hollow Replacement Guidelines. Transport for NSW.

Tozer M.G., Turner K., Keith D.A., Tindall D., Pennay C., Simpson C., MacKenzie B., Beukers P., Cox S. (2010) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Cunninghamia 11, 359–406.

Appendix A – BioNet Search

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Amphibians					
Hylidae	*Litoria littlejohni*	Littlejohn's Tree Frog	V	V	44
Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V	-	2
Birds					
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V	-	4
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	-	7
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V	-	17
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	V	-	9
Apodidae	*Apus pacificus*	Fork-tailed Swift	-	C,J,K	1
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	-	V,C,J,K	6
Artamidae	*Artamus cyanopterus*	Dusky Woodswallow	V	-	43
Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E	-	2
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	E	15
Cacatuidae	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	V	-	45
Climacteridae	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V	-	22
Dasyornithidae	*Pycnoptilus floccosus*	Pilotbird	-	V	19
Estrildidae	*Stagonopleura guttata*	Diamond Firetail	V	-	12
Falconidae	*Falco subniger*	Black Falcon	V	-	2
Laridae	*Onychoprion fuscata*	Sooty Tern	V	-	1

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	4
Meliphagidae	*Melithreptus gularis*	Black-chinned Honeyeater (eastern subspecies)	V	-	10
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	-	46
Petroicidae	*Melanodryas cucullata*	Hooded Robin (south-eastern form)	V	-	2
Petroicidae	*Petroica boodang*	Scarlet Robin	V	-	25
Petroicidae	*Petroica phoenicea*	Flame Robin	V	-	2
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V	-	62
Psittacidae	*Lathamus discolor*	Swift Parrot	E	CE	5
Psittacidae	*Neophema pulchella*	Turquoise Parrot	V	-	4
Strigidae	*Ninox connivens*	Barking Owl	V	-	2
Strigidae	*Ninox strenua*	Powerful Owl	V	-	31
Tytonidae	*Tyto novaehollandiae*	Masked Owl	V	-	3
Gastropods					
Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E	-	47
Insects					
Petaluridae	*Petalura gigantea*	Giant Dragonfly	E	-	1
Mammals					
Burramyidae	*Cercartetus nanus*	Eastern Pygmy-possum	V	-	31
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	10
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	-	5

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	1
Miniopteridae	*Miniopterus australis*	Little Bent-winged Bat	V	-	12
Miniopteridae	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V	-	32
Molossidae	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V	-	27
Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	V	3
Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V	-	8
Phascolarctidae	*Phascolarctos cinereus*	Koala	E	E	1192
Pseudocheiridae	*Petauroides volans*	Greater Glider		E	15
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	99
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	28
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-	9
Vespertilionidae	*Myotis macropus*	Southern Myotis	V	-	194
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-	19
Reptiles					
Elapidae	*Hoplocephalus bungaroides*	Broad-headed Snake	E	V	28
Varanidae	*Varanus rosenbergi*	Rosenberg's Goanna	V	-	4
Flora					
Apocynaceae	*Cynanchum elegans*	White-flowered Wax Plant	E	E	9
Ericaceae	*Epacris purpurascens var. purpurascens*		V	-	286

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Ericaceae	*Leucopogon exolasius*	Woronora Beard-heath	V	V	7
Fabaceae (Faboideae)	*Dillwynia tenuifolia*		V	-	2
Fabaceae (Faboideae)	*Pultenaea aristata*	Prickly Bush-pea	V	V	1
Fabaceae (Faboideae)	*Pultenaea pedunculata*	Matted Bush-pea	E	-	9
Fabaceae (Mimosoideae)	*Acacia bynoeana*	Bynoe's Wattle	E	V	47
Grammitidaceae	*Grammitis stenophylla*	Narrow-leaf Finger Fern	E	-	1
Gyrostemonaceae	*Gyrostemon thesioides*		E	-	1
Myrtaceae	*Darwinia peduncularis*		V	-	2
Myrtaceae	*Eucalyptus macarthurii*	Paddys River Box, Camden Woollybutt	E	E	1
Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	V	1
Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V	V	43
Myrtaceae	*Syzygium paniculatum*	Magenta Lilly Pilly	E	V	3
Orchidaceae	*Genoplesium baueri*	Bauer's Midge Orchid	E	E	1
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood	E	E	1
Polygonaceae	*Persicaria elatior*	Tall Knotweed	V	V	1
Proteaceae	*Grevillea parviflora subsp. parviflora*	Small-flower Grevillea	V	V	551
Proteaceae	*Macadamia integrifolia*	Macadamia Nut	-	V	2
Proteaceae	*Persoonia bargoensis*	Bargo Geebung	E	V	623
Proteaceae	*Persoonia glaucescens*	Mittagong Geebung	E	V	47
Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E	E	8

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Proteaceae	*Persoonia nutans*	Nodding Geebung	E	E	1
Rhamnaceae	*Pomaderris brunnea*	Brown Pomaderris	E	V	16
Rubiaceae	*Galium australe*	Tangled Bedstraw	E	-	1
Thymelaeaceae	*Pimelea curviflora var. curviflora*		V	V	2
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	E	16

Appendix B – PMST Search Results

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 22-Aug-2022

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	13
Listed Threatened Species:	64
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	11
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	21
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	1
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area	In feature area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community may occur within area	In feature area
Coastal Upland Swamps in the Sydney Basin Bioregion	Endangered	Community likely to occur within area	In feature area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area	In feature area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area	In buffer area only
Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion	Critically Endangered	Community may occur within area	In buffer area only
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community may occur within area	In feature area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area	In feature area
Southern Highlands Shale Forest and Woodland in the Sydney Basin Bioregion	Critically Endangered	Community may occur within area	In buffer area only
Turpentine-Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area	In buffer area only
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area	In feature area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community likely to occur within area	In feature area

Community Name	Threatened Category	Presence Text	Buffer Status
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area	In buffer area only

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area	In feature area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area	In buffer area only
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor			
Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
Pycnoptilus floccosus			
Pilotbird [525]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rostratula australis			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
FISH			
Macquaria australasica			
Macquarie Perch [66632]	Endangered	Species or species habitat known to occur within area	In feature area
FROG			
Heleioporus australiacus			
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area	In feature area
Litoria aurea			
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area	In feature area
Litoria littlejohni			
Littlejohn's Tree Frog, Heath Frog [64733]	Endangered	Species or species habitat known to occur within area	In buffer area only
Litoria watsoni			
Watson's Tree Frog [91509]	Endangered	Species or species habitat may occur within area	In buffer area only
Mixophyes balbus			
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area	In buffer area only
INSECT			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Austrocordulia leonardi			
Sydney Hawk Dragonfly [84741]	Endangered	Species or species habitat known to occur within area	In feature area
MAMMAL			
Chalinolobus dwyeri			
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area	In feature area
Isoodon obesulus obesulus			
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area	In feature area
Petrogale penicillata			
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
Potorous tridactylus trisulcatus			
Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pseudomys novaehollandiae			
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	In feature area
PLANT			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area	In feature area
Allocasuarina glareicola [21932]	Endangered	Species or species habitat may occur within area	In feature area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Commersonia prostrata Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area	In feature area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area	In feature area
Eucalyptus benthamii Camden White Gum, Nepean River Gum [2821]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat likely to occur within area	In feature area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area	In feature area
Grevillea raybrownii [65665]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Hakea dohertyi Kowung Hakea [66701]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area	In feature area
Leucopogon exolasius Woronora Beard-heath [14251]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat known to occur within area	In feature area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Persoonia bargoensis Bargo Geebung [56267]	Vulnerable	Species or species habitat known to occur within area	In feature area
Persoonia glaucescens Mittagong Geebung [12770]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat known to occur within area	In feature area
Persoonia mollis subsp. revoluta [56094]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat may occur within area	In buffer area only
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat likely to occur within area	In feature area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pomaderris cotoneaster Cotoneaster Pomaderris [2043]	Endangered	Species or species habitat known to occur within area	In feature area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat known to occur within area	In feature area
Pultenaea aristata [18062]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In feature area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Thelymitra kangaloonica Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	In feature area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area	In buffer area only
REPTILE			
Delma impar Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat may occur within area	In feature area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat known to occur within area	In feature area
Listed Migratory Species			[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat may occur within area	In buffer area only
Migratory Wetlands Species			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Communications, Information Technology and the Arts - Telstra Corporation Limited		
Commonwealth Land - Australian Telecommunications Commission [12104]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12107]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12101]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12102]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12103]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12108]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12119]	NSW	In buffer area only

Commonwealth Land Name	State	Buffer Status
Commonwealth Land - Australian Telecommunications Commission [12201]	NSW	In buffer area only
Commonwealth Land - Australian Telecommunications Commission [12066]	NSW	In buffer area only
Commonwealth Land - Telstra Corporation Limited [12065]	NSW	In buffer area only
Defence		
Commonwealth Land - Defence Service Homes Corporation [12106]	NSW	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pandion haliaetus			
Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
Rhipidura rufifrons			
Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus			
Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Upper Nepean	State Conservation Area	NSW	In buffer area only

Nationally Important Wetlands		[Resource Information]
Wetland Name	State	Buffer Status
Thirlmere Lakes	NSW	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Bingara Gorge staged residential development, NSW	2014/7400	Controlled Action	Post-Approval	In feature area
Clearing of vegetation for several facilities, Bargo, NSW	2009/5058	Controlled Action	Completed	In buffer area only
Consolidation of Existing Operations, Continuation of Underground Mining and Upgrade of Facilities a	2009/5142	Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
Construction of a ventilation shaft and access Road to service underground operations	2010/5722	Controlled Action	Post-Approval	In buffer area only
Cross Street Residential Development	2019/8537	Controlled Action	Further Information Request	In buffer area only
Dendrobium Mine extension, Cordeaux Rd, Mount Kembla, NSW	2017/7855	Controlled Action	Assessment Approach	In buffer area only
Dendrobium Mine Extension Project	2021/9115	Controlled Action	Assessment Approach	In buffer area only
Expansion of the NRE No. 1 Colliery Coal Mine in the Southern Coalfield of NSW	2013/6838	Controlled Action	Completed	In buffer area only
Extension of subsurface longwall mining, Wonga West and Wonga East	2010/5786	Controlled Action	Completed	In buffer area only
Extension of Underground Mining Operations at The Bulli Seam Operations	2010/5350	Controlled Action	Post-Approval	In feature area
Mt Gilead Stage 2 Residential Development	2019/8587	Controlled Action	Further Information Request	In buffer area only
Residential development, 19 Tickle Drive, Thirlmere NSW	2018/8318	Controlled Action	Post-Approval	In buffer area only
Residential development, Lots 8-9 and Lot 2 Bronzewing St and Byron Road, Tahmoor, NSW	2016/7808	Controlled Action	Post-Approval	In buffer area only
Russell Vale Colliery Revised Underground Expansion Project	2020/8702	Controlled Action	Post-Approval	In buffer area only
Russell Vale Colliery Underground Expansion Project, NSW	2014/7268	Controlled Action	Completed	In buffer area only
Tahmoor South longwall coal mining project, Southern Coalfields, NSW	2014/7162	Controlled Action	Completed	In buffer area only
Tahmoor South Project, NSW	2017/8084	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Construction of a new rail track deviation of Main Southern Railway at Tahmoor	2011/5794	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Not controlled action (particular manner)				
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

Bioregional Assessments

SubRegion	BioRegion	Website	Buffer Status
Sydney	Sydney Basin	BA website	In feature area

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

© Commonwealth of Australia

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix C – Habitat Assessment Table

This criteria is designed for use in a BAR only, and is not applicable for use in a BDAR (ie where the BAM-C is being used). Only recorded sightings from BioNet are valid in this criteria.

Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey or has been recorded within the past five years (known from a reputable source).
High	A species is considered highly likely to occur in the study area if: • There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present. OR • The species is highly mobile, dependent on identified suitable habitat within the study area (ie for breeding or important life cycle periods such as winter flowering resources) and has been recorded recently (within five years) on BioNet in the locality. This also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	A species is considered moderately likely to occur in the study area if: • Any suitable habitat (eg foraging) is present in the study area, the species is highly mobile and has been recorded in the locality in the last 10 years on BioNet. The species may be unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (ie for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area. OR • The species is not highly-mobile, dependent on identified suitable habitat features (eg hollows, rocky outcrops) within the study area and has been recorded in the locality in the last 10 years on BioNet. OR • For flora species that are associated with PCTs in the study area (see TBDC) or have been recorded in the locality in the last 10 years on BioNet – the associated PCT/habitat present in the study area is not degraded and the species was not targeted by surveys in accordance with the BAM and relevant survey guidelines. In addition, for flora species known to occur in disturbed areas (eg orchids), records from any time within the locality may warrant inclusion in this category.

Likelihood	Criteria
Low	A species is considered to have a low likelihood of occurring in the study area if: • For highly mobile species, the species may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality, meaning that the species is not dependent (ie for breeding or important life cycle periods such as winter flowering resources) on habitats in the study area and the species has not been recorded in the locality in the last 10 years on BioNet. OR • The species is not highly-mobile, dependent on identified suitable habitat features (eg hollows, rocky outcrops) within the study area and has not been recorded in the locality in the last 10 years on BioNet. OR • For flora species that are associated with PCTs in the study area (see TBDC) and the species was not identified following targeted surveys in accordance with the BAM and relevant survey guidelines. Flora species that have been recorded in the locality on BioNet at any time, associated suitable habitat (see the TBDC) is not present in the study area, though similar habitats of the same vegetation formation is present in the study area.
Unlikely	Suitable habitat for the species is absent from the study area.

Habitat assessment table

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Plants						
Acacia bynoeana (Bynoe's Wattle)	E	V	Species	Found in central eastern NSW, from the Hunter District south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood (Corymbia gummifera), Scribbly Gum (Eucalyptus haemastoma), Drooping Red Gum (E. parramattensis), Old Man Banksia (Banksia serrata) and Small-leaved Apple (Angophora bakeri).	47 (BioNet), PMST	Low. This species is associated with PCT 1395, however was not detected within the study area following targeted surveys.
Allocasuarina glareicola	E	E	Species	Grows in Castlereagh woodland on lateritic soil. Found in open woodland with Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla and Melaleuca decora. Common associated understorey species include Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis and Xanthorrhoea minor.	PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Caladenia tessellata (Thick-lipped Spider-orchid, Daddy Long-legs)	E	V	Species	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	PMST	Low. This species is associated with PCT 1395, however was not detected within the study area following targeted surveys.
Commersonia prostrata (Dwarf Kerrawang)	E	E	Species	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum (Eucalyptus pauciflora) Woodland and Ephemeral Wetland floor at Rowes Lagoon; Blue leaved Stringybark (E. agglomerata) Open Forest at Tallong; and in Brittle Gum (E. mannifera) Low Open Woodland at Penrose; Scribbly Gum (E. haemostoma)/ Swamp Mahogany (E. robusta) Ecotonal Forest at Tomago.	PMST	Unlikely. Suitable habitat for the species is absent from the study area.
Cryptostylis hunteriana (Leafless Tongue-orchid)	V	V	Species	A very rare leafless, saprophytic orchid, which has a symbiotic relationship with a mycorrhizal fungi which provides the plant with all its nutrient requirements. This orchid remains underground for the majority of its lifecycle, flowering periodically when conditions are optimal to reproduce. This species is extremely cryptic as it does not flower every year. Known to occur within a range of habitats including woodlands to swamp heaths. The larger populations have been typically found in woodland dominated by E. racemosa (Scribbly Gum) and it prefers areas with an open grassy understorey. The species typically prefers moist sandy soils in sparse to dense heath and sedgeland, or moist to dry clay loams in coastal forests.	PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Cynanchum elegans (White-flowered Wax Plant)	E	E	Species	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree Leptospermum laevigatum – Coastal Banksia Banksia integrifolia subsp. integrifolia coastal scrub; Forest Red Gum Eucalyptus tereticornis aligned open forest and woodland; Spotted Gum Corymbia maculata aligned open forest and woodland; and Bracelet Honeymyrtle Melaleuca armillaris scrub to open scrub.	9 (BioNet), PMST	Unlikely. Suitable habitat for the species is absent from the study area.
Darwinia peduncularis	V	-	Species	Occurs as local disjunct populations in coastal NSW with a couple of isolated populations in the Blue Mountains. Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone.	2 (BioNet)	Low. Associated suitable habitat is not present within the study area.
Dillwynia tenuifolia	V	-	Species	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	2 (BioNet)	Low. This species was not detected within the study area following targeted surveys.
Epacris purpurascens var. purpurascens	V	-	Species	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	286 (BioNet)	Low. This species was not detected within the study area following targeted surveys.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Eucalyptus benthamii (Camden White Gum, Nepean River Gum)	V	V	Species	Occurs on the alluvial flats of the Nepean River and its tributaries. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. A further 18 trees are scattered along the Nepean River, south to The Oaks. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Occurs in open forest. Associated species at the Bents Basin site include Eucalyptus elata, E. bauerina, E. amplifolia, E. deanei and Angophora subvelutina. Understorey species include Bursaria spinosa, Pteridium esculentum and a wide variety of agricultural weeds. The Kedumba Valley site lists E. crebra, E. deanei, E. punctata, Leptospermum flavescens, Acacia filicifolia and Pteridium esculentum among its associated species.	PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.
Eucalyptus macarthurii (Paddys River Box, Camden Woollybutt)	E	E	Species	Paddy's River Box has a moderately restricted distribution. It is currently recorded from the Moss Vale District to Kanangra-Boyd National Park. The species occurs on grassy woodland on relatively fertile soils on broad cold flats.	1 (BioNet)	Low. Associated suitable habitat is not present within the study area.
Eucalyptus nicholii (Narrow-leaved Black Peppermint)	V	V	Species	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire. Tends to grow on lower slopes in the landscape.	1 (BioNet)	Low. Associated suitable habitat is not present within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Galium australe (Tangled Bedstraw)	E	-	Species	Widspread in Victoria and Tasmania and also found in South Australia and ACT. In NSW, this species has been recorded historically in the Nowra (Colymea) and Narooma areas and is extant in Nadgee Nature Reserve, south of Eden. Records in the Sydney area are yet to be confirmed.	1 (BioNet)	Low. Associated suitable habitat is not present within the study area.
Genoplesium baueri (Bauer's Midge Orchid)	E	E	Species	Grows in dry sclerophyll forest and moss gardens over sandstone.	1 (BioNet), PMST	Low. Associated suitable habitat is not present within the study area.
Grammitis stenophylla (Narrow-leaf Finger Fern)	E	-	Species	In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri. Inhabits moist places, usually near streams, on rocks or in trees, in rainforest and moist Eucalypt forest.	1 (BioNet)	Unlikely. Suitable habitat for the species is absent from the study area.
Grevillea parviflora subsp. parviflora (Small-flower Grevillea)	V	V	Species	Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast, and Cessnock and Kurri Kurri in the Lower Hunter. Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	551 (BioNet), PMST	Low. This species was not detected within the study area following targeted surveys.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Grevillea raybrownii	V	-	Species	All natural remnant sites occur within a habitat that is both characteristic and consistent between sites. Generally occurs on ridgetops and, less often, slopes and benches of Hawkesbury Sandstone and Mittagong Formation. It occurs in Eucalyptus open forest and woodland with a shrubby understorey on sandy, gravelly loam soils derived from sandstone that are low in nutrients.	PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.
Gyrostemon thesioides	E	-	Species	Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. Grows on hillsides and riverbanks and may be restricted to fine sandy soils.	1 (BioNet)	Low. Associated suitable habitat is not present within the study area.
Hakea dohertyi (Kowung Hakea)	E	E	Species	Kowmung Hakea is confined to a small area (18 sq. km) in the Kowmung Valley in Kanangra Boyd National Park. Kowmung Hakea grows in dry sclerophyll forest, usually dominated by grey gum or silvertop ash, with a sparse groundcover and midstorey.	PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.
Haloragis exalata subsp. exalata (Wingless Raspwort, Square Raspwort)	V	V	Species	Square Raspwort appears to require protected and shaded damp situations in riparian habitats.	PMST	Unlikely. Suitable habitat for the species is absent from the study area.
Leucopogon exolasius (Woronora Beard-heath)	V	V	Species	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone. Flowering occurs in August and September.	7 (BioNet), PMST	Low. Associated suitable habitat is not present within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Macadamia integrifolia (Macadamia Nut)	-	V	Species	While specimens have been collected from the North Coast of NSW , this species is not known to occur naturally in NSW.	2 (BioNet)	Low. Although the species has been recorded from the locality, associated suitable habitat is not present in the study area and the species is not known to occur naturally in NSW.
Melaleuca deanei (Deane's Paperbark)	V	V	Species	Deane’s Paperbark occurs in two distinct areas, in the Ku-ring-gai, Berowra, Holsworthy and Wedderburn areas, and there are also more isolated occurrences at Springwood, Wollemi National Park, Yalwal and the Central Coast areas. The species grows in heath on sandstone	43 (BioNet), PMST	Low. This species was not detected within the study area following targeted surveys.
Persicaria elatior (Tall Knotweed)	V	V	Species	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	1 (BioNet), PMST	Unlikely. Suitable habitat for the species is absent from study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Persoonia bargoensis (Bargo Geebung)	E	V	Species	The Bargo Geebung is restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. The historical limits are Picton and Douglas Park (northern), Yanderra (southern), Cataract River (eastern) and Thirlmere (western). The Bargo Geebung occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and .Hawkesbury Sandstone. It favours interface soil landscapes such as between the Blacktown Soil Landscape and the complex Mittagong Formation soils (Lucas Heights Soil Landscape) with the underlying sandstone (Hawkesbury Soil Landscape and Gymea Soil Landscape). Some of the vegetation the species occurs within would be recognised as the Shale/Sandstone Transition Forest, a listed community.	623 (BioNet), PMST	Low. This species was not detected within the study area following targeted surveys.
Persoonia glaucescens (Mittagong Geebung)	E	V	Species	The Mittagong Geebung grows in woodland to dry sclerophyll forest on clayey and gravely laterite. The preferred topography is ridge-tops, plateaux and upper slopes. Aspect does not appear to be a significant factor.	47 (BioNet), PMST	Low. Associated suitable habitat is not present within the study area.
Persoonia hirsuta (Hairy Geebung)	E	E	Species	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. It is usually present as isolated individuals or very small populations.	8 (BioNet), PMST	Low. This species was not detected within the study area following targeted surveys.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Persoonia mollis subsp. revoluta	V	-	Species	Persoonia mollis subsp. revoluta is endemic to New South Wales where it is currently known to occur in seven populations, primarily in the area between Mittagong, Paddys River and High Range in the Southern Highlands with an outlying population in the Bindook Highlands. Most of the populations occur between 600 and 800m a.s.l.,and with an average annual rainfall across the range of between 700 and 900 mm.	PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.
Persoonia nutans (Nodding Geebung)	E	E	Species	Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River / Castlereagh Ironbark Forest.	1 (BioNet), PMST	Low. This species has not been recorded within the locality in the previous 10 years.
Pimelea curviflora var. curviflora	V	V	Species	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain.	2 (BioNet)	Low. This species was not detected within the study area following targeted surveys.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Pimelea spicata (Spiked Rice-flower)	E	E	Species	The Illawarra populations usually occur in one of two communities - a woodland or a coastal grassland. Woodland sites are dominated by forest red gum (E. tereticornis) and stringybark (E. eugenioides), with a groundcover dominated by kangaroo grass (Themeda australis) and matrush (Lomandra longifolia). The grassland sites are dominated by kangaroo grass (Themeda australis) and matrush (Lomandra longifolia), with blady grass (Imperata cylindrica). A shrubby layer, where present, is dominated by coastal wattle (Acacia sophorae) and coast rosemary (Westringia fruticosa) with coast banksia (Banksia integrifolia).	16 (BioNet), PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.
Pomaderris brunnea (Brown Pomaderris)	E	V	Species	Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. The species has been found in association with Eucalyptus amplifolia, Angophora floribunda, Acacia parramattensis, Bursaria spinosa and Kunzea ambigua.	16 (BioNet), PMST	Low. This species was not detected within the study area following targeted surveys.
Pomaderris cotoneaster (Cotoneaster Pomaderris)	E	E	Species	Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs.	PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Pterostylis saxicola (Sydney Plains Greenhood)	E	E	Species	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where Pterostylis saxicola occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	1 (BioNet), PMST	Low. This species has not been recorded in the locality since 1990.
Pultenaea aristata (Prickly Bush-pea)	V	V	Species	The species occurs in either dry sclerophyll woodland or wet heath on sandstone.	1 (BioNet), PMST	Low. Associated suitable habitat is not present within the study area.
Pultenaea pedunculata (Matted Bush-pea)	E	-	Species	Widespread in Victoria, Tasmania, and south-eastern South Australia, However in NSW it is represented by just three disjunct populations on the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	9 (BioNet)	Low. This species has not been detected in the locality since 2006.
Rhizanthella slateri (Eastern Underground Orchid)	V	E	Species	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	PMST	Low. This species has not been detected in the locality.
Rhodamnia rubescens (Scrub Turpentine, Brown Malletwood)	CE	CE	Species	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	PMST	Unlikely. Suitable habitat for the species is absent from the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Syzygium paniculatum (Magenta Lilly Pilly)	E	V	Species	On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	3 (BioNet), PMST	Unlikely. Suitable habitat for the species is absent from the study area.
Thelymitra kangaloonica (Kangaloon Sun Orchid)	CE	CE	Species	It is found in swamps in sedgelands over grey silty grey loam soils.	PMST	Unlikely. Suitable habitat for the species is absent from the study area.
Thesium australe (Austral Toadflax, Toadflax)	V	V	Species	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (Themeda australis).	PMST	Unlikely. Suitable habitat for the species is absent from the study area.
Xerochrysum palustre (Swamp Everlasting, Swamp Paper Daisy)	-	V	Species	Swamp Everlasting grows in wetlands including sedge-swamps and shallow freshwater marshes, often on heavy black clay soils. Commonly associated genera include Swamp Wallaby-grasses (Amphibromus spp.), Twig-sedges (Baumea spp.), Sedges (Carex spp.), Chorizandra, Billy-buttons (Craspedia spp.), Spike-sedges (Eleocharis spp.), Club-sedges (Isolepis spp.), Blowngrasses (Lachnagrostis spp.), Sword-sedges (Lepidosperma spp.), Water-milfoils (Myriophyllum spp.), Common reed (Phragmites australis), Kangaroo grass (Themea triandra) and Villarsia. Plants have been seen growing in 1 m of water on French Island areas of native grassland and heath communities. At higher altitudes in NSW it also grows in Sphagnum moss bogs.	PMST	Unlikely. Suitable habitat for the species is absent from the study area.
Birds						

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Anthochaera phrygia (Regent Honeyeater)	CE	CE	Dual Credit	The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	4 (BioNet), PMST	Low. The species is associated with PCT 1395; however it has not been recorded in the locality since 1996 and would not be dependent on habitat in the study area. It was not detected during targeted surveys.
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	V	-	Ecosystem	The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath.	43 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Botaurus poiciloptilus (Australasian Bittern)	E	E	Ecosystem	In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly Bullrushes (Typha spp.) and Spikerushes (Eleocharis spp.).	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Burhinus grallarius (Bush Stone-curlew)	E	-	Species	The curlew likes to roost and nest in grassy woodlands of buloke, gum or box with low, sparse grassy or herb understorey.	2 (BioNet)	Moderate. The species is associated with PCT 1395.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Calidris ferruginea (Curlew Sandpiper)	E	CE, Bonn, C,J,K	Dual Credit	This species has a widespread distribution in NSW east of the Great Divide, particularly in coastal regions. The Curlew Sandpiper inhabits intertidal mudflats in estuaries and bays, lakes and lagoons.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Callocephalon fimbriatum (Gang-gang Cockatoo)	V	E	Dual Credit	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas.	15 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area. This species was not detected during targeted surveys.
Calyptorhynchus lathami lathami (South-eastern Glossy Black-Cockatoo)	V	V	Dual Credit	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of she-oak occur. Black She-oak (Allocasuarina littoralis) and Forest She-oak (A. torulosa) are important foods.	45 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area. This species was not detected during targeted surveys.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Chthonicola sagittata (Speckled Warbler)	V	-	Ecosystem	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area.	4 (BioNet)	Moderate. Suitable habitat is present within the study area and the species has been recorded in the locality in the past 10 years.
Climacteris picumnus victoriae (Brown Treecreeper (eastern subspecies))	V	-	Ecosystem	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (Eucalyptus camaldulensis) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	22 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Daphoenositta chrysoptera (Varied Sittella)	V	-	Ecosystem	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	46 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Dasyornis brachypterus (Eastern Bristlebird)	E	E	Species	Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	PMST	Unlikely. Suitable habitat for the species is absent from the study area. The species has not been recorded in the locality.
Erythrotriorchis radiatus (Red Goshawk)	CE	V	Species	The Red Goshawk occurs in coastal and sub-coastal areas in wooded and forested lands of tropical and warm-temperate Australia. Riverine forests are also used frequently. Such habitats typically support high bird numbers and biodiversity, especially medium to large species which the goshawk requires for prey. The Red Goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water.	PMST	Low. The species has not been recorded in the locality. Suitable habitat is present nearby to the study area. The species is highly mobile and may be an occasional visitor, but is not dependent on habitat in the study area.
Falco hypoleucos (Grey Falcon)	E	-	Ecosystem	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	PMST	Low. The species has not been recorded in the locality. Suitable habitat is present nearby to the study area. The species is highly mobile and may be an occasional visitor, but is not dependent on habitat in the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Falco subniger (Black Falcon)	V	-	Ecosystem	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres.	2 (BioNet)	Low. The species has not been recorded in the locality since 2003. The species is highly mobile and may be an occasional visitor, but is not dependent on habitat in the study area.
Glossopsitta pusilla (Little Lorikeet)	V	-	Ecosystem	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	62 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Grantiella picta (Painted Honeyeater)	V	V	Ecosystem	Inhabits Boree/ Weeping Myall (Acacia pendula), Brigalow (A. harpophylla) and Box-Gum Woodlands and Box-Ironbark Forests.	PMST	Low. Suitable habitat is present within the study area; however the species has not been recorded in the locality.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Haliaeetus leucogaster (White-bellied Sea-Eagle)	V	-	Dual Credit	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).	7 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area. This species was not detected during targeted surveys.
Hieraaetus morphnoides (Little Eagle)	V	-	Dual Credit	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used.	17 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Hirundapus caudacutus (White-throated Needletail)	-	V,C,J,K	Ecosystem	Non-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.	6 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 10 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Lathamus discolor (Swift Parrot)	E	CE	Dual Credit	Migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and White Box E. albens. Commonly used lerp infested trees include Inland Grey Box E. microcarpa, Grey Box E. moluccana and Blackbutt E. pilularis.	5 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area. This species was not detected during targeted surveys.
Lophoictinia isura (Square-tailed Kite)	V	-	Dual Credit	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland.	9 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area. This species was not detected during targeted surveys.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Melanodryas cucullata cucullata (Hooded Robin (south-eastern form))	V	-	Ecosystem	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey.	2 (BioNet)	Low. Suitable habitat is present within the study area and the species has not been recorded in the locality in the last 10 years.
Melithreptus gularis gularis (Black-chinned Honeyeater (eastern subspecies))	V	-	Ecosystem	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa), Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	10 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Neophema pulchella (Turquoise Parrot)	V	-	Ecosystem	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter.	4 (BioNet)	Moderate. Suitable habitat is present within the study area and the species has been recorded in the locality in the past 10 years.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Ninox connivens (Barking Owl)	V	-	Dual Credit	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils.	2 (BioNet)	Moderate. Suitable habitat is present within the study area and the species has been recorded in the locality in the past 10 years.
Ninox strenua (Powerful Owl)	V	-	Dual Credit	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine Syncarpia glomulifera, Black She-oak Allocasuarina littoralis, Blackwood Acacia melanoxylon, Rough-barked Apple Angophora floribunda, Cherry Ballart Exocarpus cupressiformis and a number of eucalypt species.	31 (BioNet)	Moderate. Suitable habitat is present within the study area and the species has been recorded in the locality in the past 5 years. The species is unlikely to be dependent on habitat within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Numenius madagascariensis (Eastern Curlew, Far Eastern Curlew)	-	CE, C,J,K	Dual Credit	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms. The numbers of Eastern Curlew recorded during one study were correlated with wetland areas.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Onychoprion fuscata (Sooty Tern)	V	-	Species	Large flocks can be seen soaring, skimming and dipping but seldom plunging in offshore waters. Breeds in large colonies in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands.	1 (BioNet)	Low. Suitable habitat for the species is absent from the study area. The species has not been recorded in the locality since 1996.
Petroica boodang (Scarlet Robin)	V	-	Ecosystem	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin is primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding.	25 (BioNet)	Moderate. Suitable habitat is present within the study area and the species has been recorded in the locality in the past 5 years.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Petroica phoenicea (Flame Robin)	V	-	Ecosystem	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains).	2 (BioNet)	Moderate. Suitable habitat is present within the study area and the species has been recorded in the locality in the past 10 years.
Pycnoptilus floccosus (Pilotbird)	-	V		Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth. Critical habitat may include wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth, and dry sclerophyll forests and woodlands occupying dry slopes and ridges.	19 (BioNet), PMST	Low. The species has been recorded in the locality in the past 10 years, however suitable habitat for the species is absent from the study area.
Rostratula australis (Australian Painted Snipe)	E	E	Ecosystem	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Stagonopleura guttata (Diamond Firetail)	V	-	Ecosystem	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	12 (BioNet)	Moderate. Suitable habitat is present within the study area and the species has been recorded in the locality in the past 10 years.
Tyto novaehollandiae (Masked Owl)	V	-	Dual Credit	Found in a range of habitats, locally within sclerophyll forests and woodlands where appropriate/preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well.	3 (BioNet)	Moderate. Suitable foraging habitat is present within the study area and the species has been recorded in the locality in the past 10 years.
Mammals						
Cercartetus nanus (Eastern Pygmy-possum)	V	-	Species	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	31 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. Suitable foraging habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Chalinolobus dwyeri (Large-eared Pied Bat)	V	V	Species	This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of Fairy Martin (H. ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20¬-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy.	28 (BioNet), PMST	Moderate. Suitable roosting habitat is present in the locality and the species has been recorded in the locality in the past 5 years. The species may forage in the study area but is unlikely to be dependent on foraging habitat within the study area.
Dasyurus maculatus (Spotted-tailed Quoll)	V	E	Ecosystem	Found in a variety of forested habitats. This species creates a den in fallen hollow logs or among rocky outcrops. Generally, does not occur in otherwise suitable habitats that are in close proximity to urban development.	10 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 10 years. It is highly mobile and unlikely to be dependent on resources within the study area.
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	V	-	Ecosystem	This species is found in a variety of forest types such as open forests, woodlands and wetter sclerophyll forests (usually with trees >20m). This species roosts in tree hollows and caves. Appears to locally favour upland habitats.	9 (BioNet)	Moderate. Suitable habitat is present in the study area and the species has been recorded in the locality in the past 5 years.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Isoodon obesulus obesulus (Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern))	E	E	Species	Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. Nest during the day in a shallow depression in the ground covered by leaf litter, grass or other plant material. Nests may be located under Grass trees Xanthorrhoea spp., blackberry bushes and other shrubs, or in rabbit burrows.	PMST	Low. The species has not been recorded in the locality.
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	V	-	Ecosystem	This species is distributed south of Sydney extending north into south-eastern Queensland. There are no records west of the Great Dividing Range. Most records of this species have been reported from dry Eucalypt forest and woodland. It is expected that open forested areas and the cleared land adjacent to bushland, constitutes important habitat for this species. It is a predominantly tree-dwelling species, roosting in hollows or behind loose bark in mature Eucalypts.	27 (BioNet)	Moderate. Suitable habitat is present in the study area and the species has been recorded in the locality in the past 5 years.
Miniopterus australis (Little Bent-winged Bat)	V	-	Dual Credit	Prefers to forage in well-vegetated areas, such as within wet and dry sclerophyll forests and rainforests. Requires caves or similar structures for roosting habitat.	12 (BioNet)	Moderate. Suitable roosting habitat is present in the locality and the species has been recorded in the locality in the past 5 years. The species may forage in the study area but is unlikely to be dependent on foraging habitat within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Miniopterus orianae oceanensis (Large Bent-winged Bat)	V	-	Dual Credit	This species utilises a range of habitats for foraging, including rainforest, wet and dry sclerophyll forests, woodlands and open grasslands. Requires caves or similar structures for roosting habitat.	32 (BioNet)	Moderate. Suitable roosting habitat is present in the locality and the species has been recorded in the locality in the past 5 years. The species may forage in the study area but is unlikely to be dependent on foraging habitat within the study area.
Myotis macropus (Southern Myotis)	V	-	Species	Usually found near bodies of water, including estuaries, lakes, reservoirs, rivers and large streams, often in close proximity to their roost site. Although usually recorded foraging over wet areas, it also utilises a variety of wooded habitats adjacent to such areas including rainforest, wet and dry sclerophyll forest, woodland, and swamp forest. Roosts in small colonies of between 15 and several hundred individuals in caves, mines and disused railway tunnels.	194 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years. It may forage within the study area; however, it is unlikely to be dependent on resources within the study area.
Petauroides volans (Greater Glider (southern and central))	-	E	Species	The greater glider is an arboreal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, with a diet mostly comprising eucalypt leaves, and occasionally flowers. It is found in highest abundance typically in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows. The Greater Glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	15 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 5 years, however, it is unlikely to be dependent on resources within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Petaurus australis australis (Yellow-bellied Glider (south-eastern))	V	V	Ecosystem	Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	3 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 10 years, however, it is unlikely to be dependent on resources within the study area.
Petaurus norfolcensis (Squirrel Glider)	V	-	Species	Occurs in eucalypt forests and woodlands where it feeds on sap exudates and blossoms. In these areas tree hollows are utilised for nesting sites. This species also requires winter foraging resources when the availability of normal food resources may be limited, such as winter-flowering shrub and small tree species.	8 (BioNet)	Moderate. The species has been recorded in the locality in the past 5 years, however, it is unlikely to be dependent on resources within the study area.
Petrogale penicillata (Brush-tailed Rock-wallaby)	E	V	Species	Occurs in forests and woodlands along the Great Divide and on the western slopes in escarpment country with rocky outcrops, steep rocky slopes, gorges, boulders and isolated rocky areas. The majority of populations favour north-facing aspects, but some southern aspects have been recorded. Apart from the critical rock structure, Brush-tailed Rock-wallaby also requires adjacent vegetation types, associated types include, dense rainforest, wet sclerophyll, vine thicket, dry sclerophyll forest and open forest. They also require suitable caves and rocky overhangs for shelter and also for ‘lookout’ posts.	1 (BioNet), PMST	Low. The species has not been recorded in the locality since 1960. The species would not be dependent on habitat within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Phascolarctos cinereus (Koala)	E	E	Dual Credit	Occurs in forests and woodlands where it requires suitable feed trees (particularly Eucalyptus spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack and road mortality during these excursions.	1192 (BioNet), PMST	High. The species has been recorded within the study area in the past 10 years.
Potorous tridactylus trisulcatus (Long-nosed Potoroo (southern mainland))	V	V	Species	Prefers cool rainforest, wet sclerophyll forest and heathland. Sleeps by day in a nest on the ground, and digs for succulent roots, tubers, fungi and subterranean insects. Some diggings seemingly attributable to this species may belong to Northern Brown Bandicoot (Isoodon macrourus).	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Pseudomys novaehollandiae (New Holland Mouse, Pookila)	-	V	Ecosystem	This species has a patchy distribution within open woodlands, heathlands and in hind dune vegetation throughout Eastern Australia.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Pteropus poliocephalus (Grey-headed Flying-fox)	V	V	Dual Credit	This species forages over a large area for nectar/fruits. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforests. Frequently observed to forage in flowering Eucalypts.	99 (BioNet), PMST	Moderate. This species has been recorded in the locality in the past 5 years. A roosting site occurs in Picton, approximately 7.7km from the study area. The species may forage in the study area but is unlikely to be dependent on habitat within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	V	-	Ecosystem	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	5 (BioNet)	Moderate. Suitable habitat is present in the study area and the species has been recorded in the locality in the past 5 years.
Scoteanax rueppellii (Greater Broad-nosed Bat)	V	-	Ecosystem	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	19 (BioNet)	Moderate. Suitable habitat is present in the study area and the species has been recorded in the locality in the past 10 years.
Amphibians						
Heleioporus australiacus (Giant Burrowing Frog)	V	V	Species	The northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Litoria aurea (Green and Golden Bell Frog)	E	V	Species	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Litoria littlejohni (Littlejohn's Tree Frog)	V	V	Species	This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath-based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	44 (BioNet), PMST	Low. The species has been recorded in the locality in the past 5 years, however suitable habitat for the species is absent from the study area.
Litoria watsoni (Watson's Tree Frog)	-	V	Species	Watson’s Tree Frog is a forest-dependent species, recorded from wet and dry forest, woodland, bushland, and heathland at low to high elevations. Watson’s Tree Frog prefers moister areas, with most records from wet forest, followed by damp forest, and warm temperate rainforest.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Mixophyes balbus (Stuttering Frog, Southern Barred Frog (in Victoria))	E	V	Species	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Pseudophryne australis (Red-crowned Toadlet)	V	-	Species	Has restricted distribution from Pokolbin to Nowra and west to Mt Victoria. Occurs in open forests and wet drainage lines below sandstone ridges that often have shale lenses or cappings in the Hawkesbury and Narrabeen Sandstones.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Reptiles						
Delma impar (Striped Legless Lizard, Striped Snake-lizard)	V	V	Species	Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass Themeda australis, spear-grasses Austrostipa spp. and poa tussocks Poa spp., and occasionally wallaby grasses Austrodanthonia spp.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Hoplocephalus bungaroides (Broad-headed Snake)	E	V	Dual Credit	The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in crevices or hollows in large trees within 500m of escarpments in summer.	28 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 10 years. Suitable habitat is present within the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Varanus rosenbergi (Rosenberg's Goanna)	V	-	Ecosystem	Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Individuals require large areas of habitat. Feeds on carrion, birds, eggs, reptiles and small mammals. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens.	4 (BioNet)	Moderate. The species has been recorded in the locality in the past 10 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Invertebrates						
Meridolum corneovirens (Cumberland Plain Land Snail)	E	-	Species	Primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	47 (BioNet)	Moderate. The species has been recorded in the locality in the past 10 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Austrocordulia leonardi (Sydney Hawk Dragonfly)	E	E	Species	The Sydney Hawk dragonfly has specific habitat requirements, and has only ever been collected from deep and shady river pools with cooler water. Larvae are found under rocks where they coexist with the Eastern Hawk dragonfly.	PMST	Low. This species has not been recorded in the locality.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Petalura gigantea (Giant Dragonfly)	E	-	Species	Live in permanent swamps and bogs with some free water and open vegetation. Adults spend most of their time settled on low vegetation on or adjacent to the swamp. They hunt for flying insects over the swamp and along its margins.	1 (BioNet)	Low. This species has not been recorded within the locality in the previous 10 years.
Fish						
Macquaria australasica (Macquarie Perch)	E	E	-	The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks. Spawning occurs just above riffles (shallow running water). Populations may survive in impoundments if able to access suitable spawning sites.	PMST Mapped distribution within the Nepean River and Allens Creek	Moderate. The distribution of the species is mapped within the Nepean River and Allens Creek.
Migratory species						
Actitis hypoleucos (Common Sandpiper)	-	Bonn, C, J, K	-	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Apus pacificus (Fork-tailed Swift)	-	C,J,K	-	In NSW, the Fork-tailed Swift is recorded in all regions. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	1 (BioNet), PMST	Low. The species was recorded in the locality in 2009. The species may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality.
Calidris acuminata (Sharp-tailed Sandpiper)	-	Bonn, C,J,K	-	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Calidris melanotos (Pectoral Sandpiper)	-	Bonn,J,K	-	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Cuculus optatus (Oriental Cuckoo, Horsfield's Cuckoo)	-	C,J,K	-	Non-breeding habitat only: monsoonal rainforest, vine thickets, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands. Frequently at edges or ecotones between habitat types. Riparian forest is favoured habitat in the Kimberley region.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Gallinago hardwickii (Latham's Snipe, Japanese Snipe)	-	Bonn, J, K	-	Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Hirundapus caudacutus (White-throated Needletail)	-	V,C,J,K	-	Non-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.	6 (BioNet), PMST	Moderate. The species has been recorded in the locality in the past 10 years. Suitable habitat is present within the study area; however the species is unlikely to be dependent on habitat within the study area.
Monarcha melanopsis (Black-faced Monarch)	-	Bonn	-	Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Motacilla flava (Yellow Wagtail)	-	C,J,K	-	Non-breeding habitat only: mostly well-watered open grasslands and the fringes of wetlands. Roosts in mangroves and other dense vegetation.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Myiagra cyanoleuca (Satin Flycatcher)	-	Bonn	-	Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.	PMST	Unlikely. The species has not been recorded in the locality. Associated habitat for the species is absent from the study area.
Numenius madagascariensis (Eastern Curlew, Far Eastern Curlew)	-	CE, C,J,K	-	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in saltworks and sewage farms. The numbers of Eastern Curlew recorded during one study were correlated with wetland areas.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Pandion haliaetus (Osprey)	V	Bonn	Species	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	PMST	Low. The species has not been recorded in the locality. Suitable habitat is present nearby to the study area.

Scientific name (Common name)	Status		BAM credit type	Distribution and habitat	Number of records (source)	Likelihood of occurrence
	BC Act	EPBC Act				
Rhipidura rufifrons (Rufous Fantail)	-	Bonn	-	Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Symposiachrus trivirgatus (Spectacled Monarch)	-	Bonn	-	Dense vegetation, mainly in rainforest but also in moist forest or wet sclerophyll and occasionally in other dense vegetation such as mangroves, drier forest and woodlands.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
Tringa nebularia (Common Greenshank, Greenshank)	-	Bonn, C, J, K	-	It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.

Appendix D – Species recorded

Recorded flora

Family	Scientific name	Common name	Status		Cover (%) in each plot*					
			BC Act	EPBC Act	1	2	3	4	5	6
Adiantaceae	Adiantum aethiopicum	Common Maidenhair	-	-						0.1
Apiaceae	Hydrocotyle bonariensis	Kurnell Curse / Pennywort	-	-						
Apiaceae	Xanthosia tridentata	Rock Xanthosia	-	-	0.1	0.1				
Aquifoliaceae	Ilex aquifolium	English Holly	-	-		0.1				
Asparagaceae	Asparagus aethiopicus	Asparagus Fern	-	-		0.1				
Asteraceae	Ageratina adenophora	Crofton Weed	-	-						0.2
Asteraceae	Bidens pilosa	Cobbler's Pegs	-	-				0.1		0.3
Asteraceae	Cassinia aculeata	Dolly Bush	-	-	0.1					
Asteraceae	Cirsium arvense	Perennial Thistle	-	-			0.1			
Asteraceae	Cirsium vulgare	Spear Thistle	-	-	0.1		5			0.7
Asteraceae	Conyza bonariensis	Flax-leaf Fleabane	-	-			0.1	0.1		
Asteraceae	Hypochaeris radicata	Flatweed	-	-			0.1	0.1		
Asteraceae	Senecio madagascariensis	Fireweed	-	-	0.1		0.1	0.2		0.2
Asteraceae	Sigesbeckia orientalis subsp. orientalis	Indian Weed	-	-			0.1			

Family	Scientific name	Common name	Status		Cover (%) in each plot*					
			BC Act	EPBC Act	1	2	3	4	5	6
Asteraceae	Sonchus spp.	Sowthistle	-	-				0.1		
Brassicaceae	Sisymbrium officinale	Hedge Mustard	-	-				0.1		
Casuarinaceae	Allocasuarina littoralis	Black She-oak	-	-		5	3		2	1
Convolvulaceae	Dichondra repens	Kidney Weed	-	-	2	5	5	0.2	0.5	0.3
Cyperaceae	Lepidosperma laterale	Variable Sword-sedge	-	-		15				
Epacridaceae	Leucopogon juniperinus	Prickly Beard-heath	-	-					1	
Fabaceae (Mimosoideae)	Acacia dealbata	Silver Wattle	-	-	0.6	1		0.1	0.5	1
Fabaceae/faboideae	Glycine clandestina	Twining Glycine	-	-		0.1		0.1		
Fabaceae/faboideae	Glycine tabacina	Twining Glycine	-	-		0.1			0.5	
Fabaceae/faboideae	Hardenbergia violacea	False Sarsparilla	-	-	0.1		0.3	0.1	0.5	
Fabaceae/faboideae	Indigofera australis	Native Indigo	-	-	0.4	0.5		0.2		
Fabaceae/faboideae	Kennedia rubicunda	Dusky Coral Pea	-	-	2					
Fabaceae/faboideae/Mimosoideae	Acacia parvipinnula	Silver-stemmed Wattle	-	-			0.2			
Fabaceae/faboideae/Mimosoideae	Acacia terminalis	Sunshine Wattle	-	-	0.1				0.1	
Goodeniaceae	Dampiera purpurea	Purple Dampiera	-	-		0.1				
Goodeniaceae	Goodenia hederacea		-	-		0.1				

Family	Scientific name	Common name	Status		Cover (%) in each plot*					
			BC Act	EPBC Act	1	2	3	4	5	6
Goodeniaceae	Scaevola ramosissima	Purple Fan Flower	-	-						0.2
Juncaceae	Juncus sp.	-	-	-					0.2	
Lauraceae	Cassytha pubescens	Common Devil's Twine	-	-	2	0.5				
Lobeliaceae	Lobelia pratioides		-	-				0.1		
Lobeliaceae	Pratia purpurascens	Whiteroot	-	-		0.1				
Lomandraceae	Lomandra longifolia	Spiky-headed Mat-rush	-	-	1	0.5		1	2	0.1
Lomandraceae	Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	-	-		1			2	
Malaceae	Cotoneaster glaucophyllus	Grey-leaved Cotoneaster	-	-		1				
Malvaceae	Sida rhombifolia	Paddy's Lucerne	-	-				0.1		
Myrtaceae	Angophora bakeri	Narrow-leaved Apple	-	-			30	15		
Myrtaceae	Angophora floribunda	Rough-barked Apple	-	-					5	
Myrtaceae	Callistemon viminalis	Weeping Bottlebrush	-	-					0.1	
Myrtaceae	Corymbia gummifera	Red Bloodwood	-	-	10	5	5			4
Myrtaceae	Eucalyptus fibrosa	Broad Leaved Ironbark	-	-	20	5		10	5	
Myrtaceae	Eucalyptus punctata	Grey Gum	-	-	5	15	5	0.5	35	30

Family	Scientific name	Common name	Status		Cover (%) in each plot*					
			BC Act	EPBC Act	1	2	3	4	5	6
Myrtaceae	Kunzea ambigua	Tick Bush	-	-	0.1	20		1	1	
Oxalidaceae	Oxalis perrenans	Yellow-flowered Wood Sorrel	-	-	0.4	0.5	0.1			
Passifloraceae	Passiflora herbertiana	Native Passionfruit	-	-				4	1	12
Phormiaceae	Dianella caerulea	Blue Flax-lily	-	-	0.1	1				
Pittosporaceae	Bursaria spinosa	Native Blackthorn	-	-	2	50		0.1		
Plantaginaceae	Plantago lanceolata	Ribwort	-	-	0.1		0.5	0.1		
Poaceae	Aristida vagans	Three-awn Speargrass	-	-				0.5		
Poaceae	Brachyachne convergens	Common Native Couch	-	-		5				
Poaceae	Briza minor	Shivery Grass	-	-	0.1					
Poaceae	Chloris gayana	Rhodes Grass	-	-	20	20	25	25	5	50
Poaceae	Chloris truncata	Windmill Grass	-	-	0.1					
Poaceae	Entolasia marginata	Bordered Panic	-	-	10	0.1		0.1	5	
Poaceae	Entolasia stricta	Wiry Panic	-	-	5	10			5	0.2
Poaceae	Imperata cylindrica	Blady Grass	-	-	0.1			15		
Poaceae	Lolium perrenne	Perennial Ryegrass	-	-			0.1			
Poaceae	Microlaena stipoides	Weeping Grass	-	-	5			30	50	5

Family	Scientific name	Common name	Status		Cover (%) in each plot*					
			BC Act	EPBC Act	1	2	3	4	5	6
Poaceae	Paspalum dilatatum	Paspalum	-	-			20			
Poaceae	Paspalum distichum	Water Couch	-	-	0.1					
Poaceae	Pennisetum clandestinum	Kikuyu, Kikuyu Grass	-	-			25			
Poaceae	Setaria parviflora		-	-				0.1		
Poaceae	Themeda australis	Kangaroo Grass	-	-				0.1	0.1	0.1
Polygonaceae	Rumex crispus	Curled Dock	-	-			0.1	0.1		
Primulaceae	Anagallis arvensis	Scarlet Pimpernel	-	-			0.1	0.1		
Proteaceae	Hakea laevipes		-	-					0.3	
Proteaceae	Isopogon anemonifolius	Flat-leaved Drumsticks	-	-						0.1
Proteaceae	Persoonia linearis	Narrow-leaved Geebung	-	-					2	
Ranunculaceae	Clematis glycinoides var. glycinoides	Headache Vine	-	-		1	0.3		0.2	3
Rhamnaceae	Pomaderris discolor	-	-	-		0.1				
Rosaceae	Rubus fruticosus sp. agg.	Blackberry complex	-	-	2		2			
Rubiaceae	Galium aparine	Cleavers	-	-	1		3			0.1
Rubiaceae	Pomax umbellata	Pomax	-	-					0.1	0.1

Family	Scientific name	Common name	Status		Cover (%) in each plot*					
			BC Act	EPBC Act	1	2	3	4	5	6
Rutaceae	Correa alba var. alba	White Correa	-	-					0.1	
Rutaceae	Correa reflexa	Native Fuschia	-	-	5	10				
Santalaceae	Exocarpos cupressiformis	Native Cherry	-	-				0.1		
Sinopteridaceae	Cheilanthes austrotenuifolia	Rock Fern	-	-		0.2		0.1		
Solanaceae	Solanum nigrum	Black Nightshade, Black-berry Nightshade	-	-				0.1	0.1	0.1
Solanaceae	Solanum prinophyllum	Forest Nightshade	-	-					0.1	0.1
Thymelaeaceae	Pimelea linifolia	Slender Rice Flower	-	-						0.1
Typhaceae	Typha orientalis	Cumbungi	-	-			2			
Verbenaceae	Lantana camara	Lantana	-	-	0.1					
Verbenaceae	Verbena bonariensis	Purpletop	-	-			0.6			

**Cover has been determined in accordance with the BAM.*

Recorded fauna

Class	Scientific name	Common name	Status		Observation Type
			BC Act	EPBC Act	
Amphibia	Crinia signifera	Common Eastern Froglet	-	-	Heard
Amphibia	Litoria peronii	Peron's Tree Frog	-	-	Heard

Class	Scientific name	Common name	Status		Observation Type
			BC Act	EPBC Act	
Reptilia	Ctenotus taeniolatus	Copper-tailed Skink	-	-	Seen
Aves	Chenonetta jubata	Australian Wood Duck	-	-	Seen
Aves	Cacatua sanguinea	Little Corella	-	-	Heard
Aves	Alisterus scapularis	Australian King-Parrot	-	-	Seen/Heard
Aves	Trichoglossus haematodus	Rainbow Lorikeet	-	-	Seen/Heard
Aves	Cacomantis flabelliformis	Fan-tailed Cuckoo	-	-	Heard
Aves	Cormobates leucophaea	White-throated Treecreeper	-	-	Seen/Heard
Aves	Malurus cyaneus	Superb Fairy-wren	-	-	Seen/Heard
Aves	Pardalotus punctatus	Spotted Pardalote	-	-	Seen/Heard
Aves	Anthochaera carunculata	Red Wattlebird	-	-	Seen/Heard
Aves	Lichenostomus chrysops	Yellow-faced Honeyeater	-	-	Seen/Heard
Aves	Manorina melanocephala	Noisy Miner	-	-	Seen/Heard
Aves	Manorina melanophrys	Bell Miner	-	-	Heard
Aves	Psophodes olivaceus	Eastern Whipbird	-	-	Heard
Aves	Coracina novaehollandiae	Black-faced Cuckoo-shrike	-	-	Seen/Heard
Aves	Cracticus tibicen	Australian Magpie	-	-	Seen/Heard
Aves	Cracticus torquatus	Grey Butcherbird	-	-	Seen/Heard

Class	Scientific name	Common name	Status		Observation Type
			BC Act	EPBC Act	
Aves	Strepera graculina	Pied Currawong	-	-	Seen
Aves	Rhipidura albiscapa	Grey Fantail	-	-	Seen/Heard
Aves	Corvus coronoides	Australian Raven	-	-	Seen/Heard
Aves	Grallina cyanoleuca	Magpie-lark	-	-	Seen/Heard
Aves	Hirundo neoxena	Welcome Swallow	-	-	Seen
Aves	Sturnus tristis	Common Myna	Exotic	Exotic	Seen/Heard
Aves	Neochmia temporalis	Red-browed Finch	-	-	Seen
Mammalia	Vombatus ursinus	Common Wombat	-	-	Scat
Mammalia	Petaurus breviceps	Sugar Glider	-	-	Seen
Mammalia	Pseudocheirus peregrinus	Common Ringtail Possum	-	-	Seen/Scat
Mammalia	Macropus giganteus	Eastern Grey Kangaroo	-	-	Roadkill
Mammalia	Oryctolagus cuniculus	Rabbit	Exotic	Exotic	Scat
Mammalia	Bos taurus	European cattle	Exotic	Exotic	Seen/Heard
Mammalia	Capra hircus	Goat	Exotic	Exotic	Seen
Mammalia	Cervus timorensis	Rusa Deer	Exotic	Exotic	Roadkill

Appendix E – Assessment of Signicance

These Assessments of Significance (AoSs) have been completed for threatened communities and species listed under the BC Act and the EPBC Act that were identified as having a moderate to high potential to occur within the study area, due to the presence of nearby records and/or the presence of suitable habitat. One TEC occurs within the study area (Shale Sandstone Transition Forest in Sydney Basin Bioregion). Threatened species with a moderate to high potential to occur were identified in Section 3.5 and included below:

Scientific Name	Common Name	BC Act	EPBC Act	Source	Likelihood of Occurrence
Birds					
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	43 (BioNet) BAM-C	Moderate
Burhinus grallarius	Bush Stone-curlew	E	-	2 (BioNet) BAM-C	Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	15 (BioNet), PMST BAM-C	Moderate
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	45 (BioNet), PMST BAM-C	Moderate
Chthonicola sagittata	Speckled Warbler	V	-	4 (BioNet)	Moderate
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	22 (BioNet)	Moderate
Daphoenositta chrysoptera	Varied Sittella	V	-	46 (BioNet)	Moderate
Glossopsitta pusilla	Little Lorikeet	V	-	62 (BioNet)	Moderate
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	7 (BioNet) BAM-C	Moderate
Hieraaetus morphnoides	Little Eagle	V	-	17 (BioNet) BAM-C	Moderate
Hirundapus caudacutus	White-throated Needletail	-	V,C,J,K	6 (BioNet), PMST	Moderate
Lathamus discolor	Swift Parrot	E	CE	5 (BioNet), PMST BAM-C	Moderate
Lophoictinia isura	Square-tailed Kite	V	-	9 (BioNet) BAM-C	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Likelihood of Occurrence
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	10 (BioNet)	Moderate
Neophema pulchella	Turquoise Parrot	V	-	4 (BioNet)	Moderate
Ninox connivens	Barking Owl	V	-	2 (BioNet) BAM-C	Moderate
Ninox strenua	Powerful Owl	V	-	31 (BioNet) BAM-C	Moderate
Petroica boodang	Scarlet Robin	V	-	25 (BioNet)	Moderate
Petroica phoenicea	Flame Robin	V	-	2 (BioNet)	Moderate
Stagonopleura guttata	Diamond Firetail	V	-	12 (BioNet)	Moderate
Tyto novaehollandiae	Masked Owl	V	-	3 (BioNet) BAM-C	Moderate
Invertebrates					
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	47 (BioNet) BAM-C	Moderate
Mammals					
Cercartetus nanus	Eastern Pygmy-possum	V	-	31 (BioNet) BAM-C	Moderate
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	28 (BioNet), PMST BAM-C	Moderate
Dasyurus maculatus	Spotted-tailed Quoll	V	E	10 (BioNet), PMST	Moderate
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	9 (BioNet)	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Likelihood of Occurrence
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	27 (BioNet)	Moderate
Miniopterus australis	Little Bent-winged Bat	V	-	12 (BioNet) BAM-C	Moderate
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	32 (BioNet) BAM-C	Moderate
Myotis macropus	Southern Myotis	V	-	194 (BioNet) BAM-C	Moderate
Petauroides volans	Greater Glider (southern and central)	-	E	15 (BioNet), PMST BAM-C	Moderate
Petaurus australis australis	Yellow-bellied Glider (south-eastern)	V	V	3 (BioNet), PMST	Moderate
Petaurus norfolcensis	Squirrel Glider	V	-	8 (BioNet) BAM-C	Moderate
Phascolarctos cinereus	Koala	E	E	1192 (BioNet), PMST BAM-C	High
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	99 (BioNet), PMST BAM-C	Moderate
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	5 (BioNet)	Moderate
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	19 (BioNet)	Moderate
Reptiles					
Hoplocephalus bungaroides	Broad-headed Snake	E	V	28 (BioNet), PMST BAM-C	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Likelihood of Occurrence
Varanus rosenbergi	Rosenberg's Goanna	V	-	4 (BioNet)	Moderate

V = vulnerable; E = endangered; CE = critically endangered

Tests of significance (BC Act)

Under Part 7.3 of the NSW Biodiversity Conservation Act 2016 (BC Act), a five-part test is required to determine whether any threatened species or TEC, listed under the BC Act, that is known or considered likely to occur on a site is likely to be significantly impacted as a result of a proposed action.

Shale Sandstone Transition Forest in the Sydney Basin Bioregion

Shale Sandstone Transition Forest (SSTF) is listed as critically endangered under the BC Act. 6.20ha of this community is present within the study area.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect ecological communities:

1. In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable to ecological community.

2. In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:
    a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
    b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

The proposal will directly impact on 0.61ha of the ecological community. The extent of the community was estimated as 9600ha, representing 20-40% of its original extent, in 2010 (Tozer et al., 2010). The proposal will result in the removal of 0.61ha of the community, representing a 0.006% reduction in the extent of the community. Due to the narrow extent of the proposed works it is considered unlikely that adverse effects will be placed on the extent or composition of the ecological community. The total area of SSTF to be cleared represents less than 10% of the community within the Study Area and is contiguous with a larger patch of SSTF within the locality. Appropriate mitigation and management measures will be used during the construction phase to minimise potential adverse impacts on the community. As such, the proposal is unlikely to place the local occurrence of the community at risk of extinction.

3. In relation to the habitat of a threatened species or ecological community:

a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The proposal is considered to be of low impact on the community, as only 0.61ha of this community occurs within the subject land. The proposal will result in the removal of a linear area of

vegetation, up to 6m in width, situated at the edge of the community. As such, the proposal is unlikely to result in fragmentation or isolation of available habitat for the community.

4. Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

At the time of writing, four Areas of Outstanding Biodiversity Value (AOBV) have been declared:

- Gould's Petrel - critical habitat declaration
- Little penguin population in Sydney's North Harbour - critical habitat declaration
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve - critical habitat declaration
- Wollemi Pine - critical habitat declaration.

Of the above listed AOBV, the Little penguin population in Sydney's North Harbour - critical habitat is located closest to the Study Area. However, as the Study Area is located over 450 km from the AOBV, future development would not be expected to have any direct or indirect effect on this or any declared AOBV.

5. Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed project would or may constitute, introduce or exacerbate the following KTPs relevant to this community:

- Clearing of native vegetation
- Invasion of native plant communities
- Introduction and establishment of disease

However, these KTPs arising from the project are not considered significant on the locality scale.

Conclusion

The proposed works are considered to have a low impact on the community and appropriate mitigation measures would be implemented at the construction phase to ensure avoidable impacts do not occur.

It is considered unlikely that the project would have a significant impact on the local population of the community.

Meridolum corneovirens (Cumberland Plain Land Snail)

This species is listed as endangered under the BC Act.

This species was not detected during targeted surveys, however suitable habitat is present in the study area and the species has been recorded in the locality in the past 10 years.

Under s. 7.3 of the BC Act, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are:

(1) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposal will involve disturbance to a small area of groundcover that includes refuge habitat for the species, including leaf litter and logs. Due to the availability of habitat within the immediate locality (including habitat within the study area that will not be impacted), the species would not be dependent on habitat provided by the study area, and thus the removal of a relatively small, linear area of refuge habitat would not significantly reduce available habitat for the species to the extent that the local population would be placed at risk of extinction. Appropriate mitigation and management measures, such as the retention of habitat features (i.e. leaf litter, logs) on site, will be implemented to minimise potential negative impacts to the species.

The construction phase has to potential to directly impact the species. A pre-clearance and relocation survey for the species will be undertaken within the construction footprint prior to the commencement of any clearing activities.

Thus, the proposal is unlikely to adversely affect the life cycle of this species such that the local population is likely to be placed at risk of extinction.

(2) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(3) In relation to the habitat of a threatened species or ecological community:

a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

As discussed in (1), only a small area of refuge habitat will be removed and this would be retained on site. Due to the small size of the species, it is not expected that the fencing would inhibit movements of the species, and therefore it is unlikely that the proposal will result in fragmentation and/or isolation of habitat for the species. Additionally, the species would not be dependent on habitat provided by the study area, due to the availability of habitat within the immediate locality. Therefore the small area of habitat to be modified is not considered important to the long-term survival of the local population.

(4) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for this species. This question is not applicable, as no AOBVs have been listed for this species.

(5) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *removal of dead wood and dead trees* has the greatest potential to impact on this species. The proposal may require the removal of fallen logs from within the construction footprint, however any logs requiring removal would be retained on site. Therefore this KTP is unlikely to be exacerbated in the locality.

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* is likely to occur as a result of the proposal if weed controls are not implemented during construction. Weed control would be implemented as part of the proposal thus, this KTP is unlikely to be exacerbated.

Conclusion

While there is potential habitat for this species throughout the study area, an abundance of high-quality habitat is present within the locality and the proposal would only modify a relatively small area of habitat. The species is unlikely to be dependent on any habitat within the study area and habitat will not be fragmented as a result of the proposal. Appropriate mitigation and management measures would be implemented to avoid and/or minimise impacts to the local population. Based on this, the proposal is unlikely to significantly impact this species and a species impact statement (SIS) is not required.

Birds

Nineteen birds, listed under the BC Act, were considered to have a moderate likelihood of occurrence in the study area. These were:

- *Artamus cyanopterus* (Dusky Woodswallow) – vulnerable
- *Callocephalon fimbriatum* (Gang-gang Cockatoo) – vulnerable
- *Calyptorhynchus lathami* (South-eastern Glossy Black-Cockatoo) – vulnerable
- *Chthonicola sagittata* (Speckled Warbler) – vulnerable
- *Climacteris picumnus victoriae* (Brown Treecreeper (eastern subspecies)) – vulnerable
- *Daphoenositta chrysoptera* (Varied Sittella) – vulnerable
- *Glossopsitta pusilla* (Little Lorikeet) – vulnerable
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle) – vulnerable
- *Hieraaetus morphnoides* (Little Eagle) – vulnerable
- *Lathamus discolor* (Swift Parrot) – endangered
- *Lophoictinia isura* (Square-tailed Kite) – vulnerable
- *Melithreptus gularis* (Black-chinned Honeyeater (eastern subspecies)) – vulnerable
- *Neophema pulchella* (Turquoise Parrot) – vulnerable
- *Ninox connivens* (Barking Owl) – vulnerable
- *Ninox strenua* (Powerful Owl) – vulnerable
- *Petroica boodang* (Scarlet Robin) – vulnerable
- *Petroica phoenicea* (Flame Robin) – vulnerable
- *Stagonopleura guttata* (Diamond Firetail) – vulnerable

- *Tyto novaehollandiae (*Masked Owl) – vulnerable

None of these species were detected within the Study Area during field surveys. It is expected that, due to the abundance of higher quality vegetation within the locality, these species would only occur within the study area on a transitional basis, and would not be dependent on any habitat within the study area. Habitat within the study area consists of the disturbed interface between the Hume Motorway and higher quality vegetation in the broader locality.

The presence of suitable habitat nearby to the study area has afforded these species a moderate likelihood of occurrence. Whilst these species display variations in roosting, nesting and foraging behaviours, they have been grouped for the purposes of this assessment due to their mobility (i.e. aerial species) and the nature of the proposal (i.e. no removal of hollow bearing trees).

Under s. 7.3 of the BC Act, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are:

(1) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

These species may intermittently use habitat within the study area for foraging and roosting. They are highly-mobile and it is expected that they would only occur on a transitional basis in the study area, due to the abundance of higher quality vegetation within the locality.

The extent of vegetation clearance, as a result of the proposal, would be minor relative to the extent and connectivity of vegetation in the broader locality. Vegetation clearance may directly impact foraging habitat, however this would be considered to be sub-optimal foraging habitat, as there is an abundance of undisturbed foraging habitat available in the wider locality. No hollow bearing trees will be removed as part of the proposal. Pre-clearance surveys would be undertaken to ensure no direct impact to breeding habitat features, such as nests.

Additionally, the study area is subject to a high degree of existing noise and light disturbance and therefore it is expected that any fauna utilising the study area would be adapted to a high level of disturbance and will not be significantly impacted due to additional disturbances related to the construction phase of the proposal. Fauna species are likely to recolonise the study area once conditions return to pre-construction levels.

As these species utilise the aerial space for movements, the installation of fencing would not inhibit connectivity for these species.

Thus, the proposal is unlikely to adversely affect the life cycle of these species such that a viable local population of these species is likely to be placed at risk of extinction.

(2) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(2) In relation to the habitat of a threatened species or ecological community:

a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

As discussed in (1), the habitat to be removed is not considered optimal for the roosting or breeding of these species and they would not be dependent on habitat within the study area. The proposal would not substantially affect the foraging habitat for these species (see (1)). As these species utilise the aerial space for movements, the installation of fencing will not inhibit connectivity for these species.

Thus, the project is unlikely to modify, fragment or isolate habitat important to the long-term survival of these species in the locality.

(3) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for these species. This question is not applicable, as no AOBVs have been listed for these species.

(4) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community

Of the KTPs listed under the BC Act, Clearing of native vegetation has the greatest potential to impact these species but is considered to impose only minimal impact on the total extent of potential habitat in the locality.

Invasion and establishment of exotic vines and scramblers and Invasion of native plant communities by exotic perennial grasses is likely to occur as a result of the proposal if weed controls are not implemented during and after the construction. Weed control would be implemented as part of the proposal thus, this KTP is unlikely to be exacerbated.

Conclusion

While there is potential foraging and suboptimal roosting habitat for these species throughout the study area, an abundance of high-quality habitat is present within the locality and these species are unlikely to be dependent on any habitat within the study area. The proposal will not result in the removal of any hollow-bearing trees. Pre-clearance surveys will be undertaken to ensure no direct impact to breeding habitat features, such as nests. Additionally, these species are all aerial and the installation of fencing will not inhibit their movement throughout the locality. Based on this, the proposal is unlikely to significantly impact these species and a species impact statement (SIS) is not required.

Arboreal and/or hollow-dependent mammals

Two gliders, listed as vulnerable under the BC Act, were considered to have a moderate likelihood of occurring within the study area. These were:

- *Petaurus australis* (Yellow-bellied Glider (south-eastern))
- Petaurus norfolcensis (Squirrel Glider)

Additionally, *Cercartetus nanus* (Eastern Pygmy-possum) - listed as vulnerable under the BC Act was considered to have a moderate likelihood of occurrence and *Phascolarctos cinereus* (Koala) - listed as endangered under the BC Act was considered to have a high likelihood of occurrence.

Due to the low impact nature of the proposal (i.e. no removal of hollow bearing trees and narrow area of impact), these species have been grouped for the purposes of assessment.

Under s. 7.3 of the BC Act, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, or their habitats are:

(1) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for any of these species in the locality, due to the abundance of high-quality habitat that occurs adjacent to the study area. No suitable breeding habitat (i.e. hollow bearing trees) for the glider species would be removed as a part of the proposal. The construction phase of the proposal may result in indirect impacts to these species, such as increased noise, however it is expected that local populations will be exposed to an existing level of noise disturbance as a result of the proximity of the study area to the Hume Motorway. These disturbances will be temporary and it is expected that local fauna would recolonise the study area once conditions return to pre-construction levels.

Due to the high-mobility and gliding ability of the glider species, it is unlikely that the fencing would inhibit movement throughout the locality. Additionally, there is adequate connectivity for all four species beneath Pheasants Nest Bridge and Moolgun Creek Bridge. The installation of fencing will have a positive impact on the survival of individuals by reducing instances of roadkill, whilst maintaining connectivity in the locality. As adequate corridors exist beneath Pheasants Nest Bridge and Moolgun Creek Bridge, connectivity would be maintained with future fencing lengths.

Thus, the proposal is unlikely to adversely affect the life cycle of these species such that the local populations are likely to be placed at risk of extinction.

(2) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(3) In relation to the habitat of a threatened species or ecological community:

a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

Impacts related to construction, such as noise and vibrations, will be temporary in nature. Fauna may move away from unfavourable conditions and return once disturbance is removed. Habitat within the study area is unlikely to become further fragmented or isolated as vegetation removal will be restricted to a narrow area of vegetation along the Hume Motorway, which provides an existing barrier to fauna movement. These species will maintain connectivity in the locality through the aerial space (gliders) and/or and existing corridors beneath Pheasants Nest Bridge and Moolgun Creek Bridge. The study area exists at the interface of the Hume Motorway and higher quality habitat within the locality, and thus these species are unlikely to be dependent on habitat within the study area.

Thus, the project is unlikely to modify, fragment or isolate habitat important to the long-term survival of these species in the locality.

(4) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for this species. This question is not applicable, as no AOBVs have been listed for this species.

(5) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *Clearing of native vegetation* has the greatest potential to impact these species, howeverthis KTP is considered to impose only minimal impact on the total extent of potential habitat in the locality.

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* is likely to occur as a result of the proposal if weed controls are not implemented during construction. Weed control would be implemented as part of the proposal and thus, this KTP is unlikely to be exacerbated.

Conclusion

While there is potential habitat for these species within the study area, an abundance of high-quality habitat is present within the locality. These species are unlikely to be dependent on any habitat within the study area and fragmentation would not be significantly increased as a result of the proposal, as a result of existing barriers (i.e. the Hume Motorway). Appropriate mitigation and management measures would be implemented to avoid and/or minimise impacts to the local population. Based on this, the proposal is unlikely to significantly impact these species and no species impact statements (SIS) are required.

Dasyurus maculatus (Spotted-tail Quoll)

This species is listed as vulnerable under the BC Act. This species has been given a moderate likelihood of occurrence due to the presence of suitable habitat in the study area and recent records in the locality.

Under s.7.3 of the BC Act, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, or their habitats are:

(1) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

Impacts to vegetation and potential habitat features in the lower stratum will not be significant on the local scale. Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for this species due to the abundance of high-quality habitat that occurs in the locality. The construction phase of the proposal may result in indirect impacts to this species, such as increased noise, however it is expected that local populations will be exposed to an existing level of noise disturbance (as a result of the proximity of the study area to the Hume Motorway). These disturbances will be temporary and it is expected that local fauna would recolonise the study area once conditions return to pre-construction levels.

The installation of fencing will have a positive impact on the survival of individuals, by reducing instances of roadkill whilst maintaining connectivity in the locality. As adequate corridors exist beneath Pheasants Nest Bridge and Moolgun Creek Bridge, connectivity would be maintained with future fencing lengths.

Thus, the proposal is unlikely to adversely affect the life cycle of this species such that the local population is likely to be placed at risk of extinction.

(2) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(3) In relation to the habitat of a threatened species or ecological community:

a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

As discussed in (1), impacts to vegetation and potential habitat features in the lower stratum will not be significant on the local scale. The study area exists at the interface of the Hume Motorway and higher quality habitat within the locality, and thus this species is unlikely to be dependent on habitat within the study area. Impacts related to construction, such as noise and vibrations, will be temporary in nature and fauna may move away from unfavourable conditions and return once disturbance is removed. Habitat within the study area is unlikely to become significantly fragmented or isolated as vegetation removal will be restricted to a narrow area and the species will maintain connectivity in the locality through the existing corridors beneath Pheasants Nest Bridge and Moolgun Creek Bridge. As the species has a large home range and suitable corridors will be maintained, the project is unlikely to modify, fragment or isolate habitat important to the long-term survival of these species in the locality.

(4) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for this species. This question is not applicable, as no AOBVs have been listed for this species.

(5) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *removal of dead wood and dead trees* has the greatest potential to impact on this species. The proposal may require the removal of fallen logs from within the construction footprint, however these would be retained and this KTP is unlikely to be exacerbated in the locality.

Clearing of native vegetation may also impact this species, however, as this will be limited to a narrow area, this KTP is considered to impose only minimal impact on the total extent of potential habitat in the locality.

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* is likely to occur as a result of the proposal if weed controls are not implemented during construction. Weed control would be implemented as part of the proposal thus, this KTP is unlikely to be exacerbated.

Conclusion

While there is potential habitat for this species throughout the study area, an abundance of high-quality habitat is present within the locality and the proposal will only impact a small area of habitat that would likely only be used on a transitionary basis. The species is unlikely to be dependent on any habitat within the study area and habitat would not be significantly fragmented as a result of the proposal, as the species has a large home range and appropriate corridors would be maintained. Appropriate mitigation and management measures would be implemented to avoid and/or minimise impacts to the local population. Based on this, the proposal is unlikely to significantly impact this species and a species impact statement (SIS) is not required.

Pteropus poliocephalus (Grey-headed Flying Fox)

This species is listed as vulnerable under the BC Act. It has been given a moderate likelihood of occurrence due to the presence of suitable foraging habitat in the study area and the presence of a roosting camp approximately 7.7km from the study area, in Picton. Roosting camps are generally located within 20 kilometres of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. No roosting camps were detected within the study area.

Under s. 7.3 of the BC Act, the factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species, or their habitats are:

(1) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

There are no roost camps located within the study area. Foraging habitat for the species mainly comprises nectar resources from native trees and shrubs as well as fruit resources. The proposal will result in the removal of foraging habitat for the species; however this would be restricted to a narrow extent relative to the abundance of higher quality habitat within the locality. The construction phase of the proposal may result in indirect impacts to this species, such as increased noise, however it is expected that local populations will be exposed to an existing level of noise disturbance (as a result of the proximity of the study area to the Hume Motorway). These disturbances would be temporary and it is expected that local fauna would recolonise the study area once conditions return to pre-construction levels. Given the relative widespread nature of

similar vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, it is unlikely that the species would be dependent on habitat within the study area and the proposal is not expected to significantly affect the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

(2) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(3) In relation to the habitat of a threatened species or ecological community:

a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The proposal will result in the removal of foraging habitat for the species; however this would be restricted to a narrow extent relative to the abundance of higher quality habitat within the locality. Foraging habitat will also be temporarily modified (i.e. elevated noise, vibrations) during the construction phase, however this would be restricted to daytime hours, when the species is unlikely to be present within the study area. Due to the highly mobile nature and aerial ability of the species, the installation of fencing, including future lengths, will not result in fragmentation of foraging habitat. Given the relative widespread nature of similar vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, it is unlikely that the species would be dependent on habitat within the study area. Additionally, no roosts occur within the study area and therefore habitat within the study area is unlikely to be important to the long-term survival of the species. Modification of the habitat will be temporary in nature and will not be fragmented by the proposal due to the existing corridors.

Thus, the project is unlikely to modify, fragment or isolate habitat important to the long-term survival of these species in the locality.

(4) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for this species. This question is not applicable, as no AOBVs have been listed for this species.

(5) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Clearing of native vegetation will be limited to a narrow area of vegetation and this KTP is considered to impose only minimal impact on the total extent of potential habitat in the locality.

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* is likely to occur as a result of the proposal if weed controls are not implemented during construction. Weed control would be implemented as part of the proposal thus, this KTP is unlikely to be exacerbated.

Conclusion

While there is potential habitat for this species throughout the study area, an abundance of high-quality habitat is present within the locality and the proposal will only impact a small area of potential foraging habitat. The species is unlikely to be dependent on any habitat within the study area and habitat will not be fragmented as a result of the proposal. Appropriate mitigation and management measures would be implemented to avoid and/or minimise impacts to the local population. Based on this, the proposal is unlikely to significantly impact this species and a species impact statement (SIS) is not required.

Microbats

Eight microbat species were considered to have a moderate likelihood of occurrence. This included four hollow-roosting species, listed as vulnerable under the BC Act:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

Four cave-roosting microbat species, listed as vulnerable under the BC Act, were also considered to have a moderate likelihood of occurrence.

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- Miniopterus orianae oceanensis (Large Bent-winged Bat)
- *Myotis macropus* (Southern Myotis)

As the proposal will not result in the removal of any canopy vegetation or other roosting habitat, these species have been assessed together due to similar life stage/ habitat requirements and likely impacts. Impacts to these species will be limited to disturbance during the construction phase.

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are outlined below:

(1) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

All four species hollow-roosting species have preference to roost in tree hollows but would also inhabit man-made structures including under bridges, which occur within the study area. They may roost in colonies but can also be solitary. The cave-roosting species may utilise overhangs, crevices and caves within escarpment habitats. Roosting habitat for Southern Myotis may include

under bridges. These species have the potential to roost under the bridges within the study area or in the surrounding crevices and overhangs in the locality. Disturbances during construction, such as elevated noise or vibrations, will be temporary and it is expected that species would be exposed to an existing level of noise disturbance (due to the proximity of the study area to the Hume Motorway).

The proposal will require the removal of a narrow area of vegetation. No signs of inhabitation were observed within this area, however there is the potential for roosting habitat to occur within the subject land. A preclearance survey would be undertaken to avoid direct impact during clearing and suitable habitat is not limited in the locality.The removal of vegetation may result in the loss of a small area of foraging habitat; however this is unlikely to impact foraging for these species as they are purely aerial. Furthermore, their nocturnal foraging times are unlikely to coincide with land-based construction during the day.

The proposal will create some disturbance which may render foraging habitat unavailable during construction. However, construction activities will be undertaken during the day and the proposal will not substantially modify this foraging resource to permanently preclude it from the species' foraging territory. Foraging habitat for the Southern Myotis is unlikely to be impacted as the proposal does not relate to any works in close proximity to suitable foraging streams or pools for the species.

The proportion of potential habitat to be impacted by the proposal is very small compared to what is available in the wider locality. Thus, the proposal is unlikely to adversely affect the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.

(2) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

3. In relation to the habitat of a threatened species or ecological community:

a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The proposal may result in the removal of potential roosting habitat and temporarily modify foraging resources for these species. The proportion of potential habitat to be impacted by the proposal is very small compared to what is available in the wider locality, and it is unlikely that these species would be dependent on habitat provided by the study area. No breeding habitat would be removed by the proposal. Disturbances, such as noise and vibration, will be restricted to the construction phase and would be unlikely to significantly increase ambient noise levels above existing levels. As modifications to habitat will be predominately temporary, it is unlikely

fragmentation of habitat would occur. Additionally, as these species are aerial, the installation of fencing would not impact connectivity for the species.

4. Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for these species. This question is not applicable, as no AOBVs have been listed for these species.

5. Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *Clearing of native vegetation* has the greatest potential to impact potential foraging habitat for these microbat species but is considered to impose only minimal impact on the total extent of potential habitat in the locality.

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* are likely to occur as a result of the proposal if weed controls are not implemented during construction. Weed control would be implemented as part of the proposal thus, this KTP is unlikely to be exacerbated.

Conclusion

While there is potential habitat for these microbats throughout the study area, this habitat is widespread in the locality and the species would not be dependent on habitat within the study area. Pre-clearance surveys would be undertaken to avoid direct injury or mortality to the species during construction activities. The proposal will create some disturbance during construction activities which may render foraging habitat unavailable during construction, however this is unlikely given the nocturnal foraging behaviours of these species. The proposal will not substantially modify this foraging resource to permanently preclude it from the species' foraging territory. Disturbance to potential roosting habitat would be indirect (i.e. noise, vibrations) and would be unlikely to significantly increase disturbance above existing levels of the Hume Motorway. Based on this, the proposal is unlikely to significantly impact these species and a species impact statement (SIS) is not required.

Reptiles

Two reptiles listed under the BC Act were considered to have a moderate likelihood of occurring within the study area:

- *Hoplocephalus bungaroides* (Broad-headed Snake) – listed as endangered under the BC Act
- *Varanus rosenbergi* (Rosenberg's Goanna) - listed as vulnerable under the BC Act

The Broad-headed Snake shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring and moves from the sandstone rocks to shelters in crevices or hollows in large trees within 500m of escarpments in summer. Adults show a high degree of site fidelity and juveniles have a short dispersal distance (maximum of 375m).

Rosenberg's Goanna is found in heath, open forest and woodland, with termite mounds forming a critical habitat component. The species shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. Home ranges can extend to up to 1000 hectares.

These species have been offered a moderate likelihood of occurrence due to the presence of marginal habitat within the study area and/or the study area being within dispersal range of suitable habitat.

The factors to be considered when determining whether an action, development or activity is likely to significantly affect threatened species or their habitats are outlined below:

(1) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The proposal will not result in the removal of any key habitat features for these species, such as bush rock or termite mounds. It is unlikely that either species would be dependent on habitat within the study area due to the abundance of suitable habitat within the locality. The Broad-headed Snake may shelter within crevices in the study area during summer, however is more likely to be reliant on the exposed cliff edge and associated shelters that occur elsewhere in the locality. Rosenberg's Goanna exhibits a large home range and suitable habitat for foraging and sheltering is present within the study area. This may be used on a transitional basis. The proposal will create some disturbance during construction activities which may render habitat within the study area unavailable during construction. However, the proposal will not substantially modify this habitat to permanently preclude it from the species' ranges and upon completion of construction, this area would continue to exist as marginal habitat for the species.

The proposal will require the removal of a narrow area of vegetation within the lower strata. This is unlikely to significantly impact either species, as the proportion of potential habitat to be impacted by the proposal is very small compared to what is available in the wider locality. Thus, the proposal is unlikely to adversely affect the life cycle of these species such that a viable local population of the species is likely to be placed at risk of extinction.

(2) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

   a. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

   b. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(3) In relation to the habitat of a threatened species or ecological community:

   a. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

   b. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

   c. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.

The proposal will not result in the removal of any key habitat features for either species. The proportion of potential habitat to be impacted by the proposal is very small compared to what is available in the wider locality, and it is unlikely that these species would be dependent on habitat provided by the study area. Disturbances, such as noise and vibration, will be restricted to the construction phase and would be unlikely to significantly increase ambient noise levels above

existing levels. The proposal will not significantly fragment habitat for these species as the Hume Motorway already provides an existing barrier between habitats. Movement corridors will be maintained under the Pheasants Nest and Moolgun Creek Bridges.

(4) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).

There are no Areas of Outstanding Biodiversity Value (AOBVs) listed for these species. This question is not applicable, as no AOBVs have been listed for these species.

(5) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, population or ecological community.

Of the KTPs listed under the BC Act, *Bushrock Removal* has the greatest potential to impact these species. Any bushrock located within the construction footprint would be retained on site.

Invasion and establishment of exotic vines and scramblers and *Invasion of native plant communities by exotic perennial grasses* are likely to occur as a result of the proposal if weed controls are not implemented during construction. Weed control would be implemented as part of the proposal thus, this KTP is unlikely to be exacerbated (also see Section 4.1.7).

Conclusion

While there is marginal habitat for these species within the study area, this habitat is widespread in the locality and these species would not be dependent on habitat within the study area. The proposal will create some disturbance during construction activities which may render habitat as undesirable during construction. However, the proposal will not involve the removal of any key habitat features or substantially modify habitat to permanently preclude it from the species' territories. Connectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges. Disturbance to habitat would be indirect (i.e. noise, vibrations) and would be unlikely to significantly increase disturbance above existing levels of the Hume Motorway. Based on this, the proposal is unlikely to significantly impact these species and a species impact statement (SIS) is not required.

Significant impact assessments (EPBC Act)

Under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), an Assessment of Significance (AoS) is required to determine whether a significant impact on any threatened species or TEC listed under the act is likely to occur as a result of a proposed

action. If a significant impact is considered likely, then further assessment through a referral to the federal Minister of the Environment and Energy is required.

AoS under the EPBC Act are guided by the Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013).

Shale Sandstone Transition Forest

Shale Sandstone Transition Forest is listed as critically endangered under the EPBC Act. 2.64 ha of this community is present within the study area.

For critically endangered ecological communities, an action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

1. Reduce the extent of an ecological community

The proposal will result in the direct removal of 0.31 ha of vegetation within Shale Sandstone Transition Forest. The estimated remaining extent of the community is approximately 9600 ha. The extent of this community to be removed as a result of the proposal is minor compared to the remaining extent of the community (0.003%). Due to the narrow extent of the proposed works it is considered unlikely that adverse effects will be placed on the extent or composition of the ecological community.

2. Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

Under the EPBC Act, a patch is defined as a discrete and continuous area of the ecological community. However, a patch may include small-scale disturbances, such as tracks or breaks or small-scale variations in vegetation that do not significantly alter its overall functionality. The proposal may result in some small-scale disturbances, however, given the limited extent of vegetation removal, the proposal will not result in any large-scale alteration to overall functionality.

The proposal is unlikely to cause any significant alterations to community composition, species interactions or ecosystem functioning in the locality. The project will deliberately introduce a barrier to movement of fauna; however the Hume Motorway provides an existing barrier effect in the locality. Therefore, due to the nature and extent of the proposal habitat fragmentation is considered a minor impact.

3. Adversely affect habitat critical to the survival of an ecological community

Due to the conservation significance of the community, the remaining patches of this CEEC within NSW are likely to be important for its survival. The patches of this community within the study area are small and subject to reduced ecological integrity and function as a result of adjacent land uses and activities. Patches within the study area can be considered less important than larger high-quality examples of this CEEC within the locality. Higher quality patches in the locality are likely to be critical for the survival of this community as opposed to the vegetation within the study area.

4. Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

The extent of any modification to abiotic factors necessary to the survival of the community will be limited to the extent of vegetation clearance within the community (0.31ha) and the immediate adjacent area. This extent is considered negligible compared to the remaining extent of the community (as in 1) and is considered unlikely to influence the survival of the ecological community.

5. Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting

The proposal has the potential to result in changes to the community through the introduction of weeds and pathogens, however this impact will be mitigated through appropriate mitigation measures implemented during the construction phase. As the community is already subject to reduced ecological integrity and function as a result of adjacent land uses and activities, it is considered unlikely that the proposal will substantially alter the species composition of the community.

6. Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

    a. Assisting invasive species, that are harmful to the listed ecological community, to become established, or

    b. Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community

The proposal has the potential to introduce weeds and pathogens, however this impact will be mitigated through appropriate mitigation measures implemented during the construction phase.

No regular mobilisation of fertilisers, herbicides or other chemicals will occur as a result of the proposal.

7. Interfere with the recovery of an ecological community.

The approved conservation advice for the community outlines priority management actions and mitigation measures for key threats. The priority actions relate to habitat loss, disturbance and modification. The proposal will not result in fragmentation or further degradation of the community and will not result in the loss of any major habitat features, such as hollow bearing trees or logs.

Conclusion

The proposal will result in direct impacts to 0.31ha of Shale Sandstone Transition Forest. This extent is negligible compared to the remaining extent of the community. No large change in composition is considered likely and no further habitat fragmentation or isolation on a landscape scale will occur. The proposal is unlikely to result in a significant impact to Shale Sandstone Transition Forest.

Callocephalon fimbriatum (Gang-gang Cockatoo)

This species is listed as endangered under the EPBC Act.

A ‘population of a species’ is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations
- A population, or collection of local populations, that occurs within a particular bioregion

The Conservation Advice for this species refers to an overall population of the species.

There is a possibility of a significant impact on the Gang-gang cockatoo, and a referral under the EPBC Act should be considered, if the action will:

1. Lead to a long-term decrease in the size of a population

It is estimated that 25,300 individuals of the species occupy up to 30000 km^2. The proposal would not remove breeding habitat from this distribution. The proposal would result in the removal of suitable foraging habitat for the species; however this habitat would likely only be used on a transitionary basis and higher quality habitat is abundant in the locality. Suitable foraging habitat within the study area may be temporarily impacted by the proposed works and it is expected that fauna would return to the habitat following any disturbances during the construction phase. Therefore, it is unlikely the proposal will result in a long-term decrease in the population size of the species.

2. Reduce the area of occupancy of the species

The species is endemic south-eastern Australia. Occupancy may be temporarily reduced due to indirect impacts from noise and vibrations. No suitable breeding habitat for the species is present within the study area. Suitable foraging habitat within the study area would only be used on a transitionary basis and would mostly be retained.The area of foraging habitat to be removed is neglible as compared to available foraging habitat in the locality. Therefore, it is unlikely the proposal will result in a long-term reduction in the area of occupancy by the species.

3. Fragment an existing population into two or more populations

It is estimated that 25,300 individuals of the species occupy up to 30000 km^2. The proposal will not remove breeding habitat from this distribution and impacts to foraging habitat will be negligible (<0.0002%). The fencing will not fragment suitable habitat in the locality due to the aerial nature of the species. Habitat will not be fragmented or isolated by the proposal.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat. Available habitat in the area provides limited suitable foraging habitat that will not be impacted by the proposal. Suitable breeding habitat will not be impacted. The proposal will not adversely affect habitat critical to the survival of this species.

5. Disrupt the breeding cycle of a population

The species requires hollows greater than 9 cm diameter. No suitable hollows were observed within the study area, and therefore it is unlikely that the breeding cycle of the species will be disrupted by disturbances during the construction phase.

6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal will not remove breeding habitat from the species' distribution and impacts to foraging habitat will be negligible (<0.0002%) and therefore habitat will not be removed to the extent that the species is likely to decline. Habitat suitability may temporarily be reduced by noise and vibrations related to the construction phase. Additionally, it is considered unlikely that the species would be dependent on habitat within the study area.

7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

Gang-gang Cockatoos are susceptible to Psittacine beak and feather disease. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere with the recovery of the species.

The National Recovery Plan for the Gang-gang cockatoo identifies actions to be taken to prevent further declines and support increases in the population size. The proposal is not likely to cause population decline and therefore does not interfere with the objectives of the recovery plan. No hollow-bearing trees will be removed. The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal will not fragment or isolate any portion of habitat for this species within the study area or adjacent lands, with native vegetation adjacent to the study area to be retained. Impacts to potential foraging habitat will be negligible as compared to the abundance of suitable habitat within the locality. The species is unlikely to be dependent on any habitat provided by the study area. No significant impact on this species is anticipated by the proposed works in the study area.

Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Calyptorhynchus lathami lathami (South-eastern Glossy Black-Cockatoo)

This species is listed as vulnerable under the EPBC Act.

For species listed as vulnerable under the EPBC Act, the Matters of National Environmental Significance: Significant Impact Guidelines 1.1, an AoS must consider 'important populations' of the species. An 'important population' is a population identified as such in a recovery plan or that are:

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

Assessed against the above criteria, the local population of this species is not considered to represent an important population.

No national recovery plan for this species has been drafted. This species was not detected within the study area during surveys and the study area does not provide suitable breeding habitat for the species.

There is a possibility of a significant impact on the South-eastern Glossy Black Cockatoo, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of an important population of a species

As above, the local population of the species is not considered to comprise an important population. Regardless, the proposal is unlikely to cause a substantial impact on any local population due to the nature and extent of the proposed works. The proposed works will not result in the removal of any breeding habitat for the species. Suitable feed trees are present within the study area; however it is considered unlikely that the species would be dependent on habitat provided by the study area. The proposal may also result in indirect impacts; however these would be temporary and it is expected that fauna would return to the habitat following any disturbances during the construction phase. Therefore, it is unlikely the proposal will result in a long-term decrease in the population size of the species.

2. Reduce the area of occupancy of an important population

Occupancy may be temporarily reduced due to indirect impacts from noise and vibrations. No suitable breeding habitat for the species is present within the study area. Suitable foraging habitat within the study area would only be used on a transitionary basis and would mostly be retained. The area of foraging habitat to be removed is neglible as compared to available foraging habitat in the locality. Therefore, it is unlikely the proposal will result in a long-term reduction in the area of occupancy by the species.

3. Fragment an existing important population into two or more populations

The proposal will not remove breeding habitat from the species' distribution and impacts to foraging habitat will be neglibible. The fencing will not fragment suitable habitat in the locality due to the aerial nature of the species. Habitat will not be fragmented or isolated by the proposal.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat. The Conservation Advice lists critical habitat as areas necessary:

- For activities such as foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- To maintain genetic diversity and long-term evolutionary development; or
- For the reintroduction of populations or recovery of the species or ecological community.

It also notes that the species has a specific set of preferences in nesting tree species and hollow characteristics, and nests close to, or within, foraging habitat. Available habitat in the area provides limited suitable foraging habitat for the species. Suitable breeding habitat will not be impacted by the proposal.

5. Disrupt the breeding cycle of an important population

No mature trees will be removed, therefore suitable breeding habitat will not be directly impacted. The species requires hollows greater than 15 cm diameter and over 8m above ground level. No suitable hollows were observed within the study area, and therefore it is unlikely that the breeding cycle of the species will be disrupted by disturbances during the construction phase.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal will not remove breeding habitat from the species' distribution and impacts to foraging habitat will be negligible and therefore habitat will not be removed to the extent that the species is likely to decline. Habitat suitability may temporarily be reduced by noise and vibrations related to the construction phase. Additionally, it is considered unlikely that the species would be dependent on habitat within the study area.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

The species is susceptible to Psittacine beak and feather disease. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures would be implemented as part of the proposed works.

9. Interfere substantially with the recovery of the species

The species does not have a commonwealth recovery plan. The primary conservation actions within the conservation advice relate to the protection of important habitats and populations.

Appropriate mitigation and management measures will be implemented to avoid negative potential impacts to local ecology. The species may use habitat provided by the study area, however there are larger portions of habitat with areas of high-quality native vegetation present nearby, which provide suitable aerial and roosting habitat and will not be impacted by the proposal. The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal will result in the removal of potential foraging habitat for the species; however the species is not considered to be dependent on this habitat and an abundance of higher quality habitat is present within the locality. The proposal will not fragment or isolate any portion of habitat for this species within the study area or adjacent lands, with native vegetation adjacent to the study area to be retained. No significant impact on this species is anticipated by the proposed works in the study area.

Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Hirundapus caudacutus (White-throated Needletail)

This species is listed as vulnerable under the EPBC Act.

For species listed as vulnerable under the EPBC Act, the Matters of National Environmental Significance: Significant Impact Guidelines 1.1, an AoS must consider 'important populations' of the species. An 'important population' is a population identified as such in a recovery plan or that are:

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

Assessed against the above criteria, the local population of this species is not considered to represent an important population.

No national recovery plan for this species has been drafted. This species was not detected within the study area during surveys and the study area does not provide suitable breeding habitat for the species.

The potential for this species to fly over the study area during migration resulted in its likelihood of occurrence being assessed as moderate.

There is a possibility of a significant impact on the White-throated Needletail, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of an important population of a species

As above, the local population of the species is not considered to comprise an important population. Regardless, the proposal is unlikely to cause a substantial impact on any local population due to the nature and extent of the proposed works. The species is almost exclusively aerial, with occasional records of roosting. The study area may provide roosting habitat for the species, however would not be considered dependent on this habitat due to the abundance of suitable roosting habitat within the locality and infrequency of tree roosting in the species.

2. Reduce the area of occupancy of an important population

As above, the local population of the species is not considered to comprise an important population. Regardless, the proposal is unlikely to fragment or isolate the available habitat for this species within the Study Area. The species has a widespread distribution across eastern Australia and is almost exclusively aerial.

3. Fragment an existing important population into two or more populations

As above, the local population of the species is not considered to comprise an important population. Habitat will not be fragmented or isolated by the proposal as the species is almost exclusively aerial.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat. The study area does not contain breeding habitat for the species and contains areas of potential roosting habitat which will not be impacted by the proposed works. The proposal will not adversely affect habitat critical to the survival of this species.

5. Disrupt the breeding cycle of an important population

The local population of this species is not considered to constitute an important population. As above, breeding distribution of the species occurs from northern Japan to central and eastern

Siberia, and south-western China to northern Pakistan, therefore the proposal will not impact on breeding resources for the species.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The removal of habitat from the study area is not considered likely to impact on local habitat for this species to the extent that it is likely to decline. The proposal will involve the removal of a relatively small area of vegetation and will not impact on aerial habitat. As per (1), the species is almost exclusively aerial, with occasional records of roosting. The study area may provide roosting habitat for the species, however would not be considered dependent on this habitat due to the abundance of suitable roosting habitat within the locality and infrequency of tree roosting in the species. Habitat suitability may temporarily be reduced by noise and vibrations related to the construction phase.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

No pathogens or diseases are known to be major threats to the species, with reference to Approved Conservation Advice. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures would be implemented as part of the proposed works.

9. Interfere substantially with the recovery of the species

The species does not have a recovery plan. The primary conservation actions within the conservation advice relate to the protection of important habitats.

Appropriate mitigation and management measures will be implemented to avoid negative potential impacts to local ecology. The species may use the habitat of the study area, however there are larger portions of habitat with areas of high-quality native vegetation present nearby, which provide suitable aerial and roosting habitat and would not be impacted by the proposal. The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal will directly impact a narrow area of vegetation. The proposal will not fragment or isolate any portion of habitat for this species within the study area and vegetation adjacent to the Study Area will be retained. No significant impact on this species is anticipated as a result of the proposal.

Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Lathamus discolor (Swift Parrot)

This species is listed as critically endangered under the EPBC Act.

A ‘population of a species’ is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations
- A population, or collection of local populations, that occurs within a particular bioregion

There is a possibility of a significant impact on the Swift Parrot, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of a population

The Swift Parrot occurs as a single migratory population.

The proposal will result in the removal of suitable foraging habitat for the species; however the species would not be considered dependent on this foraging habitat and high-quality foraging habitat is abundant in the locality. Therefore, it is unlikely the proposal will result in a long-term decrease in the population size of the species.

2. Reduce the area of occupancy of the species

The species has a widespread distribution across eastern Australia. Occupancy may be temporarily reduced due to indirect impacts from noise and vibrations. Some suitable foraging habitats within the study area will be removed as a result of the proposal, however this habitat would only be used on a transitionary basis. The area of foraging habitat to be removed is negligible as compared to available foraging habitat in the locality. Therefore, it is unlikely the proposal will result in a long-term reduction in the area of occupancy by the species.

3. Fragment an existing population into two or more populations

The Swift Parrot occurs as a single migratory population.

The removal of vegetation will be limited to a narrow area of vegetation. The fencing will not fragment suitable habitat in the locality due to the aerial nature of the species. Habitat will not be fragmented or isolated by the proposal.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat. Available habitat in the area provides limited suitable foraging habitat that will not be impacted by the proposal. Suitable breeding habitat will not be impacted. The study area does not occur within any area of mapped important habitat for the species. The proposal will not adversely affect habitat critical to the survival of this species.

5. Disrupt the breeding cycle of a population

Habitat within the study area is not considered suitable breeding habitat due to the migratory nature of the species.

6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal will not remove breeding habitat from the species’ distribution. Impacts to foraging habitat will be negligible and therefore habitat will not be removed to the extent that the species is likely to decline. Habitat suitability may temporarily be reduced by noise and vibrations related to

the construction phase. Additionally, it is considered unlikely that the species would be dependent on habitat within the study area.

7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

Swift Parrots are susceptible to Psittacine beak and feather disease. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere with the recovery of the species.

The National Recovery Plan for the Swift Parrot identifies actions to be taken to ensure the long-term viability of the species. The proposal is not likely to cause population decline and does not interfere with the objectives of the recovery plan. Potential foraging habitat located within the study area will not be disturbed. The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal will not fragment or isolate any portion of habitat for this species within the study area or adjacent lands, with native vegetation adjacent to the study area to be retained. Impacts to potential foraging habitat will be negligible as compared to the abundance of suitable habitat within the locality. The species is unlikely to be dependent on any habitat provided by the study area. No significant impact on this species is anticipated by the proposed works in the study area.

Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Chalinolobus dwyeri (Large-eared Pied Bat)

This species is listed as vulnerable under the EPBC Act.

The Large-eared pied bat is a small to medium sized bat with long, prominent ears and glossy black fur. The lower body has broad white fringes running under the wings and tail-membrane, meeting in a V-shape in the pubic area. This species is one of the wattled bats, with small lobes of skin between the ears and corner of the mouth.

For species listed as vulnerable under the EPBC Act, the Matters of National Environmental Significance: Significant Impact Guidelines 1.1, an AoS must consider 'important populations' of the species. An 'important population' is a population identified as such in a recovery plan or that are:

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

This species has been recorded within the locality and potential roosting habitat is present within the cliff faces located adjacent to the study area. This species may forage within the study area.

There is a possibility of a significant impact on the Large-eared Pied Bat, and a referral under the EPBC Act should be considered, if the action will:

1. Lead to a long-term decrease in the size of an important population of a species

The proposal is unlikely to impact roosting habitat for the species. The proposal will create some disturbance during construction activities which may render foraging habitat unavailable during construction. However, the proposal will not substantially modify this foraging resource to permanently preclude it from the species' foraging territory and upon completion of construction, this area would be once again available as foraging territory. The proportion of potential habitat to be impacted by the proposal is very small compared to what is available in the wider locality. Thus, the proposal is unlikely to adversely affect the life cycle of these species such that there will be a long-term decrease in the size of the population.

2. Reduce the area of occupancy of an important population

The proposal is unlikely to impact roosting habitat for the species. The proposal will create some disturbance during construction activities which may render foraging habitat unavailable during construction. However, the proposal would not substantially modify this foraging resource to permanently preclude it from the species' foraging territory and upon completion of construction, this area will be once again available as foraging territory.

3. Fragment an existing important population into two or more populations

As this species is aerial, the installation of fencing will not impact connectivity for the species.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat. The study area does not contain breeding habitat for the species and the proportion of potential habitat to be impacted by the proposal is very small compared to what is available in the wider locality.

5. Disrupt the breeding cycle of an important population

The proposal will not result in direct impacts of any breeding or roosting habitat. The construction phase of the proposal may result in indirect impacts to this species, such as increased noise, however it is expected that local populations will be exposed to an existing level of noise disturbance (as a result of the proximity of the study area to the Hume Motorway).

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The removal of habitat from the study area is not considered likely to impact on local habitat for this species to the extent that it is likely to decline. The proposal will involve the removal of a relatively small area of vegetation and will not impact on aerial (foraging) or roosting habitat. Habitat suitability may temporarily be reduced by noise and vibrations related to the construction phase, however due to the availability of suitable foraging habitat in the broader locality, this is unlikely to result in species decline.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

The species is susceptible to White-nose syndrome. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere substantially with the recovery of the species

Recovery actions for the species relate to identification and protection of roost sites, management of priority sites, education and research.

The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species. Appropriate mitigation and management measures will be implemented to avoid negative potential impacts to local ecology.

Conclusion

While there is potential foraging habitat for this species within the study area, this habitat is widespread in the locality and the species would not be dependent on habitat within the study area. The proposal will create some disturbance during construction activities which may render foraging habitat unavailable during construction. However, the proposal would not substantially modify this foraging resource to permanently preclude it from the species' foraging territory. Disturbance to potential roosting habitat would be indirect (i.e. noise, vibrations) and would be unlikely to significantly increase disturbance above existing levels of the Hume Motorway. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Dasyurus maculatus (Spotted-tailed Quoll)

This species is listed as endangered under the EPBC Act.

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations
- A population, or collection of local populations, that occurs within a particular bioregion.

With reference to the National Recovery Plan for the Spotted-tailed Quoll, no population important to the long-term survival of the species is present within the study area.

There is a possibility of a significant impact on the Spotted-tailed Quoll, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of a population

As above, the local population is not considered to be important to the long-term survival of the species. Given the large home range of the species, the removal of habitat from the study area is not considered likely to impact on local habitat for this species to the extent that the population is likely to decline. Connectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges.

2. Reduce the area of occupancy of the species

The species has a widespread distribution across eastern Australia. The impacts of the proposed works on the area of the occupancy of the species are considered negligible due to the nature and extent of the proposed works and the area of occupancy (<500km^2) and large home range of the species. There are large portions of habitat with areas of high-quality native vegetation present nearby, which provide suitable habitat that will not be impacted by the proposal. Therefore, it is unlikely the proposal will result in a reduction in the area of occupancy by the species.

3. Fragment an existing population into two or more populations

Given the nature and extent of the proposed works, and the large home range of the species, the proposed works are unlikely to cause significant fragmentation of populations as the Hume Motorway provides existing barrier effects.Connectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat. The proposal will have negligible impacts on potential habitat due to the nature and extent of the proposed works and the availability of continuous, high-quality habitat beyond the study area. The proposal will not adversely affect habitat critical to the survival of this species.

5. Disrupt the breeding cycle of a population

There is an abundance of high-quality native vegetation present adjacent to the study area, which provides suitable breeding habitat that will not be impacted by the proposal. Connectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges. This would allow for persistence of genetic variation throughout the population.

6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal will have a negligible impact on habitat due to the nature and extent of the proposed works and the availability of continuous, high-quality habitat beyond the study area. Habitat suitability may temporarily be reduced by noise and vibrations related to the construction phase.

7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

No pathogens or diseases are known to be major threats to the species, with reference to Approved Conservation Advice. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere with the recovery of the species.

Recovery actions for the species relate to research objectives, genetic analysis, limiting fragmentation and managing introduced predators.

The proposed works do not interfere with any of the specific recovery objectives listed in the National Recovery Plan for the Spotted-tailed Quoll and the proposal is not likely to cause population decline.

Conclusion

The proposal will not fragment or isolate any portion of habitat for this species within the study area or adjacent lands. No significant impact on this species is anticipated by the proposed works in the study area.

Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Petauroides volans (Greater Glider (southern and central))

This species is listed as endangered under the EPBC Act.

Given its status, all populations of the greater glider (southern and central) are important for the conservation of the species across its range. Due to the species' low fecundity and limited dispersal capabilities, areas where the species has become locally extinct are not readily recolonised.

There is a possibility of a significant impact on the Greater Glider, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of a population

The proposal will result in the removal of suitable foraging habitat for the species. Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for this species due to the abundance of high-quality habitat that occurs adjacent to the study area. Therefore, it is unlikely the project will result in an adverse effect on the population size of the species.

2. Reduce the area of occupancy of a population

Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for the species. The proposal would involve the removal of suitable feed trees within the canopy as part of the proposed works. Given the small extent of impacts to vegetation and the abundance of suitable foraging habitat in the locality, the area of foraging habitat to be removed is negligible as compared to available foraging habitat in the locality. Therefore, it is unlikely the proposal will result in a long-term reduction in the area of occupancy by the species. The proposal will not result in the removal of any hollow bearing trees.

3. Fragment an existing population into two or more populations

The proposal will result in additional fragmentation of habitats; however this would not be significant due to the existing barrier effects provided by the Hume Motorway. Populations will not be completely fragmented asconnectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat.

5. Disrupt the breeding cycle of an important population

The proposal is not considered likely to disrupt the breeding cycle of the local population as there will be no direct impact on breeding habitat.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal is unlikely to fragment or isolate the available habitat for species using the study area, due to the retention of habitat features, narrow area of impact and connectivity of the area to patches of high-quality habitat. Habitat within the study area would only be used intermittently and is not considered a key resource for any of these species due to the abundance of high-quality habitat that occurs adjacent to the study area.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

No pathogens or diseases are known to be major threats to the species, with reference to Approved Conservation Advice. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere substantially with the recovery of the species

There is no adopted or made Recovery Plan for this species. Appropriate mitigation and management measures will be implemented to avoid negative potential impacts to local ecology. Indirect impacts such as noise disturbance would be temporary in nature. The species may use the study area on a transitional basis, however there are larger portions of habitat with areas of higher quality native vegetation present nearby, which will not be impacted by the proposal.

Conclusion

The proposal will directly impact native vegetation, however will not fragment habitat for this species within the study area. No significant impact on this species is anticipated by the proposed works in the study area. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Petaurus australis australis (Yellow-bellied Glider (south-eastern))

This species is listed as vulnerable under the EPBC Act.

For species listed as vulnerable under the EPBC Act, the Matters of National Environmental Significance: Significant Impact Guidelines 1.1, an AoS must consider 'important populations' of the species. An 'important population' is a population identified as such in a recovery plan or that are:

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

The local population is not listed as a known important population under the Conservation Advice.

There is a possibility of a significant impact on the Yellow-bellied Glider, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of an important population

The proposal will result in the removal of suitable foraging habitat for the species. Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for this species due to the abundance of high-quality habitat that occurs adjacent to the study area. Therefore, it is unlikely the project will result in an adverse effect on the population size of the species.

2. Reduce the area of occupancy of an important population

Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for the species. The proposal would involve the removal of suitable feed trees within the canopy as part of the proposed works. Given the small extent of impacts to vegetation and the abundance of suitable foraging habitat in the locality, the area of foraging habitat to be removed is negligible as compared to available foraging habitat in the locality. Therefore, it is unlikely that the proposal will reduce the area of occupancy of the local population.

3. Fragment an existing important population into two or more populations

The proposal will result in additional fragmentation of habitats; however this would not be significant due to the existing barrier effects provided by the Hume Motorway. Populations will not be completely fragmented as connectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat. With reference to the Conservation Advice, sap feed trees and hollow bearing trees are critical habitat features for the species. The proposal will not directly impact any hollow bearing trees.

- Disrupt the breeding cycle of an important population

The proposal is not considered likely to disrupt the breeding cycle of the local population as there will be no direct impact on breeding habitat.

5. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal is unlikely to fragment or isolate the available habitat for species using the study area due to the retention of habitat features, narrow area of impact and connectivity of the area to patches of high-quality habitat. Habitat within the study area would only be used intermittently and is not considered a key resource for any of these species due to the abundance of high-quality habitat that occurs adjacent to the study area.

6. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive

predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

7. Introduce disease that may cause the species to decline

No pathogens or diseases are known to be major threats to the species, with reference to Approved Conservation Advice. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

8. Interfere substantially with the recovery of the species

There is no adopted or made Recovery Plan for this species. Appropriate mitigation and management measures will be implemented to avoid negative potential impacts to local ecology. Indirect impacts such as noise disturbance would be temporary in nature. The species may use the study area on a transitional basis, however there are larger portions of habitat with areas of higher quality native vegetation present nearby, which will not be impacted by the proposal.

Conclusion

The proposal will directly impact native vegetation, however would not fragment or isolate any portion of habitat for this species within the study area. No significant impact on this species is anticipated by the proposed works in the study area. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Phascolarctos cinereus (Koala)

This species is listed as endangered under the EPBC Act.

The Conservation Advice for the Koala notes that important populations include those:

- that have the potential to act as source populations to adjacent areas of suitable, or potentially suitable, habitat
- that exist in areas of climatically suitable refuge during periods of environmental stress including droughts, heatwaves, and long-term climate change
- that are genetically diverse
- or contain adaptive genes to current and future environmental stressors
- are geographical or environmental outliers within the species range.

Koalas within the locality can be classified as part of the Southwestern Sydney Population, which is estimated to exceed 700 individuals. This population is largely disease free and expanding with numerous breeding females identified throughout the corridors. As such, it may represent an important population of the species.

Suitable foraging habitat for this species is present within the study area. There was no evidence of Koala habitation within the study area during field surveys, however there are previous records of the species within and in close proximity to the study area, including roadkill records on the Hume Motorway, approaching Pheasants Nest Bridge.

There is a possibility of a significant impact on the Koala, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of a population

The proposal will result in the removal of suitable foraging habitat for the species. Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for this species due to the abundance of high-quality habitat that occurs adjacent to the study area. The Hume Motorway forms barrier to dispersal and the installation of the fencing will limit the occurrences of vehicle-strike, whilst channelling individuals to existing crossings under the road. This would allow for dispersal of the species throughout the locality, whilst limiting mortality. Therefore, it is unlikely the project will result in an adverse effect on the population size of the species, rather facilitating reduced mortality whilst maintaining dispersal potential.

2. Reduce the area of occupancy of the species

Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for the species. The proposal would involve the removal of suitable feed trees within the canopy as part of the proposed works. Given the small extent of impacts to vegetation and the abundance of suitable foraging habitat in the locality, the area of foraging habitat to be removed is negligible as compared to available foraging habitat in the locality. Therefore, it is unlikely the proposal will result in a long-term reduction in the area of occupancy by the species. The proposal will not result in the removal of any hollow bearing trees.

3. Fragment an existing population into two or more populations

The proposal will result in additional fragmentation of habitats; however this would not be significant due to the existing barrier effects provided by the Hume Motorway. Populations will not be completely fragmented as connectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat.

The study area contains known Koala food trees and the proposal would result in the removal of some suitable foraging habitat for the species. Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for the species. The proposal would not adversely affect habitat critical to the survival of this species, rather facilitate the survival of the species throughout the locality.

5. Disrupt the breeding cycle of an important population

The proposal would increase fragmentation by introducing an additional barrier within the landscape, however will not completely fragment populations as connectivity will be maintained through existing corridors under the Pheasants Nest and Moolgun Creek Bridges. Corridors will allow for the continued exchange of genetic information within the population, with reduced mortality, as a result of the fencing, likely to increase the number of breeding individuals.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal is unlikely to fragment or isolate the available habitat for species using the study area due to the narrow area of impact and connectivity of the area to patches of high-quality habitat. Habitat within the study area would only be used intermittently and is not considered a key resource for any of these species due to the abundance of high-quality habitat that occurs adjacent to the study area.

7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

Koalas are susceptible to several diseases, including Chlamydia and Koala Retrovirus. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere substantially with the recovery of the species

A key objective of the Recovery Plan for the Koala is to increase the area of occupancy and size of declining populations. As above, the proposal is not likely to cause a decline in population size or area of occupancy and does not interfere with the objectives of the recovery plan. Due to the positive impacts of the proposal, including reduced vehicle strike and increased dispersal, the proposal is likely to facilitate the protection of the local population, consistent with the objectives of the Recovery Plan. The proposal will assist to facilitate priority conservation actions under the CPCP that aim to manage threats to Koalas within the Wilton and Greater Macarthur growth areas.

Conclusion

The proposal will result in the removal of some suitable foraging habitat for the species and introduce additional fragmentation of habitats. No significant impact on this species is anticipated by the proposed works in the study area as the proposal will result in reduced mortality of Koalas. The proposal will increase the barrier effect of the Hume Motorway, reducing incidences of vehicle strike, whilst maintain dispersal corridors for the species.

Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Pteropus poliocephalus (Grey-headed Flying-fox)

This species is listed as vulnerable under the EPBC Act.

This species has been given a moderate likelihood of occurrence due to the presence of foraging habitat in the study area and the presence of a roosting camp approximately 7.7km from the study area, in Picton. Roosting camps are generally located within 20 kilometre of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. No roosting camps were detected within the study area.

For species listed as vulnerable under the EPBC Act, the Matters of National Environmental Significance: Significant Impact Guidelines 1.1, an AoS must consider 'important populations' of the species. An 'important population' is a population identified as such in a recovery plan or that are:

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

Important populations of Grey-headed Flying Foxes are not specified. The Picton population does not occur near the limit of the species range. The nearest roosting camp to the Picton camp occurs approximately 30km away in Macquarie Fields. As such, the precautionary principle has been applied in assuming the Picton population to be an important population. It is expected that habitat within the study area would be used on a transitional basis by individuals from the Picton camp.

There is a possibility of a significant impact on the Grey-headed Flying-fox, and a referral under the EPBC Act should be considered, if the action results in:

1. Lead to a long-term decrease in the size of an important population of a species

There are no roost camps located within the study area. Foraging habitat for the species mainly comprises nectar resources from native trees and shrubs as well as fruit resources. The proposal will result in the removal of foraging habitat for the species; however this would be restricted to a narrow extent relative to the abundance of higher quality habitat within the locality. The construction phase of the proposal may result in indirect impacts to this species, such as increased noise, however it is expected that local populations will be exposed to an existing level of noise disturbance (as a result of the proximity of the study area to the Hume Motorway). These disturbances would be temporary and it is expected that local fauna would recolonise the study area once conditions return to pre-construction levels. Given the relative widespread nature of similar vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of the camps located near the study area, it is unlikely that the proposal will lead to a long-term decrease in the size of the population.

2. Reduce the area of occupancy of an important population

Potential foraging habitat within the study area would only be used intermittently and is not considered a key resource for the species. The proposal would involve the removal of suitable feed trees within the canopy as part of the proposed works. Given the small extent of impacts to vegetation and the abundance of suitable foraging habitat in the locality, the area of foraging habitat to be removed is negligible as compared to available foraging habitat in the locality. Therefore, it is unlikely the proposal will result in a long-term reduction in the area of occupancy by the species.

3. Fragment an existing important population into two or more populations

Due to the highly mobile nature and aerial ability of the species, the installation of fencing, including future lengths, will not result in fragmentation of foraging habitat.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat.

5. Disrupt the breeding cycle of an important population

No roosting camps occur within the study area. The closest known camp is located 7.7km from the study area in Picton. Therefore, the proposal is unlikely to disrupt the breeding cycle of the species.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal is unlikely to fragment or isolate the available habitat for species using the study area due to the aerial nature of the species, narrow area of impact and connectivity of the area to

patches of high-quality habitat. Habitat within the study area would only be used intermittently and is not considered a key resource for this species due to the abundance of high-quality habitat that occurs adjacent to the study area. There are no roost camps located within the study area.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

The Project is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere substantially with the recovery of the species

The National Recovery Plan for the Grey-headed Flying Fox aims to protect and increase key foraging and roosting habitat. Important habitat resources for this species would not be removed as a part of this proposal. The proposed works will not interfere with the recovery plan of the species. Appropriate mitigation and management measures will be implemented to avoid negative potential impacts to local ecology. Indirect impacts such as noise disturbance would be temporary in nature. The species may use the habitat of the study area, however there are larger portions of habitat with areas of higher quality native vegetation present nearby, which would not be directly impacted by the proposal.

The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species.

Conclusion

While there is potential habitat for this species throughout the study area, an abundance of high-quality habitat is present within the locality and the proposal will only impact relatively small area of foraging habitat. The species is unlikely to be dependent on any habitat within the study area and habitat will not be fragmented as a result of the proposal.

Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Hoplocephalus bungaroides (Broad-headed Snake)

This species is listed as vulnerable under the EPBC Act.

For species listed as vulnerable under the EPBC Act, the Matters of National Environmental Significance: Significant Impact Guidelines 1.1, an AoS must consider 'important populations' of the species. An 'important population' is a population identified as such in a recovery plan or that are:

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

The local population is not listed as a known important population under the Conservation Advice.

There is a possibility of a significant impact on the Broad-headed snake, and a referral under the EPBC Act should be considered, if the action will:

1. Lead to a long-term decrease in the size of an important population

The Broad-headed Snake may shelter within crevices in the study area during summer, however is more likely to be reliant on the exposed cliff edge and associated shelters that occur elsewhere in the locality. The proposal will not result in the removal of any key habitat features for the species, such as bush rock. It is unlikely that either species would be dependent on habitat within the study area due to the abundance of suitable habitat within the locality. Therefore, it is unlikely the proposal will result in an adverse effect on the population size of the species.

2. Reduce the area of occupancy of an important population

The species is unlikely to be dependent on habitat within the study area and the proposal will not result in the removal of any key habitat features for the species. Therefore, it is unlikely that the proposal will reduce the occupancy of the population.

3. Fragment an existing important population into two or more populations

As modifications to habitat will be predominately temporary, it is unlikely that fragmentation of habitat will occur as a result of the proposal. Additionally, the movement patterns of this species will not be impacted by the proposal, or any future linked fencing projects, due to the maintenance of corridors under the Pheasants Nest and Moolgun Creek Bridges.

4. Adversely affect habitat critical to the survival of a species

No habitat critical for the survival of this species is listed in the Commonwealth register of critical habitat.

5. Disrupt the breeding cycle of an important population

The species is unlikely to be dependent on habitat within the study area. The proposal is not considered likely to disrupt the breeding cycle of the local population as there will be no direct impact on breeding habitat.

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The proposal will only temporarily modify available habitat for this species and will not result in the removal of any key habitat features. The proportion of potential habitat to be impacted by the proposal is very small compared to what is available in the wider locality, and it is unlikely that this species would be dependent on habitat provided by the study area. Disturbances, such as noise and vibration, will be restricted to the construction phase and would be unlikely to significantly increase ambient noise levels above existing levels. As modifications to habitat will be predominately temporary, it is unlikely that fragmentation of habitat would occur. Additionally, the dispersal of this species will not be limited by the proposal, or any future linked fencing projects due to the maintenance of corridors under the Pheasants Nest and Moolgun Creek Bridges.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The proposal is not considered likely to lead to a significant increase in the local population of invasive predators. The proposal will not involve the importation of potential new invasive

predators or create conditions likely to lead to a local increase in the population of existing predators (e.g. through creating a new artificial food source).

8. Introduce disease that may cause the species to decline

No pathogens or diseases are known to be major threats to the species, with reference to Approved Conservation Advice. The proposal is considered unlikely to introduce any pathogen or disease which could cause the species to decline. Appropriate management and mitigation measures will be implemented as part of the proposed works.

9. Interfere substantially with the recovery of the species

There is no adopted or made Recovery Plan for this species. Appropriate mitigation and management measures will be implemented to avoid negative potential impacts to local ecology. Indirect impacts such as noise disturbance would be temporary in nature. The species may use the study area on a transitional basis, however there are larger portions of habitat with areas of higher quality native vegetation present nearby, which will not be impacted by the proposal.

Conclusion

The proposal will not fragment or isolate any portion of habitat for this species within the study area. No major habitat features for the species will be removed as a part of the proposal. No significant impact on this species is anticipated by the proposed works in the study area. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

May 2021 | Version: 02

Appendix D

Construction Noise Assessment – Koala Fencing Sites 2 and 3: Hume Motorway, Wilton

Construction Noise Assessment – Koala Fencing Sites 2 and 3: Hume Motorway, Wilton

1. Proposal details

1.1 Proposed scope of works

Transport for NSW (Transport) proposes to construct koala-exclusion fencing (koala fencing) at two locations along the Hume Motorway, referred to as Site 2 (Northern Hume) and Site 3 (Southern Hume). The implementation of koala fencing aims to protect koalas from the increasing urban threat of vehicle strike.

Key features of the proposal would include:

- About 420 metres of koala fencing (in total) within the road reserve along both sides of the M31 Hume Motorway, south of Moolgun Creek Bridge (referred to as Site 2 (Northern Hume)).
- About 1.4 kilometres of koala fencing (in total) within the road reserve along both sides of the southbound exit/entry ramps at the intersection of the M31 Hume Motorway and Picton Road (referred to as Site 3 (Southern Hume)).
- One-way koala/fauna escape structures located intermittently along the fence lines, to allow any koalas/fauna to move from the road-side to the habitat side of the corridor
- Selective vegetation clearing up to three metres either side of the fence to allow for the installation and maintenance of the fences and to remove overhanging branches that may allow koalas to access the road-side of the fence
- Gates (pedestrian access only) located at about 250 metre intervals for use by emergency services and maintenance personnel during incidents, mitigation works and maintenance inspections/repairs.
- Tie backs at fence ends to push koalas (and other fauna) back into the habitat areas.

1.2 Duration of works

The anticipated construction duration of the proposal is expected to be up to 12 weeks, with works proposed to commence in early 2024. Construction works would predominantly be completed outside of standard construction hours.

1.3 Proposed activities and/or equipment. Identify the noisiest activity/plant

The proposal would involve the following work stages at both sites (equivalent representative activities from the Transport Construction Noise Estimator Tool, along with their associated sound power levels, are noted in square brackets):

- Site establishment and preparatory work – [Mobilisation and site establishment – 115 dB(A)]
- Vegetation clearing – [Corridor clearing – 121 dB(A)]
- Koala fencing installation – [Road furniture installation – 110 dB(A)].

Based on the above listed methodology, it was identified that the noisiest construction activity at both sites would be vegetation clearing.

1.4 Proposed schedule

The majority of construction works would be carried out during night-time hours, as follows:

- Sunday to Thursday 8 pm to 5 am
- Public Holidays, no work.

Some works would also be undertaken during standard daytime hours which are prescribed by the NSW EPA's *Interim Construction Noise Guideline* (ICNG) are as follows:

- Monday to Friday, 7 am to 6 pm
- Saturday, 8 am to 1 pm
- Sunday and Public Holidays, no work.

2. Noise and vibration assessment

2.1 Identify the noise sensitive receivers and the distance to the nearest receivers

The sensitive receivers along the proposal alignment are mainly rural residential, with one commercial property. The major noise source in the proposal area is road traffic noise from the Hume Motorway. The following sensitive receivers have been identified in close proximity to the work, and therefore would have the highest potential to be affected (the approximate distance to each receiver is provided in brackets):

Site 2:

- Active recreation area - Bingara Gorge Golf Course, The Irons Drive, Wilton (540 m)
    - Opening hours: 9 am to 5 pm
- Residential receiver at Lot 50, Fairway Drive, Wilton (675 m).

Site 3:

- Residential receiver at 50 Janderra Lane, Wilton (140 m)
- Residential receivers along Condell Park Road, Wilton (adjacent to the proposal – 165 Condell Park Road is the closest at a distance of 195 m)
- Residential receivers along Berwick Park Road, Wilton (adjacent to the proposal – 30 Berwick Park Road is the closest at a distance of 240 m)
- Residential receivers along Emma Lane, Wilton (>330 m)
- Residential receivers along Esen Place, Pheasants Nest (>560 m)
- Residential receivers along Balmoral Rise, Wilton (>750 m).

2.2 Identify the noise area category (i.e. R0 – R4). Give reasoning.

Transport's Construction Noise Estimator Tool was used to assess the impacts on the receivers during construction. The noise area category has been selected as **R1** for all areas due to the low density of receivers and the proximity to the Hume Motorway, which has approximately 38,000 ADTC (Average Daily Traffic Count), as reported in the Transport Traffic Volume Viewer.

2.3 Indicate type of noise assessment selected (i.e. 'distance based (noisiest plant)' or 'distance based (scenario)'). Give reasoning.

The 'distance based (scenario)' assessment was selected as it considers a number of plant operating together during a certain construction activity. In this case 'Corridor clearing' was selected as the noisiest activity.

2.4 Identify the background noise levels (RBL or L_{A90}) and the noise management levels (NML or $L_{Aeq(15minute)}$)

The table below provides the background noise levels (also referred to as Rating Background Level (RBL)) and Noise Management Levels (NMLs) for the residential receivers in the noise area category mentioned above. The RBL and NML values are obtained from the Transport Construction Noise Estimator Tool.

Residential		
Noise Area Category		**R1**
RBL or L_{A90}[1] Background level (dB(A))	Day	40
	Evening	35
	Night	30
$L_{Aeq(15minute)}$ Noise Management Level[2] (dB(A))	Day	50
	Day (OOHW)[3]	45
	Evening	40
	Night	35

Notes: [1] L_{A90} = Background noise level

[2] NML for works during standard hours = Background level plus 10 dB(A)

[3] NML for out of hours works = Background level plus 5 dB(A).

Similarly, the NMLs for commercial receivers in the noise area category, R1, are summarised in the table below.

Active Recreation		
Noise Area Category		**R1**
$L_{Aeq(15minute)}$ Noise Management Level[2] (dB(A))	Day	65
	Evening	65

2.5 Determine if receivers are in line of sight or behind the barrier (noise wall or row of buildings)

As noted earlier, the nosiest activity was defined to be 'Corridor clearing'. For all sensitive receivers identified, there is line of sight to construction activities. The most sensitive receiver is located at a distance of around 115 metres from the proposal area at Site 2. The outcome of the assessment is recorded in Section 3 below.

Scenario	Corridor clearing
Is there line of sight to receiver?	Yes

OFFICIAL

3. Noise estimator output data

3.1 Predicted noise levels

The Noise Estimator Tool was used to predict noise levels and determine appropriate additional mitigation measures for various receivers. To assist with the assessment, residential receivers were grouped into noise catchment areas (NCAs) for construction noise assessment. For the NCAs, affected distances (or the distances up to which noise levels are expected to exceed the NML) are recorded in the table below together with the predicted noise levels. The results of the construction noise assessment are summarised below.

R1 noise area category:

Site 2:

Catchment distance	Day		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1 – for receivers in line of sight, at a distance up to 200 m	50	60	N
Active Recreation NCA 1 – for receivers in line of sight, at a distance up to 45 m	65	75	N, PC, RO

From the above table, the maximum affected distances for which rural residential and active recreation receivers would experience noise exceedances are 200 metres and 45 metres respectively. As seen in the figure below, the closest residential and active recreation receivers to Site 2 are located at distances beyond these respective distances from the proposal area, and thus no further additional mitigation measures are recommended for works at Site 2 outside of the standard measures outlined in the *Construction Noise and Vibration Guideline (CVNG)*.

The night-time assessment for the residential receiver near Site 2 is presented below. The active recreation receiver (Bingara Golf Course) is not assessed as it is not open past 5 pm.

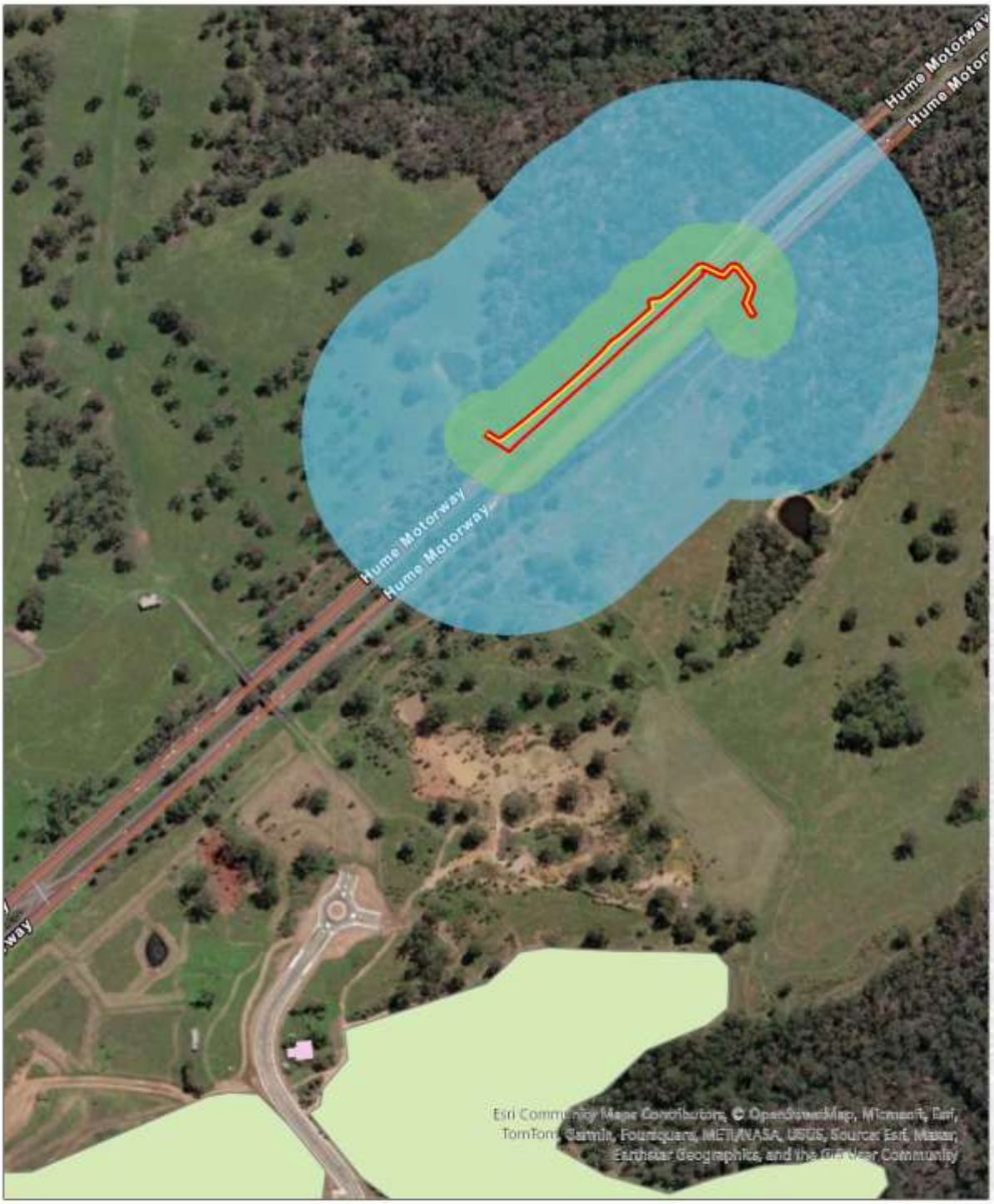
Catchment distance	Night		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1 – for receivers in line of sight, at a distance up to 875 m	35	40	N, R2, DR

Site 3:

Catchment distance	Day		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1 – for receivers in line of sight, at a distance up to 200 m	50	60	N

Catchment distance	Night		
	NML, dB(A)	Predicted noise levels, dB(A)	Recommended additional mitigation measures
Residential NCA 1 – for receivers in line of sight, at a distance up to 200 m	35	60	AA, N, PC, SN, R2, DR
Residential NCA 2 – for receivers in line of sight, at a distance up to 420 m	35	50	N. PC, SN, R2, DR
Residential NCA 3 – for receivers with no line of sight, at a distance up to 605 m	35	35	N
Residential NCA 4 – for receivers in line of sight, at a distance up to 875 m	35	40	N, R2, DR

OFFICIAL



Koala Fencing Site 2, Northern Hume Motorway, Wilton - Construction Noise Assessment (Day)

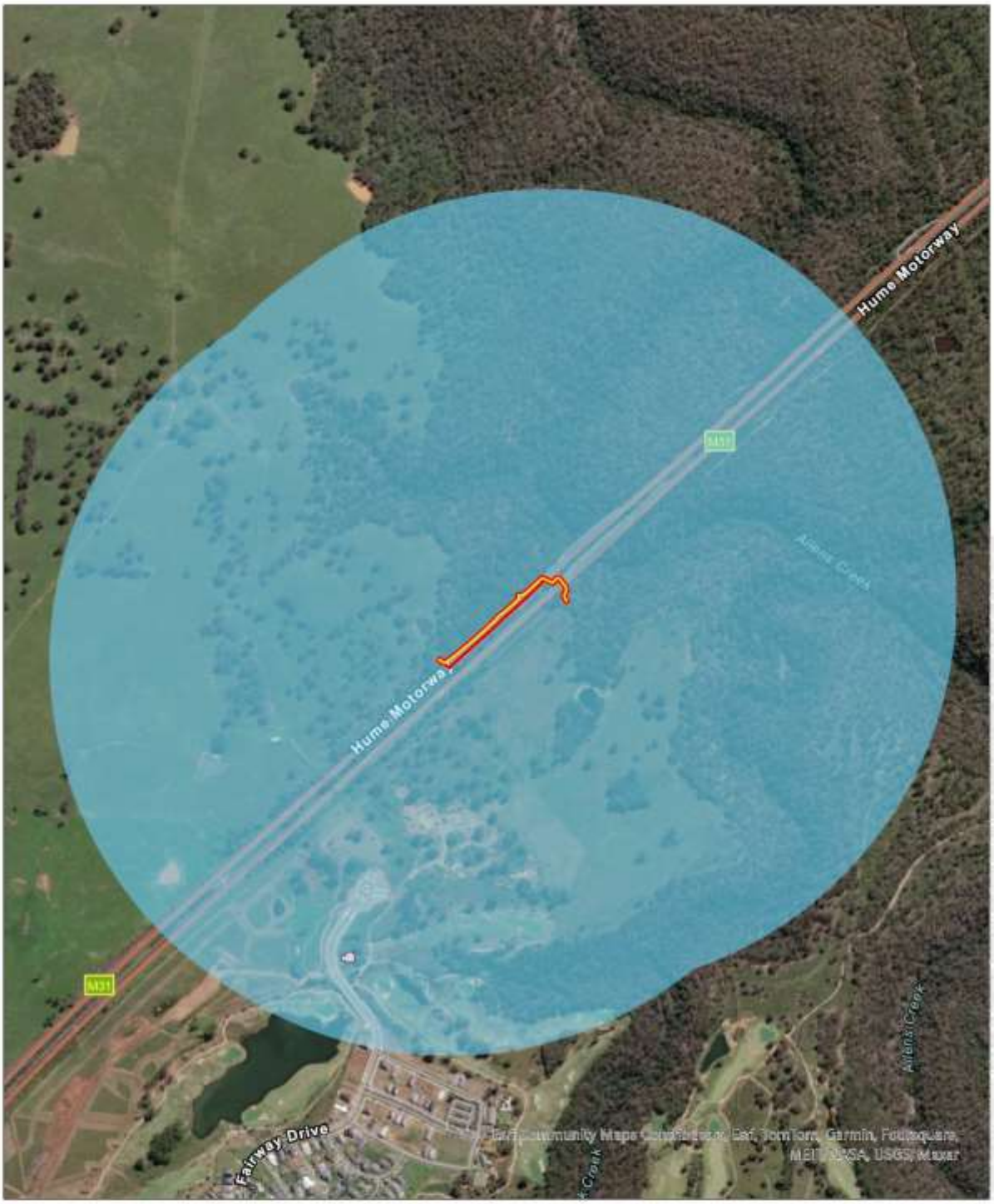
N

0 75 150 Meters

AECOM

- Koala Fencing Alignment
- Site Boundary
- Active Recreation NCA 1 (45 m, in line of sight)
- Residential NCA 1 (200 m, in line of sight)
- Active Recreation Area - Bingara Gorge Golf Course
- Residential Receiver - Lot 50, Fairway Dr, Wilton

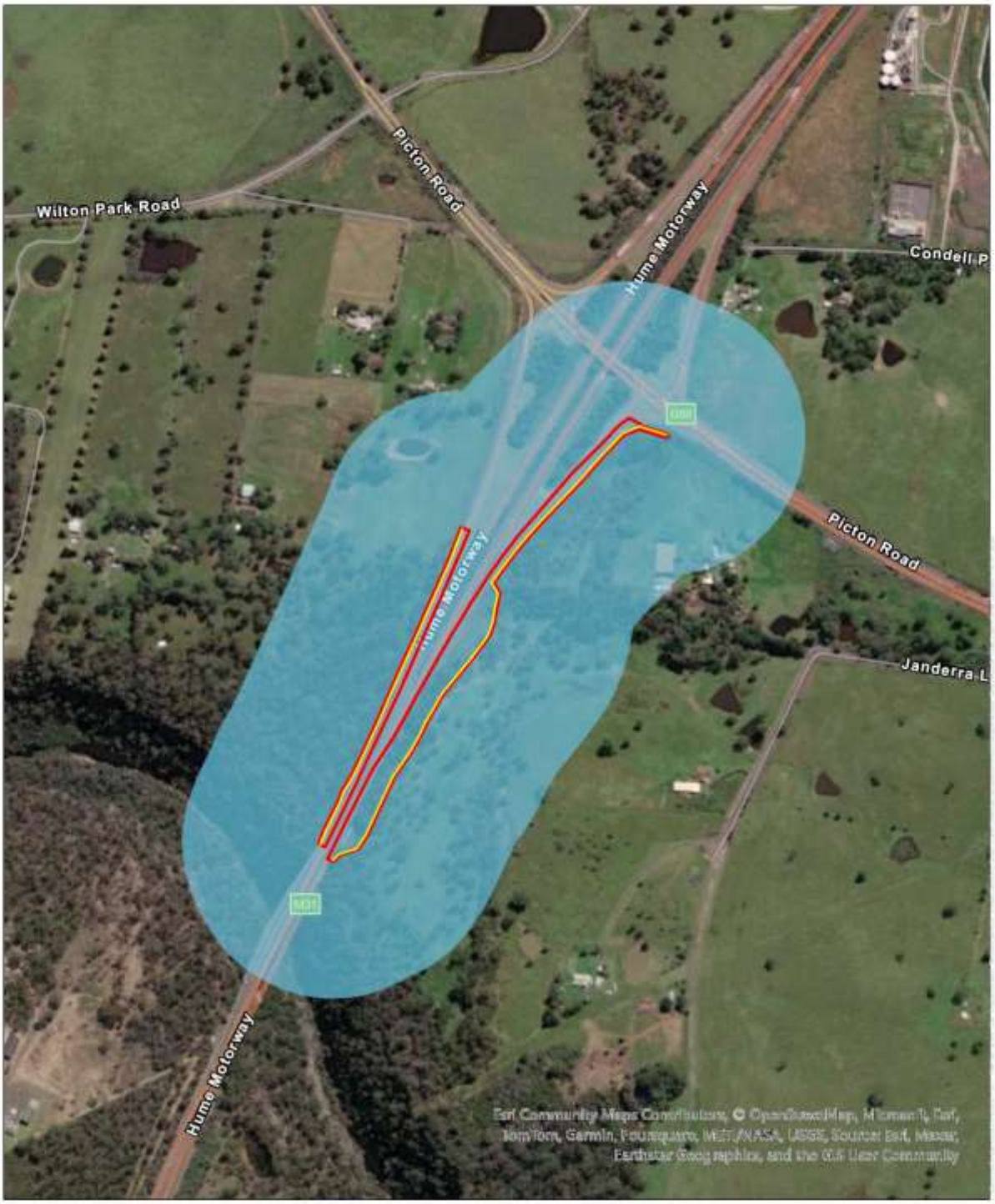
Copyright: © 2024 AECOM Australia Pty Ltd (AECOM) and the Department of Customer Service. All rights reserved, including rights to the use and reproduction of this drawing, in any form or by any means. You must not use this drawing without the permission of AECOM and the Department of Customer Service. AECOM makes no warranty as to the accuracy or completeness of any information contained in this drawing and AECOM and the Department of Customer Service assume no responsibility to any person for any loss or damage suffered by any person as a result of the use of this drawing.



Koala Fencing Site 2, Northern Hume Motorway, Wilton - Construction Noise Assessment (Night)

AECOM

- Koala Fencing Alignment
- Site Boundary
- Residential NCA 1 (875 m, in line of sight)
- Residential Receiver - Lot 50, Fairway Dr, Wilton



Koala Fencing Site 3, Southern Hume Motorway, Wilton - Construction Noise Assessment (Day)

N

0 100 200 Meters

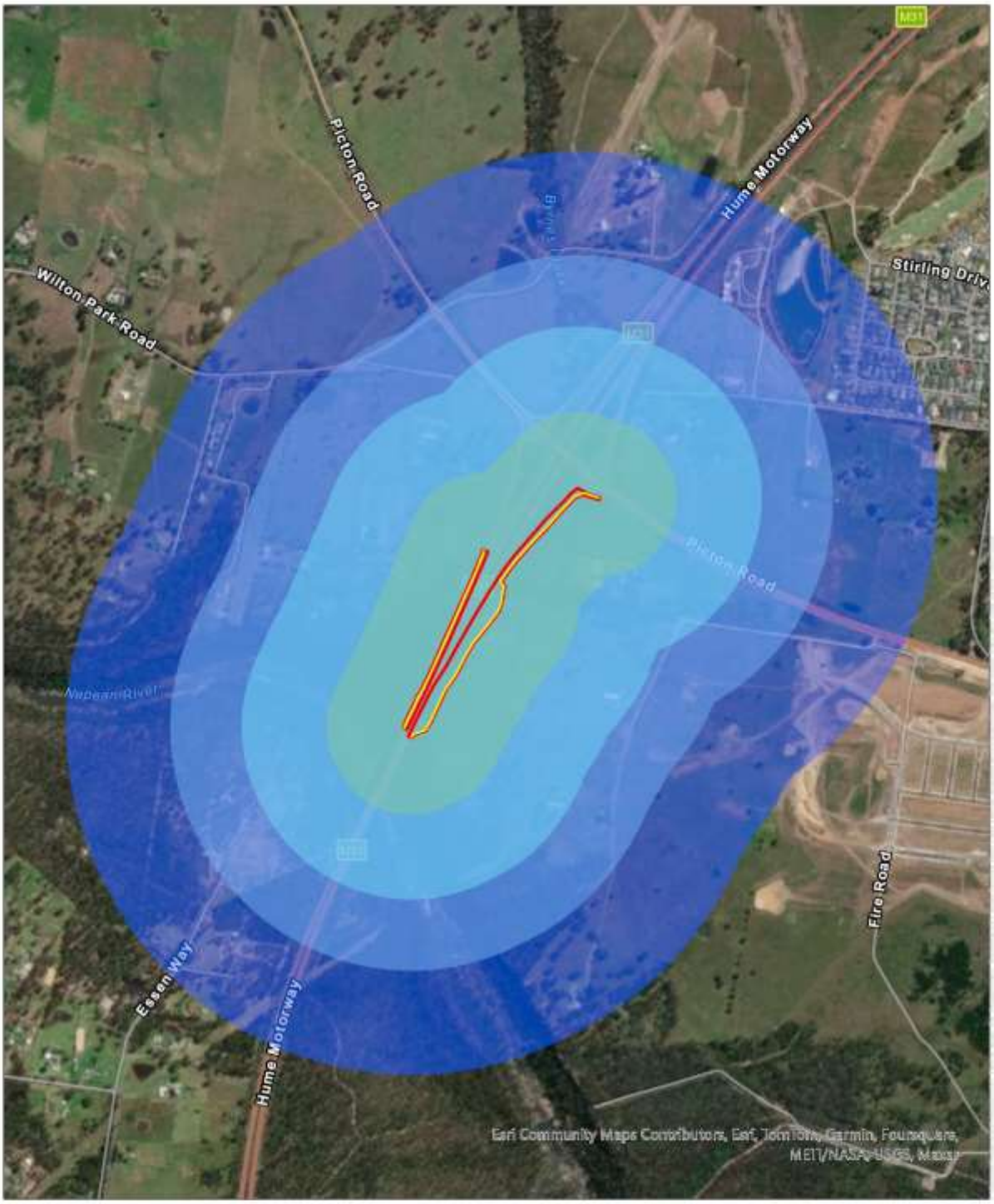
AECOM

Koala Fencing Alignment

Site Boundary

Residential NCA 1 (200 m, in line of sight)

Copyright © AECOM Australia Pty Ltd and its licensors. All rights reserved. The concepts and information contained in this document are the property of AECOM Australia Pty Ltd. Use or copying of this document in whole or in part without the written permission of AECOM Australia Pty Ltd constitutes an infringement of copyright. AECOM Australia Pty Ltd makes no warranty about the accuracy or suitability of the information in this document for any purpose. It is the responsibility of the user of the information to verify its accuracy. AECOM Australia Pty Ltd shall not be liable for any loss, damage or inconvenience caused as a result of reliance on the information provided in this document.



Koala Fencing Site 3, Southern Hume Motorway, Wilton - Construction Noise Assessment (Night)

N

0 180 360 Meters

AECOM

- Koala Fencing Alignment
- Site Boundary
- Residential NCA 1 (200 m, in line of sight)
- Residential NCA 2 (420 m, in line of sight)
- Residential NCA 3 (605 m, no line of sight)
- Residential NCA 4 (875 m, in line of sight)

Copyright: Copyright in underlying data for this base layer is licensed under a Creative Commons Attribution 4.0 Australia licence (CC BY 4.0) and/or other licence(s) listed on the page. Source: Digital Cadastral Database and/or Digital Topographic Database.

The terms of Creative Commons Attribution 4.0 Australia licence are available from https://creativecommons.org/licenses/by/4.0/ Registered Copyright Licensee.

Neither AECOM Australia Pty Ltd (AECOM) nor the Department of Customer Service make any representations or warranties of any kind, about the accuracy, reliability, completeness or suitability or fitness for purpose in relation to the content (in accordance with section 5 of the Copyright Licence). AECOM has prepared this document for the sole use of its Client based on the Client's description of its requirements having regard to the assumptions and other limitations set out in this report, including page 2.

3.2 Worst case construction noise impacts

While most construction activities for the proposal are expected to occur at separate times and/or locations, it is possible that noisy construction activities (e.g. the usage of multiple chainsaws) may occur at the same time in close proximity to each other. In these cases, it is possible that predicted noise levels may increase by up to 3 dB(A). However, it should be noted that the predicted construction noise levels at each receiver are considered to be reasonable worst-case 15-minute impacts. As a result, the project noise levels are likely to be lower than those stated in this assessment for substantial periods of time.

In summary, it is unlikely that an increase in the number of receivers affected by a 3 dB(A) increase would occur, and the implementation of standard noise mitigation measures, and additional noise mitigation measures (refer section 4.2), would ensure that the potential for adverse noise impacts at sensitive receivers is minimised.

3.3 Vibration assessment

A jackhammer is proposed to be used in the proposal which has a minimum working distance of 1 m to prevent cosmetic damage from vibration, according to '*BS 7385: Evaluation and measurement for vibration in buildings'*. There are no buildings or receivers within 1 m of the proposal area, therefore minimum working distances would not be applicable.

4. Review of additional mitigation measures

4.1 Review of additional mitigation measures to determine which are feasible and reasonable to apply

- Letterbox drop (**N = notification**) has been recommended for receivers within: 875 metre radius of the proposal area for both sites during construction work hours.
- **Specific notification (SN)** should be delivered to the residences within 420 metres of the Site 3 proposal area, as indicated by the Construction Noise Estimator Tool for night-time works. The specific notification provides more highly affected receivers additional information that is more informative than that covered in general letterbox drops. However, it may not be reasonable to undertake separate types of notifications. Instead, a single coordinated message should be delivered to the affected receivers, with all relevant specific details included.
- **Phone calls (PC)** should be made to identified/affected stakeholders within a minimum of a 420 metre radius of Site 3 detailing relevant information.
- **Respite offer (RO)** should be considered where there are high noise and vibration generating activities near receivers. RO proposes that works should be carried out in continuous blocks that do not exceed 3 hours each, with a minimum respite period of one hour between each block. The purpose of such offer is to provide residents with respite from an ongoing impact. However, this is not applicable to projects that are undertaken at night as this would only cause nuisance to the residences. As such this mitigation measure is not recommended.
- **Respite Period 2 (R2)** Night-time construction noise shall be limited to two consecutive nights except for where there is a Duration Respite. For night work these periods of work should be separated by no less than one week and no more than six nights per month. Where possible, high noise generating works shall be completed before 11pm.

- **Duration Respite (DR)** is offered when works are unable to comply with R2 respite offers. Where it can be strongly justified, it may be beneficial to increase the work duration (number of evenings or nights worked) for longer duration projects so that the project can be completed more quickly.
- **Alternate Accommodation (AA)** is an option that may be offered to residential receivers living in close proximity to construction work and are thus likely to experience highly intrusive noise levels. The Construction Noise Estimator Tool indicates that residential receivers located within 200 metres of Site 3 would likely experience highly intrusive noise levels. Below is a review of the AA recommendation:
    - Are works required beyond midnight? If so, has a justification been provided?
      Highly intrusive noise would be short in duration, and works requiring the use of particularly noisy plant, including petrol chainsaw and mulching, would be completed by midnight. Electric chainsaws may be used in works scheduled past midnight only. Works would be subject to noise mitigation measures. Works are required during out of hours to minimise traffic impacts along the motorway.

    - Does the surrounding area have a high density of receivers?
      No, the surrounding area is comprised of isolated rural single dwellings.

    - Will the receivers' exposure to the high noise generating activity occur as peak event/s or is it consistent throughout the duration of the project?
      As some works stages are anticipated to be significantly louder than others, construction noise would likely affect receivers as peak events. The worst affected receivers are located about 140 metres from the proposal area and would experience noise levels >30dB(A) above the background level; however, this is considered a worst-case scenario, and highly intrusive noise would be in short durations only.

    - Could temporary alternate accommodation be consistently applied?
      It may be possible to consistently apply alternative accommodation arrangements, although accommodation options may be limited in the area.

    - Will receivers receive detailed information on the proposed work activities and mitigation measures to be applied?
      Yes, the letterbox drop will contain information on the proposed works as well as the proposed mitigation measures, including the scheduling of works and contact details for more information. Residents will be notified prior the start of works.

<u>Outcome of the evaluation process:</u>

Alternative accommodation is not considered feasible or reasonable to implement, but will be reviewed during construction.

4.2 Additional mitigation measures that are feasible and reasonable to apply

The standard mitigation measures from the *Construction Noise and Vibration Guideline* (TfNSW, 2016) would apply to the proposal. Based on the review of additional mitigation measures in Section 4.1, the following additional safeguards are considered feasible and reasonable to implement to the proposal:

1. **Notification (N)** - Letterbox drops for receivers within: 875 metre radius of the proposal area at both Sites 2 and 3. Notifications should detail work activities, dates and hours, impacts and mitigation

measures, and contact telephone number. Notification will be sent a minimum of seven calendar days prior to the start of works.

2. **Respite Period 2 (R2)** Night-time construction noise shall be limited to two consecutive nights except for where there is a Duration Respite. For night work these periods of work should be separated by no less than one week and no more than six nights per month. Where possible, high noise generating works shall be completed before 11pm.
3. **Duration Respite (DR)** Respite Period 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance, and where it can be strongly justified, it may be beneficial to increase the work duration (number of evenings and nights worked) through Duration Respite so that the project can be completed more quickly. Council should engage with the community where noise levels are expected to exceed the NML to demonstrate support of the Duration Respite.
4. **Alternative Accommodation (AA)** options are not considered feasible and reasonable to implement but will be reviewed during construction.

Appendix E

Aboriginal Archaeological Survey Report - Stage 2 PACHCI

Appendix F

Aboriginal heritage assessment of modified trees

Appendix G

Koala fence design drawings

WOLLONDILLY SHIRE COUNCIL

HW2 - HUME HIGHWAY
STRUCTURAL VERIFICATION AND DESIGN FOR KOALA FENCING NEAR PICTON ROAD AND BINGARA GORGE

FOR CONSTRUCTION

LOCALITY PLAN
NOT TO SCALE

DRAWING INDEX

PS207943-WSP-00-GN-DRG-000001	COVER SHEET AND DRAWING INDEX
PS207943-WSP-00-GN-DRG-000011	GENERAL NOTES
PS207943-WSP-00-GN-DRG-000021	FENCING DETAILS - SHEET 1
PS207943-WSP-00-GN-DRG-000022	FENCING DETAILS - SHEET 2
PS207943-WSP-00-GN-DRG-000023	FENCING DETAILS - SHEET 3
PS207943-WSP-00-GN-DRG-000024	FENCING DETAILS - SHEET 4

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

SCALE: NTS

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
0	ISSUED FOR CONSTRUCTION	B.C 21.12.23	M.W 21.12.23	J.E 21.12.23

COORDINATE SYSTEM: | HEIGHT DATUM: AHD | DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.

wsp
Level 27, 680 George Street, Sydney
GPO Box 5394, NSW 2001, Australia
Tel: +61 2 9272 5100 Fax: +61 2 9272 5101
wsp.com
CIVIL

DRAWN	BRENT REEVE	21.12.23
DESIGNED	BREANNA CLAYTON	21.12.23
DRG CHECK	CLAUDIO BIDART	21.12.23
DESIGN CHECK	ROSLYN HANSEN	21.12.23
PROJ/DES MNGR	JONATHAN EPSELIS	21.12.23
APPROVED	JONATHAN EPSELIS	21.12.23

WOLLONDILLY SHIRE COUNCIL
HW2 HUME HIGHWAY - STRUCTURAL VERIFICATION AND DESIGN FOR KOALA FENCING NEAR PICTON ROAD AND BINGARA GORGE
COVER SHEET

DRAWING SET No: DS 2023/001330	PART:	SHEET: 01 OF 01	A1
STATUS: FOR CONSTRUCTION	BRIDGE No:		©

DRG No.	REV	VER	EDMS No.	AMD No.
PS207943-WSP-00-GN-DRG-000001	0	0		

FILE NAME: PS207943-WSP-00-GN-DRG-000001.dwg
PLOT DATE & TIME: 20/12/2023 6:18:32 PM
X:\TNSW-A1

GENERAL NOTES

1. ALL DIMENSIONS IS MILLIMETRES UNLESS NOTED OTHERWISE.
2. WIND LOADING IS IN ACCORDANCE WITH AS 5100.2.
   - WIND TERRAIN CATEGORY: TC2.5
   - WIND REGION: A2
   - REGIONAL WIND SPEED SLS: 37m/s
   - REGIONAL WIND SPEED ULS: 48m/s
   - AVERAGE RECURRENCE INTERVAL SLS: R = 20 YEARS
   - AVERAGE RECURRENCE INTERVAL ULS: R = 50 YEARS
3. CONCRETE GRADE SHALL BE N32/20.
4. CIRCULAR HOLLOW SECTION (CHS) TO BE GRADE C250 TO AS 1163.
5. BOLTS, NUTS AND WASHERS TO BE HOT-DIP GALVANISED TO AS 1214.
6. WELDING SHALL BE TO AS/NZ 1554.1.
7. ALL STEELWORK AND FITTINGS SHALL BE HOT-DIP GALVANISED TO AS/NZS 4680.
8. ALL FENCING MATERIALS TO BE IN ACCORDANCE WITH SPECIFICATION R201.
9. PRE-PAINTED GALVANISED STEEL SHEET SHALL BE 0.40 BMT TO AS2728 COLOURED ON HIGHWAY SIDE IN WOODLAND GREY.
10. PREPAINTED GALVANISED SHEET TO BE CONTINUOUS, NEATLY BUTT SHEETS OR SLIGHTLY OVERLAP AT ALL JOINTS TO ENSURE NO GAPS
11. GALVANIZED CHAIN WIRE SHALL CONFORM TO AS 2423 WITH A MESH SIZE OF 50mm AND 3.15mm WIRE
12. TIE WIRE SHALL BE 2.0mm GALVANISED WIRE UNLESS SPECIFIED OTHERWISE.
13. BRACE POSTS TO BE ADOPTED WHERE CHANGE IN HORIZONTAL ALIGNMENT EXCEEDS 20 DEGREES AND AT GATE POSTS AND END POSTS.
14. STRAINER POSTS TO BE PROVIDED AT 150m INTERVALS. PROVIDE BRACING STAYS IN EACH DIRECTION OF STRAINER POST BETWEEN INTERMEDIATE PANELS
15. FENCE POSTS MUST COMPLY WITH MAXIMUM SPACING OF 3000mm.
16. BRACE POSTS TO BE FIXED TO VERTICAL POSTS WITH CLAMPS.
17. ALL POSTS TO BE FITTED WITH GALVANISED POST CAPS.
18. END, CORNER AND GATE POST FOOTINGS TO BE 1200 DEEP UNO.
19. CHAIN WIRE WITH THE PREPAINTED GALVANISED SHEET OUTERMOST, SHALL BE LOCATED ON THE HABITAT SIDE TO PREVENT KOALAS CLIMBING THE CHS POSTS, STAYS AND BRACING. ENSURE ANY GAPS BETWEEN THE KOALA FENCING AND OTHER STRUCTURES ARE NARROW ENOUGH TO PREVENT KOALAS PASSING THROUGH. IF THE FENCE IS TO CONNECT TO OTHER STRUCTURES, THE ASSET OWNERS PERMISSION IS TO BE SOUGHT
20. POST AND GATE FOOTINGS ARE DESIGNED FOR STIFF RESIDUAL CLAY HAVING A MINIMUM UNDRAINED SHEAR STRENGTH GREATER THAN OR EQUAL TO 50kPa. NOT TO BE FOUNDED IN FILL MATERIAL.
21. WHERE FOOTINGS ARE TO BE IMMEDIATELY ADJACENT TO NATURAL DRAINAGE CHANNELS, FOOTING DEPTH TO INCREASE 200mm GREATER THAN SPECIFIED IN THE DETAIL.
22. VISUAL INSPECTION OF EMBEDMENT MATERIAL SHALL BE UNDERTAKEN BY A SUITABLY QUALIFIED ENGINEER NOMINATED BY THE PRINCIPAL. EMBEDMENT MATERIAL TO BE STIFF CLAY OR BETTER. SHOULD INSPECTED MATERIAL APPEAR TO HAVE UNDRAINED SHEAR STRENGTH OF LESS THAN 50kPa, EMBEDMENT DEPTH SHALL BE REVISED TO SUIT SITE CONDITIONS.

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
0	ISSUED FOR CONSTRUCTION	B.C 21.12.23	M.W 21.12.23	J.E 21.12.23

COORDINATE SYSTEM:

HEIGHT DATUM: AHD

SCALE: NTS

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.

Level 27, 680 George Street, Sydney
GPO Box 5394, NSW 2001, Australia
Tel: +61 2 9272 5100 Fax: +61 2 9272 5101
wsp.com
CIVIL

DRAWN	BRENT REEVE	21.12.23
DESIGNED	BREANNA CLAYTON	21.12.23
DRG CHECK	CLAUDIO BIDART	21.12.23
DESIGN CHECK	ROSLYN HANSEN	21.12.23
PROJ/DES MNGR	JONATHAN EPSELIS	21.12.23
APPROVED	JONATHAN EPSELIS	21.12.23

WOLLONDILLY SHIRE COUNCIL

HW2 HUME HIGHWAY - STRUCTURAL VERIFICATION AND DESIGN FOR KOALA FENCING NEAR PICTON ROAD AND BINGARA GORGE

GENERAL NOTES

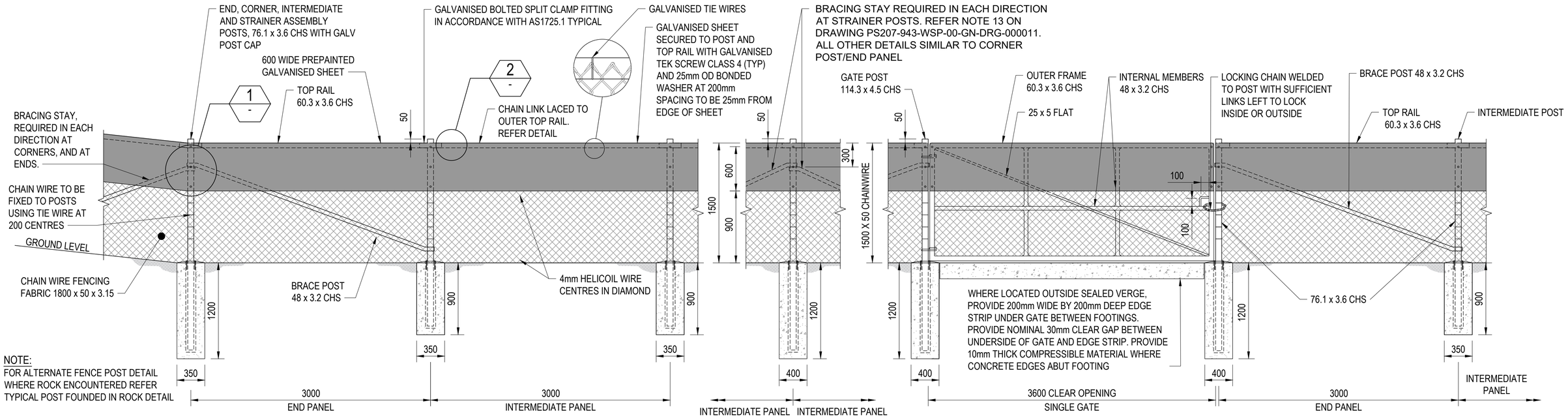
DRAWING SET No: DS 2023/001330	PART:	SHEET: 01 OF 01	A1
STATUS: FOR CONSTRUCTION	BRIDGE No:		©

DRG No.	REV	VER	EDMS No.	AMD No.
PS207943-WSP-00-GN-DRG-000011	0	0		

FILE NAME: PS207943-WSP-00-GN-DRG-000011.dwg

PLOT DATE & TIME: 20/12/2023 6:18:24 PM

X:\TNSW-A1



KOALA PROOF FENCE TYPICAL ARRANGEMENT VIEWED FROM HABITAT SIDE

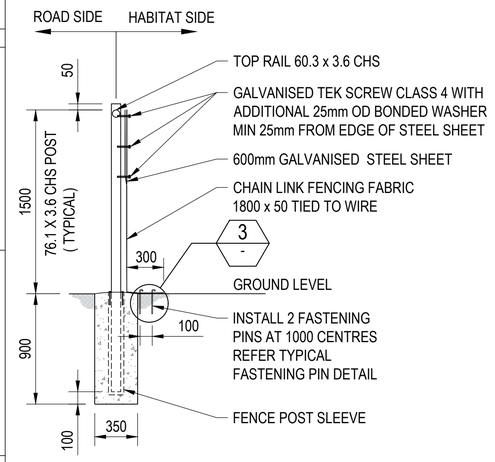
SCALE 1:25

TYPICAL INTERMEDIATE STRAINER POST ASSEMBLY VIEWED FROM HABITAT SIDE

SCALE 1:25

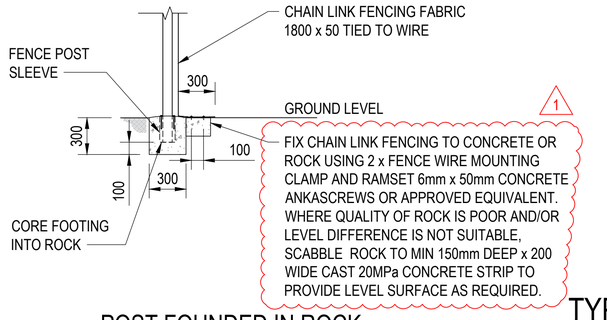
KOALA PROOF FENCE AT GATE VIEWED FROM HABITAT SIDE

SCALE 1:25



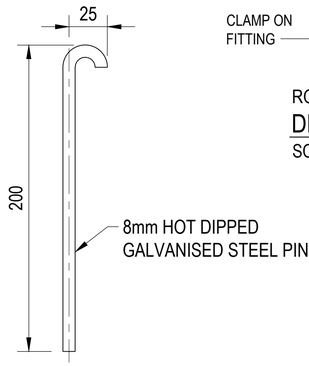
INTERMEDIATE POST FOUNDED IN CLAY SIDE ELEVATION

SCALE 1:25



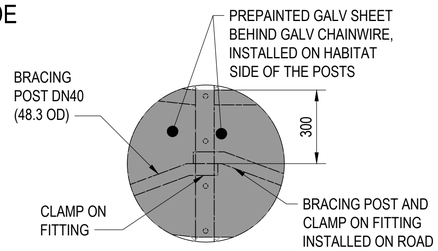
POST FOUNDED IN ROCK SIDE ELEVATION

SCALE 1:25



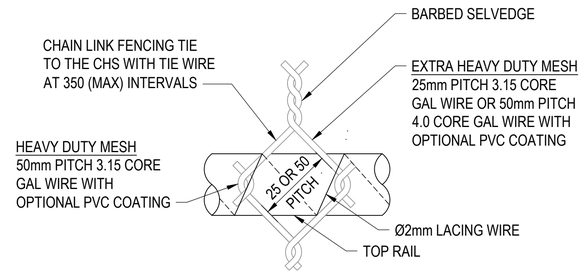
TYPICAL FASTENING PIN DETAIL

DETAIL 3 - SCALE 1:5



ROAD SIDE VIEW

DETAIL 1 - SCALE : NTS



DETAIL 2 - SCALE : NTS

NOTES:

1. FOR GENERAL NOTES REFER TO DRAWING PS207943-WSP-00-GN-DRG-000011
2. FOR KOALA FENCE END TIE BACK REFER TO DRAWING PS207943-WSP-00-GN-DRG-000023

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
1	RE-ISSUED FOR CONSTRUCTION	B.C 25.01.24	M.W 25.01.24	J.E 25.01.24
0	ISSUED FOR CONSTRUCTION	B.C 21.12.23	M.W 21.12.23	J.E 21.12.23

COORDINATE SYSTEM: HEIGHT DATUM: AHD

SCALE: AS SHOWN

0 0.1 0.2m — SCALE 1:5 @A1

0 0.5 1m — SCALE 1:25 @A1

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.

wsp
Level 27, 680 George Street, Sydney
GPO Box 5394, NSW 2001, Australia
Tel: +61 2 9272 5100 Fax: +61 2 9272 5101
wsp.com
CIVIL

DRAWN	BRENT REEVE	25.01.24
DESIGNED	BREANNA CLAYTON	25.01.24
DRG CHECK	CLAUDIO BIDART	25.01.24
DESIGN CHECK	ROSLYN HANSEN	25.01.24
PROJ/DES MNGR	JONATHAN EPSELIS	25.01.24
APPROVED	JONATHAN EPSELIS	25.01.24

WOLLONDILLY SHIRE COUNCIL

HW2 HUME HIGHWAY - STRUCTURAL VERIFICATION AND DESIGN FOR KOALA FENCING NEAR PICTON ROAD AND BINGARA GORGE

FENCING DETAILS - SHEET 1

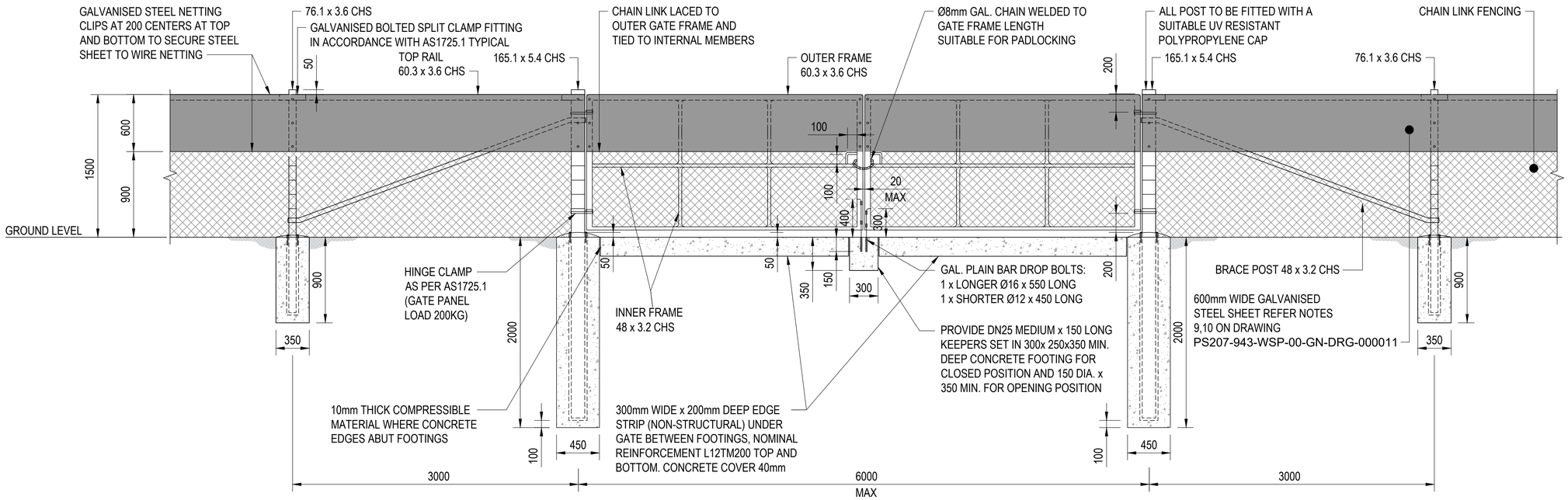
DRAWING SET No: DS 2023/001330	PART:	SHEET: 01 OF 04	A1
STATUS: FOR CONSTRUCTION	BRIDGE No:		©

DRG No.	REV	VER	EDMS No.	AMD No.
PS207943-WSP-00-GN-DRG-000021	1	-		

X:\INS\W:A1
X:PS207943-00-GV-RF-FENCING-DETAILS.

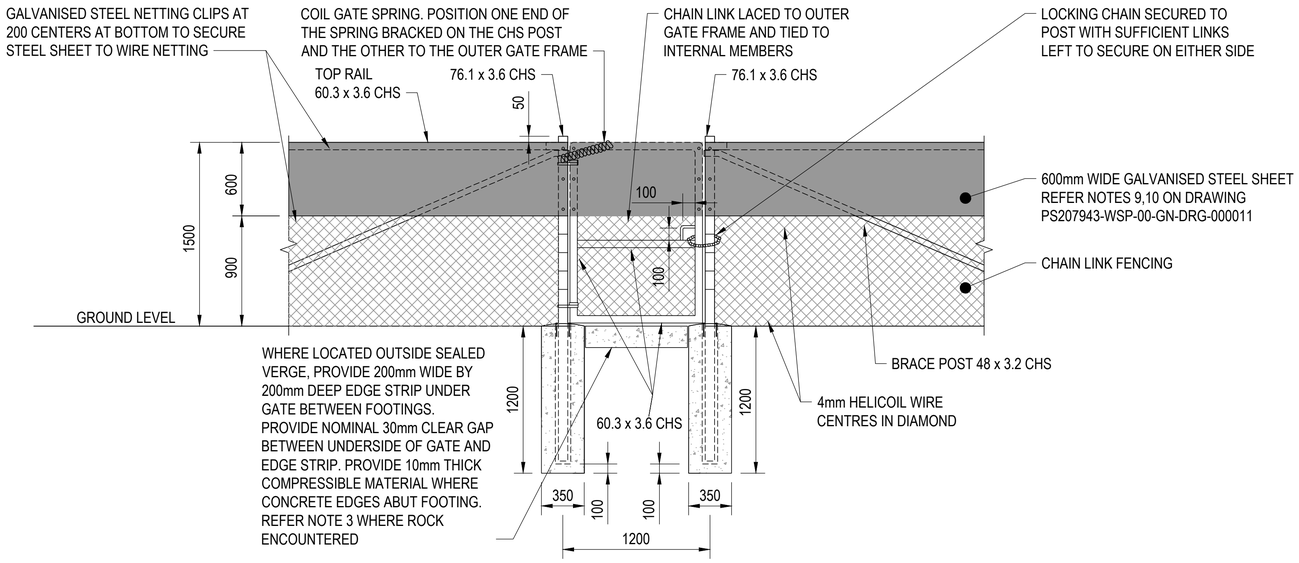
FILE NAME: PS207943-WSP-00-GN-DRG-000021.dwg

PLOT DATE & TIME: 25/01/2024 4:02:40 PM



6.0m WIDE MAINTENANCE VEHICLE ACCESS GATE DETAIL
ELEVATION VIEWED FROM HABITAT SIDE

SCALE 1:25



1.2m WIDE MAINTENANCE GATE DETAIL
ELEVATION VIEWED FROM HABITAT SIDE

SCALE 1:25

NOTES:

1. FOR TYPICAL FENCE ELEVATIONS REFER TO DRAWING PS207943-WSP-00-GN-DRG-000021
2. FOR GENERAL NOTES REFER TO DRAWING PS207943-WSP-00-GN-DRG-000011
3. CONTRACTOR TO REMOVE ANY ROCK THAT MAY PREVENT GATE FROM OPENING. IF MIN 30mm GAP IS NOT POSSIBLE DUE TO VARYING LEVELS OF ROCK IT IS RECOMMENDED TO SCABBLE ROCK TO 150mm DEEP x 200mm WIDE FOR PROVISION OF 20MPa CONCRETE STRIP

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
0	ISSUED FOR CONSTRUCTION	B.C 21.12.23	M.W 21.12.23	J.E 21.12.23

COORDINATE SYSTEM: HEIGHT DATUM: AHD

SCALE: AS SHOWN

0 0.5 1m
SCALE 1:25 @A1

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.
Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.

Level 27, 680 George Street, Sydney
GPO Box 5394, NSW 2001, Australia
Tel: +61 2 9272 5100 Fax: +61 2 9272 5101
wsp.com
CIVIL

DRAWN	BRENT REEVE	21.12.23
DESIGNED	BREANNA CLAYTON	21.12.23
DRG CHECK	CLAUDIO BIDART	21.12.23
DESIGN CHECK	ROSLYN HANSEN	21.12.23
PROJ/DES MNGR	JONATHAN EPSELIS	21.12.23
APPROVED	JONATHAN EPSELIS	21.12.23

WOLLONDILLY SHIRE COUNCIL

HW2 HUME HIGHWAY - STRUCTURAL VERIFICATION AND DESIGN FOR KOALA FENCING NEAR PICTON ROAD AND BINGARA GORGE

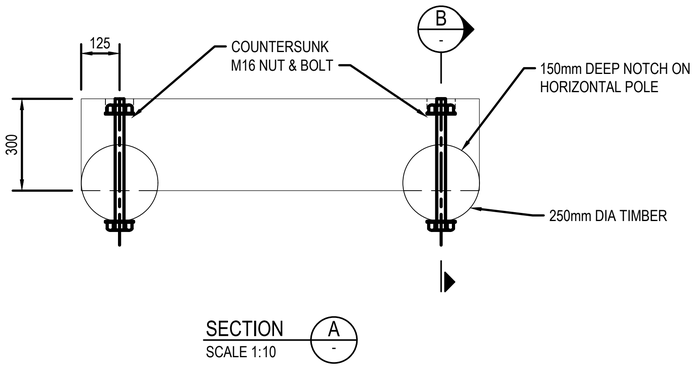
FENCING DETAILS - SHEET 2

DRAWING SET No: DS 2023/001330	PART:	SHEET: 02 OF 04		A1
STATUS: FOR CONSTRUCTION	BRIDGE No:			©
DRG No. PS207943-WSP-00-GN-DRG-000022	REV 0	VER 0	EDMS No.	AMD No.

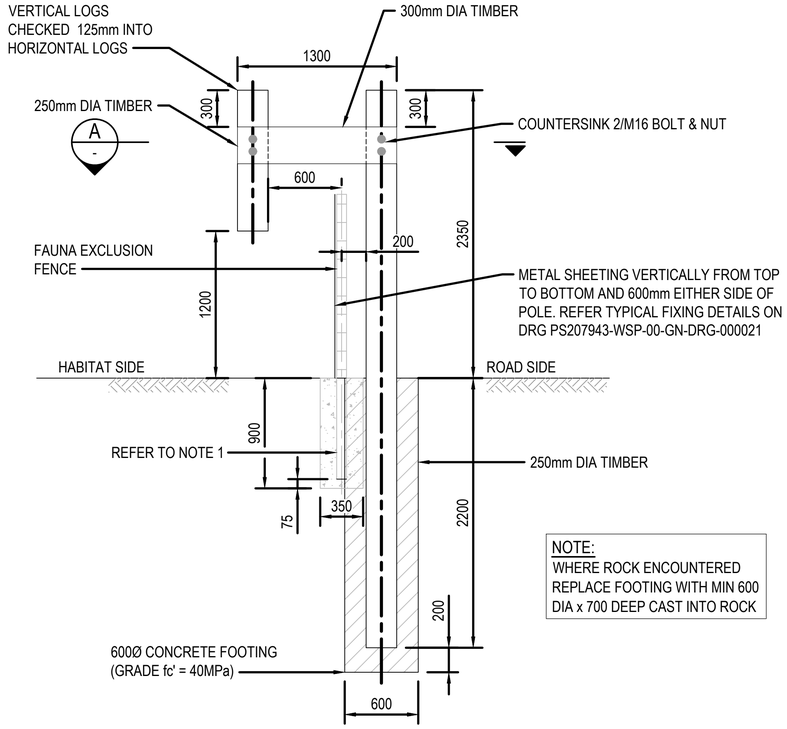
X:\TNSW\A1 X:\PS207943-00-CIV-RF-FENCING-DETAILS.

FILE NAME: PS207943-WSP-00-GN-DRG-000022.dwg

PLOT DATE & TIME: 25/01/2024 11:49:10 AM



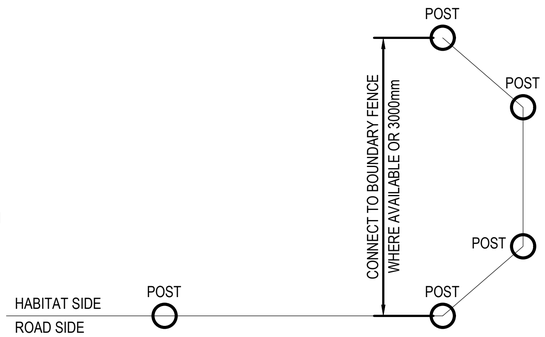
SECTION A - / SCALE 1:10



KOALA ESCAPE POLES ELEVATION

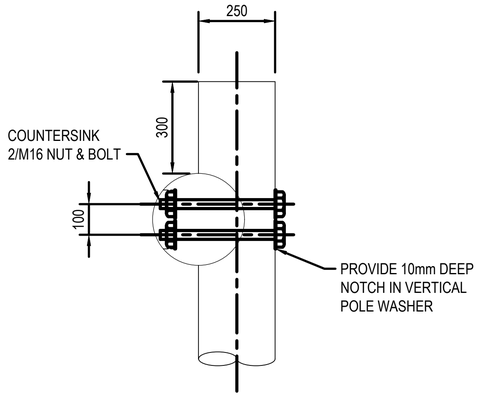
SCALE 1:25

NOTE:
WHERE ROCK ENCOUNTERED
REPLACE FOOTING WITH MIN 600
DIA x 700 DEEP CAST INTO ROCK



KOALA FENCE END TIEBACK

SCALE - N.T.S



SECTION B - / SCALE 1:10

NOTES:

1. POSITION ESCAPE POLE IN BETWEEN THE FENCE FOOTING
2. FOR FENCE DETAILS REFER TO DRAWINGS PS207943-WSP-00-GN-DRG-000021 AND PS207943-WSP-00-GN-DRG-000022
3. FOR GENERAL NOTES REFER TO DRAWING PS207943-WSP-00-GN-DRG-000011
4. TIMBER POLES TO BE MIN F17 HARDWOOD WITH DURABILITY CLASS 1 IN ACCORDANCE WITH AS5604.1
5. BOLTS, NUTS AND WASHERS TO BE HOT DIPPED GALVANISED TO AS 1214
6. ISO METRIC HEXAGONAL BOLTS MUST BE PROPERTY CLASS 4.6 TO AS1110 U.N.O ALL BOLTS, NUTS AND WASHERS MUST CONFORM TO TfNSW B240

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
0	ISSUED FOR CONSTRUCTION	B.C 21.12.23	M.W 21.12.23	J.E 21.12.23

COORDINATE SYSTEM: | HEIGHT DATUM: AHD

SCALE: AS SHOWN

0 0.2 0.4m
SCALE 1:10 @A1

0 0.5 1m
SCALE 1:25 @A1

DESIGN LOT CODE:

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW. Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.

Level 27, 680 George Street, Sydney
GPO Box 5394, NSW 2001, Australia
Tel: +61 2 9272 5100 Fax: +61 2 9272 5101
wsp.com
CIVIL

DRAWN	BRENT REEVE	21.12.23
DESIGNED	BREANNA CLAYTON	21.12.23
DRG CHECK	CLAUDIO BIDART	21.12.23
DESIGN CHECK	ROSLYN HANSEN	21.12.23
PROJ/DES MNGR	JONATHAN EPSELIS	21.12.23
APPROVED	JONATHAN EPSELIS	21.12.23

WOLLONDILLY SHIRE COUNCIL

HW2 HUME HIGHWAY - STRUCTURAL VERIFICATION AND DESIGN FOR KOALA FENCING NEAR PICTON ROAD AND BINGARA GORGE

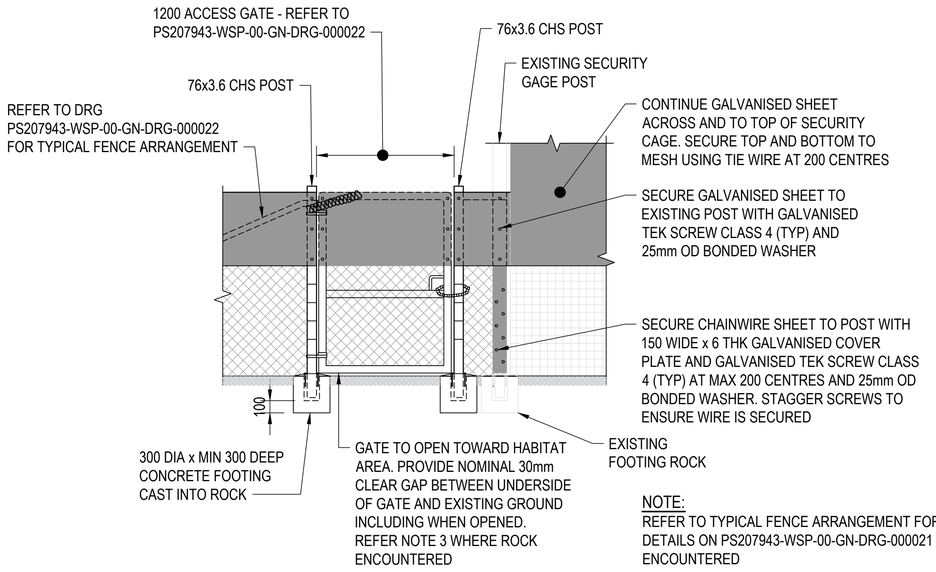
FENCING DETAILS - SHEET 3

DRAWING SET No: DS 2023/001330	PART:	SHEET: 03 OF 04		A1
STATUS: FOR CONSTRUCTION	BRIDGE No:			©
DRG No. PS207943-WSP-00-GN-DRG-000023	REV 0	VER 0	EDMS No.	AMD No.

X:\TfNSW-A1 X:\PS207943-00-CIV-RF-FENCING-DETAILS.

FILE NAME: PS207943-WSP-00-GN-DRG-000023.dwg

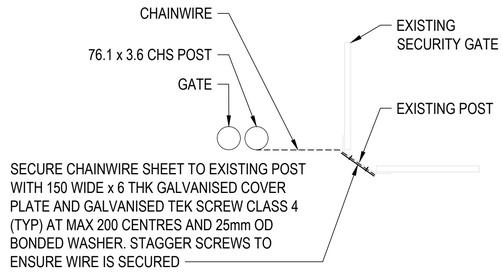
PLOT DATE & TIME: 20/12/2023 6:18:30 PM



NOTE:
REFER TO TYPICAL FENCE ARRANGEMENT FOR FOUNDATION DETAILS ON PS207943-WSP-00-GN-DRG-000021 IF NO ROCK ENCOUNTERED

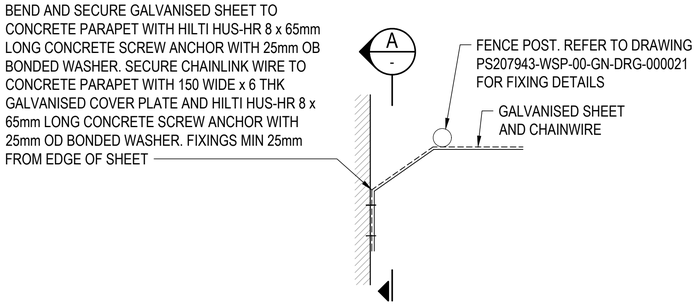
SITE 2 - TYPICAL ACCESS GATE AT NORTHBOUND SECURITY FENCE (SOUTHBOUND SIMILAR)

SCALE 1:25



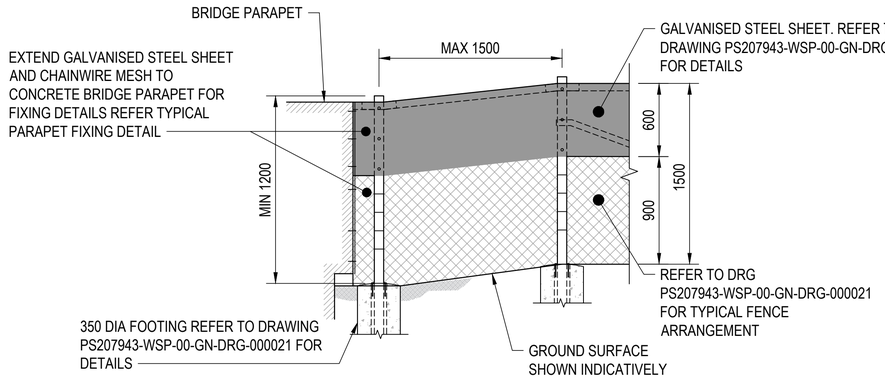
TYPICAL FIXING TO EXISTING SECURITY FENCE POST

SCALE 1:10



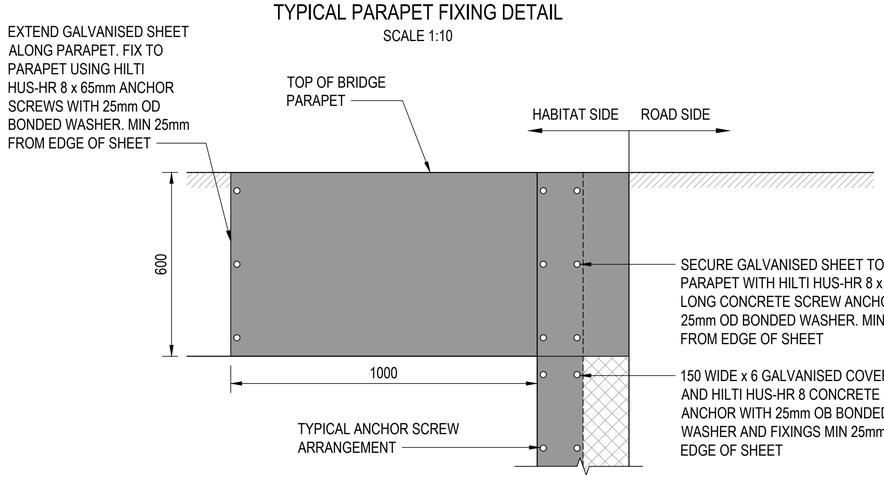
TYPICAL PARAPET FIXING DETAIL

SCALE 1:10



SITE 3 - TYPICAL KOALA FENCE AT NORTHBOUND BRIDGE INTERFACE (SOUTHBOUND SIMILAR)

SCALE 1:25



SECTION A - SCALE 1:10

NOTES:

1. FOR GENERAL NOTES REFER TO DRAWING PS207943-WSP-00-GN-DRG-000011
2. FOR FENCE DETAILS REFER TO DRAWINGS PS207943-WSP-00-GN-DRG-000021 AND PS207943-WSP-00-GN-DRG-000022
3. CONTRACTOR TO REMOVE ANY ROCK THAT MAY PREVENT GATE FROM OPENING. IF MIN 30mm GAP IS NOT POSSIBLE DUE TO VARYING LEVELS OF ROCK IT IS RECOMMENDED TO SCABBLE ROCK TO 150mm DEEP x 200mm WIDE FOR PROVISION OF 20MPa CONCRETE STRIP

DRAWING COLOUR CODED - PRINT ALL COPIES IN COLOUR

FOR CONSTRUCTION

REFERENCES:

THIS DRAWING MAY BE PREPARED IN COLOUR AND MAY BE INCOMPLETE IF COPIED.

REV	DESCRIPTION	DESIGNER INITIAL/DATE	VERIFIED INITIAL/DATE	APPROVED INITIAL/DATE
0	ISSUED FOR CONSTRUCTION	B.C 21.12.23	M.W 21.12.23	J.E 21.12.23

COORDINATE SYSTEM: | HEIGHT DATUM: AHD | DESIGN LOT CODE:

SCALE: AS SHOWN

0 0.2 0.4m
SCALE 1:10 @A1

0 0.5 1m
SCALE 1:25 @A1

CLIENT: NSW GOVERNMENT Transport for NSW

PREPARED FOR:

This drawing and the related information have been prepared by, or at the request of, Transport for NSW for a specific purpose and may not be used for any purpose other than the purpose intended by Transport for NSW.
Transport for NSW does not provide any warranties and accepts no liability arising out of the use of this drawing or any of the related information for any purpose other than the intended purpose. This drawing is protected by copyright and no part of this drawing may be reproduced in any form without the express written permission of Transport for NSW.

wsp
Level 27, 680 George Street, Sydney
GPO Box 5394, NSW 2001, Australia
Tel: +61 2 9272 5100 Fax: +61 2 9272 5101
wsp.com
CIVIL

DRAWN	BRENT REEVE	21.12.23
DESIGNED	BREANNA CLAYTON	21.12.23
DRG CHECK	CLAUDIO BIDART	21.12.23
DESIGN CHECK	ROSLYN HANSEN	21.12.23
PROJ/DES MNGR	JONATHAN EPSELIS	21.12.23
APPROVED	JONATHAN EPSELIS	21.12.23

WOLLONDILLY SHIRE COUNCIL

HW2 HUME HIGHWAY - STRUCTURAL VERIFICATION AND DESIGN FOR KOALA FENCING NEAR PICTON ROAD AND BINGARA GORGE

FENCING DETAILS - SHEET 4

DRAWING SET No: DS 2023/001330	PART:	SHEET: 04 OF 04		A1
STATUS: FOR CONSTRUCTION	BRIDGE No:			©
DRG No. PS207943-WSP-00-GN-DRG-000024	REV 0	VER 0	EDMS No.	AMD No.

X:\TNSW-A1
X:\PS207943-00-CV-RF-FENCING-DETAILS.

FILE NAME: PS207943-WSP-00-GN-DRG-000024.dwg

PLOT DATE & TIME: 20/12/2023 6:18:32 PM

© Transport for New South Wales

Copyright: The concepts and information contained in this document are the property of Transport for NSW. Use or copying of this document in whole or in part without the written permission of Transport for NSW constitutes an infringement of copyright.

NSW GOVERNMENT