

# Koala Fencing – Hume Motorway, Wilton

## Review of Environmental Factors

February 2024



Indicative only

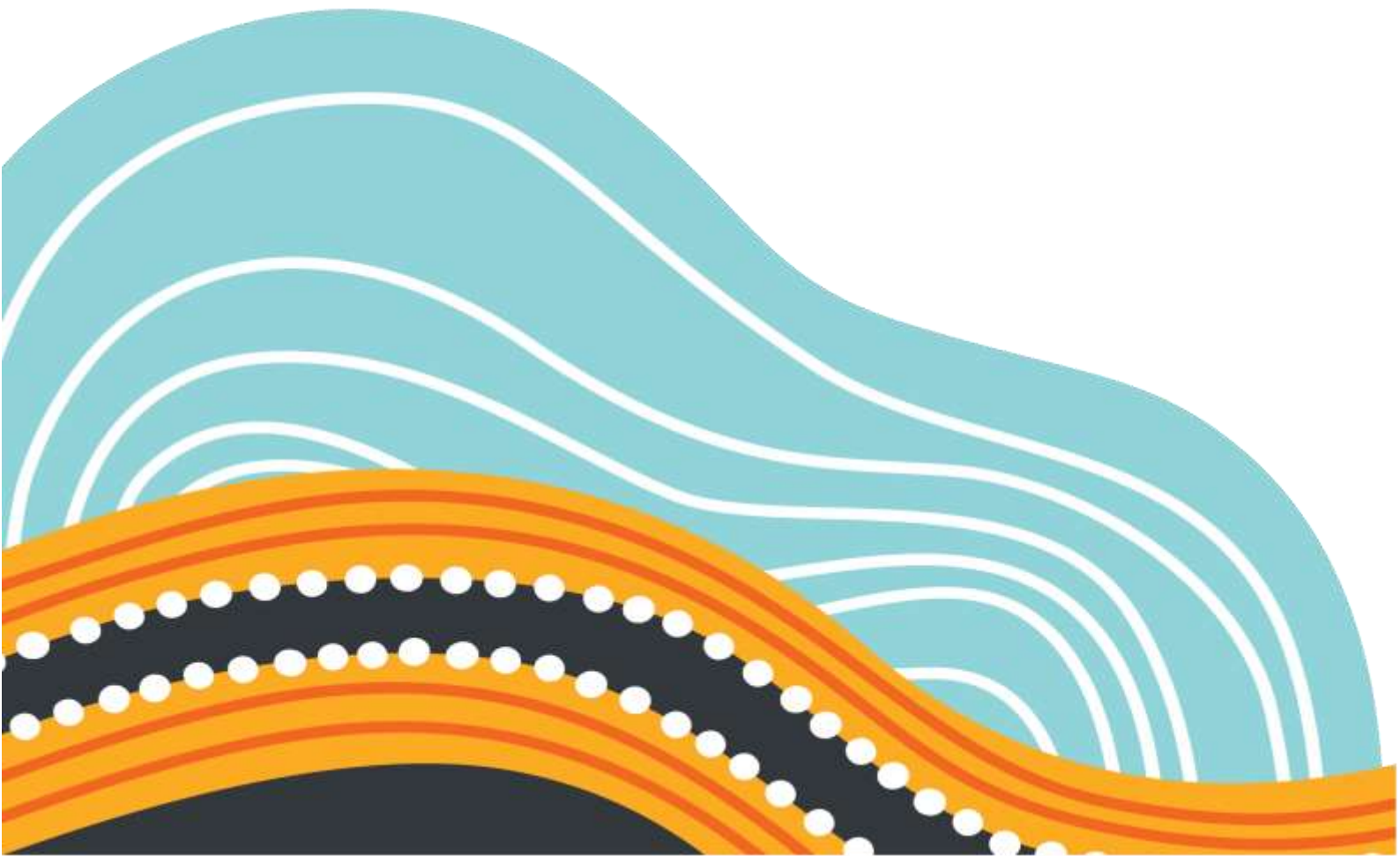
## Acknowledgement of Country

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	
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.



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# 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.





**FIGURE 1-1:**  
LOCATION OF THE PROPOSAL SITES



### Legend

- Proposal area
- Watercourse

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## 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**

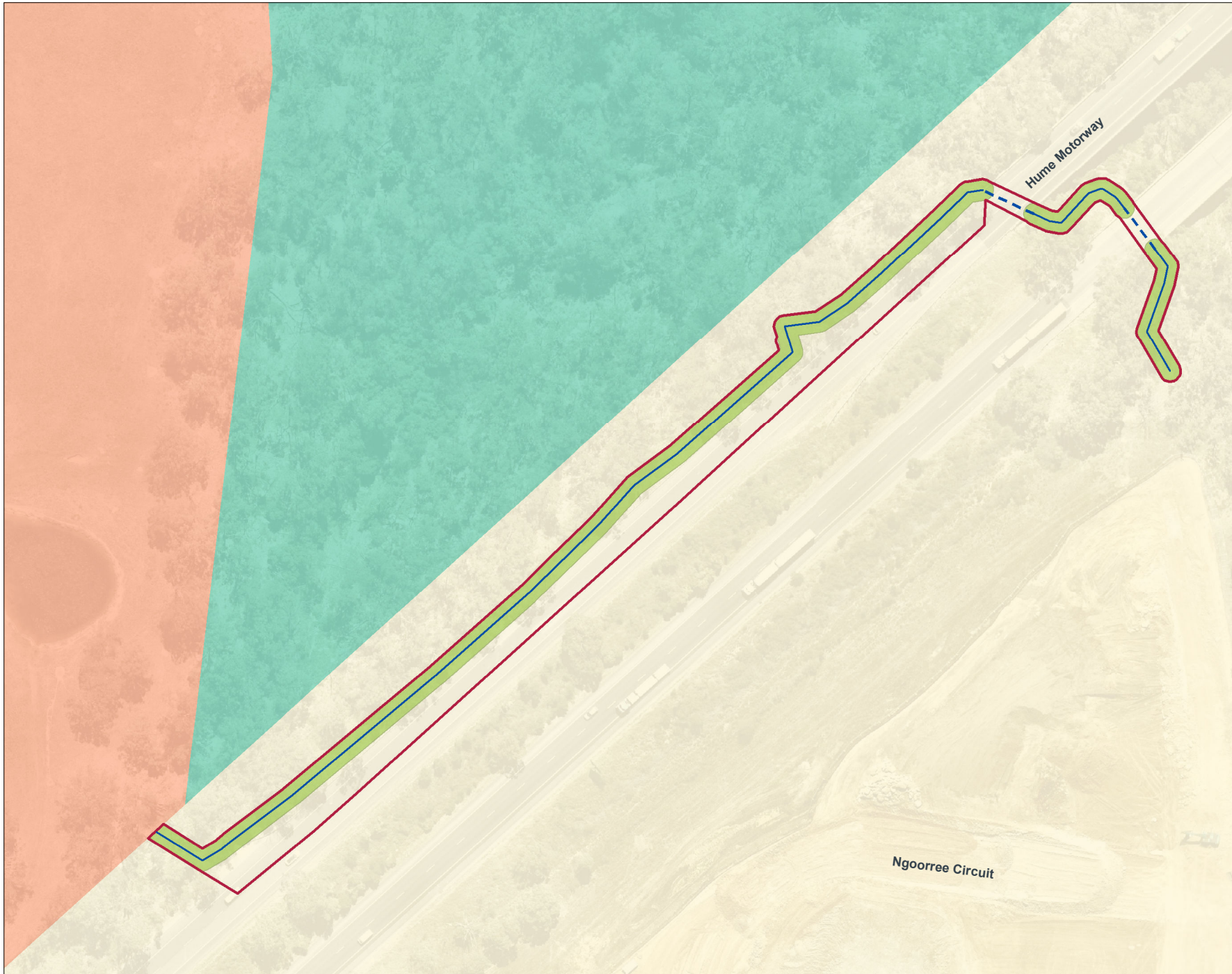
*Wollondilly 2040, A Vision for the Future of Wollondilly, Local Strategic Planning Statement* (Wollondilly Shire Council, 2020) (Wollondilly 2040) identifies and outlines Council's strategic planning priorities for the Wollondilly LGA. There are four main themes including infrastructure and collaboration, 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.





**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

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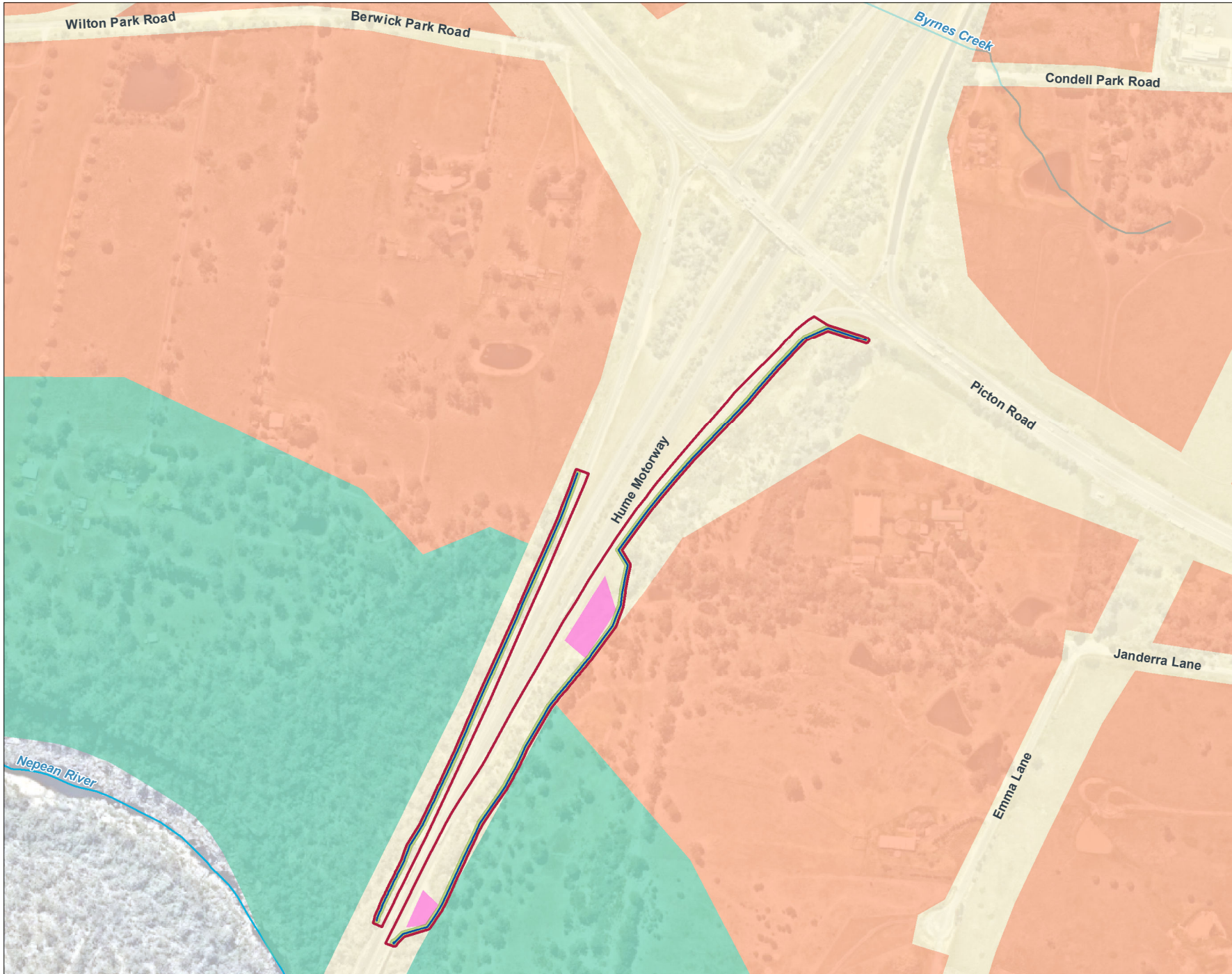
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**FIGURE 2-2:**  
CUMBERLAND PLAIN CONSERVATION  
PLAN LAND CATERGORIES  
SITE 3 (SOUTHERN HUME)



### Legend

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

### CPCP Land Category

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

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## 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 <i>Cumberland Plain Conservation Plan (CPCP)</i>	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.

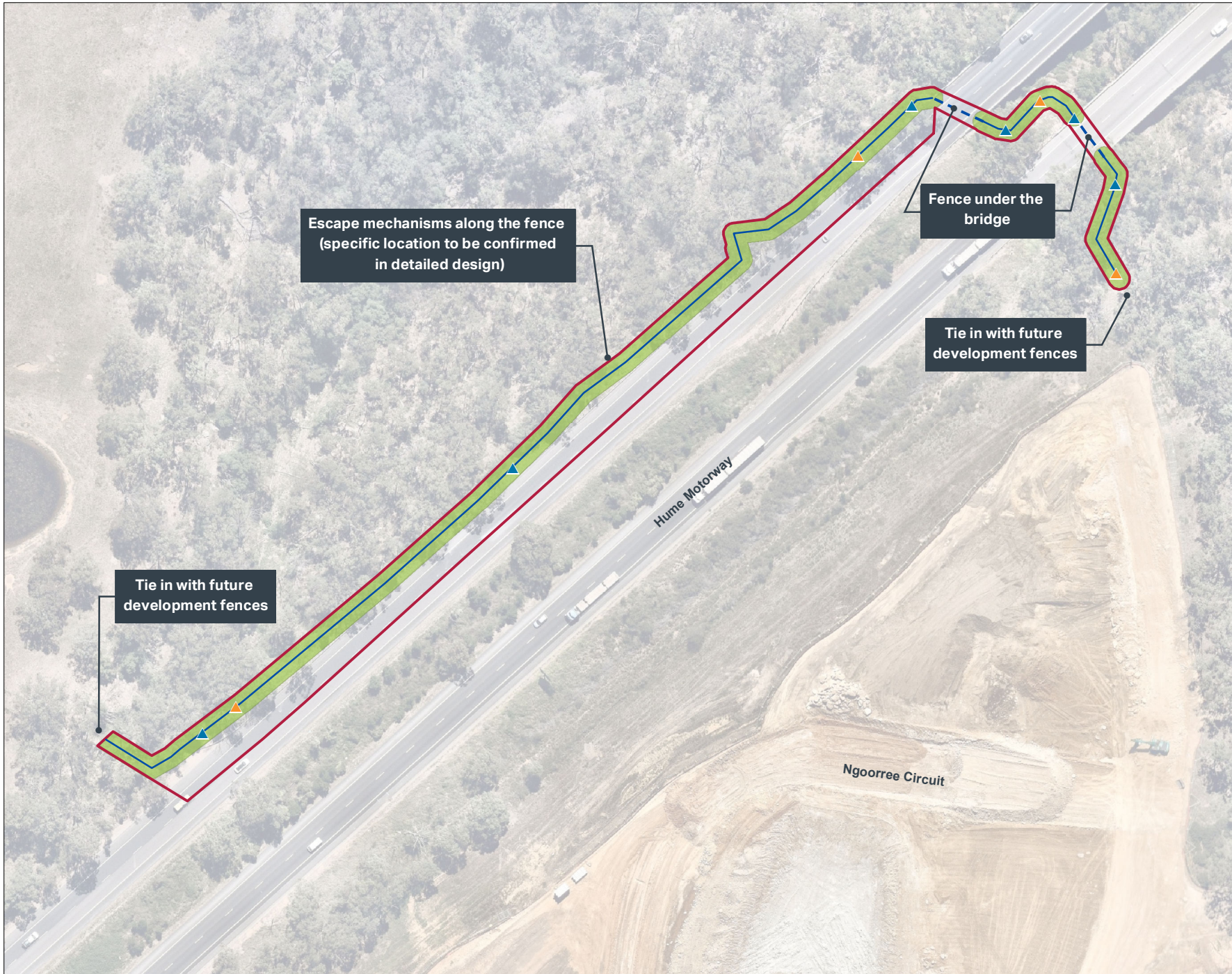
Key features of the proposal would include:

- 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.



**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

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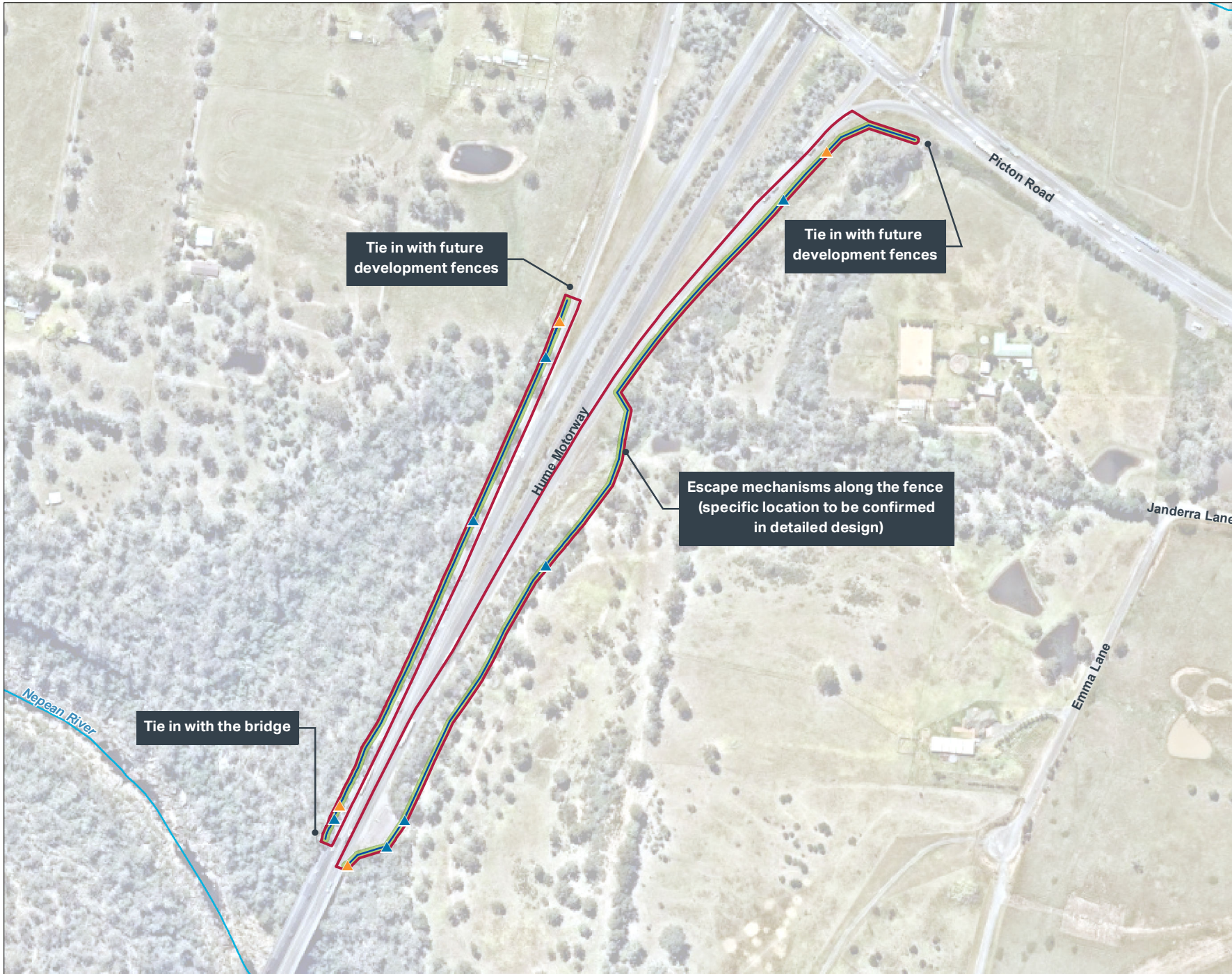
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**FIGURE 3-2:**  
KEY FEATURES OF THE PROPOSAL  
- SITE 3 (SOUTHERN HUME)



### Legend

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

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## 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.

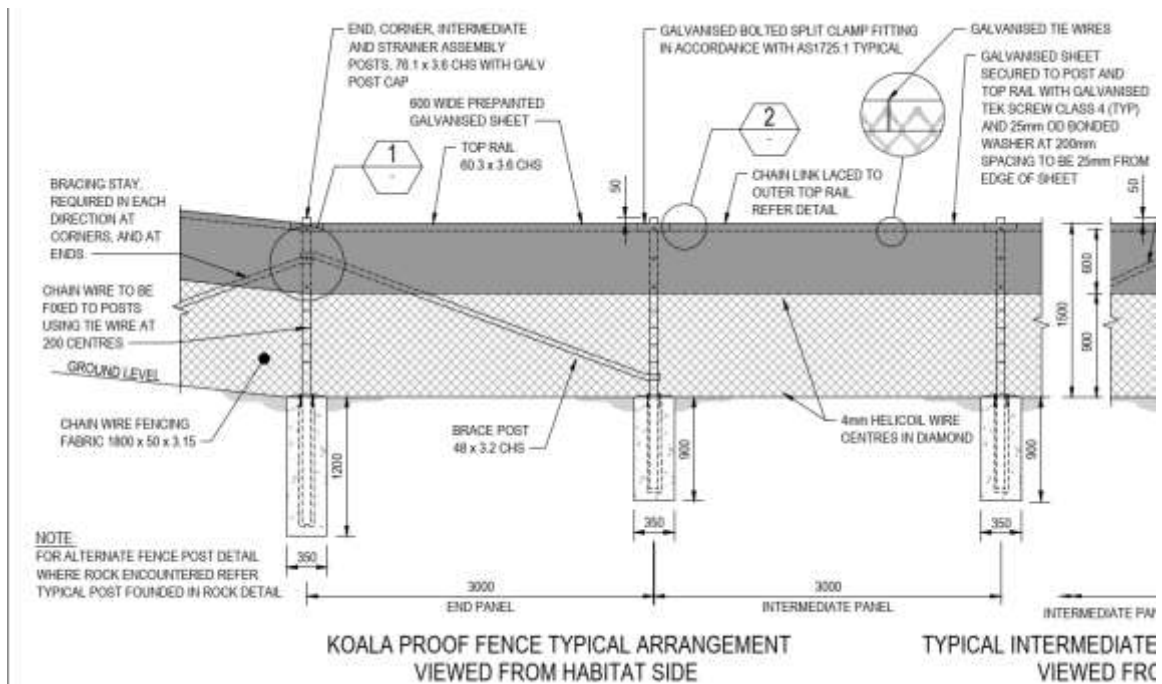


Figure 3-3: Koala fence – typical arrangement



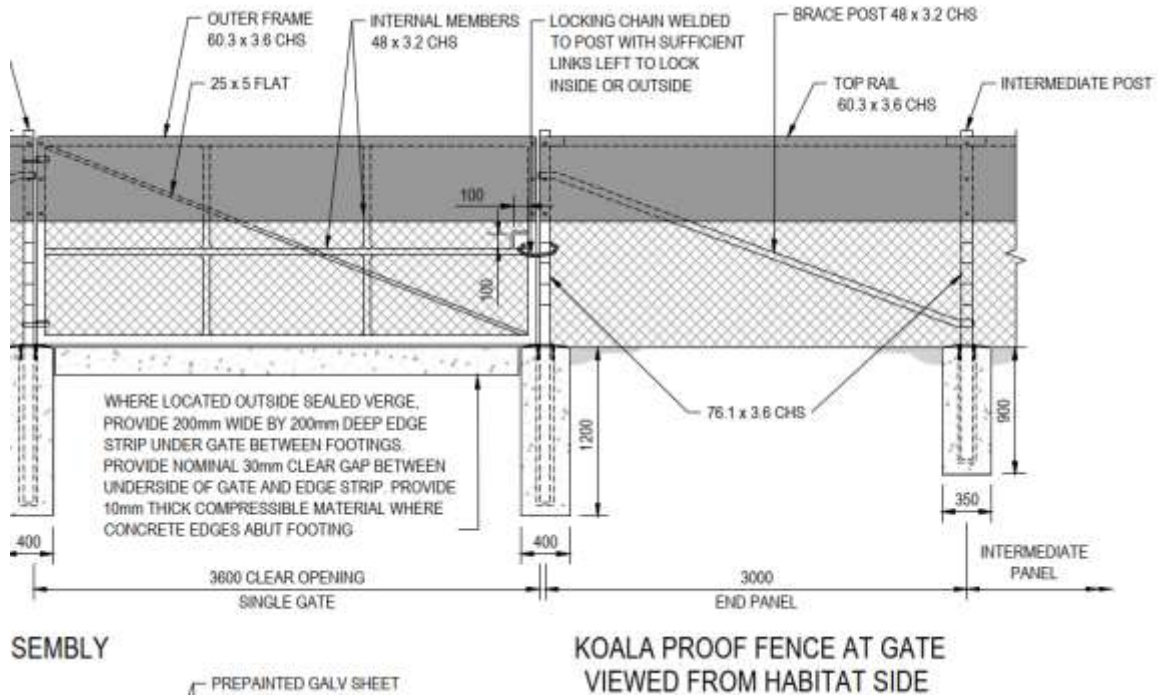


Figure 3-4: Indicative elevation - Koala fencing and gate (3.6m-wide gate detail)

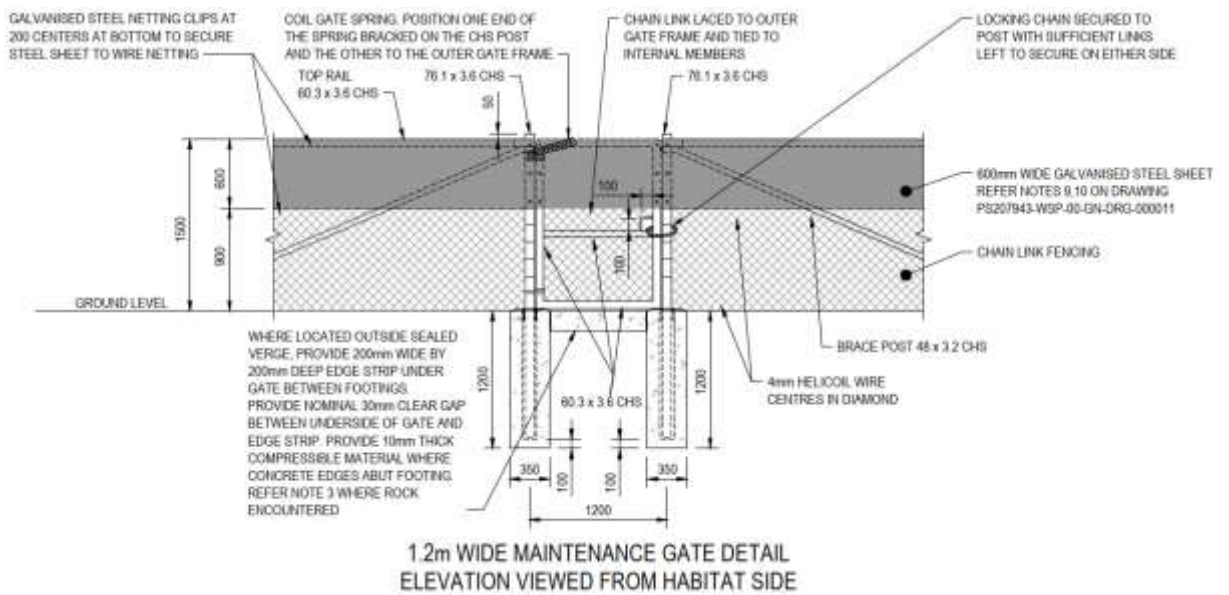


Figure 3-5: Indicative elevation - Koala fencing and 1.2m-wide maintenance gate

**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).

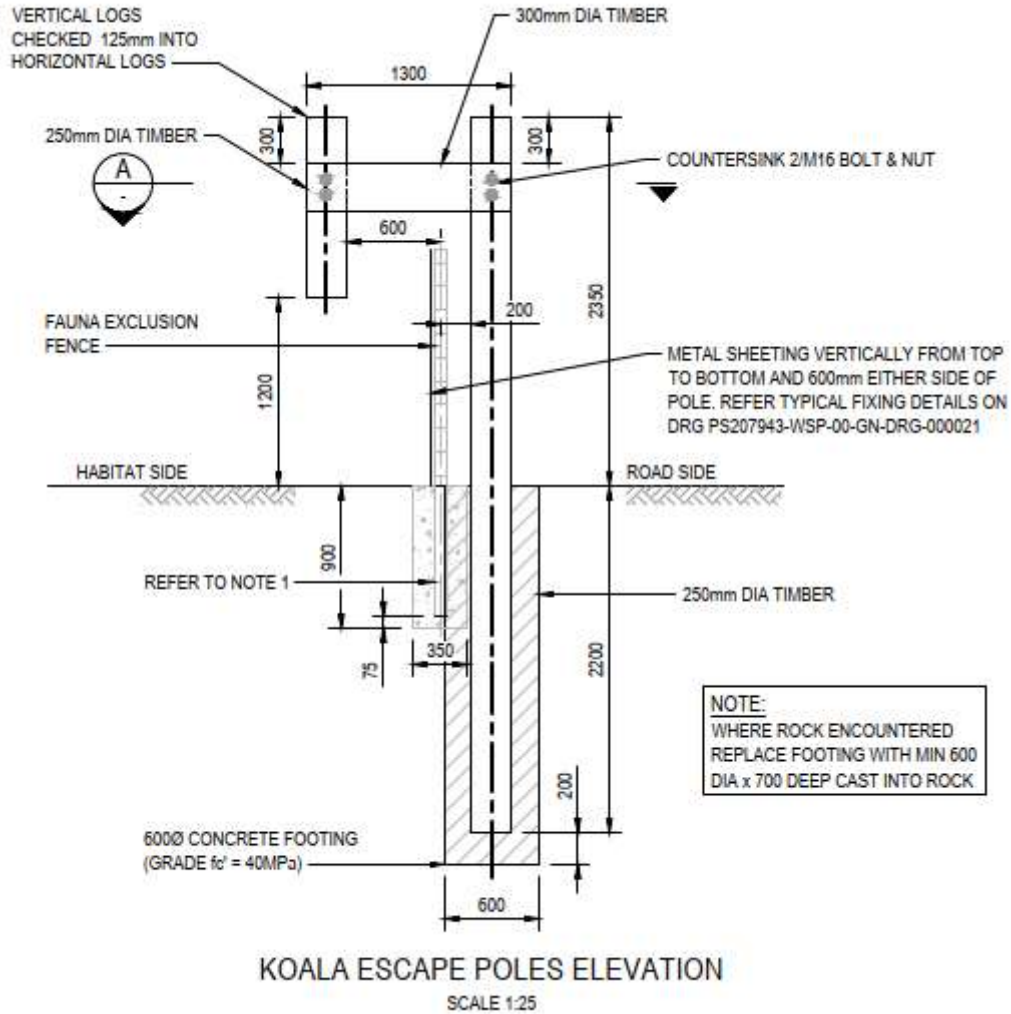


Figure 3-6: Indicative elevation - Koala escape structure

### 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	<ul style="list-style-type: none"> <li>Establishment of traffic control.</li> <li>Delivery of fencing components, materials and equipment to designated laydown areas/working areas within the proposal area.</li> <li>Setting out of the fence alignment.</li> <li>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.</li> <li>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.</li> <li>Installation of erosion and sediment controls.</li> <li>Trimming and levelling of the ground using a mini excavator along the proposed fence alignment.</li> </ul>
Fencing panel and gate installation	<ul style="list-style-type: none"> <li>Excavation of fence post foundations along the alignment using a handheld or plant/ute mounted auger or jackhammer.</li> <li>Positioning of the fence post and foundation concreting.</li> <li>Allowing a period of one to two days for foundation concrete to dry.</li> <li>Where site access is difficult, hand tools would be used and fencing materials would be transported manually to minimise impacts to vegetation.</li> <li>Installation of chain link mesh, steel sheeting and gates would be carried out sequentially.</li> <li>Installation of escape structures.</li> </ul>
Finalisation and reinstatement	<ul style="list-style-type: none"> <li>Backfilling under and around new fencing as required.</li> <li>Removal of erosion and sediment controls.</li> <li>Reinstatement of disturbed soil.</li> </ul>

#### 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 <sup>3</sup> ) for posts	Excavated soil volume (m <sup>3</sup> )	No. of gates	Concrete footing under gates (m <sup>3</sup> ) (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
<b>Total</b>	<b>1,856</b>	<b>2,046</b>	<b>692</b>	<b>307</b>	<b>67.5</b>	<b>77</b>	<b>9</b>	<b>2</b>

### 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

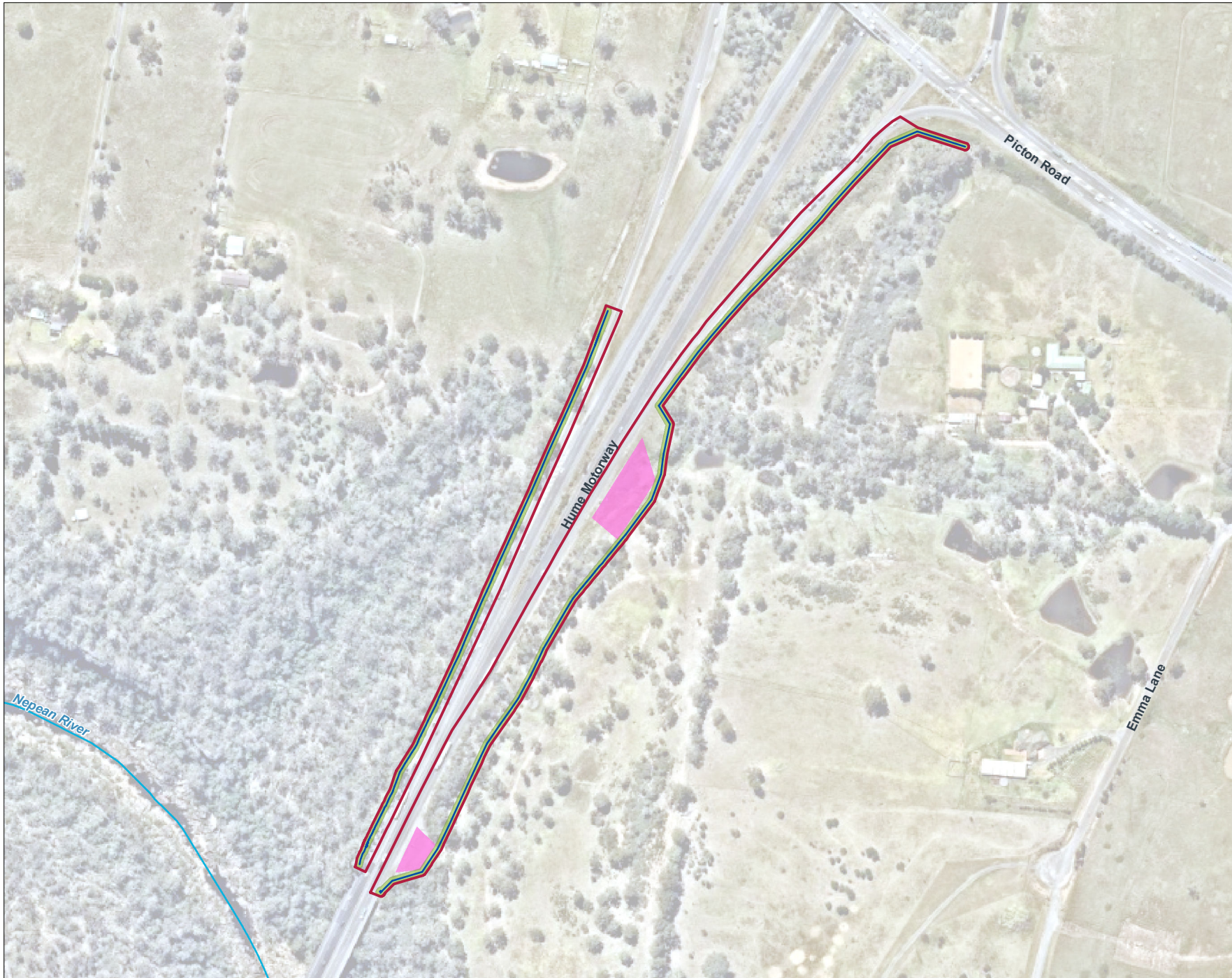
Any utilities along the proposed fence alignment would be identified prior to the commencement of construction. The location of fence components would be adjusted if required to avoid impacts to utilities. In some case utilities would be adjusted to avoid the fence in consultation with the relevant service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

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



### Legend

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

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## 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 (Northern 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.

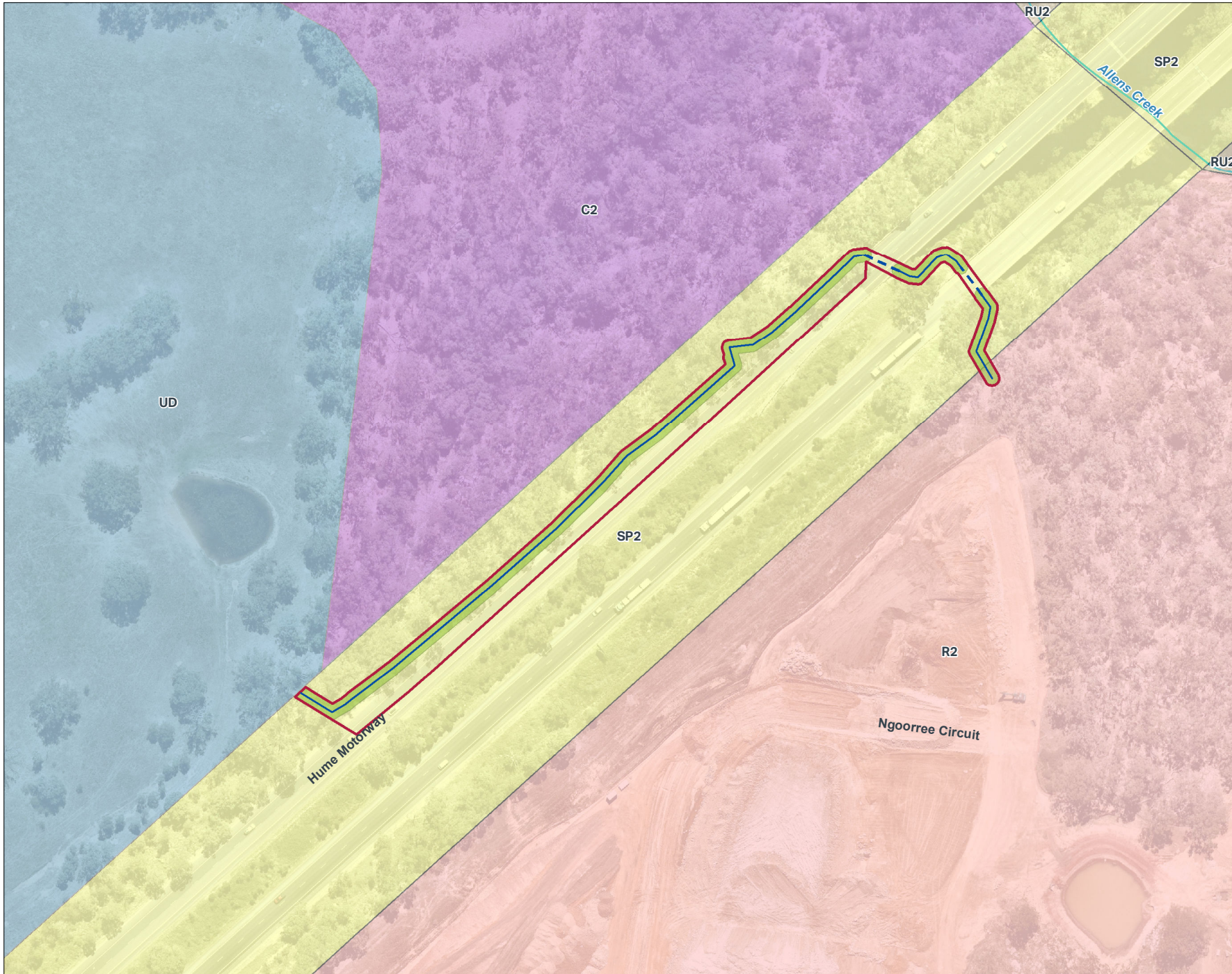
Table 4-1: Land use impacted by the proposal

Land zone (and relevant instrument)	Stated objectives of the land zone	Proposed consistency
R2 – Low Density Residential (Wollondilly LEP)	<ul style="list-style-type: none"> <li>To provide for the housing needs of the community within a low density residential environment</li> <li>To enable other land uses that provide facilities or services to meet the day to day needs of residents</li> <li>To support the health and well-being of the community by providing well-connected and walkable residential areas close to services and employment.</li> </ul>	<ul style="list-style-type: none"> <li>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.</li> </ul>
SP2 – Infrastructure (Classified road) (Wollondilly LEP for Site 3 (Southern Hume), and SEPP (Western Parklands City Precincts) for Site 2 (Northern Hume))	<ul style="list-style-type: none"> <li>To provide for infrastructure and related uses</li> <li>To prevent development that is not compatible with or that may detract from the provision of infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>The proposal is a related use of road infrastructure, as it provides wildlife exclusion fencing to prevent vehicle strike along the road corridor.</li> </ul>





**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

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**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

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## 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 1997* 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
<b>Total</b>					<b>1.07</b>	<b>9.53</b>



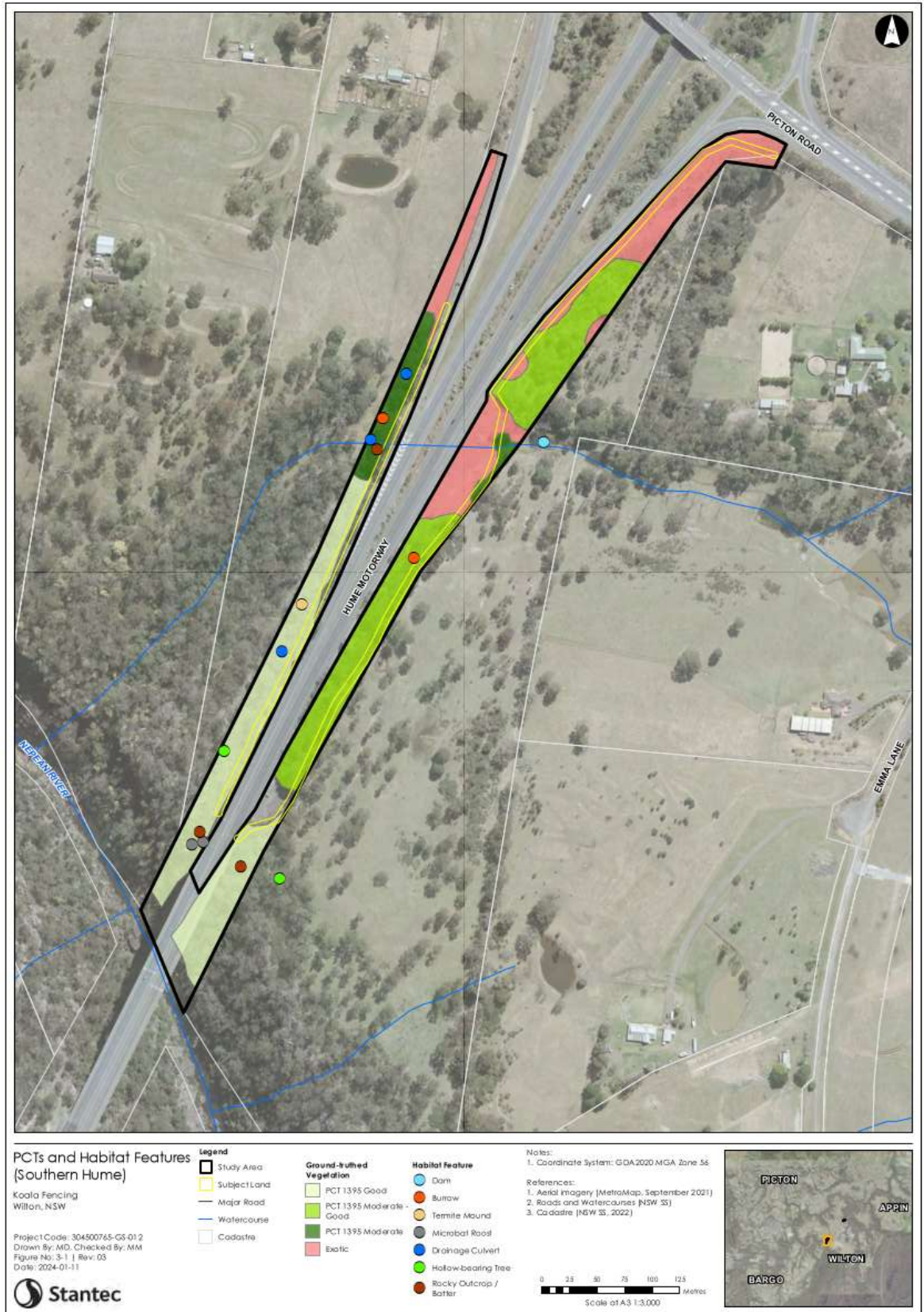


Figure 6-1 Plant community types, habitat features Site 2 (Southern Hume) and subject land to be impacted



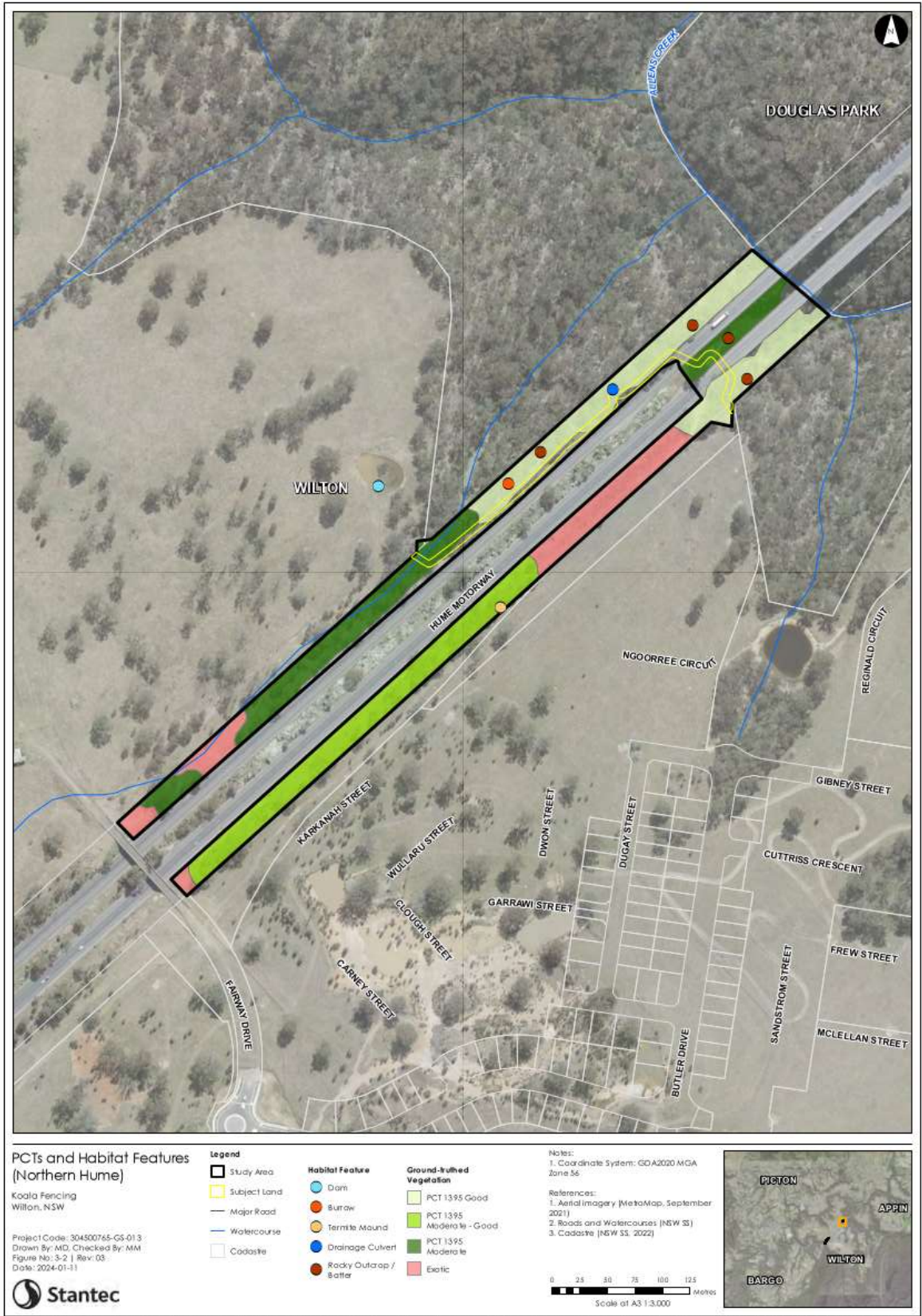


Figure 6-2 Plant community types and habitat features Site 3 (Northern Hume), and subject land to be impacted

### 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 Nest 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 Adenophora*)
- 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
<i>Meridolum corneovirens</i> (Cumberland Plain Land Snail)	BC Act	No
Birds (19 x species)	BC Act and/or EPBC Act	No
<i>Petaurus norfolcensis</i> (Squirrel Glider)	BC Act	No
<i>Pteropus poliocephalus</i> (Grey-headed Flying Fox)	BC Act, EPBC Act	No
Microbats (8 x species)	BC Act and/or EPBC Act	No
<i>Varanus rosenbergi</i> (Rosenberg's Goanna )	BC Act	No
<i>Collocephalon fimbriatum</i> (Gang-gang Cockatoo)	BC Act, EPBC Act	No
<i>Calyptorhynchus lathami lathami</i> (South-eastern Glossy Black Cockatoo)	BC Act, EPBC Act	No
<i>Hirundapus caudacutus</i> (White-throated Needletail)	EPBC Act	No
<i>Lathamus discolor</i> (Swift Parrot)	BC Act, EPBC Act	No
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	BC Act, EPBC Act	No
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	BC Act, EPBC Act	No
<i>Petauroides volans</i> (Greater Glider (southern and central))	EPBC Act	No
<i>Petaurus australis australis</i> (Yellow-bellied Glider (south-eastern))	BC Act, EPBC Act	No
<i>Phascolarctos cinereus</i> (Koala)	BC Act, EPBC Act	No
<i>Hoplocephalus bungaroides</i> (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	<p>A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features</li> <li>Safeguards in this REF</li> <li>Identification of the clearing boundary and identification of habitat features to be protected (e.g., by marking using flagging tape)</li> <li>Map/ plans produced showing vegetation clearing boundaries, areas to be protected including sensitive areas/no go zones, protected habitat features and revegetation areas</li> <li>A detailed vegetation clearing process in accordance with Transport's <i>Biodiversity Guidelines</i> (RMS, 2011) including requirements of Guide 1,2, 4 and 9</li> <li>Toolbox talks where biodiversity will be included such as vegetation clearing or works in or adjacent to sensitive locations</li> <li>Identify control/mitigations measures to prevent impacts on sensitive locations or no-go zones</li> <li>Procedures for unexpected threatened species finds and fauna handling</li> <li>Procedures addressing relevant matters specified in the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (Department of Primary Industries, 2013)</li> <li>Protocols to manage weeds and pathogens.</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 Environment Protection; <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 2011); <i>Guidelines for Fish Habitat Conservation and Management</i> (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	<p>A Biodiversity Offset Strategy in accordance with Transport's <i>No Net Loss Guideline</i> (Transport, 2022) will be developed to outline the offsetting strategies required. for biodiversity impacts.</p> <p>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.</p>	Transport	Prior to construction	<i>No Net Loss Guideline</i> (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 <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Prior to construction	<i>Guide 1 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).
Biodiversity	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Prior to construction	<i>Guide 4 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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	<i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)
Biodiversity	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	<i>Guide 9 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).
Biodiversity	Exclusion zones will be set up at the limit of clearing in accordance with <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	<i>Guide 2 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).
Biodiversity	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	<i>Guide 6 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	<i>Guide 2 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <sup>2</sup> (dB(A))	Day	50
	Day (OOHW) <sup>3</sup>	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 <sup>1</sup> (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 (Northern 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 predicted 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.



**Koala Fencing Site 2, Northern Hume Motorway, Wilton - Construction Noise Assessment (Day)**



- 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

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









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

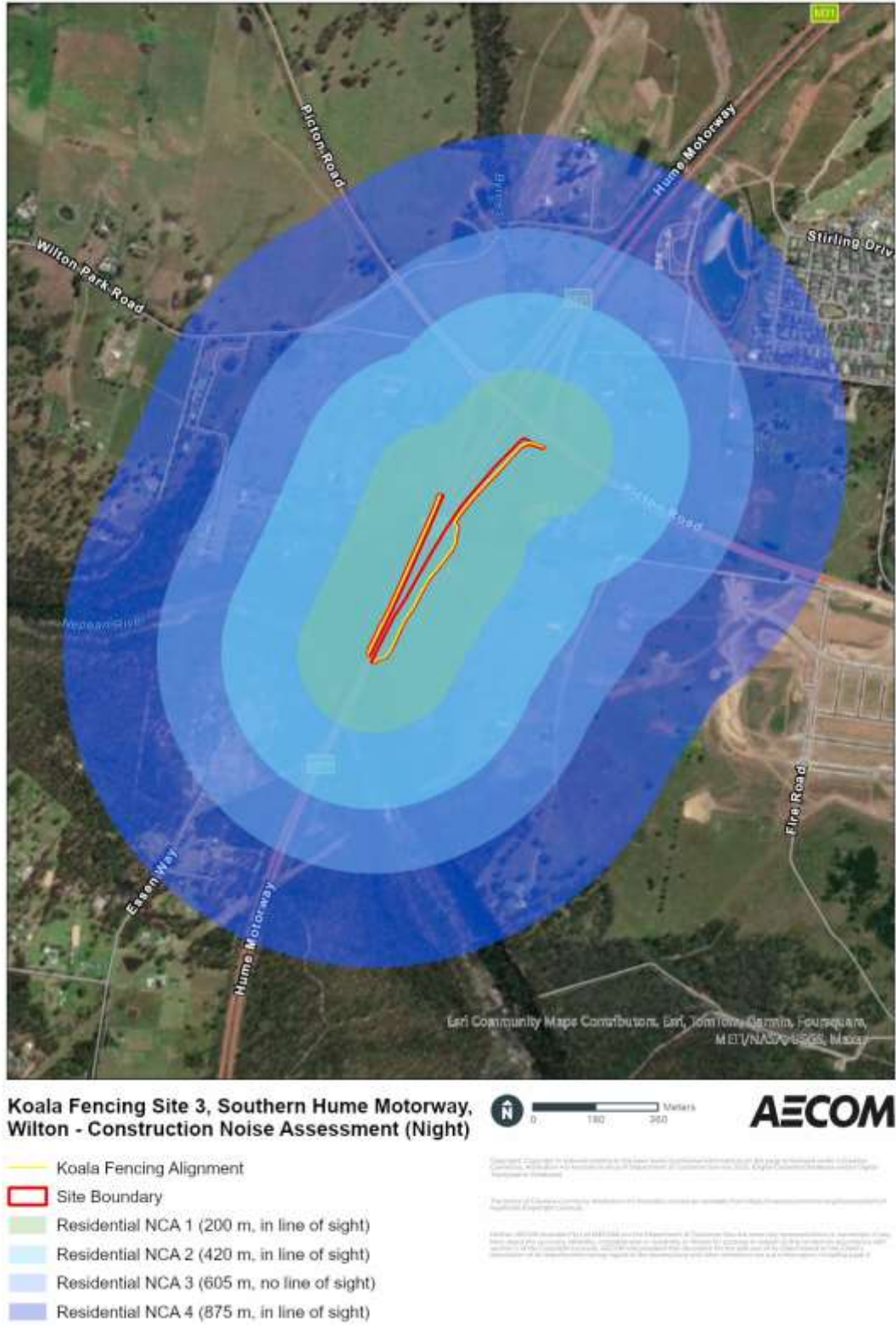


Figure 6-6 Predicted construction noise impacts at Site 3 (Southern Hume) during the night

## 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	<p>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 <i>Interim Construction Noise Guidelines</i> (DECCW, 2009) and <i>Construction Noise and Vibration Guideline</i> (CNVG), and include:</p> <ul style="list-style-type: none"> <li>• All potential high noise generating activities associated with the activity</li> <li>• A map indicating the locations of sensitive receivers including residential properties</li> <li>• A quantitative noise assessment in accordance with the Environment Protection Authority's <i>Interim Construction Noise Guidelines</i> (DECCW, 2009) and <i>Construction Noise and Vibration Guideline</i> (CNVG)</li> <li>• Feasible and reasonable mitigation measures to be implemented, taking into account the CNVG.</li> <li>• Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures.</li> <li>• A process for assessing the performance of the implemented mitigation measures</li> <li>• An outline of a monitoring program</li> <li>• A process for documenting and resolving issues and complaints</li> </ul>	Contractor	Pre-construction	Environment Protection Authority's <i>Interim Construction Noise Guidelines</i> (DECCW, 2009) and <i>Construction Noise and Vibration Guideline</i> (CNVG).
Construction noise	<p>An Out of Hours Works procedure will be prepared as part of the Construction Noise Management Plan and will include:</p> <ul style="list-style-type: none"> <li>• 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 <i>Construction Noise and Vibration Guideline</i>. The OOHWA will be based on construction planning developed by the construction contractor.</li> </ul>	Contractor	Pre-construction	Transport for NSW's <i>Construction Noise and Vibration Guideline</i>
Construction noise	<p>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).</p>	Contractor	Construction	N/A
Construction noise	<p>Noise curtains are to be used for mulching during out of hours work where sensitive receivers are predicted to exceed the NML.</p>	Contractor	Construction	N/A



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 <i>Construction Noise and Vibration Guideline</i> (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	<p>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 <i>Transport Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Transport, 2008). The TGS will include:</p> <ul style="list-style-type: none"> <li>measures to maintain access to local roads and properties</li> <li>site-specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>requirements and methods to notify the local community of impacts on the local road network</li> <li>access to construction sites including entry and exit locations</li> <li>a response plan for any construction traffic incident</li> <li>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</li> <li>monitoring, review and amendment mechanisms.</li> </ul>	Contractor	Detailed design, pre-construction, construction	Section 4.8 of QA G36 <i>Environment Protection</i>

Impact	Environmental safeguards	Responsibility	Timing	Reference
Construction traffic and transport impacts	Traffic management measures will be developed with reference to the <i>Traffic Control at Work Sites Technical Manual</i> (Transport, 2022).	Contractor	Pre-construction, construction	<i>Traffic Control at Work Sites Technical Manual</i> (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	<i>Roads Act 1993</i>

## 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 <sup>1</sup>	Artefact	9
	Artefact; Potential Archaeological Deposits (PAD)	3
	Modified tree (scarred or carved)	4
	PAD	5
	PAD; stone arrangement	1
Closed <sup>2</sup>	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.

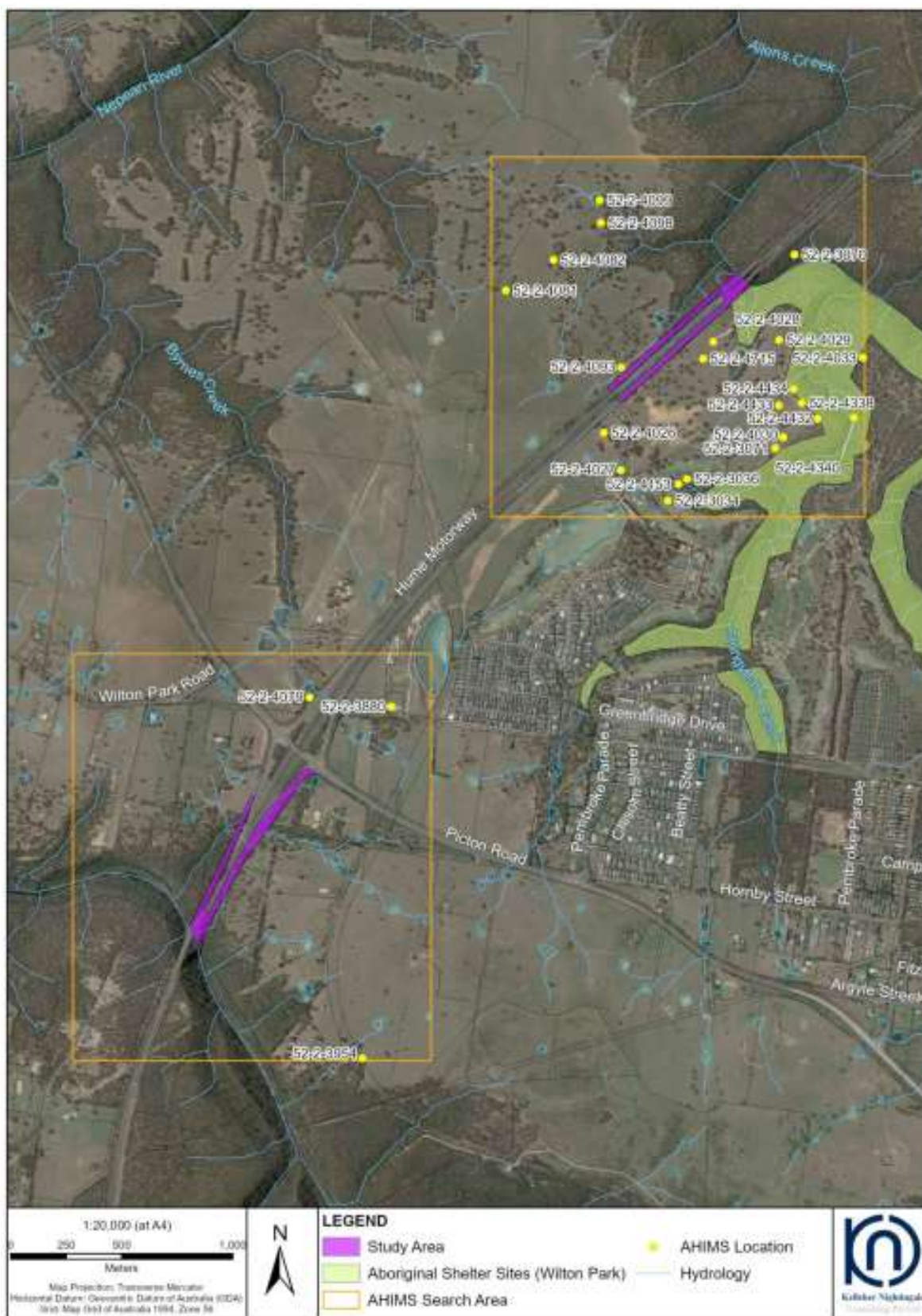


Figure 6-7: Location of known Aboriginal sites

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 <i>Standard Management Procedure – Unexpected Heritage Items</i> (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 <i>Environment Protection</i>
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 <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i> (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	High-moderate	Moderate	Negligible
Moderate	Moderate	High-moderate	Moderate	Moderate-low	Negligible
Low	Low	Moderate	Moderate-low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

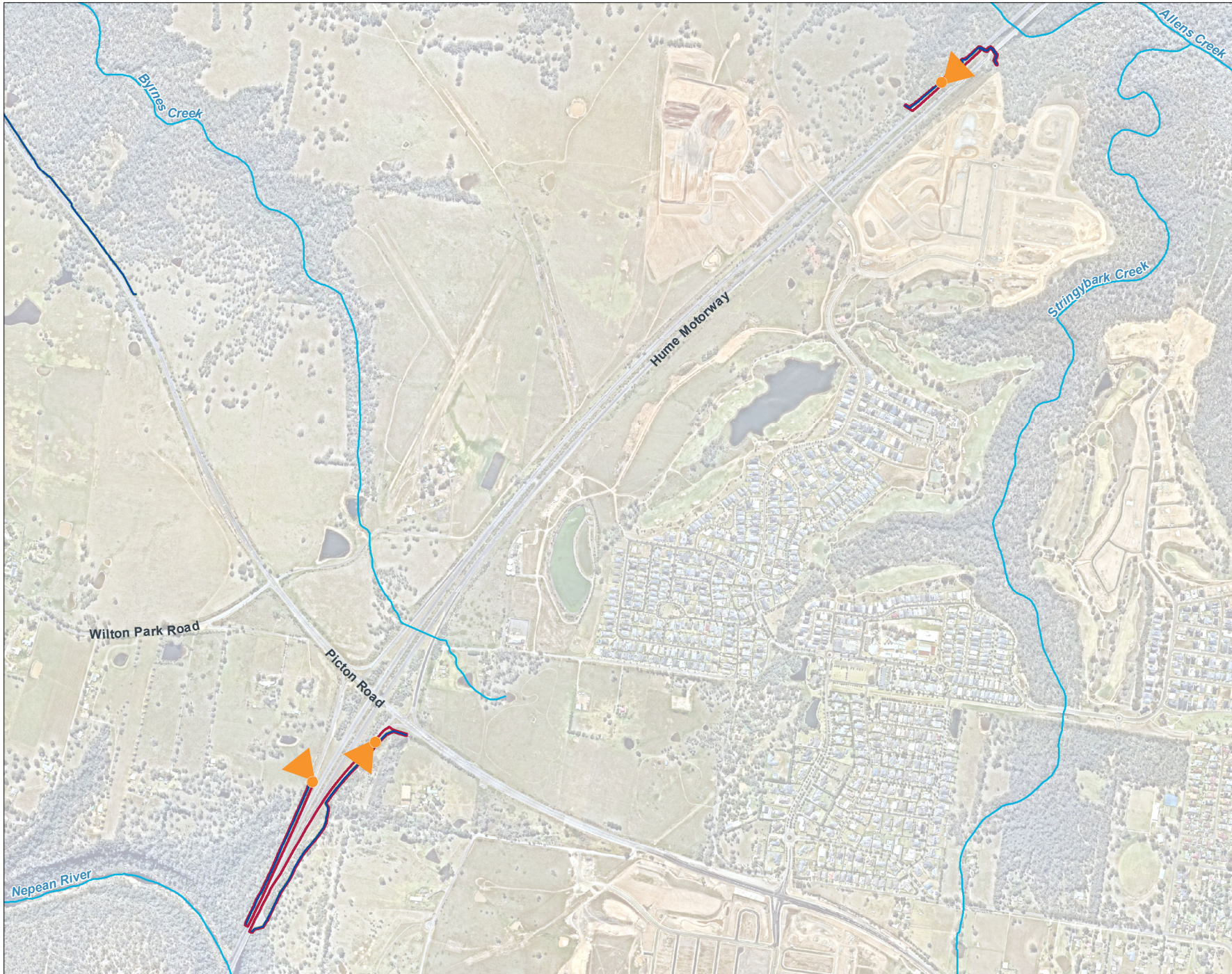
### 6.5.2 Existing environment

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.



**FIGURE 6-8: LOCATION OF VIEWPOINTS**



### Legend

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

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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<sub>3</sub>) and particle matter (particles less than 2.5 and 10 micrometres diameter, PM<sub>2.5</sub> and PM<sub>10</sub> 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 <i>Protection of the Environment Operations (Clean Air) Regulation 2010</i> .	Construction contractor	Construction	Schedule 4 of the <i>Protection of the Environment Operations (Clean Air) Regulation 2010</i> .

## 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

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

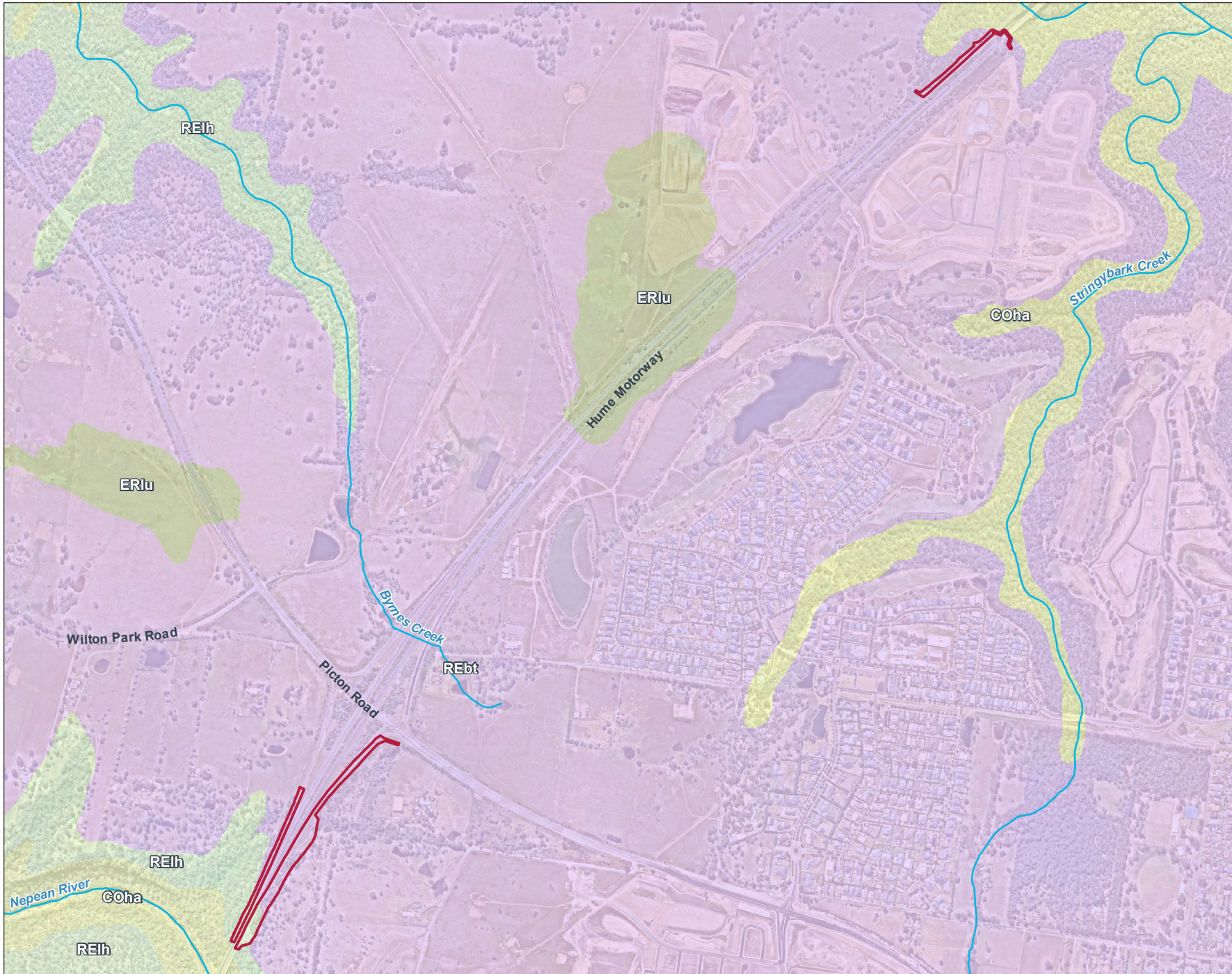
A search of the NSW EPA contaminated land register on 24 March 2023 did not identify any recorded contaminated sites in the vicinity of the proposal area.

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.



**FIGURE 6-12:**  
SOIL LANDSCAPES



**Legend**

- Proposal area
- Watercourse
- Soil Landscapes**
- Hawkesbury
- Luddenham
- Blacktown
- Lucas Heights

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### 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 <i>Environment Protection</i>
Accidental spill	A site-specific emergency spill plan will be developed and include spill-management measures in accordance with the Transport <i>Code of Practice for Water Management</i> (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 <i>Environment Protection</i>

## 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 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.

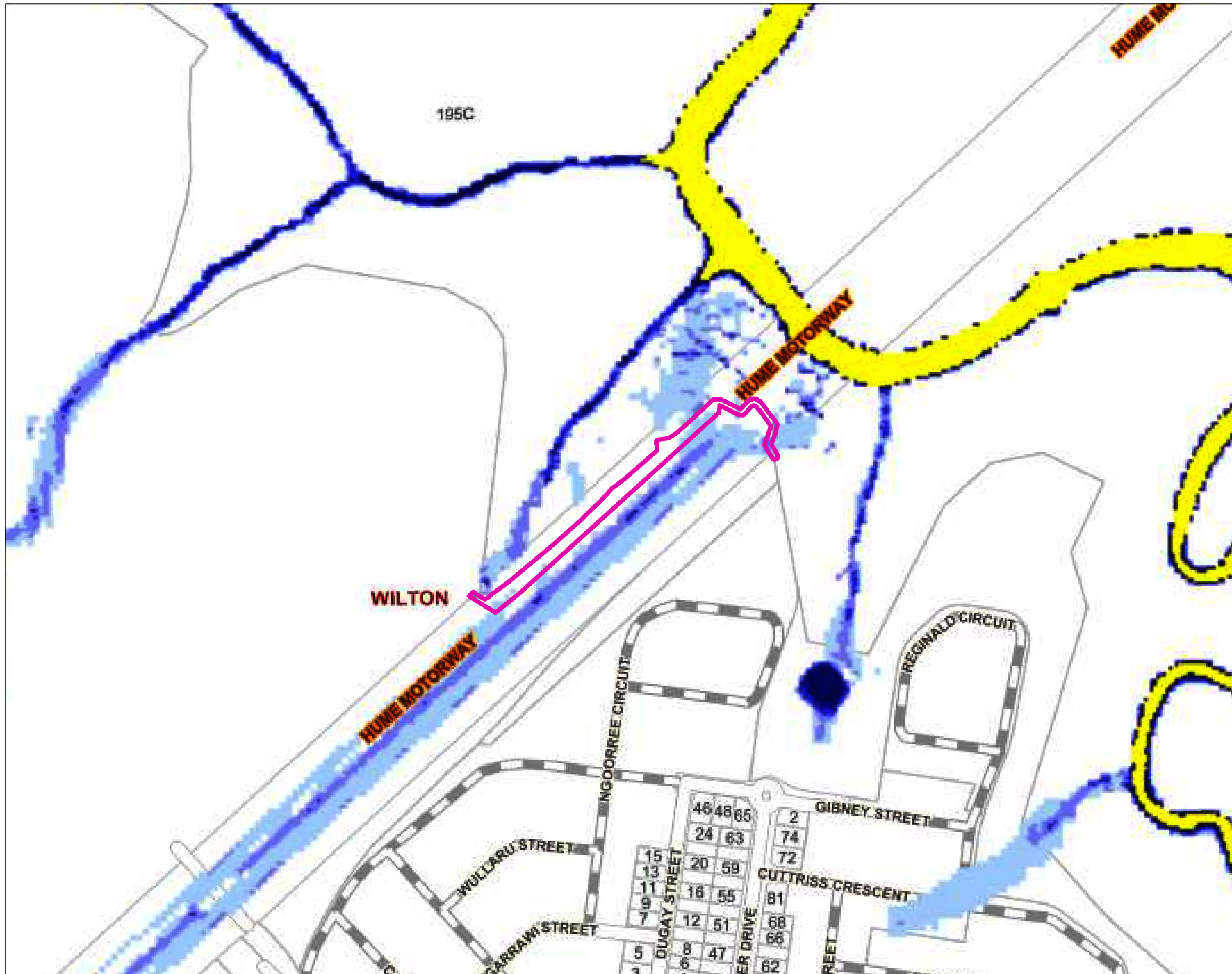
The major water use within the catchment is for the agricultural industry (DPE, 2023). Water within the catchment is heavily controlled by five major water supply dams which retain river flows. Key water management challenges in the broader catchment include intensive urban and industrial development,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

**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

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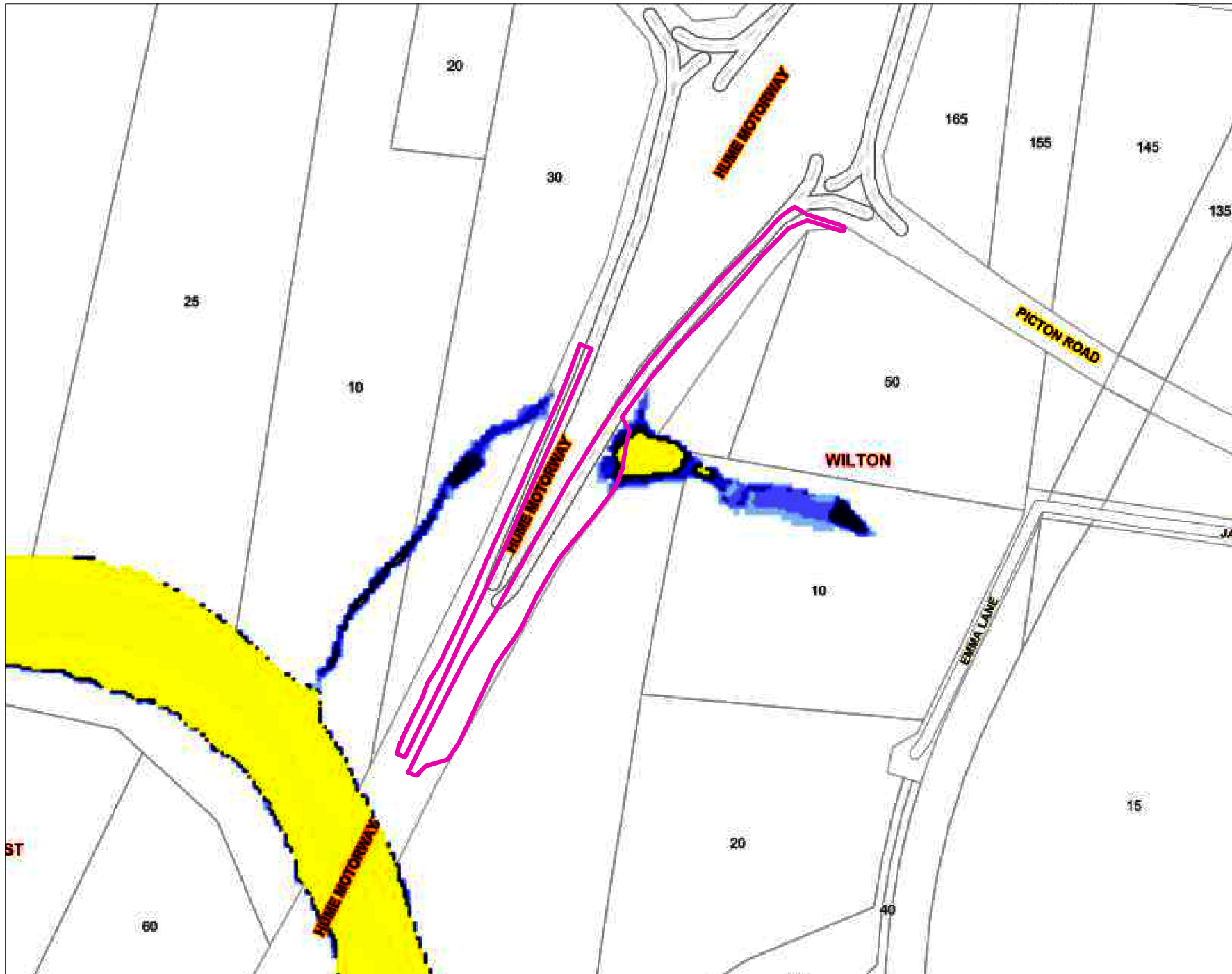
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**FIGURE 6-14: 1% AEP FLOOD EVENT MAPPING - SITE 3 (SOUTHERN HUME)**



**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

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### 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 <i>QA G38 Soil and Water Management</i>
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 <i>QA G38 Soil and Water Management</i>

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 <i>Environmental Incident Procedure</i> (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 <i>Environmental Incident Procedure</i> (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	<p>A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:</p> <ul style="list-style-type: none"> <li>Measures to avoid and minimise waste associated with the proposal</li> <li>Classification of wastes and management options (re-use, recycle, stockpile, disposal) in accordance with <i>the Waste Classification Guidelines</i> (EPA, 2014) and NSW legislative requirements</li> <li>Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions</li> <li>Procedures for storage, transport and disposal</li> <li>Monitoring, record keeping and reporting.</li> </ul> <p>The WMP will align with the <i>Environmental Procedure – Management of Wastes on Transport for NSW Land</i> (Transport, 2014) and relevant Transport Waste fact sheets.</p>	Contractor	Detailed design / pre-construction and construction	Section 4.2 of <i>QA G36 Environment Protection; Waste Classification Guidelines</i> (EPA, 2014); <i>Environmental Procedure – Management of Wastes on Transport for NSW Land</i> (Transport, 2014) and relevant Transport Waste fact sheets.
Vegetation waste	<p>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: <i>Mulch Management</i>.</p>	Contractor	Construction, pre-construction	Transport for NSW Technical Procedure: <i>Mulch Management</i>
Unexpected finds	<p>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.</p> <p>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.</p>	Contractor, Transport	Construction	N/A
Impacts from operational waste	<p>Reuse and recycle materials where feasible during operation to minimise the amount of material sent to waste management/disposal facilities.</p>	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	<p>Database searches did not identify any local, State or Commonwealth listed non-Aboriginal heritage items within 250 metres of the proposal area.</p> <p>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.</p>	<p>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.</p> <p>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.</p> <p>If unexpected heritage finds are encountered during construction a standard Transport procedure for unexpected finds would be followed.</p>
Cumulative impacts	<p>Other projects identified in the surrounding area that may have a cumulative impact with the proposal include:</p> <ul style="list-style-type: none"> <li>• Picton Road upgrade project</li> <li>• Numerous developments in Bingara Gorge about 500 metres from the proposal area</li> <li>• Wilton North suburb directly adjacent to the proposal area (Site 2 (Northern Hume))</li> <li>• Other koala fencing projects in the region by Transport and DPE</li> </ul>	<p>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.</p> <p>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.</p> <p>At Site 2 (Northern Hume), the proposal would also tie into adjacent residential development fencing proposed.</p> <p>Biodiversity impacts due to the maintenance zone required would combine with other vegetation losses in the area, however, would be small in scale.</p> <p>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.</p>

### 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 <i>Standard Management Procedure – Unexpected Heritage Items</i> (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 <i>Environment Protection</i>
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.

# Transport for NSW

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
<b>Biodiversity</b>					
B1	Biodiversity	<p>A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to:</p> <ul style="list-style-type: none"> <li>Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features</li> <li>Safeguards in this REF</li> <li>Identification of the clearing boundary and identification of habitat features to be protected (e.g., by marking using flagging tape)</li> <li>Map/ plans produced showing vegetation clearing boundaries, areas to be protected including sensitive areas/no go zones, protected habitat features and revegetation areas</li> <li>A detailed vegetation clearing process in accordance with Transport's <i>Biodiversity Guidelines</i> (RMS, 2011) including requirements of Guide 1,2, 4 and 9</li> <li>Toolbox talks where biodiversity will be included such as vegetation clearing or works in or adjacent to sensitive locations</li> <li>Identify control/mitigations measures to prevent impacts on sensitive locations or no-go zones</li> <li>Procedures for unexpected threatened species finds and fauna handling</li> <li>Procedures addressing relevant matters specified in the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (Department of Primary Industries, 2013)</li> <li>Protocols to manage weeds and pathogens.</li> </ul>	Contractor	Detailed design / pre-construction	Section 4.8 of QA G36 Environment Protection <i>Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects</i> (RMS, 2011); <i>Guidelines for Fish Habitat Conservation and Management</i> (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	<p>A Biodiversity Offset Strategy in accordance with Transport's <i>No Net Loss Guideline</i> (Transport, 2022) will be developed to outline the offsetting strategies required. for biodiversity impacts.</p> <p>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.</p>	Transport	Prior to construction	<i>No Net Loss Guideline</i> (Transport, 2022)

## Transport for NSW

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 <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Prior to construction	<i>Guide 1 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).
B6	Biodiversity	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Prior to construction	<i>Guide 4 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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	<i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011)
B9	Biodiversity	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	<i>Guide 9 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Contractor	Construction	<i>Guide 2 of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).

## Transport for NSW

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
					<i>biodiversity on RTA projects (RTA 2011).</i>
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
<b>Noise and vibration</b>					
NV1	Construction noise	<p>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:</p> <ul style="list-style-type: none"> <li>• All potential high noise generating activities associated with the activity</li> <li>• A map indicating the locations of sensitive receivers including residential properties</li> <li>• A quantitative noise assessment in accordance with the Environment Protection Authority Interim Construction Noise Guidelines (DECCW, 2009) and Construction Noise and Vibration Guideline (CNVG)</li> <li>• Feasible and reasonable mitigation measures to be implemented, taking into account the CNVG.</li> <li>• Arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures.</li> <li>• A process for assessing the performance of the implemented mitigation measures</li> <li>• An outline of a monitoring program</li> <li>• A process for documenting and resolving issues and complaints</li> </ul>	Contractor	Pre-construction	
NV2	Construction noise	<p>An Out of Hours Works procedure will be prepared as part of the Construction Noise Management Plan and will include:</p> <p>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.</p>	Contractor	Pre-construction	



## Transport for NSW

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 <i>Construction Noise and Vibration Guideline</i> (Transport, 2016) provided in Appendix D will be implemented.	Transport / contractor	Pre-construction, construction and operation	CNVG
<b>Traffic and transport</b>					
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 <i>Transport Traffic Control at Work Sites Manual</i> (RTA, 2010) and <i>QA Specification G10 Control of Traffic</i> (Transport, 2008). The TGS will include: <ul style="list-style-type: none"> <li>• measures to maintain access to local roads and properties</li> <li>• site-specific traffic control measures (including signage) to manage and regulate traffic movement</li> <li>• requirements and methods to notify the local community of impacts on the local road network</li> <li>• access to construction sites including entry and exit locations</li> <li>• a response plan for any construction traffic incident</li> <li>• 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</li> </ul>	Contractor	Detailed design, pre-construction, construction	Section 4.8 of QA G36 <i>Environment Protection</i>

## Transport for NSW

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		<ul style="list-style-type: none"> <li>monitoring, review and amendment mechanisms.</li> </ul>			
TT2	Construction traffic and transport impacts	Traffic management measures will be developed with reference to the <i>Traffic Control at Work Sites Technical Manual</i> (Transport, 2022).	Contractor	Pre-construction, construction	<i>Traffic Control at Work Sites Technical Manual</i> (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	<i>Roads Act 1993</i>
<b>Aboriginal cultural heritage</b>					
AH1	Aboriginal cultural heritage	The <i>Standard Management Procedure – Unexpected Heritage Items</i> (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 <i>Environment Protection</i>
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 <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i> (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
<b>Visual amenity</b>					
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
<b>Air quality</b>					
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

## Transport for NSW

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 <i>Protection of the Environment Operations (Clean Air) Regulation 2010</i> .	Construction contractor	Construction	Schedule 4 of the <i>Protection of the Environment Operations (Clean Air) Regulation 2010</i> .
<b>Socio-economic, property and land use</b>					
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
<b>Soils and contamination</b>					
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 <i>Environment Protection</i>
SC2	Accidental spill	A site-specific emergency spill plan will be developed and include spill-management measures in accordance with the Transport <i>Code of Practice for Water Management</i> (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 <i>Environment Protection</i>
<b>Surface water, flooding and groundwater</b>					
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 <i>Soil and Water Management</i>

## Transport for NSW

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 <i>QA G38 Soil and Water Management</i>
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 <i>EMF-EM-PR-0001 Environmental Incident Procedure</i> (Transport, 2021) would be followed and the relevant Transport Contract Manager and Environment Manager would be notified as soon as practicable.	Contractor	Construction	<i>EMF-EM-PR-0001 Environmental Incident Procedure</i> (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
<b>Waste and resource use</b>					
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: <ul style="list-style-type: none"> <li>Measures to avoid and minimise waste associated with the proposal</li> <li>Classification of wastes and management options (re-use, recycle, stockpile, disposal) in accordance with <i>the Waste Classification Guidelines</i> (EPA, 2014) and NSW legislative requirements</li> <li>Statutory approvals required for managing both on and off-site waste, or application of any relevant resource recovery exemptions</li> <li>Procedures for storage, transport and disposal</li> <li>Monitoring, record keeping and reporting.</li> </ul> The WMP will align with the <i>Environmental Procedure – Management of Wastes on Transport for NSW Land</i> (Transport, 2014) and relevant Transport Waste fact sheets.	Contractor	Detailed design / pre-construction and construction	Section 4.2 of <i>QA G36 Environment Protection Waste Classification Guidelines</i> (EPA, 2014); <i>Environmental Procedure – Management of Wastes on Transport for NSW Land</i> (Transport, 2014) and relevant Transport Waste fact sheets.



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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: <i>Mulch Management</i> .	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
<b>Other impacts</b>					
OI1	Unexpected find of non-Aboriginal heritage	The <i>Standard Management Procedure – Unexpected Heritage Items</i> (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 <i>Environment Protection</i>
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 within private property.

## 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 <i>Wollondilly 2040</i> .
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and	Ecologically sustainable development is considered in Section 8.2.1 below and Chapter 6 of this REF has considered

Instrument	Requirement
social considerations in decision-making about environmental planning and assessment.	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

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- 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-f00n\\_n-AhUAAAAAHQAAAAQAw&url=https%3A%2F%2Fenvironment.des.gld.gov.au%2F\\_data%2Fassets%2Fpdf\\_file%2F0025%2F102859%2Fkoala-sensitive-design-guideline.pdf&psig=AOvVaw2ep9IQmK8RP85IH4aCyPu1&ust=1684306125095983](https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=0CAIQw7AJahcKEwi4-f00n_n-AhUAAAAAHQAAAAQAw&url=https%3A%2F%2Fenvironment.des.gld.gov.au%2F_data%2Fassets%2Fpdf_file%2F0025%2F102859%2Fkoala-sensitive-design-guideline.pdf&psig=AOvVaw2ep9IQmK8RP85IH4aCyPu1&ust=1684306125095983) in May 2023.
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## 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	<i>Biodiversity Conservation Act 2016 (NSW)</i>
BDAR	Biodiversity Development Assessment Report
CEMP	Construction environmental management plan
CPCP	The Cumberland Plain Conservation Plan
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i> . Provides the legislative framework for land use planning and development assessment in NSW
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2021</i>
EPA	NSW Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i> . 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	<i>Fisheries Management Act 1994 (NSW)</i>
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?	<p>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.</p> <p>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.</p>
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?	<p>The proposal would have visual amenity impacts during construction from the presence of the construction sites and use of night lighting.</p> <p>Once installed the proposal would not result in significant reduction in any of these aspects to the locality.</p>
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 <i>Biodiversity Conservation Act 2016</i> )?	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?	<p>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.</p> <p>The proposal would have long term beneficial impacts with other projects in the area aimed at protecting koala populations.</p>
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 <i>substantial</i> 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 <i>strain</i> 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 <i>substantial</i> 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 <i>substantial</i> 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 <i>minor</i> or <i>inconsequential</i> disruption to pedestrian or vehicular flow?	No	N/A	Section 2.10
Road & footpath excavation	Will the works involve more than <i>minor</i> or <i>inconsequential</i> 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 <i>minor</i> 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 <i>National Parks and Wildlife Act 1974</i> , 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 <i>Mine Subsidence Compensation Act 1961</i> ?	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?  <i>The proposal is within the Western Parkland City however has a capital investment value of less than \$30 million.</i>	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

<b>Version</b>	<b>Date</b>	<b>Revision description</b>
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1.0	03/02/2021	New Resource 4 template created to reflect: <ul style="list-style-type: none"><li>• <i>Biodiversity Conservation Act 2016</i>, Biodiversity Conservation Regulation 2017, Biodiversity Conservation (Savings and Transitional) Regulation 2017, Biodiversity Conservation Amendment (Controlled Actions) Regulation 2019, and minor amendments to the <i>Environmental Planning and Assessment Act 1979</i></li><li>• Establishment of Transport for NSW (TfNSW)</li></ul>
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2.0	07/05/2021	Template updated to provide further detail on certain components of the Biodiversity Assessment Method 2020
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# Koala Fencing – Hume Highway, Wilton

## Biodiversity Assessment Report

Transport for NSW | January 2024

Prepared by Stantec Australia, Pty Ltd

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## Document controls

## Approval and authorisation

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

## Document status

<b>Document status</b>	<b>Description</b>	<b>Date</b>	<b>Prepared by</b>	<b>Reviewed by</b>
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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
<b>V4</b>	Final – Updates from detailed design	12/01/2024	Dane Fogliada	Catriona Sutherland



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# Executive summary

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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 <a href="http://www.environment.nsw.gov.au/research/Visclassification.htm">www.environment.nsw.gov.au/research/Visclassification.htm</a> (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	<p>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:</p> <ul style="list-style-type: none"><li>• 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.</li><li>• 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.</li><li>• 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).</li></ul>
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	<p>Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary,</p> <p>(a) trees (including any sapling or shrub or any scrub),</p> <p>(b) understorey <a href="#">plants</a>,</p> <p>(c) groundcover (being any type of herbaceous vegetation),</p> <p>(d) <a href="#">plants</a> occurring in a wetland.</p> <p>A <a href="#">plant</a> is native to New South Wales if it was established in New South Wales before European settlement (BC Act).</p> <p>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.</p>

## Definitions

Patch size	<p>An area of native vegetation that:</p> <ul style="list-style-type: none"> <li>• occurs on the development site or biodiversity stewardship site</li> <li>• includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or <math>\leq 30</math> m for non-woody ecosystems).</li> </ul> <p>Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).</p>
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	<p>Spatial databases required to prepare a BDAR</p> <ul style="list-style-type: none"> <li>• BioNet NSW (Mitchell) Landscapes – Version 3.1</li> <li>• NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7</li> <li>• NSW soil profiles</li> <li>• hydrogeological landscapes</li> <li>• acid sulfate soils risk</li> <li>• digital cadastral database</li> <li>• Vegetation Information Systems maps</li> <li>• Geological sites of NSW.</li> </ul>
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](http://www.bionet.nsw.gov.au).

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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).

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## Abbreviations

AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method calculator
BC Act	<i>Biodiversity Conservation Act 2016 (NSW)</i>
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	<i>Environment Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i>
Fisheries NSW Policy and Guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
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

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## 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).

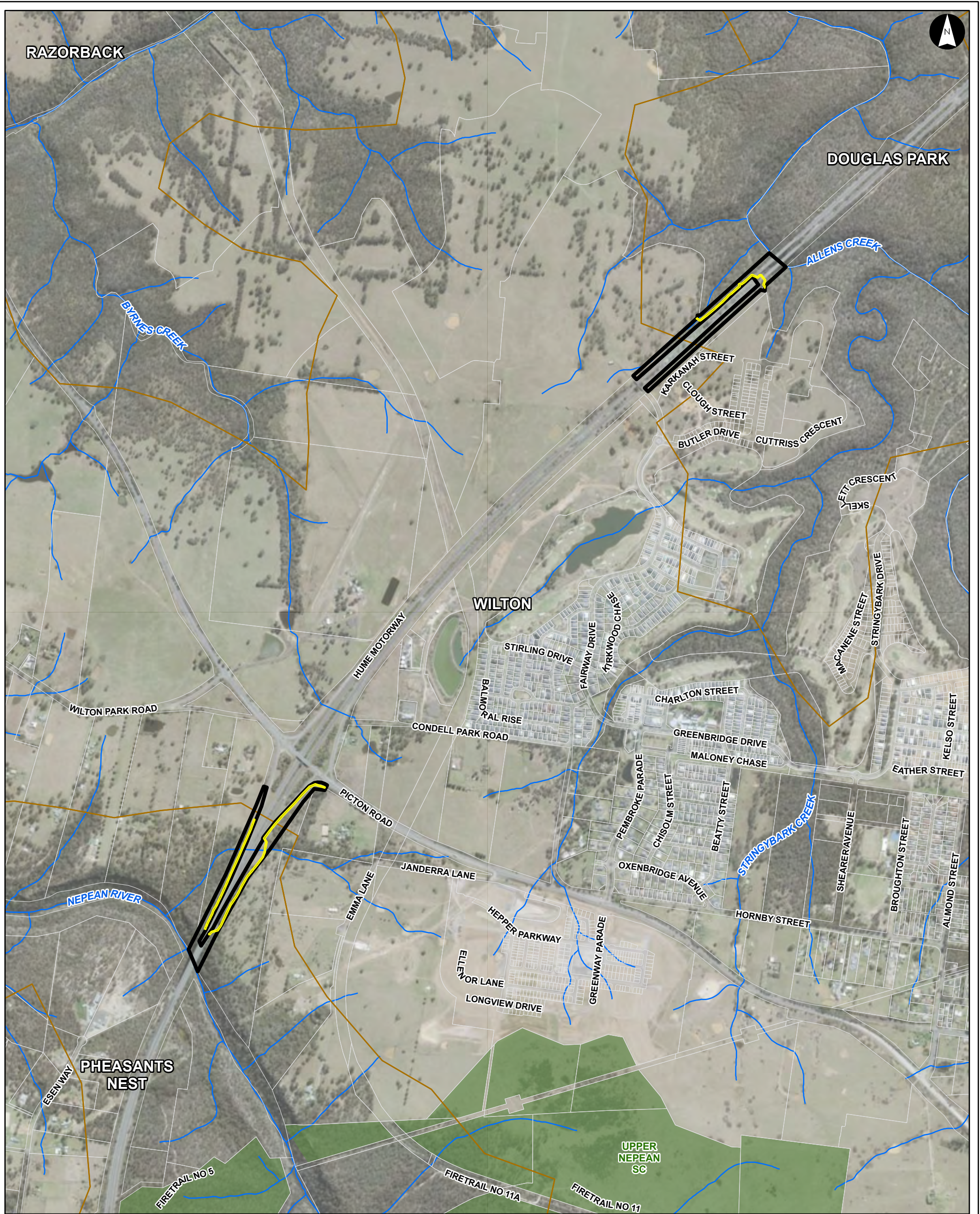
In accordance with the DPE Koala Vehicle Strike Fact sheet 2 (DPE 2020), fencing will be well-maintained, having no gaps or holes, trees or shrubs within 3m, overhanging vegetation or built-up debris. The fence would be 1.5m in height.

## 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

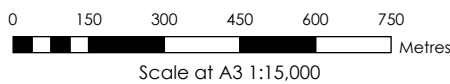
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 Drawn By: MD, Checked By: MM  
 Figure No: 1-1 | Rev: 03  
 Date: 2024-01-11



**Legend**

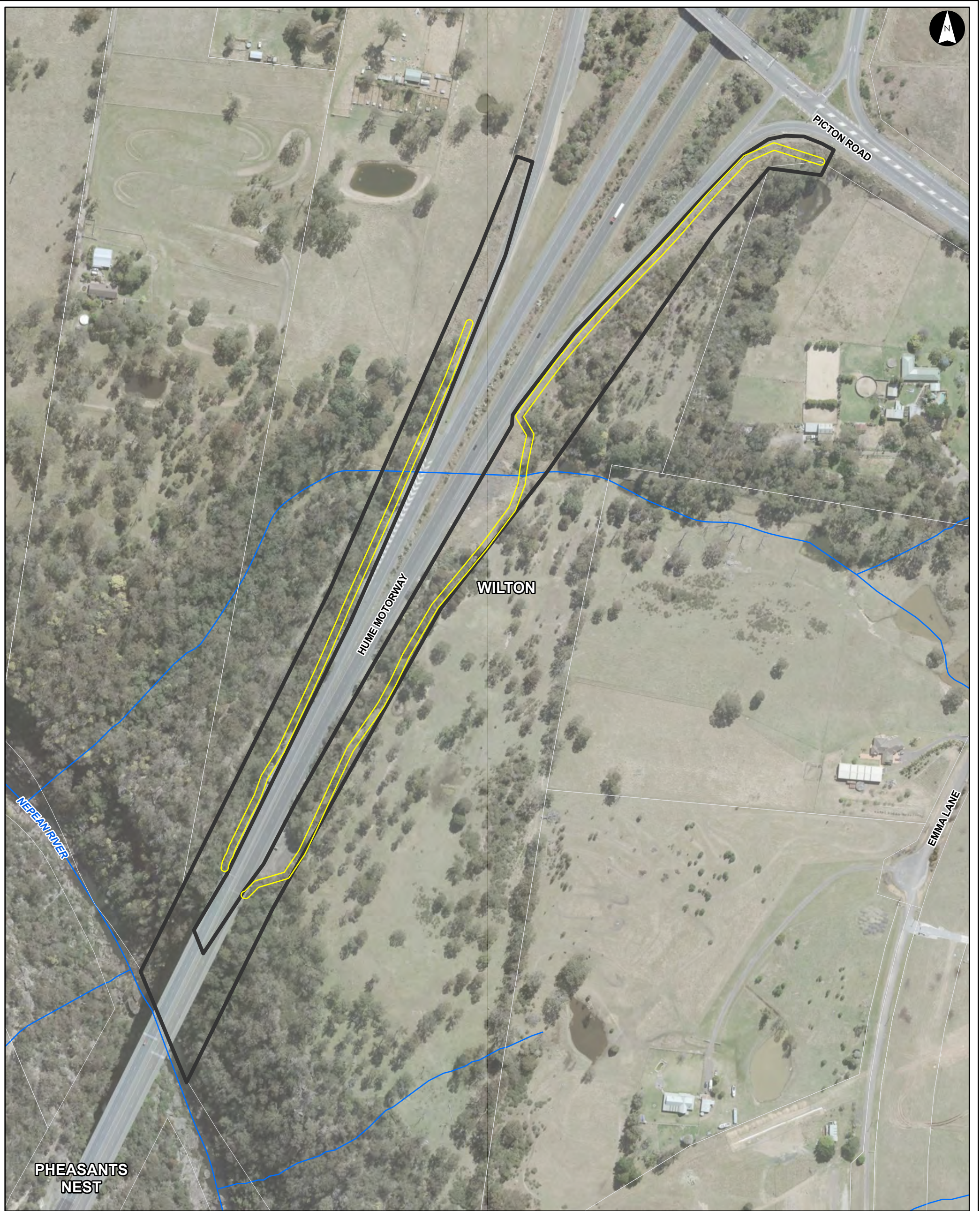
- Study Area
- Subject Land
- Major Road
- Watercourse
- Mitchell Landscape
- NPWS Reserve
- Cadastre

- 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)



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



Legend

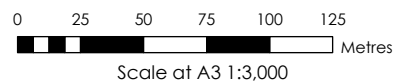
- Study Area
- Subject Land
- Watercourse
- Cadastre

Notes:

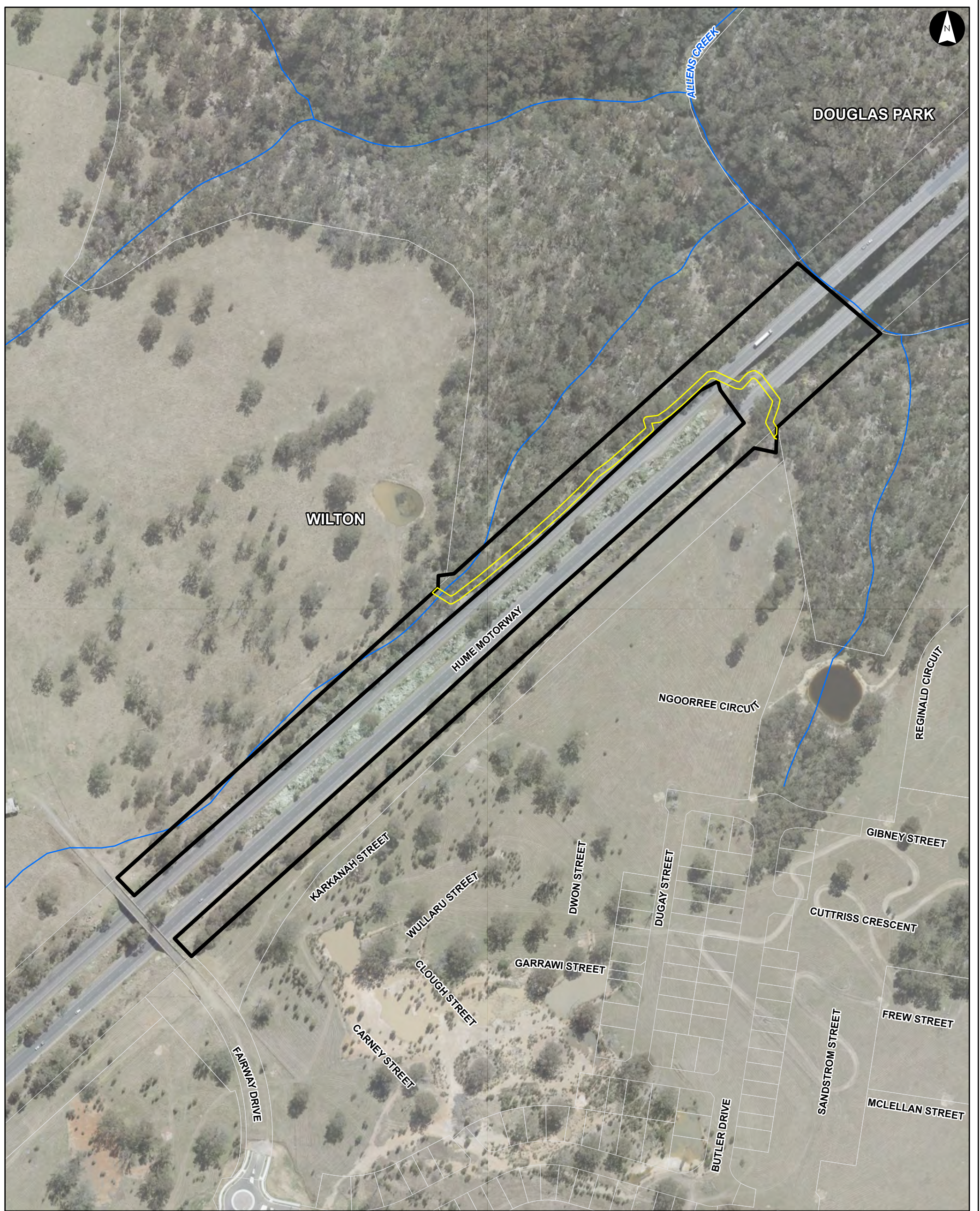
1. Coordinate System: GDA2020 MGA Zone 56

References:

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












**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

**Legend**

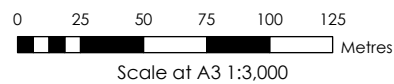
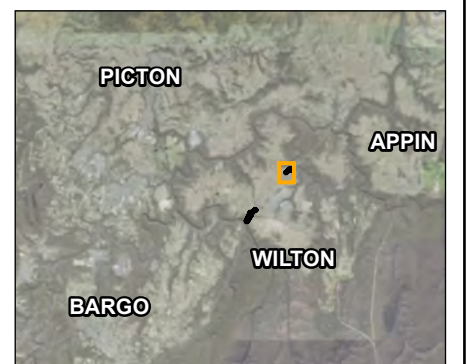
-  Study Area
-  Subject Land
-  Major Road
-  Watercourse
-  Cadastre

**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)





## **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 (SAIL).

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	<ul style="list-style-type: none"><li>• Technical review</li></ul>	<ul style="list-style-type: none"><li>• B Sc (Hons)</li><li>• M Sc (Environment)</li><li>• Executive Masters (Public Administration)</li><li>• BAM Accredited Assessor (BAAS1707)</li></ul>
David Wassman	<ul style="list-style-type: none"><li>• Project manager</li></ul>	<ul style="list-style-type: none"><li>• B Sc (EnvSc)</li><li>• CEnvP</li></ul>
Christopher Wellington	<ul style="list-style-type: none"><li>• Report review</li></ul>	<ul style="list-style-type: none"><li>• PhD Candidate</li><li>• B Sc (Ecology)</li></ul>
Dane Fogliada	<ul style="list-style-type: none"><li>• Report writing</li><li>• Field ecologist</li><li>• Figure preparation</li></ul>	<ul style="list-style-type: none"><li>• B Sc (Environment)</li><li>• Certificate II (Conservation Land Management)</li><li>• BAM Accredited Assessor (BAAS23010)</li></ul>
Annabelle McTaggart	<ul style="list-style-type: none"><li>• Report writing</li><li>• Field ecologist</li><li>• Figure preparation</li></ul>	<ul style="list-style-type: none"><li>• B Sc (Conservation Biology)</li></ul>

### 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 <a href="http://www.bionet.nsw.gov.au/">http://www.bionet.nsw.gov.au/</a>	22/08/2022	10 km
NSW DPI Fisheries Spatial Data Portal: <a href="https://www.dpi.nsw.gov.au/about-us/science-and-research/spatial-data-portal">https://www.dpi.nsw.gov.au/about-us/science-and-research/spatial-data-portal</a>	22/08/2022	10 km

Source	Date Accessed	Search Area
SEED datasets including Biodiversity Values Map and available native vegetation community mapping (VIS 4207) ( <a href="https://www.seed.nsw.gov.au/">https://www.seed.nsw.gov.au/</a> )	24/08/2022	10 km
The DAWE's Protected Matters Search Tool: <a href="https://pmst.awe.gov.au/">https://pmst.awe.gov.au/</a>	22/08/2022	10 km
The Commonwealth Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE): <a href="http://www.bom.gov.au/water/groundwater/gde/map.shtml">http://www.bom.gov.au/water/groundwater/gde/map.shtml</a>	24/08/2022	10 km
National Flying-fox monitoring viewer: <a href="http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf">http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf</a>	24/08/2022	10 km
Threatened biodiversity profile search. Profiles for NSW listed species ( <a href="https://www.environment.nsw.gov.au/threatenedspeciesapp/">https://www.environment.nsw.gov.au/threatenedspeciesapp/</a> ) and nationally listed species at ( <a href="http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl">http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl</a> )	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	Native tree cover <25 % of the tree cover benchmark for the PCT  <b><u>AND</u></b>
	Wet-sclerophyll Forest	

Cat.	Vegetation formation	Criteria
	Dry-sclerophyll Forest Grassy Woodland Semi-arid Woodland Forested Wetland	Less than 50% of ground cover vegetation consists of either: <ul style="list-style-type: none"> <li>• species listed in the BioNet Vegetation Classification PCT profile for medium to high classification confidence PCTs, <b><u>or</u></b></li> <li>• any native species for very low to low classification confidence PCTs,</li> </ul> <b><u>OR</u></b> 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 <b><u>AND</u></b> Less than 50% of ground cover vegetation consists of either: <ul style="list-style-type: none"> <li>• species listed in the BioNet Vegetation Classification PCT profile for medium to high classification confidence PCTs, <b><u>or</u></b></li> <li>• any native species for very low to low classification confidence PCTs,</li> </ul> <b><u>OR</u></b> 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: <ul style="list-style-type: none"> <li>• species listed in the BioNet Vegetation Classification PCT profile for medium to high classification confidence PCTs, <b><u>or</u></b></li> <li>• any native species for very low to low classification confidence PCTs,</li> </ul> <b><u>OR</u></b> 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



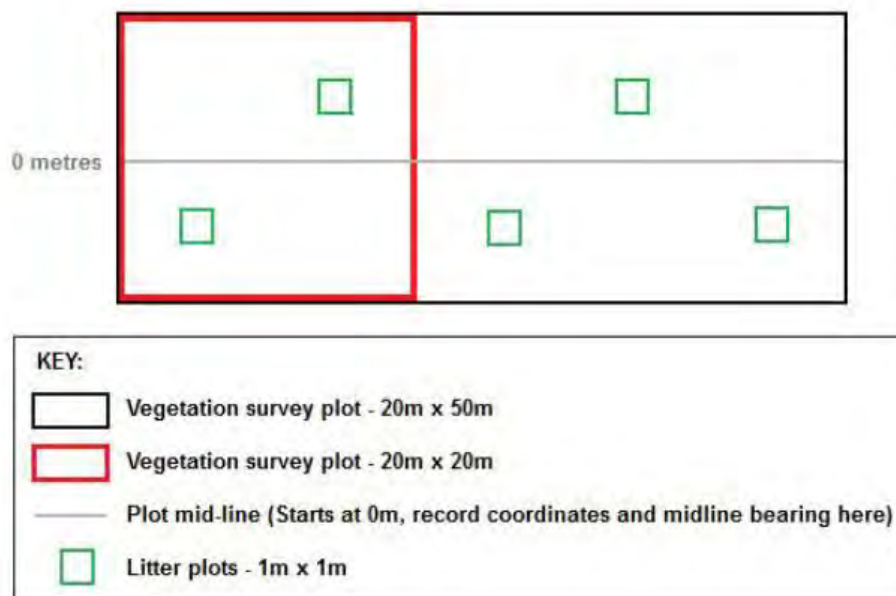


Figure 2-1: The proposal (Northern Hume)

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

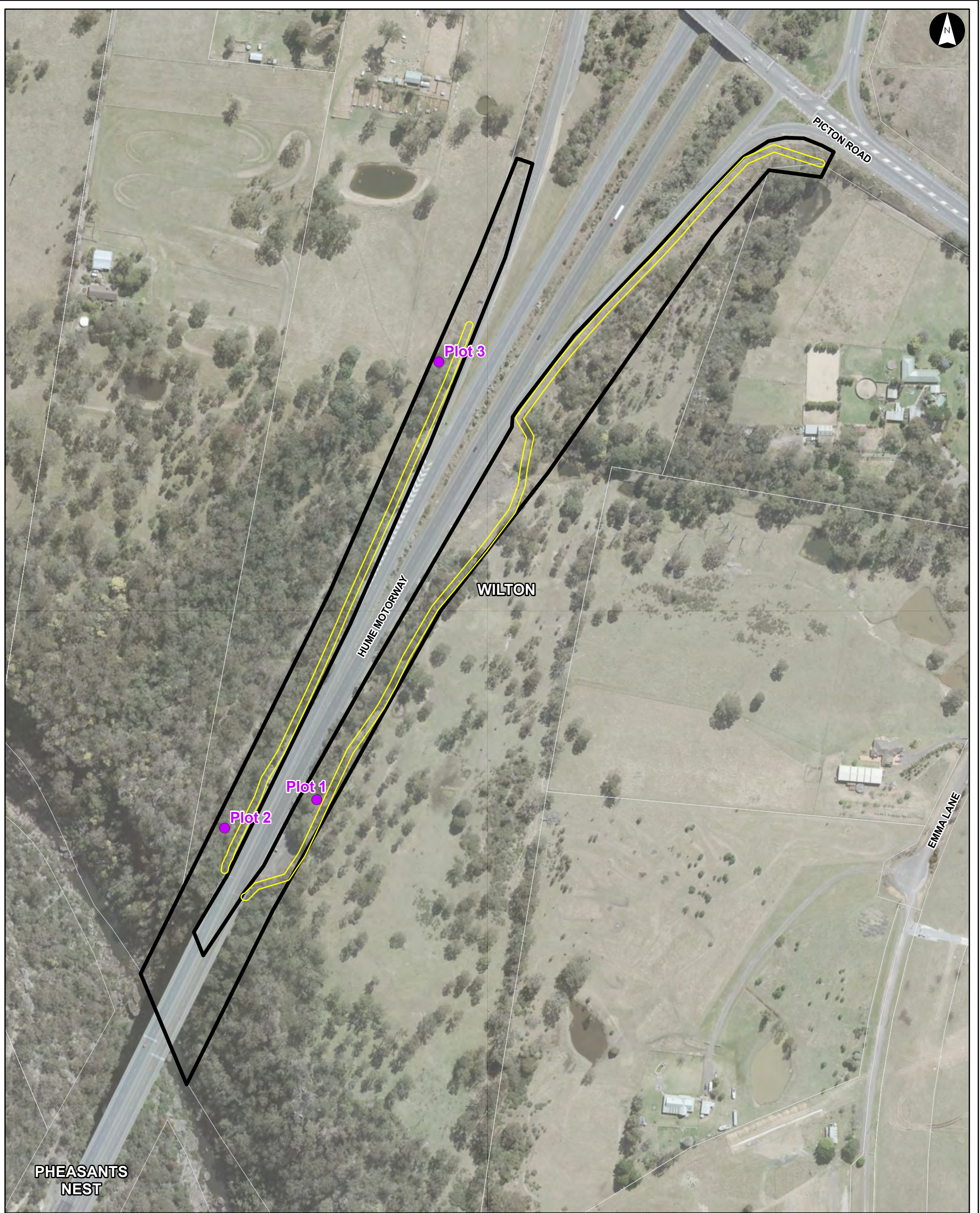
Attribute	Qualitative data collected
Location	Geographic coordinates (easting and northing – MGA 2020 Zone 56) collected using ArcGIS field application Collector
Native and exotic species richness and cover percentage	Plot: 20 x 20 m All plant species were recorded and cover percentage of each species 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: <ul style="list-style-type: none"> <li>• The entrance could be seen;</li> <li>• The estimated entrance width was at least 5 cm;</li> <li>• The hollow appeared to have depth;</li> <li>• The hollow was at least 1 m above the ground; and</li> <li>• The centre of the tree was located within the plot.</li> </ul> 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 $\leq$ 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



**Legend**

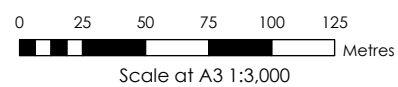
- |              |            |
|--------------|------------|
| Study Area   | Major Road |
| Subject Land | Cadastre   |
| BAM Plot     |            |

**Notes:**

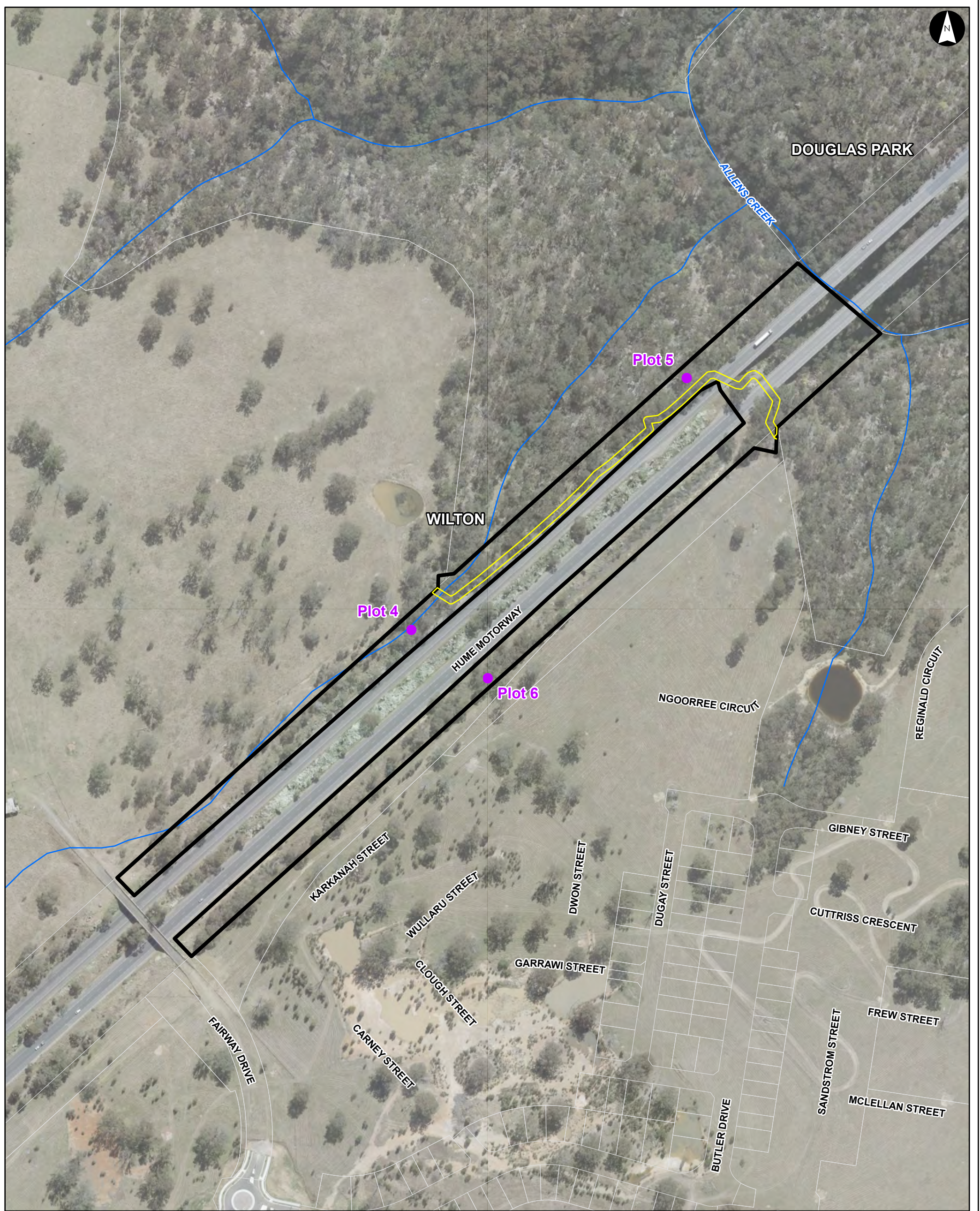
1. Coordinate System: GDA2020 MGA Zone 56

**References:**

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







**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



**Legend**

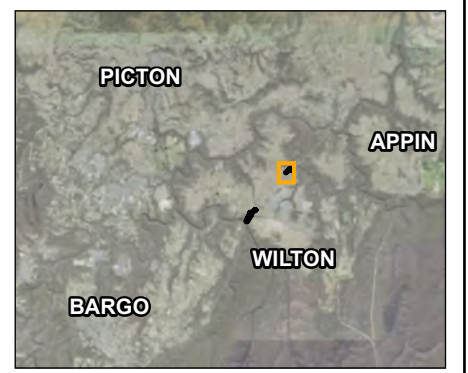
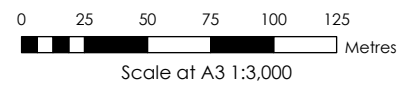
- Study Area
- Subject Land
- BAM Plot
- Major Road
- Watercourse
- Cadastre

**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)





## 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 <sup>1</sup>	Survey completed
<i>Acacia bynoeana</i>	Bynoe's Wattle	All year	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	September - October	PCT 1395 – 0.617 ha	• Flora transects	Surveys completed
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	August - November	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
<i>Melaleuca deanei</i>	Deane's Paperbark	All year	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
<i>Persoonia bargoensis</i>	Bargo Geebung	All year	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
<i>Persoonia hirsuta</i>	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 <sup>1</sup>	Survey completed
<i>Pimelea curviflora</i> var. <i>curviflora</i>	-	October - March	PCT 1395 – 0.61 ha	• Flora transects	Surveys completed
<i>Pomaderris brunnea</i>	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 <sup>1</sup>	Survey completed
<b>Birds</b>					
<i>Anthochaera phrygia</i>	Regent Honeyeater	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> <li>• Mapped important habitat</li> </ul>	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022 Not within mapped important habitat
<i>Burhinus grallarius</i>	Bush Stone-curlew	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> <li>• Call playback</li> </ul>	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	October - January	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> <li>• Hollow-bearing trees with suitable sized hollows for breeding</li> </ul>	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022 No suitable breeding hollows (>9cm) within the subject land
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	January - September	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> <li>• Hollow-bearing trees with suitable sized hollows for breeding</li> </ul>	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022 No suitable breeding hollows within the subject land
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	July - December	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> </ul>	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 <sup>1</sup>	Survey completed
<i>Hieraaetus morphnoides</i>	Little Eagle	August - October	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> </ul>	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022
<i>Lathamus discolor</i>	Swift Parrot	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> <li>• Mapped important habitat</li> </ul>	Not within mapped important habitat
<i>Lophoictinia isura</i>	Square-tailed Kite	September - January	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal bird surveys</li> </ul>	Four 20-minute diurnal bird surveys completed: 21/09/2022 14/10/2022
<i>Ninox connivens</i>	Barking Owl	May - December	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Nocturnal bird surveys</li> <li>• Hollow-bearing trees with suitable sized hollows for breeding</li> </ul>	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022 No suitable breeding hollows within the subject land
<i>Ninox strenua</i>	Powerful Owl	May - August	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Nocturnal bird surveys</li> <li>• Hollow-bearing trees with suitable sized hollows for breeding</li> </ul>	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022 No suitable breeding hollows within the subject land

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements <sup>1</sup>	Survey completed
<i>Tyto novaehollandiae</i>	Masked Owl	May - August	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Nocturnal bird surveys</li> <li>Hollow-bearing trees with suitable sized hollows for breeding</li> </ul>	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022 No suitable breeding hollows within the subject land
<b>Reptiles</b>					
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Reptile search in all areas of suitable habitat</li> </ul>	Seven hand searches of sheltering sites complete: 21/09/2022 12/10/2022 13/10/2022 14/10/2022
<b>Mammals</b>					
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	October - March	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Spotlighting transects</li> <li>Stag watching</li> </ul>	Two repeat spotlighting transects: 12/10/2022 13/10/2022
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	November - January	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Diurnal and nocturnal roost search</li> <li>Acoustic survey (ANABAT)</li> </ul>	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
<i>Miniopterus australis</i>	Little Bent-winged Bat	December - February	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Microbat trapping</li> <li>Caves or tunnels as breeding habitat</li> </ul>	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 <sup>1</sup>	Survey completed
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	December - February	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Microbat trapping</li> <li>• Caves or tunnels as breeding habitat</li> </ul>	No suitable breeding habitat within the subject land
<i>Myotis macropus</i>	Southern Myotis	October - March	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Diurnal and nocturnal roost search</li> <li>• Acoustic survey (ANABAT)</li> </ul>	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
<i>Petauroides volans</i>	Greater Glider	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Spotlighting transects</li> <li>• Stag watching</li> </ul>	Two repeat spotlighting transects: 12/10/2022 13/10/2022
<i>Petaurus norfolcensis</i>	Squirrel Glider	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Spotlighting transects</li> <li>• Stag watching</li> </ul>	Two repeat call playback and spotlighting transects: 12/10/2022 13/10/2022
<i>Phascolarctos cinereus</i>	Koala	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Koala SAT</li> <li>• Spotlighting transects</li> <li>• Call playback</li> </ul>	12 SAT surveys complete: 21/09/2022 12/10/2022 13/10/2022 14/10/2022
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>• Spotlighting transects</li> </ul>	No camp within the study area.
<b>Gastropods</b>					

Species name	Common name	Required survey period (TBDC)	Associated PCTs in the subject land	Minimum survey requirements <sup>1</sup>	Survey completed
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	All year	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Gastropod survey</li> </ul>	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

<i>Heleioporus australiacus</i>	Giant Burrowing Frog	September - April	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Aural/visual surveys and/or Tadpole searches</li> <li>Flowing ephemeral streams within the study area</li> </ul>	No suitable habitat within the subject land
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	July - November	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Aural/visual surveys and/or Tadpole searches</li> <li>Dams or pools within the study area</li> </ul>	No suitable habitat within the subject land
<i>Mixophyes balbus</i>	Stuttering Frog	September - March	PCT 1395 – 0.61 ha	<ul style="list-style-type: none"> <li>Aural/visual surveys</li> <li>Flowing ephemeral streams within the study area</li> </ul>	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		
<ul style="list-style-type: none"> <li>Gastropod surveys (3)</li> <li>Koala SAT (3)</li> <li>Diurnal bird surveys (2)</li> <li>Reptile searches (1)</li> </ul>	21/09/2022 2	9.6	19.9	0	-



Surveys undertaken (number of surveys)	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
<ul style="list-style-type: none"> <li>Gastropod surveys (3)</li> <li>Koala SAT (3)</li> <li>Microbat roost search (1)</li> <li>Reptile searches (2)</li> <li>Nocturnal surveys (1 Call Playback Survey, Spotlighting transects)</li> </ul>	12/10/2022	9.1	20.9	0	Significant rain event 09/10/2022 with approximately 58.4 mm of rainfall
<ul style="list-style-type: none"> <li>Gastropod surveys (3)</li> <li>Koala SAT (3)</li> <li>Microbat roost searches (2)</li> <li>Reptile searches (2)</li> <li>Nocturnal surveys (1 Call Playback Survey, Spotlighting transects)</li> </ul>	13/10/2022	12.0	21.5	0	
<ul style="list-style-type: none"> <li>Gastropod surveys (3)</li> <li>Koala SAT (3)</li> <li>Diurnal bird surveys (2)</li> <li>Reptile searches (2)</li> </ul>	14/10/2022	14.7	23.2	0.4	
<ul style="list-style-type: none"> <li>Microbat survey (ANABAT)</li> </ul>	31/10/2022	11.9	27.3	0	-
<ul style="list-style-type: none"> <li>Microbat survey (ANABAT)</li> </ul>	07/11/2022	11.2	25.4	0	-
<ul style="list-style-type: none"> <li>Microbat survey (ANABAT)</li> </ul>	08/11/2022	12.0	24.7	0	-
<ul style="list-style-type: none"> <li>Microbat survey (ANABAT)</li> </ul>	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.

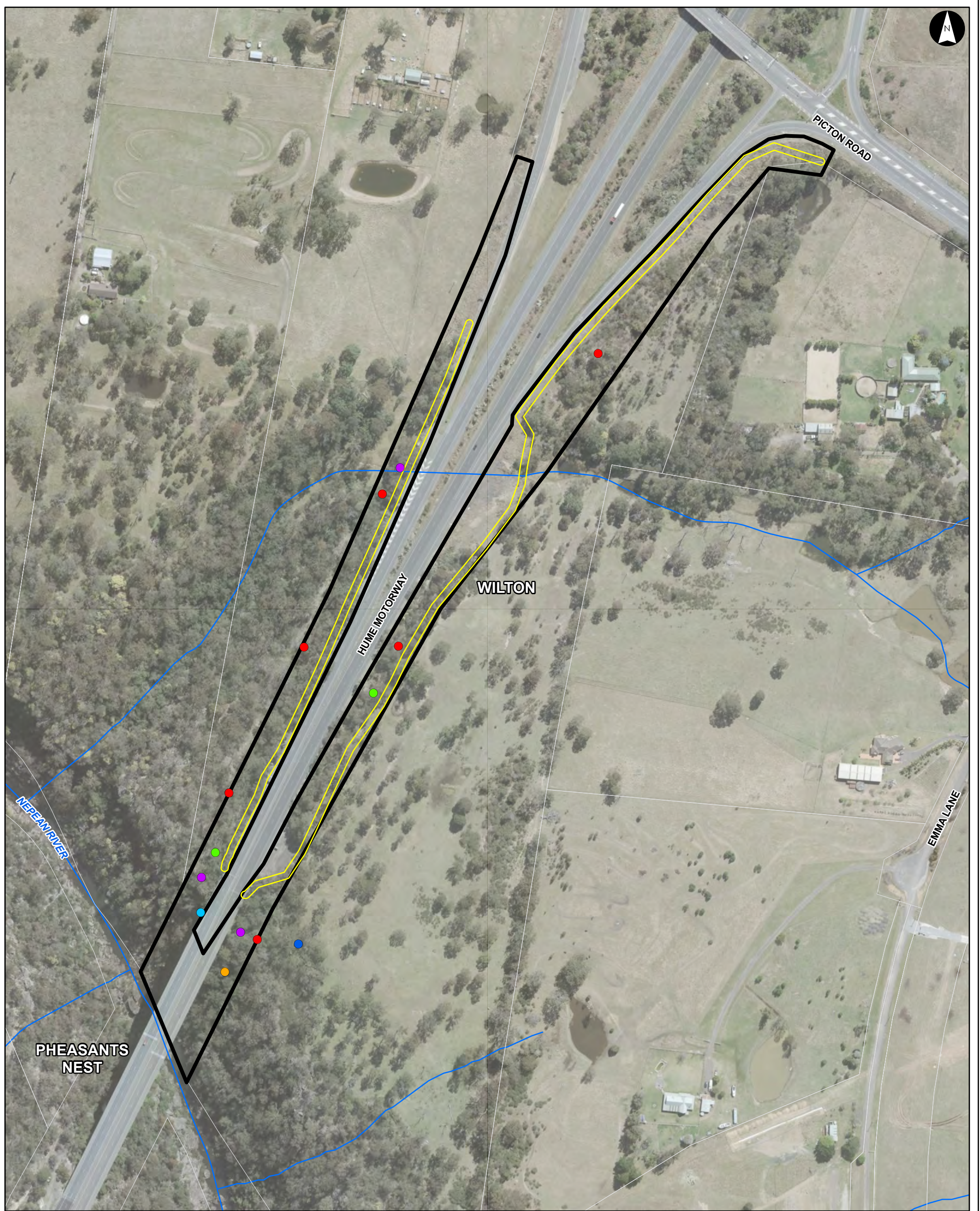
#### **2.4.3.5 Reptile Surveys**

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.





**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



**Legend**

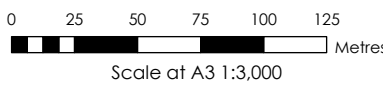
- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

**Threatened Species Survey**

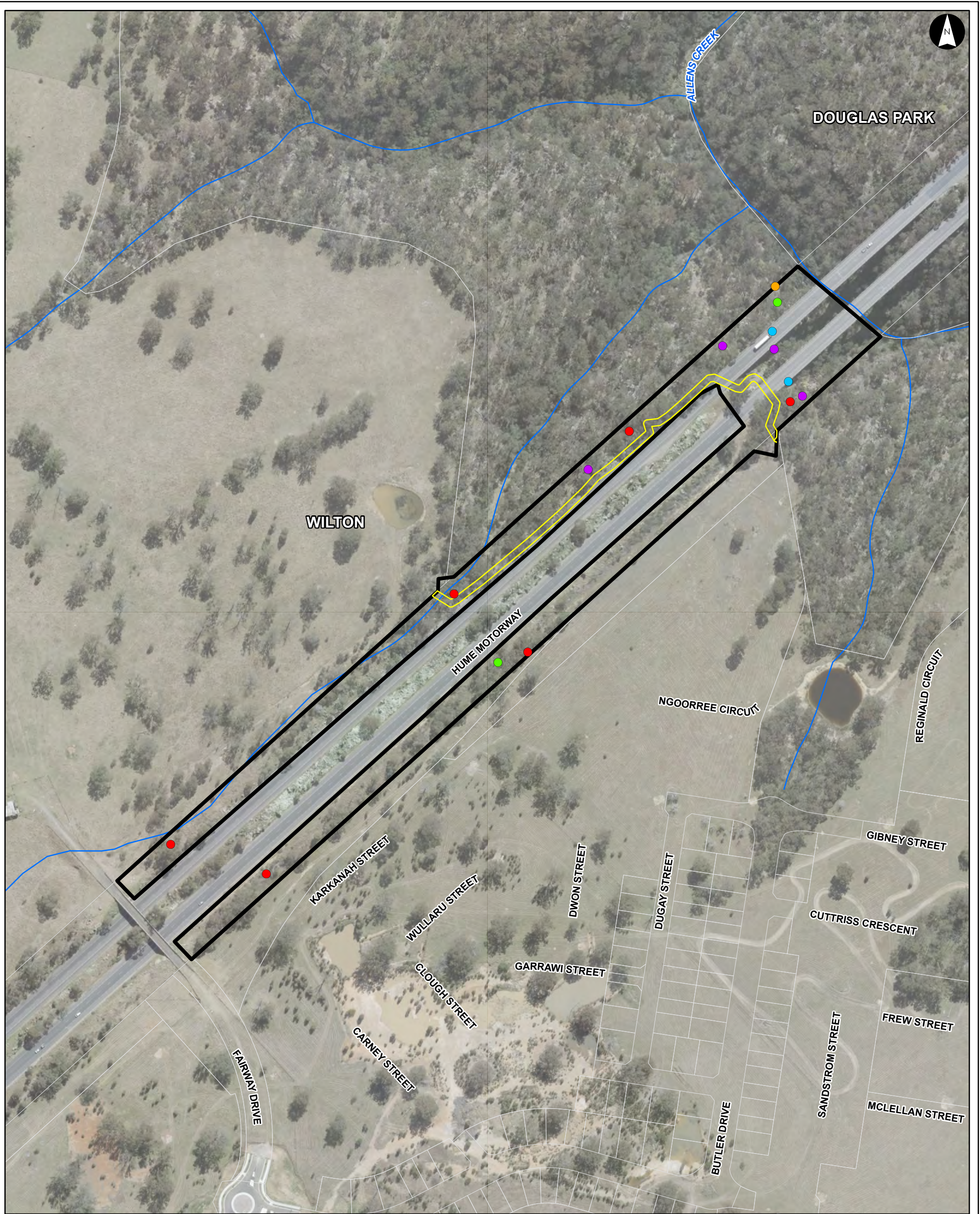
- Bird Survey
- Call Playback
- Reptile
- Roost Search
- Spot Assessment Technique
- Stag Watch

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)







**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



**Legend**

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

**Threatened Species Survey**

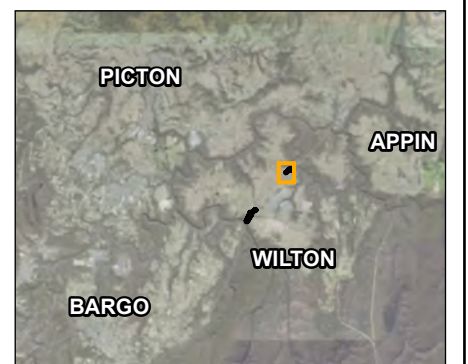
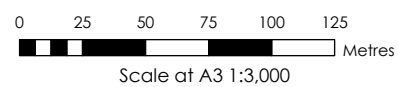
- Bird Survey
- Call Playback
- Reptile
- Roost Search
- Spot Assessment Technique

**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)





## 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)	<p>There are two mapped NSW landscape regions within the study area:</p> <ul style="list-style-type: none"> <li>• Upper Nepean Gorges; and</li> <li>• Picton- Razorback Hills</li> </ul> <p>The Upper Nepean Gorges was selected as the NSW landscape for analysis in the BAM-C.</p>
Cleared areas	<p>Patches of exotic vegetation are present within the study area.</p> <p>The study area occurs adjacent to open and cleared pasture lands, used for agricultural purposes, and areas of residential development, notably Bingara Gorge.</p>

Landscape features	Site Particular
Rivers and streams	<p>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.</p> <p>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 7<sup>th</sup> order watercourse. At the northern extent of the Northern Hume site, Moolgun Creek Bridge crosses Allens Creek, a 4<sup>th</sup> order stream.</p>
Wetlands	<p>There are no mapped or observed wetlands in the study area.</p>
Connectivity features	<p>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.</p> <p>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.</p> <p>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.</p>
Areas of Geological Significance and Soil Hazard Features	<p>There are no areas of geological significance and soil hazard features present within the study area.</p>
Areas of outstanding biodiversity value	<p>There are four declared areas of outstanding biodiversity value (AOBV) in NSW:</p> <ul style="list-style-type: none"> <li>• Gould's Petrel</li> <li>• Little Penguin population in Sydney's North Harbour</li> <li>• Mitchell's Rainforest Snail in Stotts Island Nature Reserve</li> <li>• Wollemi Pine.</li> </ul> <p>None of these areas occur within or nearby to the study area.</p>

### 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, decorticated 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 transitional 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	Good	65.5	Critically endangered (BC Act and EPBC Act)	0.31	2.64
2	Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	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





**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



**Legend**

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

**Ground-truthed  
Vegetation**

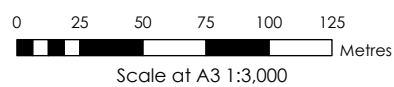
- PCT 1395 Good
- PCT 1395 Moderate - Good
- PCT 1395 Moderate
- Exotic

**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)







**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



**Legend**

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

**Habitat Feature**

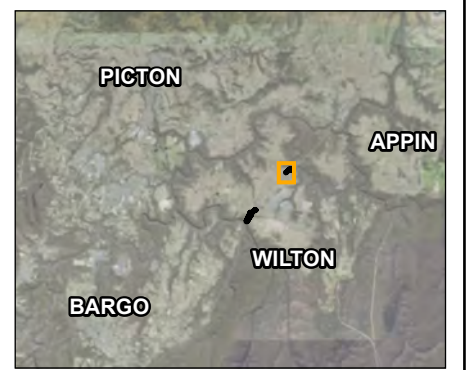
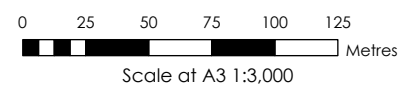
- Dam
- Burrow
- Termite Mound
- Drainage Culvert
- Rocky Outcrop / Batter

**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)





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



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	<i>Paragraph 2:</i> 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	<i>Paragraph 1:</i> 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 Plain subregion. Based on derived Hawkesbury Sandstone.
	<i>Paragraph 9:</i> 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	<i>Paragraph 4:</i> 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
	<p><i>Paragraph 6:</i> 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.</p>	<p>Meets final determination reference. Vegetation varies from an open grassland and shrubby understorey within the subject land.</p>
<p>Characteristic tree species</p>	<p><i>Paragraph 5:</i> Characteristic tree species in Shale Sandstone Transition Forest are; <i>Eucalyptus punctata</i>, <i>Eucalyptus resinifera</i>, one of the stringybarks (<i>Eucalyptus globoidea</i>, <i>Eucalyptus eugenioides</i>, <i>Eucalyptus sparsifolia</i>, <i>Eucalyptus agglomerata</i>). One or more ironbarks (<i>Eucalyptus fibrosa</i>, <i>Eucalyptus crebra</i>, <i>Eucalyptus paniculata</i>, <i>Eucalyptus beyeriana</i>) may be locally important.</p>	<p>Meets final determination reference. Dominant tree species within the subject land include <i>Eucalyptus punctata</i> and <i>Eucalyptus fibrosa</i>.</p>
<p>Disturbance</p>	<p><i>Paragraph 14:</i> 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.</p>	<p>Meets final determination reference. Land adjacent to the subject land has been historically cleared for agricultural/farming practices.</p>





**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



**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**

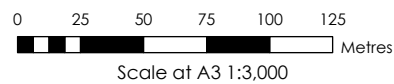
- Shale Sandstone Transition Forest in the Sydney Basin Bioregion - CE

**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)







**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



**Legend**

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

**Threatened Ecological Community (EPBC Act) - Growth-truethed**

- Shale Sandstone Transition Forest of the Sydney Basin Bioregion - CE

**Threatened Ecological Community (BC Act) - Growth-truethed**

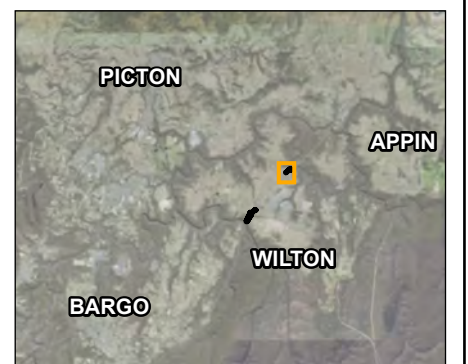
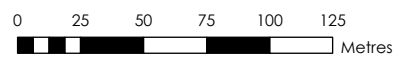
- Shale Sandstone Transition Forest in the Sydney Basin Bioregion - CE

**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)





### 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.

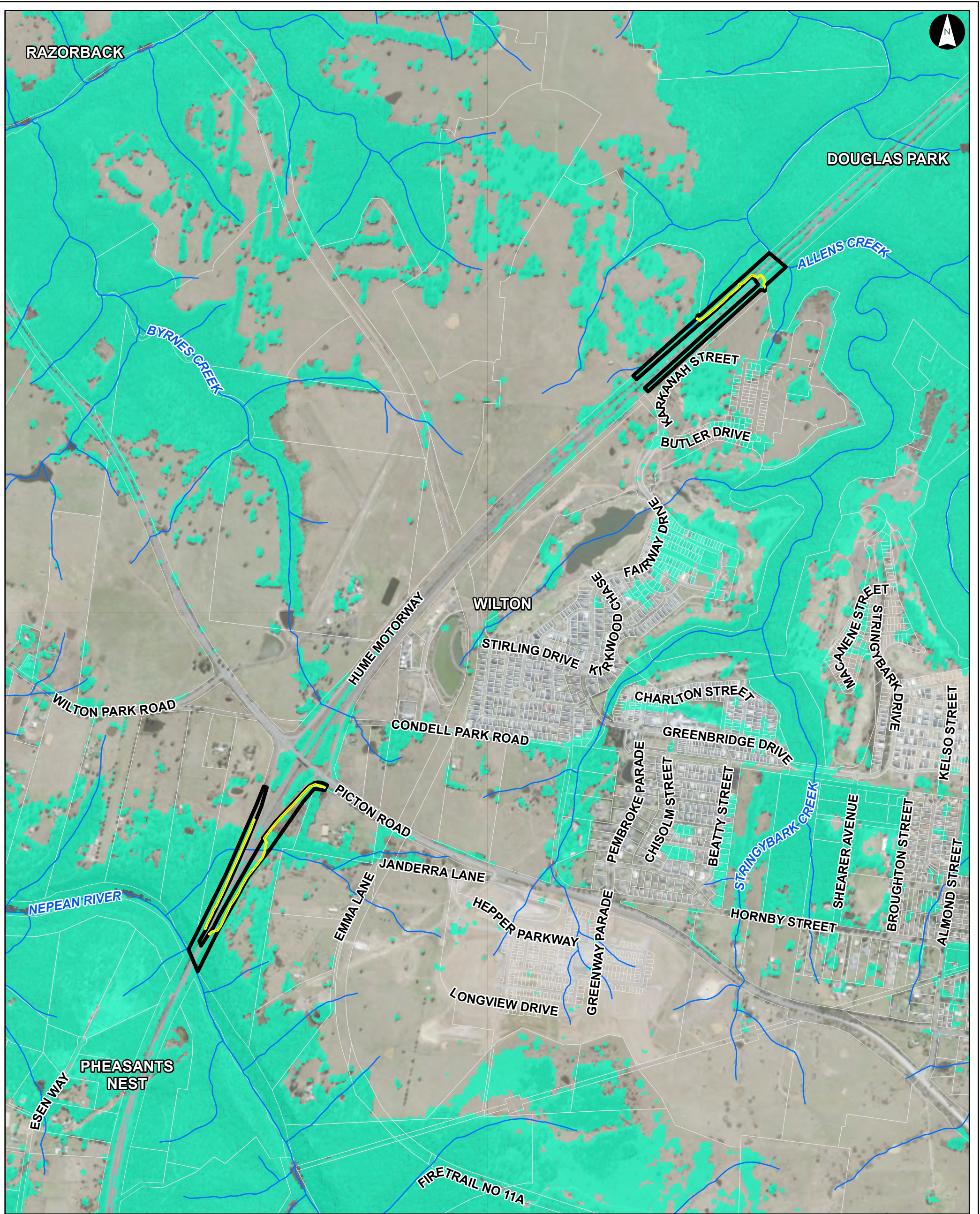
The Nepean River is considered a moderate potential aquatic GDE that occurs within proximity to the subject land.

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



**Legend**

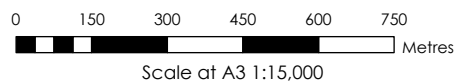
- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre
- Terrestrial Groundwater Dependant Ecosystems

**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)





## 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
<b>Flora</b>						
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	47 (BioNet) BAM-C	Species	Moderate
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	V	-	286 (BioNet) BAM-C	Species	Moderate
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	551 (BioNet) BAM-C	Species	Moderate
<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	43 (BioNet) BAM-C	Species	Moderate
<i>Persoonia bargoensis</i>	Bargo Geebung	E	V	623 (BioNet) BAM-C	Species	Moderate
<i>Persoonia hirsuta</i>	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
<i>Pimelea curviflora</i> <i>var. curviflora</i>	-	V	V	2 (BioNet) BAM-C	Species	Moderate
<i>Pomaderris brunnea</i>	Brown Pomaderris	E	V	16 (BioNet) BAM-C	Species	Moderate
<b>Birds</b>						
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	-	43 (BioNet)	Ecosystem	Moderate
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	2 (BioNet) BAM-C	Species	Moderate
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	E	15 (BioNet), PMST BAM-C	Dual	Moderate
<i>Calyptorhynchus lathami lathami</i>	Glossy Black-Cockatoo	V	V	45 (BioNet), PMST BAM-C	Dual	Moderate
<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	4 (BioNet)	Ecosystem	Moderate
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	22 (BioNet)	Ecosystem	Moderate
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	46 (BioNet)	Ecosystem	Moderate
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	62 (BioNet)	Ecosystem	Moderate
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	-	7 (BioNet) BAM-C	Dual	Moderate
<i>Hieraaetus morphnoides</i>	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
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	V,C,J,K	6 (BioNet), PMST	Ecosystem	Moderate
<i>Lathamus discolor</i>	Swift Parrot	E	CE	5 (BioNet), PMST BAM-C	Dual	Moderate
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	9 (BioNet) BAM-C	Dual	Moderate
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	-	10 (BioNet)	Ecosystem	Moderate
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	4 (BioNet)	Ecosystem	Moderate
<i>Ninox connivens</i>	Barking Owl	V	-	2 (BioNet) BAM-C	Dual	Moderate
<i>Ninox strenua</i>	Powerful Owl	V	-	31 (BioNet) BAM-C	Dual	Moderate
<i>Petroica boodang</i>	Scarlet Robin	V	-	25 (BioNet)	Ecosystem	Moderate
<i>Petroica phoenicea</i>	Flame Robin	V	-	2 (BioNet)	Ecosystem	Moderate
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	12 (BioNet)	Ecosystem	Moderate
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	3 (BioNet) BAM-C	Dual	Moderate
<b>Invertebrates</b>						
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E	-	47 (BioNet) BAM-C	Species	Moderate
<b>Fish</b>						



Scientific Name	Common Name	BC Act	EPBC Act	Source	Credit type	Likelihood of Occurrence prior to survey
<i>Macquaria australasica</i>	Macquarie Perch	E	E	PMST	NA	Moderate*
<b>Mammals</b>						
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	31 (BioNet) BAM-C	Species	Moderate
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	28 (BioNet), PMST BAM-C	Species	Moderate
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	10 (BioNet), PMST	Ecosystem	Moderate
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	9 (BioNet)	Ecosystem	Moderate
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	27 (BioNet)	Ecosystem	Moderate
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	-	12 (BioNet) BAM-C	Dual	Moderate
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	32 (BioNet) BAM-C	Dual	Moderate
<i>Myotis macropus</i>	Southern Myotis	V	-	194 (BioNet) BAM-C	Species	Moderate/Possible detection/ Assumed present
<i>Petauroides volans</i>	Greater Glider (southern and central)	-	E	15 (BioNet), PMST BAM-C	Species	Moderate
<i>Petaurus australis</i>	Yellow-bellied Glider (south-eastern)	V	V	3 (BioNet), PMST	Ecosystem	Moderate
<i>Petaurus norfolcensis</i>	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
<i>Phascolarctos cinereus</i>	Koala	E	E	1192 (BioNet), PMST BAM-C	Species	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	99 (BioNet), PMST BAM-C	Dual	Moderate
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	5 (BioNet)	Ecosystem	Moderate
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	19 (BioNet)	Ecosystem	Moderate
<b>Reptiles</b>						
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	28 (BioNet), PMST BAM-C	Dual	Moderate
<i>Varanus rosenbergi</i>	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
<b>Flora</b>					

Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? <sup>1</sup>	Results
<i>Acacia bynoeana</i> (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.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	V	-	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (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.
<i>Melaleuca deanei</i> (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.
<i>Persoonia bargoensis</i> (Bargo Geebung)	E	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
<i>Persoonia hirsuta</i> (Hairy Geebung)	E	E	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	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? <sup>1</sup>	Results
<i>Pomaderris brunnea</i> (Brown Pomaderris)	E	V	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
<b>Birds</b>					
<i>Anthochaera phrygia</i> (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 transitional basis but would not be dependent on it.
<i>Burhinus grillarius</i> (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 transitional basis but would not be dependent on it.
<i>Callocephalon fimbriatum</i> (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 transitional 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? <sup>1</sup>	Results
<i>Calyptorhynchus lathami</i> (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 transitional basis but would not be dependent on it.
<i>Haliaeetus leucogaster</i> (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 transitional basis but would not be dependent on it.
<i>Hieraaetus morphnoides</i> (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 transitional basis but would not be dependent on it.
<i>Lathamus discolor</i> (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 transitional 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? <sup>1</sup>	Results
<i>Lophoictinia isura</i> (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 transitional basis but would not be dependent on it.
<i>Ninox connivens</i> (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 transitional basis but would not be dependent on it. No suitable breeding hollows occur within the study area.
<i>Ninox strenua</i> (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 transitional basis but would not be dependent on it. No suitable breeding hollows occur within the study area.

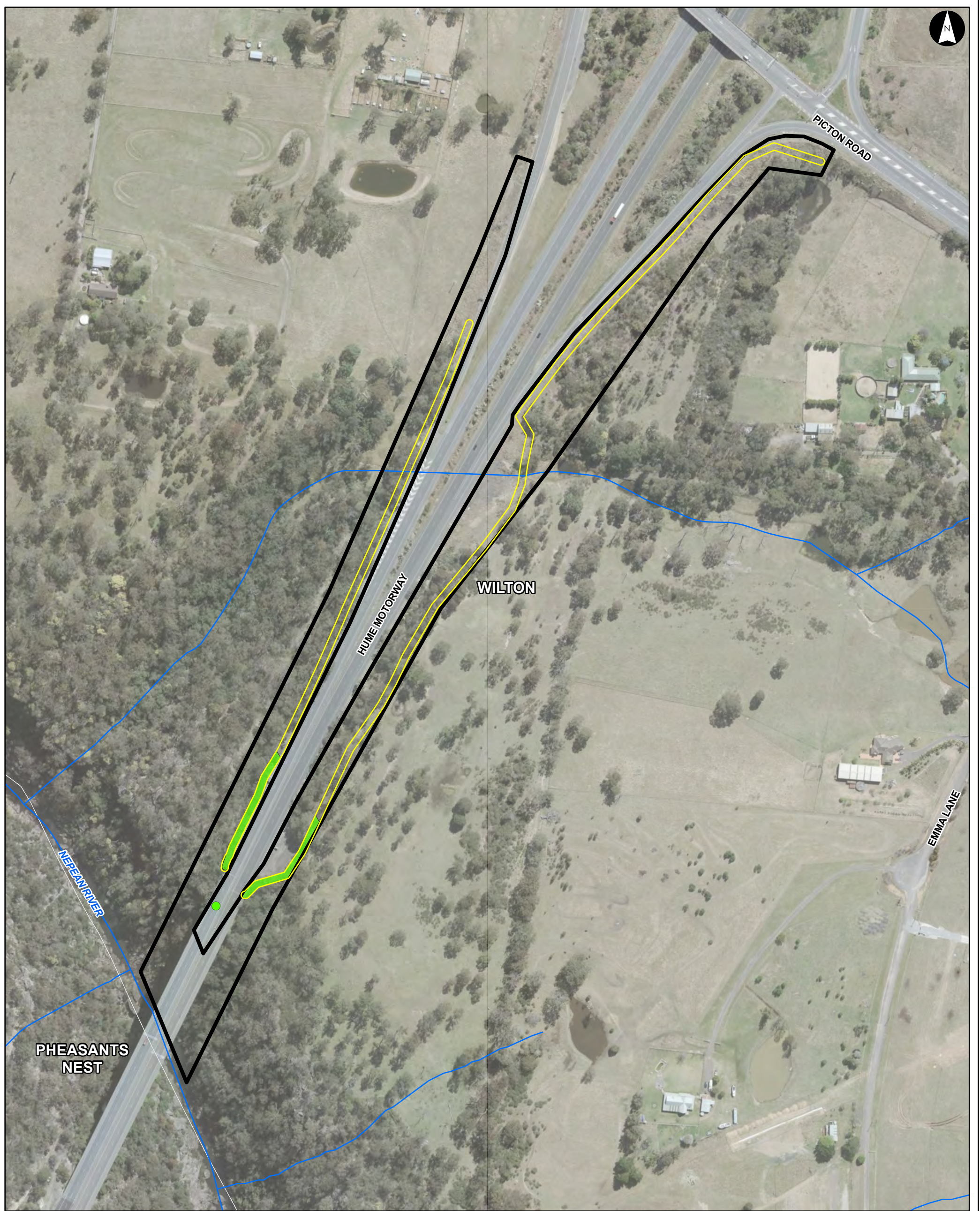


Species	BC Act	EP BC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant? <sup>1</sup>	Results
<i>Tyto novaehollandiae</i> (Masked Owl)	V	-	Not recorded	Yes	Dual Credit species.  This species is associated with PCT 1395, however was not detected during targeted surveys.  It has the potential to use habitat within the study area on a transitional basis but would not be dependent on it. No suitable breeding hollows occur within the study area.
<b>Reptiles</b>					
<i>Hoplocephalus bungaroides</i> (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 transitional basis but would not be dependent on it.
<b>Mammals</b>					
<i>Cercartetus nanus</i> (Eastern Pygmy-possum)	V	-	Not recorded	Yes	Species Credit species.  This species is associated with PCT 1395, however was not detected during targeted surveys.
<i>Chalinolobus dwyeri</i> (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? <sup>1</sup>	Results
<i>Miniopterus australis</i> (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.
<i>Miniopterus orianae oceanensis</i> (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.
<i>Myotis macropus</i> (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.
<i>Petauroides volans</i> (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? <sup>1</sup>	Results
<i>Petaurus norfolcensis</i> (Squirrel Glider)	V	-	Not recorded	Yes	Species Credit species. This species is associated with PCT 1395, however was not detected during targeted surveys.
<i>Phascolarctos cinereus</i> (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.
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	V	V	Not recorded	Yes	Dual Credit species. No breeding camps occur within the study area.
<b>Gastropods</b>					
<i>Meridolum corneovirens</i> (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.
<b>Amphibians</b>					
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	V	V	Not recorded	Yes	Species credit species. No suitable habitat is present within the study area.
<i>Litoria littlejohni</i> (Littlejohn's Tree Frog)	V	V	Not recorded	Yes	Species credit species. No suitable habitat is present within the study area.
<i>Mixophyes balbus</i> (Stuttering Frog)	E	V	Not recorded	Yes	Species credit species. No suitable habitat is present within the study area.
<i>Note: 1. As identified in Section 2.4 of this BAR.</i>					





**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



**Legend**

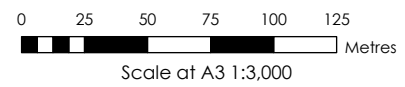
- Study Area
- Subject Land
- Major Road
- Watercourse
- Cadastre

**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)





### 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.





**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



**Legend**

- Study Area
- Subject Land
- Major Road
- Macquarie Perch Indicative Distribution
- Cadastre
- Wollondilly Key Fish Habitat

**Stream Order**

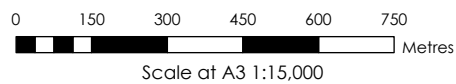
- 1, 2
- 3
- 4
- 6
- 7

**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)





### **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.

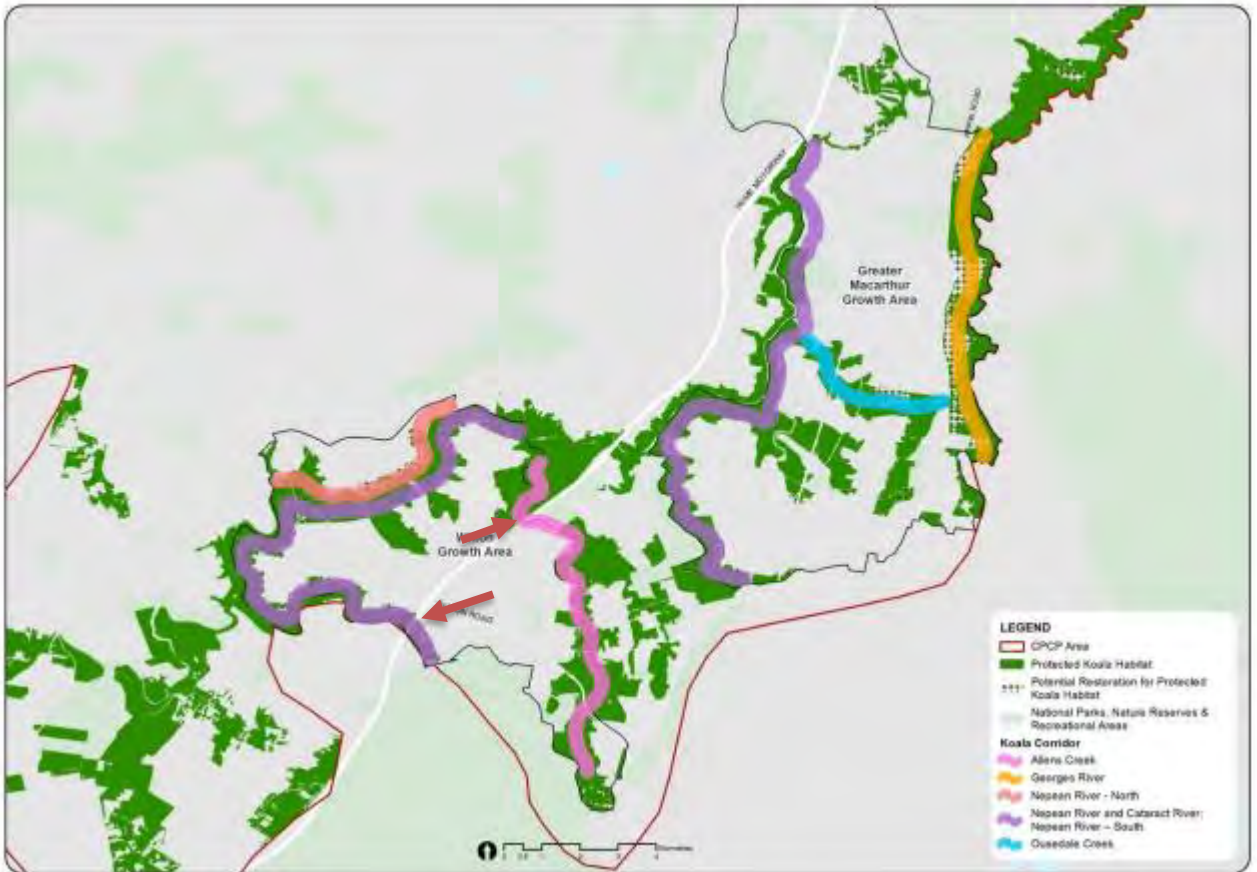


Figure 3-8: Identified Koala corridors (study area location represented by red arrows) (DPIE 2019c)

### 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

MNES	PMST predicted	Applicability to subject land																																			
Great Barrier Reef Marine Park	None	NA																																			
Commonwealth Marine Area	None	NA																																			
Threatened Ecological Communities (TECs)	A total of 13 TECs are predicted as likely or may occur within 10km of the subject land, including: <ul style="list-style-type: none"> <li>• Four endangered TECs; and</li> <li>• Nine critically endangered TECs</li> </ul>	Further assessment is presented in Section 3.4																																			
Threatened Species	A total of 66 threatened species were predicted to occur within 10km of the subject land as per table below. <table border="1" data-bbox="491 667 1086 947"> <thead> <tr> <th rowspan="2">Group</th> <th colspan="3">Number of species predicted</th> </tr> <tr> <th>Vulnerable</th> <th>Endangered</th> <th>Critically endangered</th> </tr> </thead> <tbody> <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> </tbody> </table>	Group	Number of species predicted			Vulnerable	Endangered	Critically endangered	Birds	4	4	4	Fish	-	1	-	Frogs	3	2	-	Mammals	7	3	-	Plants	21	12	2	Reptiles	2	-	-	Insects	-	1	-	Further assessment is presented in Section 3.6
Group	Number of species predicted																																				
	Vulnerable	Endangered	Critically endangered																																		
Birds	4	4	4																																		
Fish	-	1	-																																		
Frogs	3	2	-																																		
Mammals	7	3	-																																		
Plants	21	12	2																																		
Reptiles	2	-	-																																		
Insects	-	1	-																																		
Migratory Species	A total of 16 migratory species were predicted to occur within 10km of the subject land.	Further assessment is presented in Section 3.10																																			
<b>Other matters</b>																																					
Commonwealth Lands	A total of 11 Commonwealth land parcels were predicted to occur within 10km of the subject land.	Listed Commonwealth lands do not occur within the subject land																																			
Commonwealth Heritage Places	None	NA																																			
Listed Marine Species	A total of 22 Listed Marine Species were predicted to occur within 10km of the subject land.	Further assessment of threatened species was undertaken as shown in Appendix B.																																			
Whales and Other Cetaceans	None	NA																																			
Critical Habitats	None	NA																																			
Commonwealth Reserves Terrestrial	None	NA																																			
Australian Marine Parks	None	NA																																			
Habitat Critical to the Survival of Marine Turtles	None	NA																																			



### 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 understorey within the study area.
The canopy is a mix of native tree species typically including two or more of the following: <i>Eucalyptus punctata</i> (grey gum), <i>E. crebra</i> (narrow-leaved ironbark), <i>E. fibrosa</i> subsp. <i>fibrosa</i> (broad-leaved ironbark), <i>E. tereticornis</i> subsp. <i>tereticornis</i> (forest red gum), <i>E. resinifera</i> subsp. <i>resinifera</i> (red mahogany), <i>E. eugenioides</i> (or <i>E. globoidea</i> depending on local species present and degree of sandstone influence) and <i>Angophora bakeri</i> (narrow-leaved apple).	Meets key diagnostic characteristic. Dominant tree species within the subject land include <i>Eucalyptus punctata</i> and <i>Eucalyptus fibrosa</i> .
<p>Where present the mid layer of the understorey varies in structure and floristics.</p> <p>Where present, the small tree layer is likely to be dominated by Eucalypt species and <i>Allocasuarina littoralis</i> (black she-oak).</p> <p>Where shrubs are present, the mid layer is likely to be dominated by <i>Bursaria spinosa</i> (blackthorn) in areas with low sandstone influence, with other common species including <i>Leucopogon juniperinus</i>, <i>Kunzea ambigua</i> (tick bush), <i>Persoonia linearis</i> (narrow-leaved geebung), <i>Ozothamnus diosmifolius</i> (rice flower, sago bush, white dogwood) and <i>Hibbertia aspera</i> (rough guinea flower)</p>	Meets key diagnostic characteristic. Shrubs within the subject land include <i>Bursaria spinosa</i> (blackthorn), <i>Leucopogon juniperinus</i> , <i>Kunzea ambigua</i> (tick bush) and <i>Persoonia linearis</i> (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
<b>Location of the proposal</b>	
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.
<b>Design refinement of the proposal</b>	
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.	

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:
  - o Barrier effect of fencing; and
  - o Maintenance of fencing.

Potential impacts of the proposal are listed below. Further detail is provided in section 5.1 and 5.2.

- Construction impacts:
  - o Removal of native vegetation
  - o Removal of threatened fauna species habitat and habitat features
  - o Injury and mortality of fauna
- Operation/indirect impacts:
  - o Wildlife connectivity and habitat fragmentation
  - o Edge effects on adjacent native vegetation and habitat
  - o Injury and mortality
  - o Invasion and spread of weeds
  - o Invasion and spread of pests
  - o Invasion and spread of pathogens and disease
  - o 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	Shale Sandstone Transition Forest in the Sydney Basin Bioregion – listed as critically endangered under the BC Act	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, decorticated 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 transitional 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
<i>Ageratina adenophora</i>	Crofton Weed	Few individuals in Northern Hume
<i>Bidens pilosa</i>	Cobbler's Pegs	Scattered individuals throughout the study area
<i>Chloris gayana</i>	Rhodes Grass	Abundant throughout the study area, particularly along the roadside
<i>Paspalum dilatatum</i>	Paspalum	Infestation in the south-western portion of the study area
<i>Asparagus aethiopicus</i>	Asparagus Fern	Few individuals in the south-eastern portion of the study area
<i>Lantana camara</i>	Lantana	Scattered juveniles in Northern Hume
<i>Rubus fruticosus</i> sp. agg.	Blackberry complex	Small patches present in the western portions of Southern Hume and Northern Hume
<i>Senecio madagascariensis</i>	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

Threatened species, or communities	Significance assessment question*					Likely significant impact?
	a	b	c	d	e	
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	X	N	N	N	N	No
<i>Meridolum corneovirens</i> (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
<i>Dasyurus maculatus</i> (Spotted-Tail Quoll)	N	X	N	N	N	No
<i>Pteropus poliocephalus</i> (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?
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	N	N
<i>Calyptorhynchus lathami lathami</i> (South-eastern Glossy Black-Cockatoo)	N	N
<i>Hirundapus caudacutus</i> (White-throated Needletail)	N	N
<i>Lathamus discolor</i> (Swift Parrot)	N	N
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	N	N
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	N	N
<i>Petauroides volans</i> (Greater Glider (southern and central))	N	N
<i>Petaurus australis australis</i> (Yellow-bellied Glider (south-eastern))	N	N
<i>Phascolarctos cinereus</i> (Koala)	Y+	N
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	Y+	N
<i>Hoplocephalus bungaroides</i> (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

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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 <i>Guide 1: Pre-clearing process</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	Prior to construction	Effective		Contractor
	Vegetation removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock</i> of the <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective		Contractor
	The unexpected species find procedure is to be followed under <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	None	Contractor
	Habitat removal will be undertaken in accordance with <i>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Guide 5: Re-use of woody debris and bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Proven	None	Contractor
Removal of threatened flora	Pre-clearing surveys will be undertaken in accordance with <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Proven	None	Contractor
	The unexpected species find procedure is to be followed under <i>Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Draft Wildlife Connectivity Guidelines for Road Projects</i> (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 <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	None	Contractor
Injury and mortality of fauna	Fauna will be managed in accordance with <i>Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA 2011).	During construction	Effective	None	Contractor
Invasion and spread of weeds	Weed species will be managed in accordance with <i>Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (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 <i>Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011)</i> .	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 $\geq$ 2 ha in 'moderate to good' condition
Works involving clearing of VEC	Where clearing of VEC $\geq$ 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 $\geq$ 1 ha in 'moderate to good' condition
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is $\geq$ 10 or where clearing of habitat is $\geq$ 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 $\geq$ 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	<b>Yes</b> 'Where there is any clearing of a CEEC in 'moderate to good' condition'
2		Moderate-Good	Critically endangered (BC Act)	55.4	0.20	<b>Yes</b> '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	<b>Yes</b> '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?
<i>Myotis macropus</i> (Southern Myotis)	-	Vulnerable	1	0.08	<b>No</b> 'Clearing area is not ≥ 1 ha in 'moderate to good' condition'
			2	0.01	<b>No</b> 'Clearing area is not ≥ 1 ha in 'moderate to good' condition'

The assessment in 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	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 ( $\geq 5\text{cm}$  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

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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.

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## Appendix A – BioNet Search

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
<b>Amphibians</b>					
Hylidae	<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	44
Myobatrachidae	<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	-	2
<b>Birds</b>					
Acanthizidae	<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	4
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	-	7
Accipitridae	<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	17
Accipitridae	<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	9
Apodidae	<i>Apus pacificus</i>	Fork-tailed Swift	-	C,J,K	1
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail	-	V,C,J,K	6
Artamidae	<i>Artamus cyanopterus</i>	Dusky Woodswallow	V	-	43
Burhinidae	<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	2
Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	E	15
Cacatuidae	<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-	45
Climacteridae	<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	22
Dasyornithidae	<i>Pycnoptilus floccosus</i>	Pilotbird	-	V	19
Estrildidae	<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	12
Falconidae	<i>Falco subniger</i>	Black Falcon	V	-	2
Laridae	<i>Onychoprion fuscata</i>	Sooty Tern	V	-	1

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Meliphagidae	<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	4
Meliphagidae	<i>Melithreptus gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	-	10
Neosittidae	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	46
Petroicidae	<i>Melanodryas cucullata</i>	Hooded Robin (south-eastern form)	V	-	2
Petroicidae	<i>Petroica boodang</i>	Scarlet Robin	V	-	25
Petroicidae	<i>Petroica phoenicea</i>	Flame Robin	V	-	2
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	62
Psittacidae	<i>Lathamus discolor</i>	Swift Parrot	E	CE	5
Psittacidae	<i>Neophema pulchella</i>	Turquoise Parrot	V	-	4
Strigidae	<i>Ninox connivens</i>	Barking Owl	V	-	2
Strigidae	<i>Ninox strenua</i>	Powerful Owl	V	-	31
Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	V	-	3
<b>Gastropods</b>					
Camaenidae	<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E	-	47
<b>Insects</b>					
Petaluridae	<i>Petalura gigantea</i>	Giant Dragonfly	E	-	1
<b>Mammals</b>					
Burramyidae	<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	31
Dasyuridae	<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	10
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	5



Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Macropodidae	<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	1
Miniopteridae	<i>Miniopterus australis</i>	Little Bent-winged Bat	V	-	12
Miniopteridae	<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	32
Molossidae	<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	27
Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	V	V	3
Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	8
Phascolarctidae	<i>Phascolarctos cinereus</i>	Koala	E	E	1192
Pseudocheiridae	<i>Petauroides volans</i>	Greater Glider		E	15
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	99
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	28
Vespertilionidae	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	9
Vespertilionidae	<i>Myotis macropus</i>	Southern Myotis	V	-	194
Vespertilionidae	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	19
<b>Reptiles</b>					
Elapidae	<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	28
Varanidae	<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V	-	4
<b>Flora</b>					
Apocynaceae	<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	9
Ericaceae	<i>Epacris purpurascens</i> var. <i>purpurascens</i>		V	-	286

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Ericaceae	<i>Leucopogon exolasius</i>	Woronora Beard-heath	V	V	7
Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>		V	-	2
Fabaceae (Faboideae)	<i>Pultenaea aristata</i>	Prickly Bush-pea	V	V	1
Fabaceae (Faboideae)	<i>Pultenaea pedunculata</i>	Matted Bush-pea	E	-	9
Fabaceae (Mimosoideae)	<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	47
Grammitidaceae	<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	E	-	1
Gyrostemonaceae	<i>Gyrostemon thesioides</i>		E	-	1
Myrtaceae	<i>Darwinia peduncularis</i>		V	-	2
Myrtaceae	<i>Eucalyptus macarthurii</i>	Paddys River Box, Camden Woollybutt	E	E	1
Myrtaceae	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	1
Myrtaceae	<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	43
Myrtaceae	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	3
Orchidaceae	<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E	E	1
Orchidaceae	<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	1
Polygonaceae	<i>Persicaria elatior</i>	Tall Knotweed	V	V	1
Proteaceae	<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	V	V	551
Proteaceae	<i>Macadamia integrifolia</i>	Macadamia Nut	-	V	2
Proteaceae	<i>Persoonia bargoensis</i>	Bargo Geebung	E	V	623
Proteaceae	<i>Persoonia glaucescens</i>	Mittagong Geebung	E	V	47
Proteaceae	<i>Persoonia hirsuta</i>	Hairy Geebung	E	E	8

Family	Scientific Name	Common Name	BC Act	EPBC Act	Records
Proteaceae	<i>Persoonia nutans</i>	Nodding Geebung	E	E	1
Rhamnaceae	<i>Pomaderris brunnea</i>	Brown Pomaderris	E	V	16
Rubiaceae	<i>Galium australe</i>	Tangled Bedstraw	E	-	1
Thymelaeaceae	<i>Pimelea curviflora</i> <i>var. curviflora</i>		V	V	2
Thymelaeaceae	<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	16



## **Appendix B – PMST Search Results**



# 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](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance (Ramsar)</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	13
<a href="#">Listed Threatened Species:</a>	64
<a href="#">Listed Migratory Species:</a>	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.

<a href="#">Commonwealth Lands:</a>	11
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	22
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None
<a href="#">Habitat Critical to the Survival of Marine Turtles:</a>	None

## Extra Information

This part of the report provides information that may also be relevant to the area you have

<a href="#">State and Territory Reserves:</a>	1
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Nationally Important Wetlands:</a>	1
<a href="#">EPBC Act Referrals:</a>	21
<a href="#">Key Ecological Features (Marine):</a>	None
<a href="#">Biologically Important Areas:</a>	None
<a href="#">Bioregional Assessments:</a>	1
<a href="#">Geological and Bioregional Assessments:</a>	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
<a href="#">Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion</a>	Endangered	Community may occur	In feature area within area
<a href="#">Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland</a>	Endangered	Community may occur	In feature area within area
<a href="#">Coastal Upland Swamps in the Sydney Basin Bioregion</a>	Endangered	Community likely to occur	In feature area within area
<a href="#">Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion</a>	Critically Endangered	Community may occur	In feature area within area
<a href="#">Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest</a>	Critically Endangered	Community likely to occur	In buffer area only within area
<a href="#">Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion</a>	Critically Endangered	Community may occur	In buffer area only within area
<a href="#">River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria</a>	Critically Endangered	Community may occur	In feature area within area
<a href="#">Shale Sandstone Transition Forest of the Sydney Basin Bioregion</a>	Critically Endangered	Community likely to occur	In feature area within area
<a href="#">Southern Highlands Shale Forest and Woodland in the Sydney Basin Bioregion</a>	Critically Endangered	Community may occur	In buffer area only within area
<a href="#">Turpentine-Ironbark Forest of the Sydney Basin Bioregion</a>	Critically Endangered	Community likely to occur	In buffer area only within area
<a href="#">Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion</a>	Endangered	Community may occur	In feature area within area
<a href="#">Western Sydney Dry Rainforest and Moist Woodland on Shale</a>	Critically Endangered	Community likely to occur	In feature area within area

Community Name	Threatened Category	Presence Text	Buffer Status
<a href="#">White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland</a>	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
<b>BIRD</b>			
<a href="#">Anthochaera phrygia</a> Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Callocephalon fimbriatum</a> Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Calyptorhynchus lathami lathami</a> South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Dasyornis brachypterus</a> Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area	In buffer area only
<a href="#">Erythrorchis radiatus</a> Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Falco hypoleucos</a> Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Grantiella picta</a> Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Lathamus discolor</a> Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Pycnoptilus floccosus</a> Pilotbird [525]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
<b>FISH</b>			
<a href="#">Macquaria australasica</a> Macquarie Perch [66632]	Endangered	Species or species habitat known to occur within area	In feature area
<b>FROG</b>			
<a href="#">Heleioporus australiacus</a> Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Litoria aurea</a> Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Litoria littlejohni</a> Littlejohn's Tree Frog, Heath Frog [64733]	Endangered	Species or species habitat known to occur within area	In buffer area only
<a href="#">Litoria watsoni</a> Watson's Tree Frog [91509]	Endangered	Species or species habitat may occur within area	In buffer area only
<a href="#">Mixophyes balbus</a> 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
<a href="#">Austrocordulia leonardi</a> Sydney Hawk Dragonfly [84741]	Endangered	Species or species habitat known to occur within area	In feature area
<b>MAMMAL</b>			
<a href="#">Chalinolobus dwyeri</a> Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Dasyurus maculatus maculatus (SE mainland population)</a> 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
<a href="#">Isoodon obesulus obesulus</a> Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area	In buffer area only
<a href="#">Petauroides volans</a> Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Petaurus australis australis</a> Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Petrogale penicillata</a> Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</a> 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
<a href="#">Potorous tridactylus trisulcatus</a> Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Pseudomys novaehollandiae</a> New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Pteropus poliocephalus</a> Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	In feature area

**PLANT**

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Acacia bynoeana</a> Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Allocasuarina glareicola</a> [21932]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Caladenia tessellata</a> Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Commersonia prostrata</a> Dwarf Kerrawang [87152]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Cryptostylis hunteriana</a> Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
<a href="#">Cynanchum elegans</a> White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Eucalyptus benthamii</a> Camden White Gum, Nepean River Gum [2821]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Genoplesium baueri</a> Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Grevillea parviflora subsp. parviflora</a> Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Grevillea raybrownii</a> [65665]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Hakea dohertyi</a> Kowung Hakea [66701]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Haloragis exalata subsp. exalata</a> Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Leucopogon exolasius</a> Woronora Beard-heath [14251]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Melaleuca deanei</a> Deane's Melaleuca [5818]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Persicaria elatior</a> Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area	In feature area
<a href="#">Persoonia bargoensis</a> Bargo Geebung [56267]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Persoonia glaucescens</a> Mittagong Geebung [12770]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
<a href="#">Persoonia hirsuta</a> Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Persoonia mollis subsp. revoluta</a> [56094]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<a href="#">Persoonia nutans</a> Nodding Geebung [18119]	Endangered	Species or species habitat may occur within area	In buffer area only
<a href="#">Pimelea spicata</a> Spiked Rice-flower [20834]	Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Pomaderris brunnea</a> 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
<a href="#">Pomaderris cotoneaster</a> Cotoneaster Pomaderris [2043]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Pterostylis saxicola</a> Sydney Plains Greenhood [64537]	Endangered	Species or species habitat known to occur within area	In feature area
<a href="#">Pultenaea aristata</a> [18062]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
<a href="#">Rhizanthella slateri</a> Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Rhodamnia rubescens</a> Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Syzygium paniculatum</a> 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
<a href="#">Thelymitra kangaloonica</a> Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
<a href="#">Thesium australe</a> Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Xerochrysum palustre</a> Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat may occur within area	In buffer area only
<b>REPTILE</b>			
<a href="#">Delma impar</a> Striped Legless Lizard, Striped Snake-lizard [1649]	Vulnerable	Species or species habitat may occur within area	In feature area
<a href="#">Hoplocephalus bungaroides</a> Broad-headed Snake [1182]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<b>Migratory Marine Birds</b>			
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
<b>Migratory Terrestrial Species</b>			
<a href="#">Cuculus optatus</a> Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
<a href="#">Symposiachrus trivirgatus as Monarcha trivirgatus</a> Spectacled Monarch [83946]		Species or species habitat may occur within area	In buffer area only
<b>Migratory Wetlands Species</b>			
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area	In feature area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area	In feature area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
<a href="#">Tringa nebularia</a> 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
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#### Listed Marine Species [ [Resource Information](#) ]

Scientific Name	Threatened Category	Presence Text	Buffer Status
<b>Bird</b>			
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
<a href="#">Bubulcus ibis as Ardea ibis</a> Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area	In feature area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Chalcites osculans as Chrysococcyx osculans</a> 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
<a href="#">Gallinago hardwickii</a> Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area overfly marine area	In feature area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
<a href="#">Hirundapus caudacutus</a> White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Lathamus discolor</a> Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Monarcha melanopsis</a> Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Motacilla flava</a> Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Myiagra cyanoleuca</a> Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Neophema chrysostoma</a> Blue-winged Parrot [726]		Species or species habitat may occur within area overfly marine area	In feature area
<a href="#">Numenius madagascariensis</a> 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
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
<a href="#">Rhipidura rufifrons</a> Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
<a href="#">Rostratula australis as Rostratula benghalensis (sensu lato)</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
<a href="#">Symposiachrus trivirgatus as Monarcha trivirgatus</a> Spectacled Monarch [83946]		Species or species habitat may occur within area overfly marine area	In buffer area only
<a href="#">Tringa nebularia</a> 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			[ <a href="#">Resource Information</a> ]
Protected Area Name	Reserve Type	State	Buffer Status
Upper Nepean	State Conservation Area	NSW	In buffer area only

Nationally Important Wetlands			[ <a href="#">Resource Information</a> ]
Wetland Name		State	Buffer Status
<a href="#">Thirlmere Lakes</a>		NSW	In buffer area only

EPBC Act Referrals					[ <a href="#">Resource Information</a> ]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status	
<a href="#">Controlled action</a>					
<a href="#">Bingara Gorge staged residential development, NSW</a>	2014/7400	Controlled Action	Post-Approval	In feature area	
<a href="#">Clearing of vegetation for several facilities, Bargo, NSW</a>	2009/5058	Controlled Action	Completed	In buffer area only	
<a href="#">Consolidation of Existing Operations, Continuation of Underground Mining and Upgrade of Facilities a</a>	2009/5142	Controlled Action	Completed	In buffer area only	



Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
<b>Controlled action</b>				
<a href="#">Construction of a ventilation shaft and access Road to service underground operations</a>	2010/5722	Controlled Action	Post-Approval	In buffer area only
<a href="#">Cross Street Residential Development</a>	2019/8537	Controlled Action	Further Information Request	In buffer area only
<a href="#">Dendrobium Mine extension, Cordeaux Rd, Mount Kembla, NSW</a>	2017/7855	Controlled Action	Assessment Approach	In buffer area only
<a href="#">Dendrobium Mine Extension Project</a>	2021/9115	Controlled Action	Assessment Approach	In buffer area only
<a href="#">Expansion of the NRE No. 1 Colliery Coal Mine in the Southern Coalfield of NSW</a>	2013/6838	Controlled Action	Completed	In buffer area only
<a href="#">Extension of subsurface longwall mining, Wonga West and Wonga East</a>	2010/5786	Controlled Action	Completed	In buffer area only
<a href="#">Extension of Underground Mining Operations at The Bulli Seam Operations</a>	2010/5350	Controlled Action	Post-Approval	In feature area
<a href="#">Mt Gilead Stage 2 Residential Development</a>	2019/8587	Controlled Action	Further Information Request	In buffer area only
<a href="#">Residential development, 19 Tickle Drive, Thirlmere NSW</a>	2018/8318	Controlled Action	Post-Approval	In buffer area only
<a href="#">Residential development, Lots 8-9 and Lot 2 Bronzewing St and Byron Road, Tahmoor, NSW</a>	2016/7808	Controlled Action	Post-Approval	In buffer area only
<a href="#">Russell Vale Colliery Revised Underground Expansion Project</a>	2020/8702	Controlled Action	Post-Approval	In buffer area only
<a href="#">Russell Vale Colliery Underground Expansion Project, NSW</a>	2014/7268	Controlled Action	Completed	In buffer area only
<a href="#">Tahmoor South longwall coal mining project, Southern Coalfields, NSW</a>	2014/7162	Controlled Action	Completed	In buffer area only
<a href="#">Tahmoor South Project, NSW</a>	2017/8084	Controlled Action	Post-Approval	In buffer area only
<b>Not controlled action</b>				
<a href="#">Construction of a new rail track deviation of Main Southern Railway at Tahmoor</a>	2011/5794	Not Controlled Action	Completed	In buffer area only
<a href="#">Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia</a>	2015/7522	Not Controlled Action	Completed	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
<b>Not controlled action</b>				
<a href="#">INDIGO Central Submarine Telecommunications Cable</a>	2017/8127	Not Controlled Action	Completed	In feature area
<b>Not controlled action (particular manner)</b>				
<a href="#">INDIGO Marine Cable Route Survey (INDIGO)</a>	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area

## Bioregional Assessments

SubRegion	BioRegion	Website	Buffer Status
Sydney	Sydney Basin	<a href="#">BA website</a>	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.

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## 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	<p>A species is considered highly likely to occur in the study area if:</p> <ul style="list-style-type: none"> <li>There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present.</li> </ul> <p><u>OR</u></p> <ul style="list-style-type: none"> <li>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.</li> </ul>
Moderate	<p>A species is considered moderately likely to occur in the study area if:</p> <ul style="list-style-type: none"> <li>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.</li> </ul> <p><u>OR</u></p> <ul style="list-style-type: none"> <li>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.</li> </ul> <p><u>OR</u></p> <ul style="list-style-type: none"> <li>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.</li> </ul>

**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 ( <i>Corymbia gummifera</i> ), Scribbly Gum ( <i>Eucalyptus haemastoma</i> ), Drooping Red Gum ( <i>E. parramattensis</i> ), Old Man Banksia ( <i>Banksia serrata</i> ) and Small-leaved Apple ( <i>Angophora bakeri</i> ).	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 <i>Eucalyptus parramattensis</i> , <i>Eucalyptus fibrosa</i> , <i>Angophora bakeri</i> , <i>Eucalyptus sclerophylla</i> and <i>Melaleuca decora</i> . Common associated understorey species include <i>Melaleuca nodosa</i> , <i>Hakea dactyloides</i> , <i>Hakea sericea</i> , <i>Dillwynia tenuifolia</i> , <i>Micromyrtus minutiflora</i> , <i>Acacia elongata</i> , <i>Acacia brownei</i> , <i>Themeda australis</i> and <i>Xanthorrhoea minor</i> .	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 ( <i>Eucalyptus pauciflora</i> ) Woodland and Ephemeral Wetland floor at Rowes Lagoon; Blue leaved Stringybark ( <i>E. agglomerata</i> ) Open Forest at Tallong; and in Brittle Gum ( <i>E. mannifera</i> ) Low Open Woodland at Penrose; Scribbly Gum ( <i>E. haemostoma</i> )/ Swamp Mahogany ( <i>E. robusta</i> ) 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 <i>E. racemosa</i> (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				
<i>Cynanchum elegans</i> (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 <i>Leptospermum laevigatum</i> – Coastal Banksia <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> coastal scrub; Forest Red Gum <i>Eucalyptus tereticornis</i> aligned open forest and woodland; Spotted Gum <i>Corymbia maculata</i> aligned open forest and woodland; and Bracelet Honey Myrtle <i>Melaleuca armillaris</i> scrub to open scrub.	9 (BioNet), PMST	Unlikely. Suitable habitat for the species is absent from the study area.
<i>Darwinia peduncularis</i>	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.
<i>Dillwynia tenuifolia</i>	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.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	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				
<i>Eucalyptus benthamii</i> (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 <i>Eucalyptus elata</i> , <i>E. bauerina</i> , <i>E. amplifolia</i> , <i>E. deanei</i> and <i>Angophora subvelutina</i> . Understorey species include <i>Bursaria spinosa</i> , <i>Pteridium esculentum</i> and a wide variety of agricultural weeds. The Kedumba Valley site lists <i>E. crebra</i> , <i>E. deanei</i> , <i>E. punctata</i> , <i>Leptospermum flavescens</i> , <i>Acacia filicifolia</i> and <i>Pteridium esculentum</i> 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.
<i>Eucalyptus macarthurii</i> (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.
<i>Eucalyptus nicholii</i> (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				
<i>Galium australe</i> (Tangled Bedstraw)	E	-	Species	Widespread 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.
<i>Genoplesium baueri</i> (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.
<i>Grammitis stenophylla</i> (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.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (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				
<i>Grevillea raybrownii</i>	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.
<i>Gyrostemon thesioides</i>	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.
<i>Hakea dohertyi</i> (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.
<i>Haloragis exalata</i> subsp. <i>exalata</i> (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.
<i>Leucopogon exolasius</i> (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				
<i>Persoonia bargoensis</i> (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 Gynea 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.
<i>Persoonia glaucescens</i> (Mittagong Geebung)	E	V	Species	The Mittagong Geebung grows in woodland to dry sclerophyll forest on clayey and gravelly 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.
<i>Persoonia hirsuta</i> (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				
<i>Persoonia mollis</i> subsp. <i>revoluta</i>	V	-	Species	<i>Persoonia mollis</i> subsp. <i>revoluta</i> 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.
<i>Persoonia nutans</i> (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.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	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				
<i>Pimelea spicata</i> (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 ( <i>E. tereticornis</i> ) and stringybark ( <i>E. eugenioides</i> ), with a groundcover dominated by kangaroo grass ( <i>Themeda australis</i> ) and matrush ( <i>Lomandra longifolia</i> ). The grassland sites are dominated by kangaroo grass ( <i>Themeda australis</i> ) and matrush ( <i>Lomandra longifolia</i> ), with blady grass ( <i>Imperata cylindrica</i> ). A shrubby layer, where present, is dominated by coastal wattle ( <i>Acacia sophorae</i> ) and coast rosemary ( <i>Westringia fruticosa</i> ) with coast banksia ( <i>Banksia integrifolia</i> ).	16 (BioNet), PMST	Low. Associated suitable habitat is not present within the study area. The species has not been recorded in the locality.
<i>Pomaderris brunnea</i> (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 <i>Eucalyptus amplifolia</i> , <i>Angophora floribunda</i> , <i>Acacia parramattensis</i> , <i>Bursaria spinosa</i> and <i>Kunzea ambigua</i> .	16 (BioNet), PMST	Low. This species was not detected within the study area following targeted surveys.
<i>Pomaderris cotoneaster</i> (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				
<i>Pterostylis saxicola</i> (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 <i>Pterostylis saxicola</i> 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.
<i>Pultenaea aristata</i> (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.
<i>Pultenaea pedunculata</i> (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.
<i>Rhizanthella slateri</i> (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.
<i>Rhodamnia rubescens</i> (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				
<i>Syzygium paniculatum</i> (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.
<i>Thelymitra kangaloonica</i> (Kangaloon Sun Orchid)	CE	CE	Species	It is found in swamps in sedgeland over grey silty grey loam soils.	PMST	Unlikely. Suitable habitat for the species is absent from the study area.
<i>Thesium australe</i> (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 ( <i>Themeda australis</i> ).	PMST	Unlikely. Suitable habitat for the species is absent from the study area.
<i>Xerochrysum palustre</i> (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 ( <i>Amphibromus</i> spp.), Twig-sedges ( <i>Baumea</i> spp.), Sedges ( <i>Carex</i> spp.), Chorizandra, Billy-buttons ( <i>Craspedia</i> spp.), Spike-sedges ( <i>Eleocharis</i> spp.), Club-sedges ( <i>Isolepis</i> spp.), Blowngrasses ( <i>Lachnagrostis</i> spp.), Sword-sedges ( <i>Lepidosperma</i> spp.), Water-milfoils ( <i>Myriophyllum</i> spp.), Common reed ( <i>Phragmites australis</i> ), Kangaroo grass ( <i>Themeda triandra</i> ) and <i>Villarsia</i> . 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				
<i>Anthochaera phrygia</i> (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.
<i>Artamus cyanopterus cyanopterus</i> (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.
<i>Botaurus poiciloptilus</i> (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 ( <i>Typha</i> spp.) and Spikerushes ( <i>Eleocharis</i> spp.).	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
<i>Burhinus grallarius</i> (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				
<i>Calidris ferruginea</i> (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.
<i>Callocephalon fimbriatum</i> (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.
<i>Calyptorhynchus lathami</i> 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 ( <i>Allocasuarina littoralis</i> ) and Forest She-oak ( <i>A. torulosa</i> ) 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				
<i>Chthonicola sagittata</i> (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.
<i>Climacteris picumnus victoriae</i> (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 ( <i>Eucalyptus camaldulensis</i> ) 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.
<i>Daphoenositta chrysoptera</i> (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.
Erythrorchis 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 ( <i>Acacia pendula</i> ), Brigalow ( <i>A. harpophylla</i> ) 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				
<i>Haliaeetus leucogaster</i> (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.
<i>Hieraaetus morphnoides</i> (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.
<i>Hirundapus caudacutus</i> (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	<p>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.</p> <p>Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey.</p>	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	<p>Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>).</p> <p>Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.</p>	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	<p>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.</p>	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 <i>Syncarpia glomulifera</i> , Black She-oak <i>Allocasuarina littoralis</i> , Blackwood <i>Acacia melanoxylon</i> , Rough-barked Apple <i>Angophora floribunda</i> , Cherry Ballart <i>Exocarpus cupressiformis</i> 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				
<i>Petroica phoenicea</i> (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 sedgeland 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.
<i>Pycnoptilus floccosus</i> (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.
<i>Rostratula australis</i> (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				
<i>Stagonopleura guttata</i> (Diamond Firetail)	V	-	Ecosystem	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> 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.
<i>Tyto novaehollandiae</i> (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						
<i>Cercartetus nanus</i> (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 ( <i>H. ariel</i> ), 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				
<p>Isoodon obesulus obesulus</p> <p>(Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern))</p>	E	E	Species	<p>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.</p>	PMST	Low. The species has not been recorded in the locality.
<p>Micronomus norfolkensis</p> <p>(Eastern Coastal Free-tailed Bat)</p>	V	-	Ecosystem	<p>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.</p>	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.
<p>Miniopterus australis</p> <p>(Little Bent-winged Bat)</p>	V	-	Dual Credit	<p>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.</p>	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				
<p><i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat)</p>	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.
<p><i>Myotis macropus</i> (Southern Myotis)</p>	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.
<p><i>Petauroides volans</i> (Greater Glider (southern and central))</p>	-	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				
<i>Phascolarctos cinereus</i> (Koala)	E	E	Dual Credit	Occurs in forests and woodlands where it requires suitable feed trees (particularly <i>Eucalyptus</i> 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.
<i>Potorous tridactylus trisulcatus</i> (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 ( <i>Isoodon macrourus</i> ).	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
<i>Pseudomys novaehollandiae</i> (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.
<i>Pteropus poliocephalus</i> (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 <i>Eucalypts</i> .	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				
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-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.
<i>Scoteanax rueppellii</i> (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						
<i>Heleioporus australiacus</i> (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 ( <i>Typha</i> spp.) or spikerushes ( <i>Eleocharis</i> spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow ( <i>Gambusia holbrooki</i> ), 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				
<i>Pseudophryne australis</i> (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						
<i>Delma impar</i> (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 <i>Themeda australis</i> , spear-grasses <i>Austrostipa</i> spp. and poa tussocks <i>Poa</i> spp., and occasionally wallaby grasses <i>Austrodanthonia</i> spp.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
<i>Hoplocephalus bungaroides</i> (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				
<i>Apus pacificus</i> (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.
<i>Calidris acuminata</i> (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, salt pans and hypersaline salt lakes inland.	PMST	Unlikely. The species has not been recorded in the locality. Suitable habitat for the species is absent from the study area.
<i>Calidris melanotos</i> (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.
<i>Cuculus optatus</i> (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	<i>Adiantum aethiopicum</i>	Common Maidenhair	-	-							0.1
Apiaceae	<i>Hydrocotyle bonariensis</i>	Kurnell Curse / Pennywort	-	-							
Apiaceae	<i>Xanthosia tridentata</i>	Rock Xanthosia	-	-	0.1	0.1					
Aquifoliaceae	<i>Ilex aquifolium</i>	English Holly	-	-		0.1					
Asparagaceae	<i>Asparagus aethiopicus</i>	Asparagus Fern	-	-		0.1					
Asteraceae	<i>Ageratina adenophora</i>	Crofton Weed	-	-							0.2
Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	-	-				0.1			0.3
Asteraceae	<i>Cassinia aculeata</i>	Dolly Bush	-	-	0.1						
Asteraceae	<i>Cirsium arvense</i>	Perennial Thistle	-	-				0.1			
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle	-	-	0.1		5				0.7
Asteraceae	<i>Conyza bonariensis</i>	Flax-leaf Fleabane	-	-			0.1	0.1			
Asteraceae	<i>Hypochaeris radicata</i>	Flatweed	-	-			0.1	0.1			
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	-	-	0.1		0.1	0.2			0.2
Asteraceae	<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>	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	<i>Sonchus</i> spp.	Sowthistle	-	-				0.1			
Brassicaceae	<i>Sisymbrium officinale</i>	Hedge Mustard	-	-				0.1			
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak	-	-		5	3		2	1	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	-	-	2	5	5	0.2	0.5	0.3	
Cyperaceae	<i>Lepidosperma laterale</i>	Variable Sword-sedge	-	-		15					
Epacridaceae	<i>Leucopogon juniperinus</i>	Prickly Beard-heath	-	-					1		
Fabaceae (Mimosoideae)	<i>Acacia dealbata</i>	Silver Wattle	-	-	0.6	1		0.1	0.5	1	
Fabaceae/faboideae	<i>Glycine clandestina</i>	Twining Glycine	-	-		0.1		0.1			
Fabaceae/faboideae	<i>Glycine tabacina</i>	Twining Glycine	-	-		0.1			0.5		
Fabaceae/faboideae	<i>Hardenbergia violacea</i>	False Sarsparilla	-	-	0.1		0.3	0.1	0.5		
Fabaceae/faboideae	<i>Indigofera australis</i>	Native Indigo	-	-	0.4	0.5		0.2			
Fabaceae/faboideae	<i>Kennedia rubicunda</i>	Dusky Coral Pea	-	-	2						
Fabaceae/faboideae/Mimosoideae	<i>Acacia parvipinnula</i>	Silver-stemmed Wattle	-	-			0.2				
Fabaceae/faboideae/Mimosoideae	<i>Acacia terminalis</i>	Sunshine Wattle	-	-	0.1				0.1		
Goodeniaceae	<i>Dampiera purpurea</i>	Purple Dampiera	-	-		0.1					
Goodeniaceae	<i>Goodenia hederacea</i>		-	-		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 perenne	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	<i>Paspalum dilatatum</i>	Paspalum	-	-			20				
Poaceae	<i>Paspalum distichum</i>	Water Couch	-	-	0.1						
Poaceae	<i>Pennisetum clandestinum</i>	Kikuyu, Kikuyu Grass	-	-			25				
Poaceae	<i>Setaria parviflora</i>		-	-				0.1			
Poaceae	<i>Themeda australis</i>	Kangaroo Grass	-	-				0.1	0.1	0.1	
Polygonaceae	<i>Rumex crispus</i>	Curled Dock	-	-			0.1	0.1			
Primulaceae	<i>Anagallis arvensis</i>	Scarlet Pimpernel	-	-			0.1	0.1			
Proteaceae	<i>Hakea laevipes</i>		-	-						0.3	
Proteaceae	<i>Isopogon anemonifolius</i>	Flat-leaved Drumsticks	-	-							0.1
Proteaceae	<i>Persoonia linearis</i>	Narrow-leaved Geebung	-	-						2	
Ranunculaceae	<i>Clematis glycinoides</i> var. <i>glycinoides</i>	Headache Vine	-	-		1	0.3		0.2	3	
Rhamnaceae	<i>Pomaderris discolor</i>	-	-	-		0.1					
Rosaceae	<i>Rubus fruticosus</i> sp. agg.	Blackberry complex	-	-	2		2				
Rubiaceae	<i>Galium aparine</i>	Cleavers	-	-	1		3				0.1
Rubiaceae	<i>Pomax umbellata</i>	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	<i>Ctenotus taeniolatus</i>	Copper-tailed Skink	-	-	Seen
Aves	<i>Chenonetta jubata</i>	Australian Wood Duck	-	-	Seen
Aves	<i>Cacatua sanguinea</i>	Little Corella	-	-	Heard
Aves	<i>Alisterus scapularis</i>	Australian King-Parrot	-	-	Seen/Heard
Aves	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	-	-	Seen/Heard
Aves	<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	-	-	Heard
Aves	<i>Cormobates leucophaea</i>	White-throated Treecreeper	-	-	Seen/Heard
Aves	<i>Malurus cyaneus</i>	Superb Fairy-wren	-	-	Seen/Heard
Aves	<i>Pardalotus punctatus</i>	Spotted Pardalote	-	-	Seen/Heard
Aves	<i>Anthochaera carunculata</i>	Red Wattlebird	-	-	Seen/Heard
Aves	<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater	-	-	Seen/Heard
Aves	<i>Manorina melanocephala</i>	Noisy Miner	-	-	Seen/Heard
Aves	<i>Manorina melanophrys</i>	Bell Miner	-	-	Heard
Aves	<i>Psophodes olivaceus</i>	Eastern Whipbird	-	-	Heard
Aves	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	-	-	Seen/Heard
Aves	<i>Cracticus tibicen</i>	Australian Magpie	-	-	Seen/Heard
Aves	<i>Cracticus torquatus</i>	Grey Butcherbird	-	-	Seen/Heard

Class	Scientific name	Common name	Status		Observation Type
			BC Act	EPBC Act	
Aves	<i>Strepera graculina</i>	Pied Currawong	-	-	Seen
Aves	<i>Rhipidura albiscapa</i>	Grey Fantail	-	-	Seen/Heard
Aves	<i>Corvus coronoides</i>	Australian Raven	-	-	Seen/Heard
Aves	<i>Grallina cyanoleuca</i>	Magpie-lark	-	-	Seen/Heard
Aves	<i>Hirundo neoxena</i>	Welcome Swallow	-	-	Seen
Aves	<i>Sturnus tristis</i>	Common Myna	Exotic	Exotic	Seen/Heard
Aves	<i>Neochmia temporalis</i>	Red-browed Finch	-	-	Seen
Mammalia	<i>Vombatus ursinus</i>	Common Wombat	-	-	Scat
Mammalia	<i>Petaurus breviceps</i>	Sugar Glider	-	-	Seen
Mammalia	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum	-	-	Seen/Scat
Mammalia	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	-	-	Roadkill
Mammalia	<i>Oryctolagus cuniculus</i>	Rabbit	Exotic	Exotic	Scat
Mammalia	<i>Bos taurus</i>	European cattle	Exotic	Exotic	Seen/Heard
Mammalia	<i>Capra hircus</i>	Goat	Exotic	Exotic	Seen
Mammalia	<i>Cervus timorensis</i>	Rusa Deer	Exotic	Exotic	Roadkill

## Appendix E – Assessment of Significance

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
<b>Birds</b>					
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	-	43 (BioNet) BAM-C	Moderate
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	2 (BioNet) BAM-C	Moderate
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	E	15 (BioNet), PMST BAM-C	Moderate
<i>Calyptorhynchus lathami lathami</i>	South-eastern Glossy Black-Cockatoo	V	V	45 (BioNet), PMST BAM-C	Moderate
<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	4 (BioNet)	Moderate
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	22 (BioNet)	Moderate
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	46 (BioNet)	Moderate
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	62 (BioNet)	Moderate
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	-	7 (BioNet) BAM-C	Moderate
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	17 (BioNet) BAM-C	Moderate
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	V,C,J,K	6 (BioNet), PMST	Moderate
<i>Lathamus discolor</i>	Swift Parrot	E	CE	5 (BioNet), PMST BAM-C	Moderate
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	9 (BioNet) BAM-C	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Likelihood of Occurrence
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	-	10 (BioNet)	Moderate
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	4 (BioNet)	Moderate
<i>Ninox connivens</i>	Barking Owl	V	-	2 (BioNet) BAM-C	Moderate
<i>Ninox strenua</i>	Powerful Owl	V	-	31 (BioNet) BAM-C	Moderate
<i>Petroica boodang</i>	Scarlet Robin	V	-	25 (BioNet)	Moderate
<i>Petroica phoenicea</i>	Flame Robin	V	-	2 (BioNet)	Moderate
<i>Stagonopleura guttata</i>	Diamond Firetail	V	-	12 (BioNet)	Moderate
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	3 (BioNet) BAM-C	Moderate
<b>Invertebrates</b>					
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E	-	47 (BioNet) BAM-C	Moderate
<b>Mammals</b>					
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	31 (BioNet) BAM-C	Moderate
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	28 (BioNet), PMST BAM-C	Moderate
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	10 (BioNet), PMST	Moderate
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	9 (BioNet)	Moderate



Scientific Name	Common Name	BC Act	EPBC Act	Source	Likelihood of Occurrence
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	27 (BioNet)	Moderate
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	-	12 (BioNet) BAM-C	Moderate
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-	32 (BioNet) BAM-C	Moderate
<i>Myotis macropus</i>	Southern Myotis	V	-	194 (BioNet) BAM-C	Moderate
<i>Petauroides volans</i>	Greater Glider (southern and central)	-	E	15 (BioNet), PMST BAM-C	Moderate
<i>Petaurus australis australis</i>	Yellow-bellied Glider (south-eastern)	V	V	3 (BioNet), PMST	Moderate
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	-	8 (BioNet) BAM-C	Moderate
<i>Phascolarctos cinereus</i>	Koala	E	E	1192 (BioNet), PMST BAM-C	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	99 (BioNet), PMST BAM-C	Moderate
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V	-	5 (BioNet)	Moderate
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	19 (BioNet)	Moderate
<b>Reptiles</b>					
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	28 (BioNet), PMST BAM-C	Moderate

Scientific Name	Common Name	BC Act	EPBC Act	Source	Likelihood of Occurrence
<i>Varanus rosenbergi</i>	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 the 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, however 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 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 transitional 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 Shearwater-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<sup>2</sup>. 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 transitional 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 transitional basis and would mostly be retained. 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

It is estimated that 25,300 individuals of the species occupy up to 30000 km<sup>2</sup>. 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 transitional basis and would mostly be retained. 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

The proposal will not remove breeding habitat from the species' distribution and impacts to foraging habitat will be negligible. 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 Needle-tail, 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 transitional 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<sup>2</sup>) 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 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.

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.



## 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 LA90) and the noise management levels (NML or LAeq(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 LA90 <sup>1</sup> Background level (dB(A))	Day	40
	Evening	35
	Night	30
LAeq(15minute) Noise Management Level <sup>2</sup> (dB(A))	Day	50
	Day (OOHW) <sup>3</sup>	45
	Evening	40
	Night	35

Notes: <sup>1</sup> LA90 = Background noise level

<sup>2</sup> NML for works during standard hours = Background level plus 10 dB(A)

<sup>3</sup> 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
LAeq(15minute) Noise Management Level <sup>2</sup> (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 noisiest 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

### 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

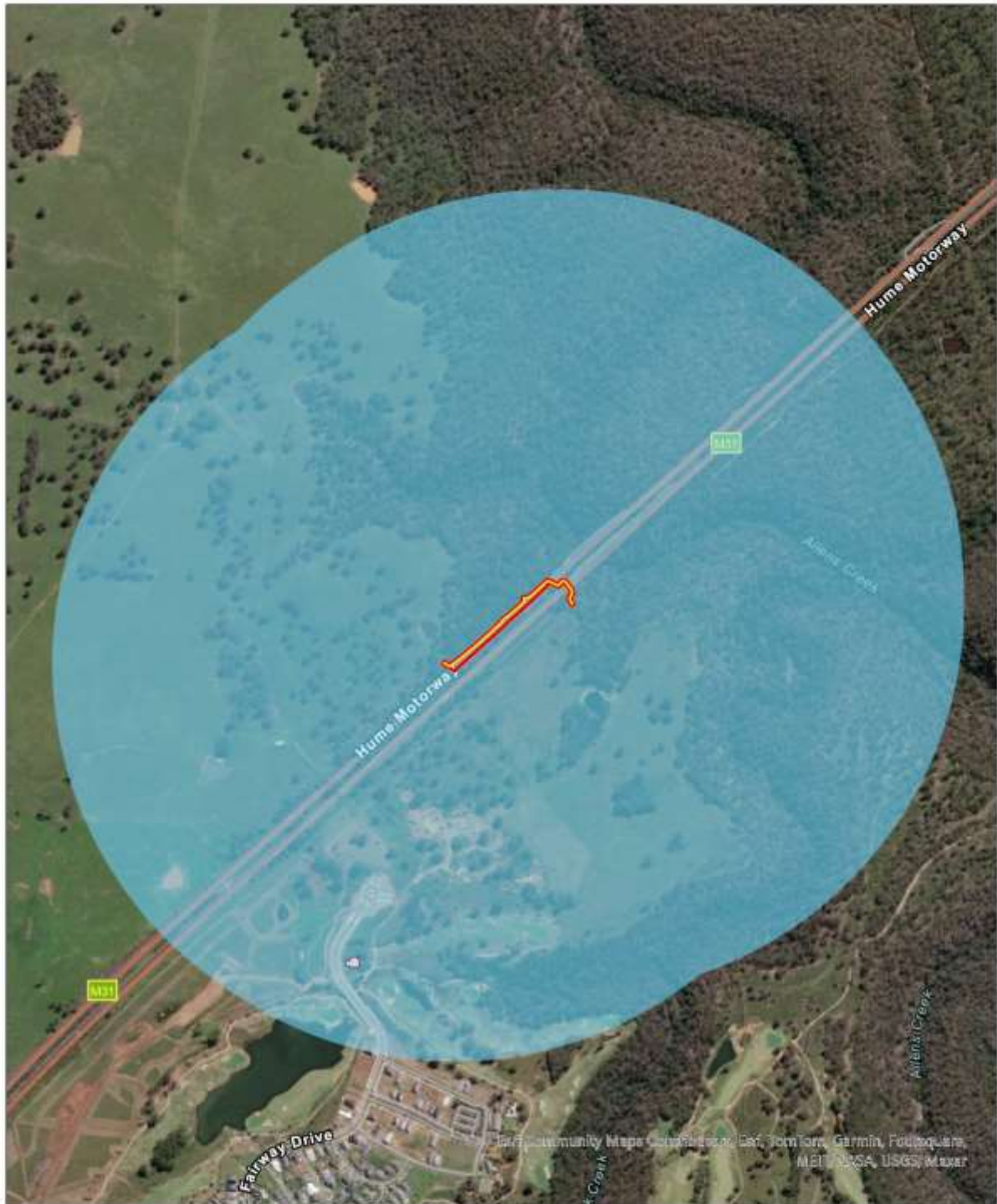
##### Site 3:

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







**Koala Fencing Site 2, Northern Hume Motorway, Wilton - Construction Noise Assessment (Night)**

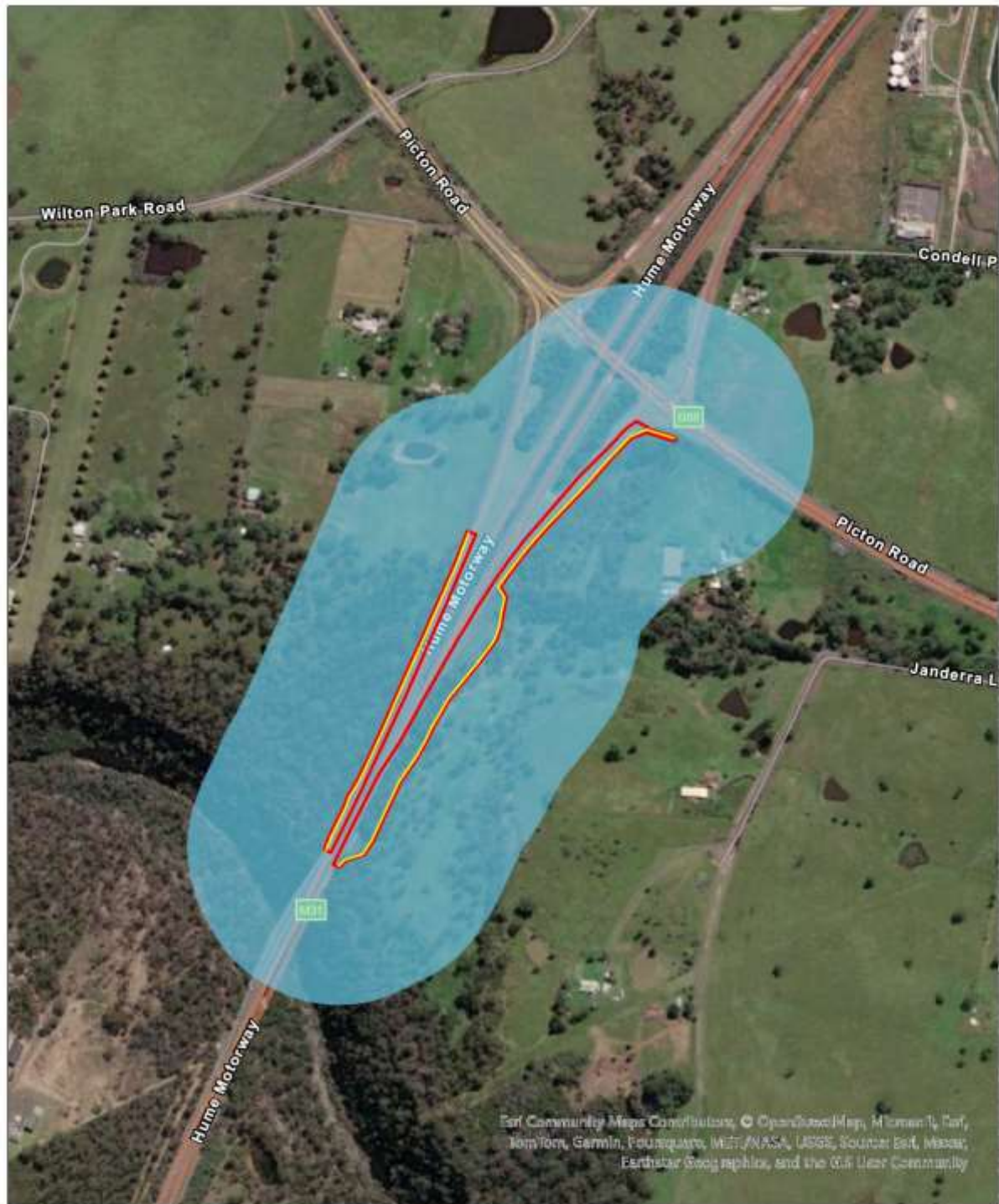
- Koala Fencing Alignment
- Site Boundary
- Residential NCA 1 (875 m, in line of sight)
- Residential Receiver - Lot 50, Fairway Dr, Wilton



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**Koala Fencing Site 3, Southern Hume Motorway, Wilton - Construction Noise Assessment (Day)**

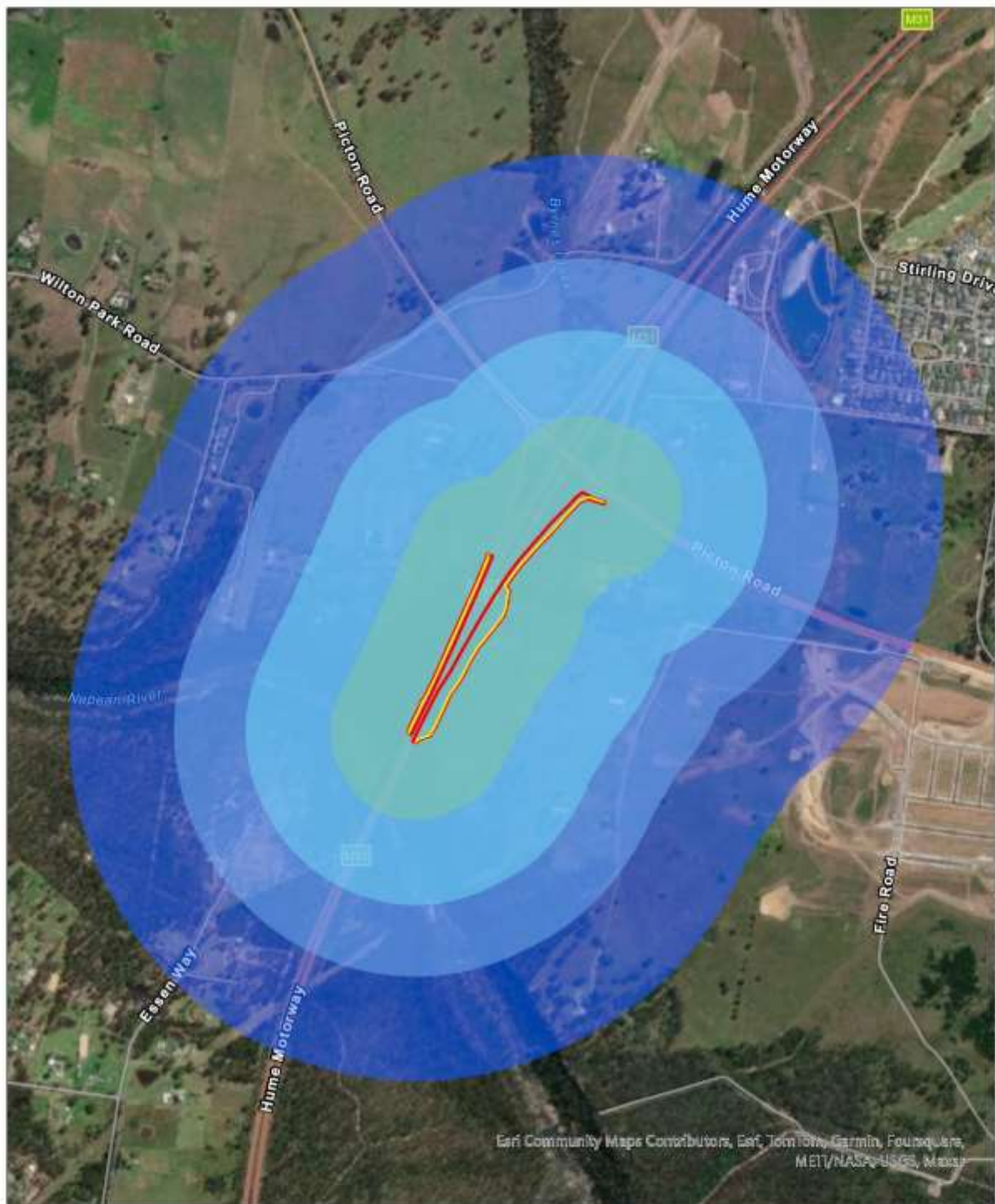
- Koala Fencing Alignment
- Site Boundary
- Residential NCA 1 (200 m, in line of sight)



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**Koala Fencing Site 3, Southern Hume Motorway, Wilton - Construction Noise Assessment (Night)**

-  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)



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### 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.*

Outcome of the evaluation process:

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





**KOALA FENCING – HUME HIGHWAY  
WILTON, NSW**

**Aboriginal Archaeological Survey Report  
Stage 2 PACHCI**

Prepared for Transport for NSW

Wollondilly Shire Local Government Area

February 2023

Ref. 2208

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## Document Information

Project Name	Koala Fencing – Hume Highway at Wilton, NSW Aboriginal Archaeological Survey Report - Stage 2 PACHCI
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Version	V2
Client Name	Transport for NSW
Issue Date	1 February 2023
Prepared by	Dr Matthew Kelleher; Mark Rawson; Madeline Harding; Ben Anderson
Approved by	Dr Matthew Kelleher

## Executive Summary

Transport for NSW (TfNSW) proposes to establish koala fencing at two locations adjacent to the Hume Highway at Wilton, NSW. The locations include an approximately 1200 metre section of the Hume Highway road corridor, south of Allens Creek and an approximately 1000 metre section of the Hume Highway road corridor from Picton Road to the Nepean River. The project is located in the Wollondilly Local Government Area.

Kelleher Nightingale Consulting Pty Ltd (KNC) was engaged by TfNSW to prepare an Aboriginal archaeological survey report to inform the Review of Environmental Factors and design for the proposed works. This assessment was prepared in accordance with the Stage 2 requirements of the *TfNSW Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (TfNSW 2011) and the Heritage NSW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW 2010).

No Aboriginal objects, Aboriginal archaeological sites or areas of potential archaeological deposit were identified within the study area. No Aboriginal cultural features were identified by Tharawal Local Aboriginal Land Council as a result of archaeological survey.

No further assessment of Aboriginal heritage is warranted for the proposed works undertaken within the current study area boundary. Stage 3 PACHCI assessment is not required at this stage as no impact to Aboriginal heritage has been identified.

Should future design exceed the current study area boundary (the existing road corridor) and extend into additional areas not assessed as part of the current Stage 2 PACHCI assessment, additional assessment in accordance with the Stage 2 requirements of the *TfNSW Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime 2011) and the Heritage NSW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW 2010) would be required.

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## 1 Introduction

### 1.1 Project background

The Office of the NSW Chief Scientist and Engineer (OSEC) koala advices and departmental response was publicly released on 2 December 2021. One of the principles advised by the OSEC is that maintaining a separation between koalas and threats using exclusion fencing should be a priority. The NSW government has committed to constructing koala exclusion fencing in the Wilton and Greater Macarthur Growth areas. A number of priority koala exclusion fencing locations under the Cumberland Plain Conservation Plan (CPCP) are located on Transport for NSW land. It is proposed that Transport for NSW (TfNSW) lead the installation of the fencing at these sites funded by the Department of Planning, Industry and Environment (DPIE) under the upfront funding for implementation of the CPCP.

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, dog attacks and drowning in swimming pools. Around 40 kilometres of this fencing will be constructed as part of the priority conservation actions in Years 1-5 of the CPCP. Further funding over the life of the Plan will allow TfNSW to roll out the fencing in stages, as new development occurs.

TfNSW proposes to establish koala fencing at two locations adjacent to the Hume Highway at Wilton, NSW. The locations include an approximately 1200 metre section of the Hume Highway road corridor, south of Allens Creek and an approximately 1000 metre section of the Hume Highway road corridor from Picton Road to the Nepean River. The project is located in the Wollondilly Local Government Area (LGA). The 'study area' for this assessment is shown on Figures 1 and 2.

Kelleher Nightingale Consulting Pty Ltd (KNC) was engaged by TfNSW to prepare an Aboriginal archaeological survey report to inform the Review of Environmental Factors (REF) and design for the proposed works. This assessment was prepared in accordance with the Stage 2 requirements of the TfNSW *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) (TfNSW 2011) and the Heritage NSW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW 2010).

### 1.2 Summary of findings

Background research, AHIMS records and archaeological survey did not identify any Aboriginal objects, Aboriginal archaeological sites or areas of potential archaeological deposit within the study area. No Aboriginal cultural features were identified by Tharawal Local Aboriginal Land Council (TLALC) as a result of archaeological survey. The study area displays low archaeological potential due to a combination of archaeologically unfavourable topography, erosion and disturbance related to the construction of the existing road corridor and associated drainage infrastructure as well as utilities installation.

No further assessment of Aboriginal heritage is warranted for the proposed works undertaken within the current study area boundary. Stage 3 PACHCI assessment is not required at this stage as no impact to Aboriginal heritage has been identified. Should future design exceed the current study area boundary (the existing road corridor) and extend into additional areas not assessed as part of the current Stage 2 PACHCI assessment, additional assessment in accordance with the Stage 2 requirements of the TfNSW *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime 2011) and the Heritage NSW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW 2010) would be required.

### 1.3 Investigator / contributors

A full list of investigator / contributors to the current study is included in Table 1 below.

**Table 1. Investigator / contributor**

Investigator / Contributor	Affiliation	Role
Dr Matthew Kelleher	Kelleher Nightingale Consulting	Advisor and Review, Survey, Reporting
Shazda Brown	Tharawal Local Aboriginal Land Council	Survey, Cultural Heritage Advisor
Mark Rawson	Kelleher Nightingale Consulting	Survey
Madeline Harding	Kelleher Nightingale Consulting	Reporting
Ben Anderson	Kelleher Nightingale Consulting	GIS mapping



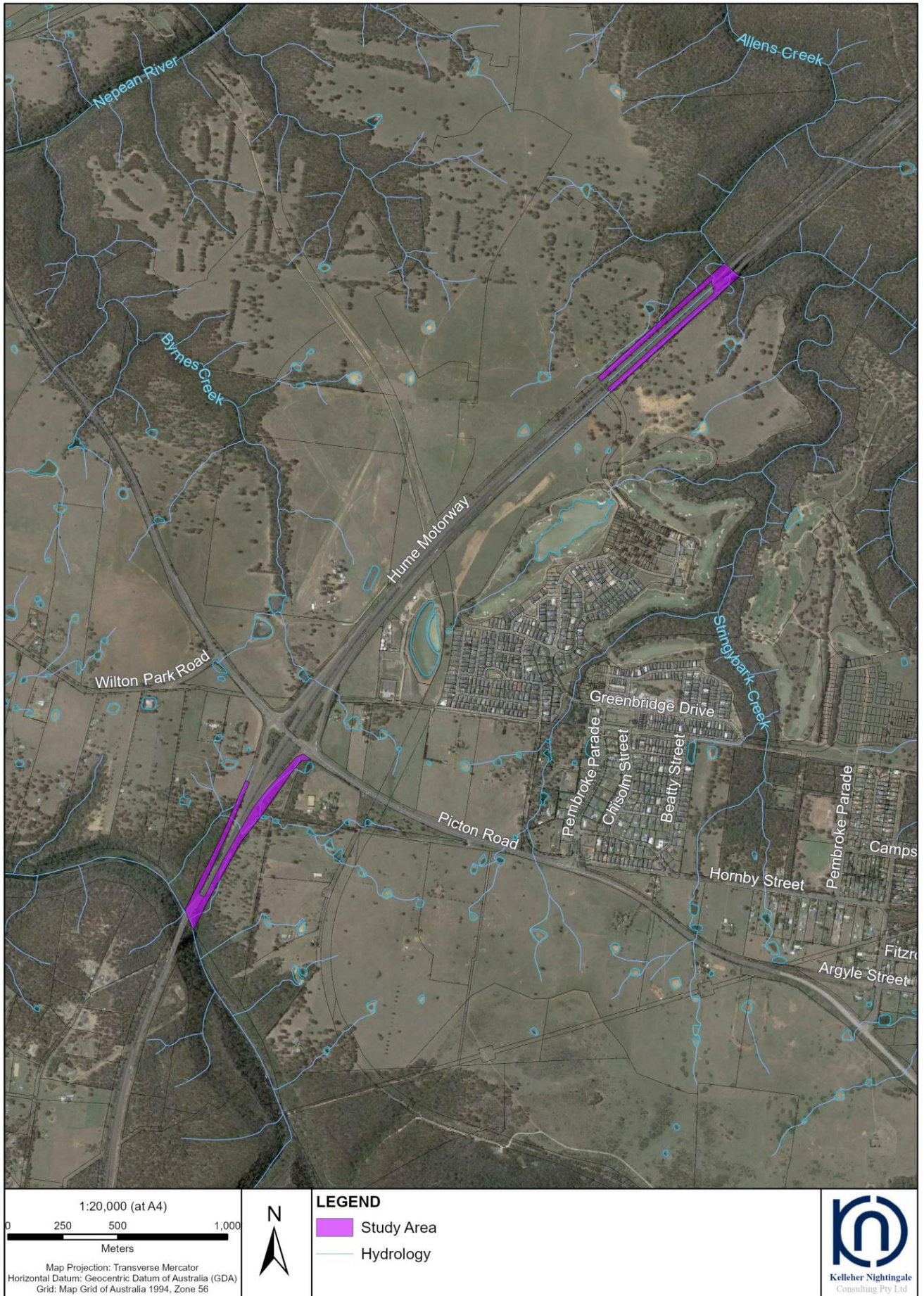


Figure 1. Study area location



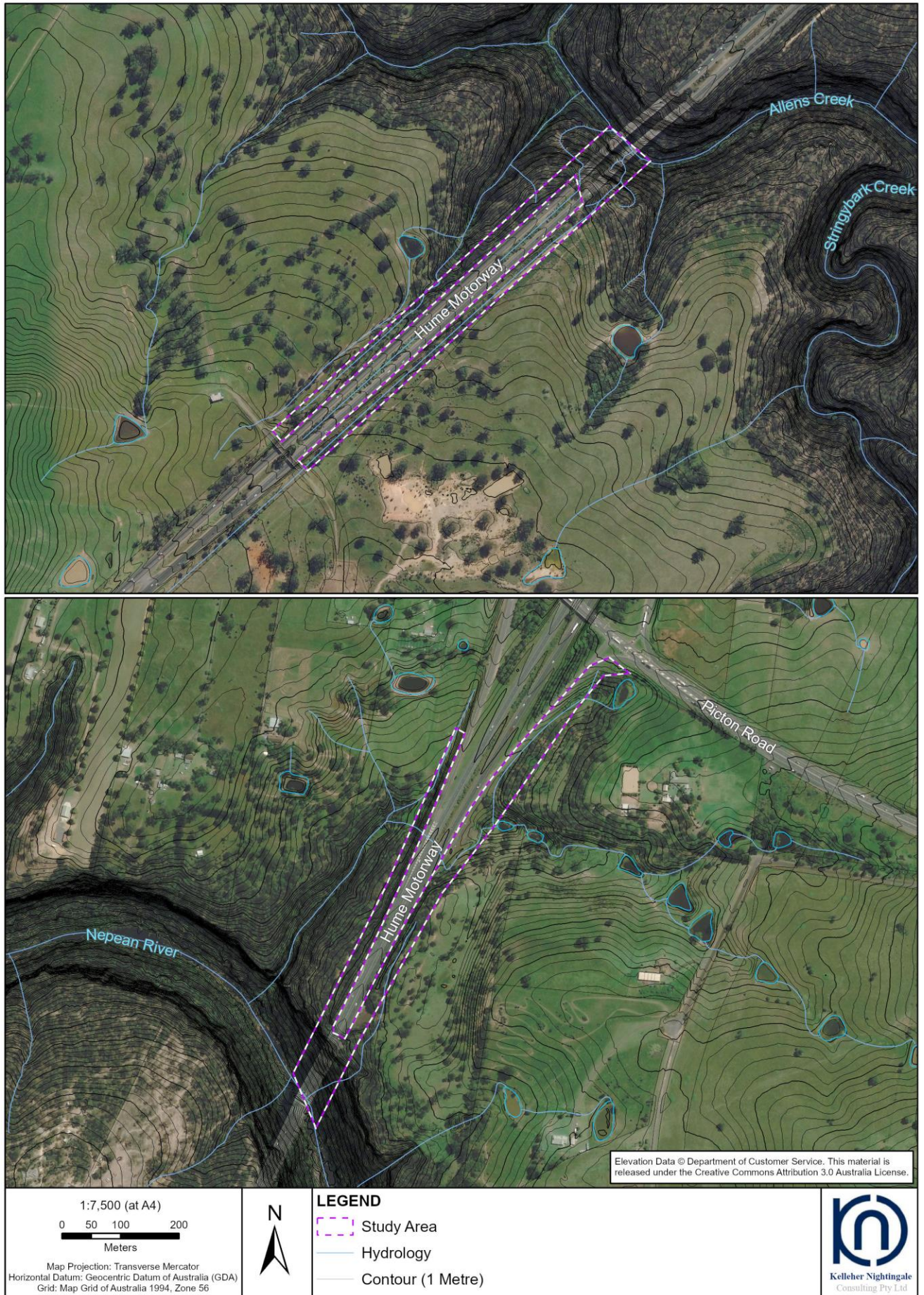


Figure 2. Detail of study area



## 2 Aboriginal stakeholder consultation

TfNSW has developed the PACHCI to provide a consistent means of effective consultation with Aboriginal communities regarding activities which may impact on Aboriginal cultural heritage and a consistent assessment process for TfNSW activities across NSW. In accordance with the PACHCI, the early stages of TfNSW projects involve consultation with Local Aboriginal Land Councils and registered Native Title holders/claimants. No Native Title holders/claimants are currently registered for the study area.

The project has been conducted in consultation with TLALC. TLALC were contacted at the commencement of the project to discuss the proposed works and invited to participate in the archaeological survey. The archaeological survey of the study area was undertaken with TLALC on 21 September 2022. Shazda Brown from TLALC participated in the survey.

TLALC will provide a survey and cultural assessment report for TfNSW in accordance with the TfNSW PACHCI (*still to be provided*).

### 3 Review of previous archaeological investigations

#### 3.1 AHIMS web services

The Aboriginal Heritage Information Management System (AHIMS) is a database operated by Heritage NSW and regulated under section 90(Q) of the (NSW) *National Parks and Wildlife Act 1974* (NPW Act). AHIMS contains information and records related to registered Aboriginal archaeological sites (Aboriginal objects, as defined under the NPW Act) and declared Aboriginal places (as defined under the NPW Act) in NSW. AHIMS searches were conducted on 27 October 2022 to identify registered (known) Aboriginal sites or declared Aboriginal places within or adjacent to the study area (Client Service IDs: 727152 & 727171). The AHIMS search results are attached as Appendix B. The AHIMS Web Service database searches were conducted within the following coordinates (GDA, Zone 56):

##### Northern Section

Eastings: 286050 – 287732  
 Northings: 6210968 – 6212594  
 Buffer: 0 metres (the search coordinates included a buffer around the study area).

##### Southern Section

Eastings: 284165 – 285778  
 Northings: 6208517 – 6210352  
 Buffer: 0 metres (the search coordinates included a buffer around the study area).

The AHIMS search results showed:

<b>25</b>	<b>Aboriginal sites are recorded in or near the above location</b>
<b>0</b>	<b>Aboriginal places have been declared in or near the above location</b>

The distribution of registered Aboriginal sites within these coordinates is shown in Figure 3. The frequencies of site types (site ‘features’) within the search area are shown in Table 2.

**Table 2. Frequency of site types and context from AHIMS database search**

Site Context	Site Feature	Number	Frequency
Open	Artefact	9	36
	Artefact; Potential Archaeological Deposit (PAD)	3	12
	Modified Tree (Scarred or Carved)	4	16
	PAD	5	20
	PAD; Stone Arrangement	1	4
Closed	Art (Pigment or Engraved)	2	8
	Habitation Structure; PAD	1	4
<b>Total</b>		<b>25</b>	<b>100%</b>

AHIMS records show that three previously registered sites have been listed as partially destroyed. The AHIMS results, the nature of previously recorded sites and previous archaeological investigations in the area are discussed further in section 3.3.

#### 3.2 Other heritage registers and databases

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

- Wollondilly Local Environmental Plan 2011
- 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)’ immediately borders the northern part of the study area, on the south western side of the Hume Highway at Allens Creek. The item (no. I285) was gazetted on 23 February 2011. The item comprised a number of identified Aboriginal shelter sites located within the deeply incised gullies carrying Allens Creek and Stringy Bark Creek. The item is not located within the current study area.



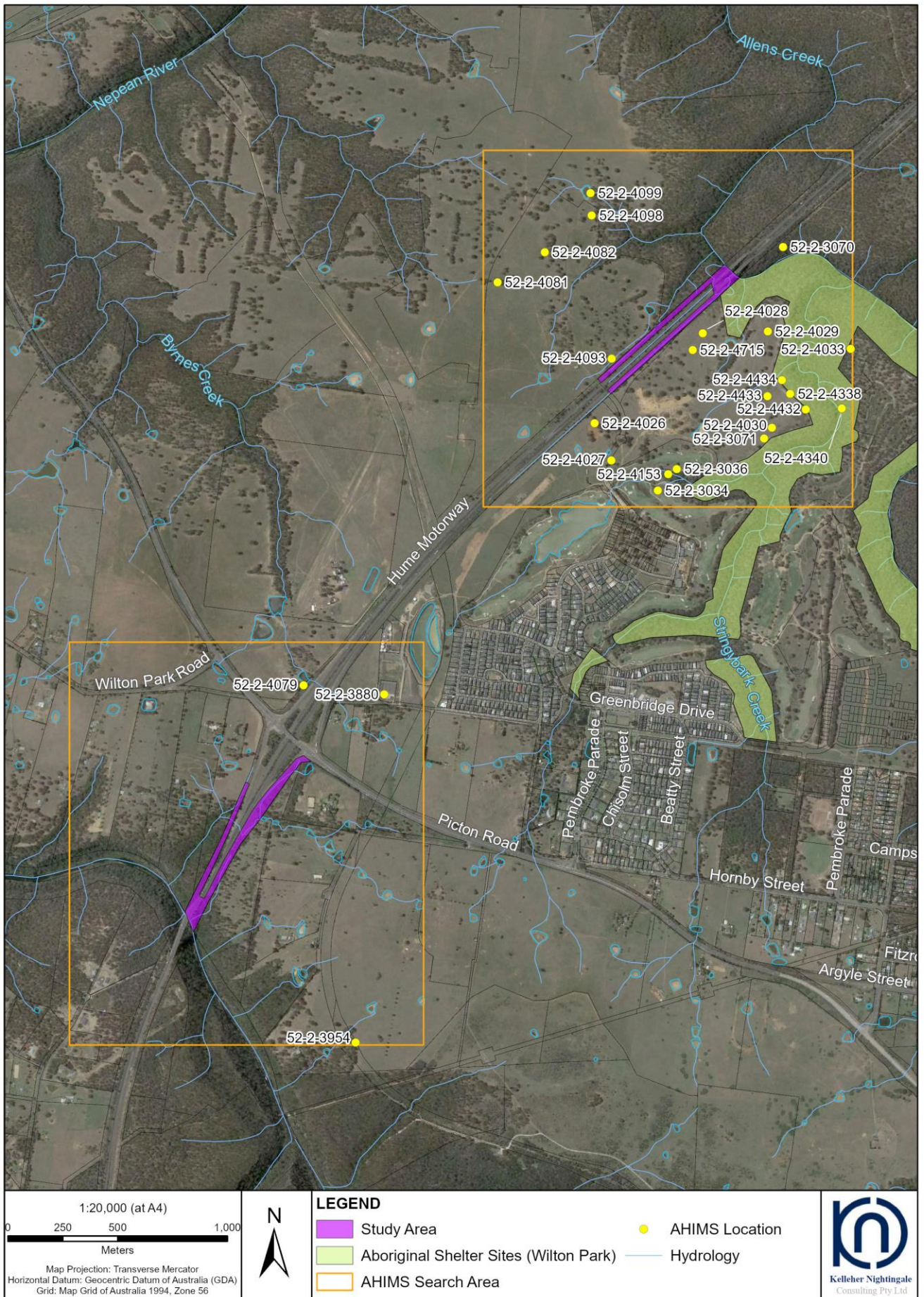


Figure 3. AHIMS search results



### 3.3 Previous archaeological investigations

The Wilton area has been subject to several previous archaeological investigations conducted for residential development and related infrastructure projects. The results of investigations relevant to understanding the Aboriginal archaeological record of the current study area are presented below.

#### Navin Officer 2003

An archaeological assessment was undertaken by Navin Officer Heritage Consultants in 2003 for proposed residential development at “Wilton Park”, Wilton NSW (Navin Officer Heritage Consultants 2003). The assessment included lands located immediately south of the northern portion of the current study area. A total of 20 Aboriginal archaeological sites were identified within the assessment area. Fourteen of these sites comprised newly recorded sites identified as a result of archaeological survey. Sites identified consisted of five rockshelters with art and PAD, three rockshelters with PAD, four rockshelters with art, artefacts and PAD, two rockshelters with art, artefacts, PAD and grinding grooves, five open context artefact scatters and one open context isolated artefact.

Art identified within rockshelter sites consisted mostly of black pigment graphic animal motifs (eels, lizards and marsupials) and anthropomorphic images, as well as red and white hand stencils. Artefacts identified consisted primarily of complete flakes, flaked pieces, lithic fragments and core fragments. Two stone ground-edge hatchet heads were also identified at one open context artefact scatter site. Raw materials identified were silcrete, chert, volcanic materials and quartz. Rockshelter sites were identified along the upper reaches of both Allens Creek and Stringy Bark Creek. Open context artefact sites were predominately identified along drainage depressions associated with the upper reaches of the western tributary of Stringy Bark Creek and at the junction of basal hillslopes and the tops of gorges of Allens and Stringy Bark Creeks. These landforms were also determined to contain moderate archaeological potential for subsurface archaeological deposits. Sites identified within the assessment area were assessed as having a mixture of moderate, low to moderate and low local archaeological significance. Two areas of PAD were assessed as displaying moderate research potential. The assessment recommended that further archaeological assessment should be undertaken, including further detailed recordings and test excavation prior to any development impacts. Conservation was recommended for all rockshelter sites within the assessment area.

No Aboriginal archaeological sites recorded as part of the assessment were identified within the current study area. One site recorded as part of the assessment (WP 14) comprised a rockshelter site with art located at the junction of Allens Creek and an unnamed drainage tributary. The site was later recorded on AHIMS as BC14, Bradcorp (AHIMS 52-2-3070). The AHIMS site location is incorrectly recorded on the AHIMS database on the northern side of the creek. The site is located on the southern side of Allens Creek, approximately 150 metres west of the northern portion of the current study area.

#### Kayandel 2014

An Aboriginal cultural heritage assessment was undertaken for the proposed rezoning of “Wilton Junction” at Wilton in 2014 (Kayandel Archaeological Services 2014). The assessment area covered the entirety of the current study area along the Hume Highway road corridor and included over 2700 hectares of land located in the Wollondilly Shire, surrounding the Hume Highway-Picton Road intersection. The assessment included Aboriginal community consultation, a review of previous archaeological studies, and landscape context, and the formulation of a site prediction model. An archaeological field survey of the assessment area (excluding conservation areas associated with the Nepean River and Byrnes Creek) was also undertaken over a ten day period between April, May and June 2013. It was anticipated that further archaeological survey of the conservation areas bordering the Nepean River and Byrnes Creek would result in the recording of multiple additional Aboriginal rockshelter sites with art and/or artefacts (Kayandel 2014).

A total of 49 Aboriginal archaeological sites had previously been registered on the AHIMS database within the assessment area. These sites predominantly comprised rockshelter sites with art (pigment or engraved), artefacts and/or PAD and open context artefact scatters and isolated finds. Lesser numbers of grinding grooves, and modified trees (scarred or carved) had also been recorded within the assessment area.

The assessment area was divided into 38 survey units for archaeological field survey. Survey did not include the current Hume Highway corridor study area. Landforms were inspected for potential archaeological sensitivity and surface exposures were inspected for Aboriginal objects. Large mature trees were also inspected for signs of cultural modification. The site prediction model was confirmed through archaeological survey; it was determined that open context sites (artefact scatters and isolated finds) were more likely to occur on flat, elevated landforms associated with creek lines where visibility was good. Areas of archaeological sensitivity were identified at these locations where visibility was low.

Thirty newly recorded Aboriginal sites were identified as a result of field survey. Newly identified sites within the assessment area included seven open context artefact scatters, ten open context isolated finds, eight rock shelters with either PAD, art or artefacts and five culturally modified (scarred) trees. Rockshelter sites were recorded along Byrnes Creek to the west of the current study area. Four of the modified trees were identified north of Picton Road in open cleared areas; one of the scarred trees was found in bushland bordering Byrnes Creek.



Artefacts identified at both open context and closed context sites consisted of complete flakes, flake fragments, flaked pieces and debitage. One core artefact was identified at a low density open context artefact scatter site and two scrapers were identified at separate low density open context artefact scatter sites. One bondi point and one backed blade were also identified at open context sites, along with several artefacts demonstrating usewear. One ground edge hatchet was identified at a rockshelter site. Raw materials present included chert, silcrete, indurated mudstone/tuff, quartz and quartzite.

The assessment recommended that further archaeological investigations (including archaeological test excavation of archaeologically sensitive areas) be undertaken prior to any future development associated with the rezoning proposal. Additionally, it was recommended that where identified scarred trees remained in good condition, that these be conserved and retained within public open spaces or conservation area. Where scarred trees were in poor condition, it was suggested that the Aboriginal community would support the item being removed and conserved at an alternate location.

No Aboriginal archaeological sites identified as part of the assessment were identified within the current study area. Two Aboriginal archaeological sites recorded as part of the assessment were recorded within proximity to the current study area. These included a surface isolated artefact, WJ-IF-03 (AHIMS 52-2-4093) and a culturally modified (scarred) tree, WJ-ST-04 (AHIMS 52-2-4079). These sites are located on the northern side of the Hume Highway road corridor, adjacent to the northern and southern portions of the current study area respectively.

#### **Biosis 2016**

A due diligence assessment was undertaken for the proposed rezoning and subdivision of 585 Picton Road, Wilton (Biosis 2016). The assessment encompassed lands located to the northwest of the southern portion of the current study area. The assessment included a review of previous archaeological studies, environmental context and a site prediction model. A total of nine previously registered Aboriginal archaeological sites were recorded within the assessment area. These consisted of one rockshelter with art and PAD site, three scarred trees, three isolated finds and one artefact scatter. Four of these sites could not be relocated during field survey undertaken for the project. Three newly recorded Aboriginal sites including a rockshelter with deposit, a rockshelter with art and an open context isolated find were recorded (none of these sites were recorded within the current study area).

Areas of high, moderate and low archaeological potential were also identified across the assessment area. Areas of high archaeological potential were associated with drainage lines featuring sandstone cliffs and overhangs or exposed sandstone outcrops (such as Allens and Stringybark Creek). Areas of moderate archaeological potential were identified on elevated ridges and crests located above drainage lines. Areas of low archaeological potential were present across the steep slopes or open undulating plain within the assessment area (including the current study area). The due diligence assessment determined that further archaeological investigations would be required prior to any impacts.

#### **Biosis 2018**

Archaeological assessments were undertaken for Stage 1 and Stage 2 of the Wilton South East Precinct by Biosis (Biosis 2018). The assessment included lands south of Picton Road and west of the Hume Highway. The assessment included background archaeological research, Aboriginal community consultation, archaeological survey and a test excavation program. Archaeological survey identified a number of archaeologically sensitive landforms including level, elevated landforms near Allens Creek, Stringybark Creek and a flat raised area in close proximity to a drainage line and previously registered PAD, M2D PAD 1 (AHIMS 52-2-3954). Two previously registered AHIMS sites identified within the assessment area, Wilton 02 (AHIMS 52-2-3591) and WJ-IF-10 (AHIMS 52-2-4085) could not be relocated during survey. These sites consisted of a surface artefact scatter and an isolated surface artefact.

Archaeological test excavation was undertaken in January 2018. Test excavation was undertaken within two previously identified high sensitivity PADs and one moderate sensitivity PAD. A total of 44 50x50cm test squares were excavated across the crest, midslopes, lower slope and flat landforms. One artefact was identified and consisted of a quartz flake. The artefact was associated with M2D PAD 1 (AHIMS 52-2-3954). The test excavation results determined that it was likely that neighbouring areas (like the Cordeaux catchment area) would have provided a higher volume of environmental resources such as permanent watercourses and shelter sites. A cultural heritage assessment for the assessment area determined that two sites would be potentially impacted by proposed rezoning and development. These sites consisted of a scarred tree, Wilton 01 (AHIMS 52-2-3590) and the newly identified subsurface isolated artefact, M2D PAD 1 (AHIMS 52-2-3954). Wilton 01 was assessed as displaying high archaeological significance, M2D PAD 1 was assessed as having low archaeological significance.

#### **Kayandel 2018**

An Aboriginal survey report was prepared for the “Wilton Town Centre Precinct” at Wilton, NSW (Kayandel 2018). The assessment area bordered to the southern part of the current study area located adjacent to the Hume Highway/Picton Road intersection.

The assessment included an update to the previous archaeological field survey assessment undertaken for the wider “Wilton Junction” assessment area. The assessment relocated 16 Aboriginal sites identified through the previous archaeological assessment. These included five open context artefact scatters, four isolated finds, one rockshelter with art, artefacts and PAD, two rockshelters with art and PAD, two rockshelters with PAD and two scarred trees. The assessment relocated previously recorded site WJ-ST-04 located within proximity to the current study area. Areas of archaeological sensitivity were also confirmed to be located along Byrnes Creek, its tributaries and neighbouring elevated flats. It was recommended that further archaeological assessment including a test excavation program be undertaken prior to any development.

#### **Kayandel 2022**

Recent archaeological investigations have been undertaken bordering the northern portion of the current study area to the west. The assessment was undertaken by Kayandel in 2022 (Kayandel 2022a; 2022b). These assessments have included an additional archaeological survey, a test excavation program and a cultural heritage assessment of the proposed Stage 1 residential subdivision and construction of a sub-arterial road at Lots 1-11 DP 1280088 and Lot 37 DP270536 at Wilton, NSW. The assessment relocated two previously registered Aboriginal archaeological sites, WJ-ST-01 (AHIMS 52-2-4081) and WJ-ST-02 (AHIMS 52-2-4082) and archaeologically sensitive landforms previously identified by Kayandel Archaeological Services (2014) and Biosis (2016).

The test excavation program aimed at determining whether the identified archaeologically sensitive landforms contained subsurface archaeological deposit. A total of 33 50x50cm test squares were excavated across the assessment area. Test squares were excavated to a maximum depth of 40cm before basal clays were encountered. Soils generally consisted of an A-Horizon of dark brown/reddish silt/silt-clay and a B-Horizon of light brown/medium brown clay. Land use disturbance appeared to be dominated by previous agricultural and pastoral practices. No artefacts were identified as a result of test excavation. The assessment determined that it was likely that the area had been utilised for hunting and gathering and as a travel route (Kayandel 2022: 36). The findings of the assessment determined to be consistent with other test excavation programs undertaken in the wider region. The assessment area was found to have low archaeological significance. The CHAR assessment determined that no impact would occur to the identified scarred trees and recommended that these Aboriginal sites be protected by temporary fencing (a ten-metre buffer) and adequate signage, should works be undertaken within proximity to the sites.

### **3.4 Previously recorded sites within proximity to the study area**

A total of five previously registered AHIMS sites are located within 300 metres of the current study area. The sites comprise a PAD area, isolated finds, a culturally modified (scarred) tree and a rockshelter site with art. Site descriptions are provided below.

#### **BG-PAD-01 (AHIMS 52-2-4028)**

The site was a PAD recorded by Kayandel Archaeological Services in 2013. The PAD area was present across a crest landform recorded within proximity to an unnamed tributary of Allens Creek. The PAD area measured approximately 400 metres in length and 150 metres in width.

#### **WJ-IF-03 (AHIMS 52-2-4093)**

Site WJ-IF-03 was recorded by Kayandel Archaeological Services in 2013. An isolated find was recorded on an erosion scour north of the Hume Highway. The artefact consisted of a chert proximal flake fragment identified on the edge of an artificial drainage line.

#### **BC14, Bradcorp (AHIMS 52-2-3070)**

The site comprised a rockshelter with art site located approximately 50 metres from the junction of Allens Creek and its drainage tributary. The site was recorded approximately 100 metres from the bridge crossing Allens Creek, on the south western side. The rock shelter was situated approximately 30 metres in elevation above the creek bed, at the top of the gorge. The site is not registered in its correct location on the AHIMS database.

The north west facing rock shelter had been formed predominantly by cavernous weathering, with a low boulder at the base. The floor of the shelter was primarily comprised of roof fall. The shelter measured approximately 8.5 metres in length, three metres in depth and three metres in height. The site consisted of four art motifs including a charcoal and cream ochre outlined snake with abraded infill, two eels outlined in cream ochre and black pigment with cream coloured diagonal infill stripes and an animal (possibly echidna) executed in cream outline with black indetermined fill.

#### **BG-IF-01 (AHIMS 52-2-4026)**

The site was a surface isolated artefact recorded by Kayandel Archaeological Services in 2013. The site was located approximately 75 metres northwest of the northern intersection of Kirkwood Chase and Sarazen Crescent. The artefact consisted of a quartz proximal flake fragment recorded on a large erosion scour. The site is listed on AHIMS as partially destroyed under AHIP #4944 granted on 7 July 2022. The site was subject to community collection, however the artefact could not be relocated.

**WJ-ST-04 (AHIMS 52-2-4079)**

Site WJ -ST-04 consisted of a culturally modified (scarred) tree identified by Kayandel Archaeological Services in 2013. The tree was a mature stringybark with a southwest facing oval scar. The scar measured 3.5-4 metres in length, 60 centimetres in width and 15cm in depth. The scar was located 1.25 metres above ground level and was old, cracked and rotting. The tree appeared in good health, and was approximately 30 metres in height, with a girth at breast height of 4.5 metres.

**3.5 Summary**

Review of background information provides archaeological context for the study area and what might be expected to occur. The AHIMS searches indicate that previously recorded sites in the immediate area are predominantly low density open context artefact sites and culturally modified (scarred) trees located on elevated, gentle gradient ridge crests and elevated ground across the plateaux. Artefact raw materials were mostly locally-sourced chert and quartz, with a moderate component of silcrete and a variety of other raw materials, all available from regional geologies. Reported artefact types from previously recorded sites included cores, backed artefacts and flakes with retouch/usewear. Rockshelter sites containing art and/or archaeological deposit have also been recorded along creeklines within the vicinity, including Allens Creek, the Nepean River and their tributaries.

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.

## 4 Landscape context

The study area is located on the southern end of the Cumberland Plain, a physiographic 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 Sydney Basin is a large geological feature stretching from Batemans Bay in the south to Newcastle in the north and Lithgow in the west. The formation of the basin began between 250 to 300 million years ago when river deltas gradually replaced the ocean that had extended as far west as Lithgow. The oldest, Permian layers of the Sydney Basin consist of marine, alluvial and deltaic deposits that include shales and mudstone overlain by coal measures.

The local area lies within the transitional zone between the Cumberland Plain and the Woronora Plateau, which grade into one another across a relatively narrow zone with landscape features of both physiographical regions. The morphology changes from wide and shale based on low gradient slopes, to steeply graded sandstone valleys; ridgeline topography changes from broad gently graded or rounded crests into flat plateau land surfaces. The study area is chiefly characterised by gentle crests slopes present across the plateau. These slopes descend generally north and south across the northern and southern parts of the study area respectively. These slopes descend to steep, vegetated gorges containing Allens Creek in the north and the Nepean River in the south (Figures 4-6). The underlying bedrock geology of the study area comprises Ashfield Shale of the Wianamatta Group and Hawkesbury Sandstone (Figure 5). Ashfield Shale comprises dark-grey to black sideritic claystone that grades upward into a fine siltstone-sandstone laminate. Hawkesbury Sandstone geology is characterised by fine to coarse grained quartzose sandstone with minor interbeds of siltstone/sandstone laminate, siltstone and claystone (Bowman, Stroud, Sherwin and Ray 1986: 36).

Soils across the study area derive from Blacktown, Hawkesbury and Lucas Heights soils (Figure 6). Blacktown soils are present across the gentle slopes across the majority of the study 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 (Hazelton and Tille 1990). As a residual soil landscape, Blacktown soils have the potential to conserve archaeological deposits intact where disturbance levels are low but these are likely to retain horizontal integrity only (i.e. stratification of deposit is rare). Where steeper landforms are present, preservation of archaeological deposits is less likely, especially where combined with landscape disturbance.

The Hawkesbury Soil Landscape is associated with the rugged, rolling to very steep hills on the Hawkesbury Sandstone slopes and ridges of the Woronora Plateau (Hazelton and Tille 1990). This colluvial soil landscape is located within the northern part of the study area bordering Allens Creek. Rock outcrops, surface boulders and cobbles comprise more than 50% of the ground surface. The soils in this landscape are shallow, discontinuous and generally sandy. On crests and ridges, soils are shallow due to the sandstone outcrops and surface fragments, with rock fragments occurring throughout all soil horizons. Weakly coherent, loose, coarse quartz sand to sandy loams occur as topsoils, commonly directly overlying either bedrock (lithosols), or overlaying yellow earthy subsoil (yellow podzolic soils) consisting of yellowish-brown sandy clay loam with an abundance of gravels, stones and ironstone-plated sandstone fragments. Erosion is high, particularly when the vegetation is removed. 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 rock platform 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 generally associated with the gently undulating crests, ridges and plateau surfaces of the Woronora Plateau. The soils are moderately deep, hardsetting Yellow Podzolics on ridges and plateau surfaces. On crests and slopes they consist of loose, greyish brown fine sandy loam with frequent iron-coated sandstone fragments occurring as topsoil, overlying earthy yellowish brown sandy clay loams developed on coarse-grained sandstone. Crests and plateau surface soils consist of bleached stony sandy clay loam with abundant iron-coated fine sandstone fragments occurring as topsoil, overlying pedal, yellowish brown clay to heavy clay with frequent iron-coated fine sandstone fragments occurring as subsoil. Sheet erosion can occur where there has been damage or removal of vegetation cover. In more protected areas with low levels of erosion, this soil landscape is considered to have some archaeological potential due to its age and slow accumulation of soil matrix; site types likely to be present are low density artefact scatters and scarred trees in areas with remnant mature vegetation cover.

Landuse practices have had an impact on the landscape within and bordering the study area. European settlement expanded into the Wilton area in 1834 when land grants were issued to Sir Thomas Mitchell, Surveyor General. Up to the 1880s, the main produce of the area was wheat, maize, barley and oats. As the crops gradually diminished due to the lack of soil replenishment, these were replaced by the raising of cattle, sheep and pigs and the production of hay. Dairying started in the 1870 and this became a dominant regional industry in the late 1800s and early 1900s. For much of the twentieth century Wilton remained a quiet rural village. In recent years, larger residential developments have been established. Within the study area, predominant land use disturbance is the result of infrastructure development, specifically the construction and maintenance of the Hume Highway road corridor. However, pockets of remnant native vegetation is 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 contained a diverse range of native flora which was likely to have provided past Aboriginal people with a range of raw materials and food sources.



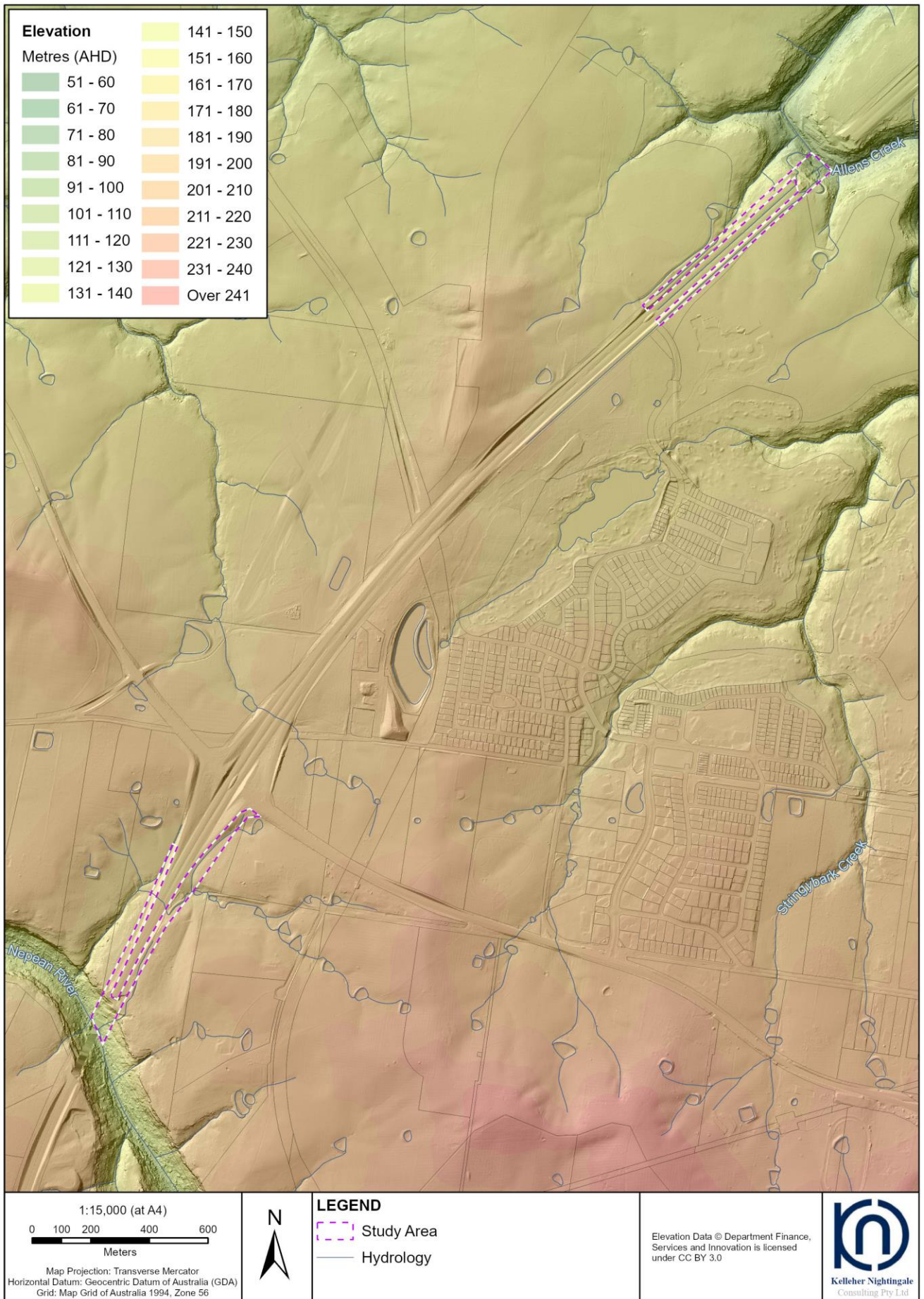


Figure 4. Elevation and topography of the study area



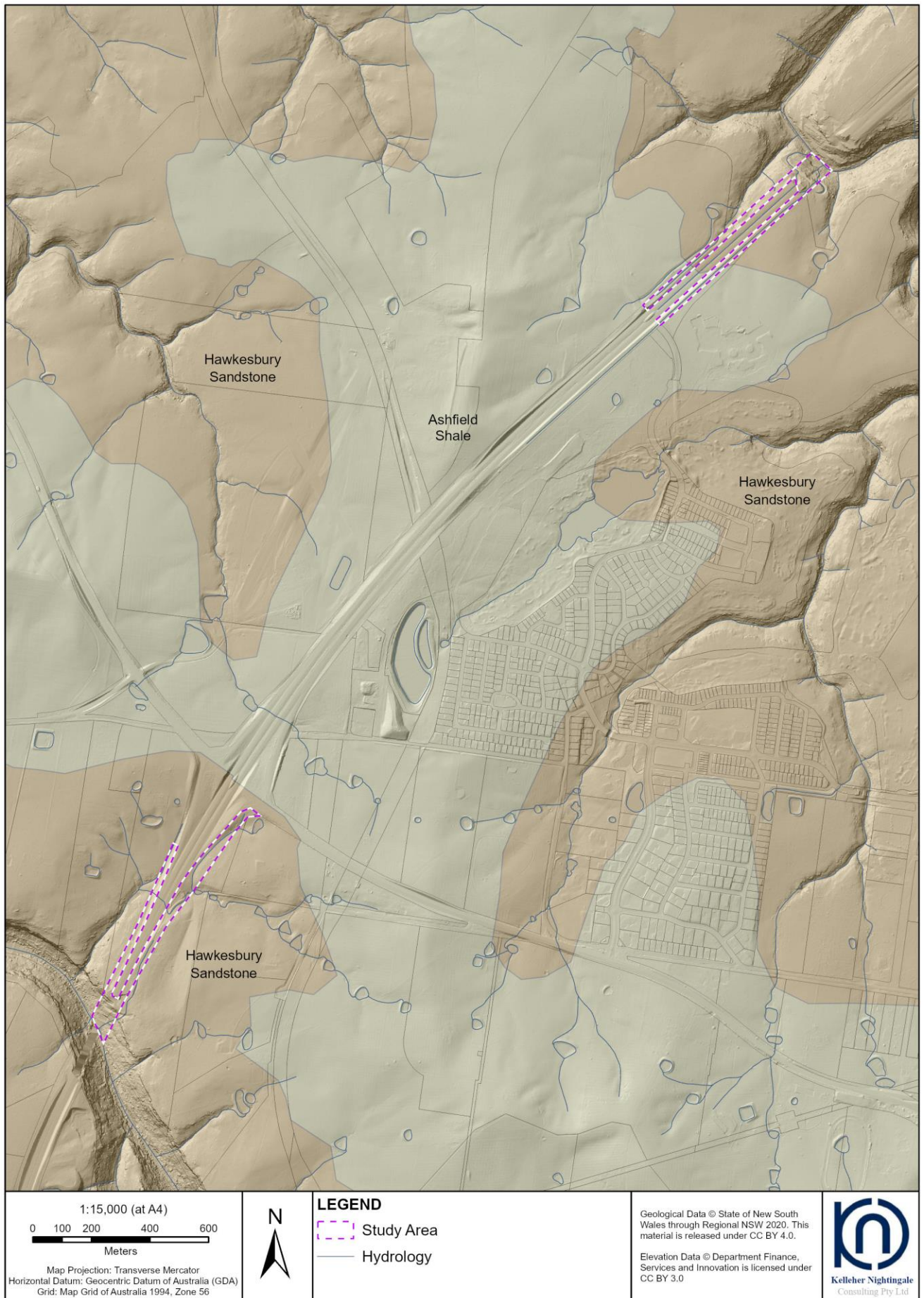


Figure 5. Geology of the study area



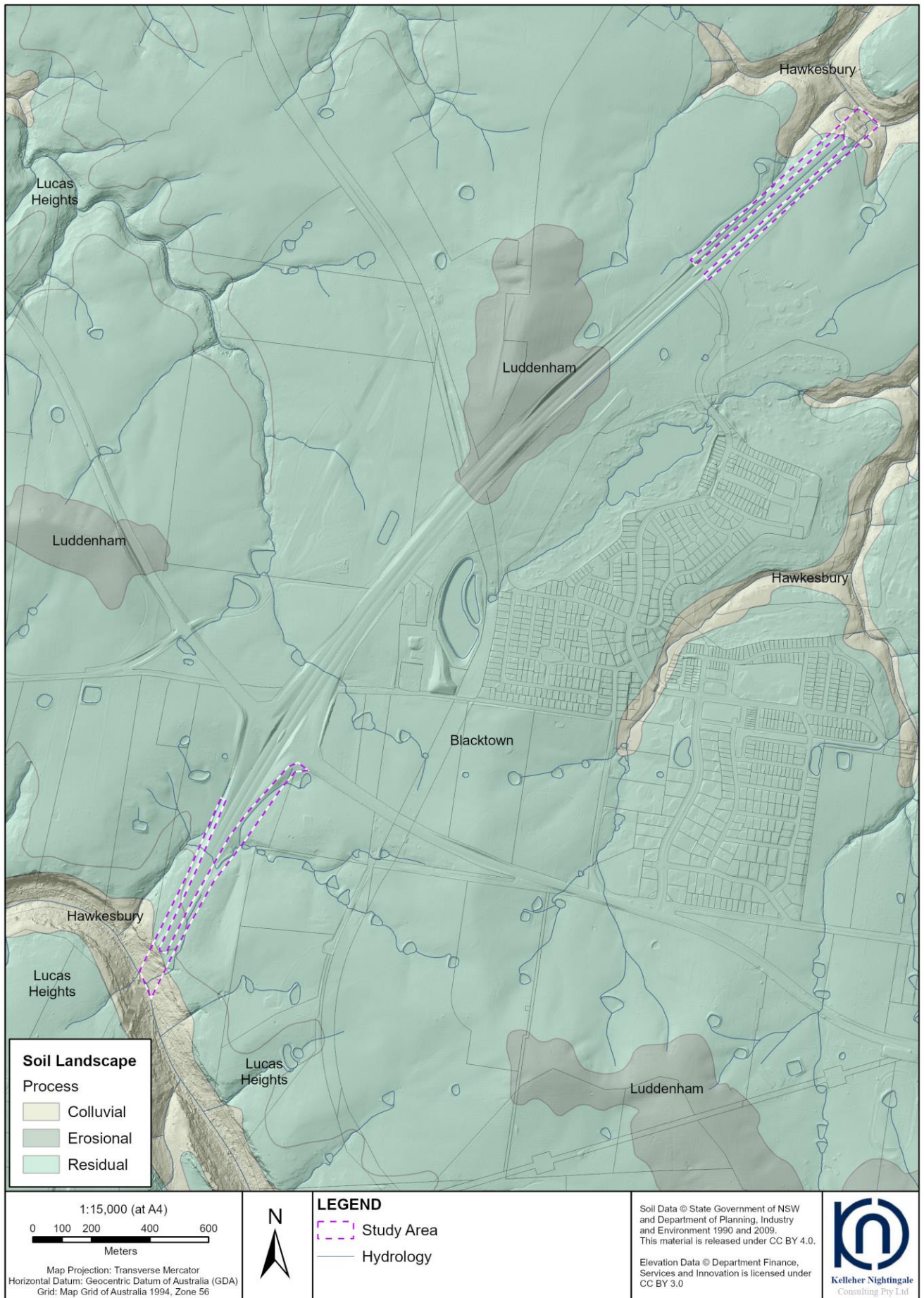


Figure 6. Soils of the study area

## 5 Regional character and site predictions

Previous archaeological investigations have provided data on site distribution, site typology and lithic raw material use that aids in assessing the archaeological character of the region. Site frequency and density can be related to key landscape factors including distance to water, landform, slope gradient, soil landscape and proximity to environmental resources. Additionally, historical land use practices and disturbance provide data that assists in formulating predictions of expected site types and distribution within the study area. Previous investigations undertaken throughout the region have typified that the distribution of archaeological material in the region around the Hume Highway focusses on a combination of suitable geology and low disturbance.

Various resources that would have been valued by Aboriginal people are present within region, including various native plant and animal species, sources of fresh water, good views over the surrounding landscape from the ridgelines and spurs across the plateau, exposed sandstone for grinding grooves and engravings, rock shelters suitable for use as campsites and elevated ridge corridors allowing for easier transit. The underlying Hawkesbury sandstone geology of the area is conducive to the formation of rock shelters and this site type is a commonly identified site type in the wider region. Shelters containing art, archaeological deposit or potential archaeological deposit are distributed across the steep slopes of the gorges north and south of the current study area. The Hawkesbury sandstone outcrops as benches and slabs which can provide flat or gently sloping surfaces suitable for engraving sites and grinding grooves. Grinding grooves are well represented among previously recorded sites in the region. Grinding grooves occur on suitable sandstone outcrops that also offer a source of water, whether within or adjacent to creeklines or due to seepage and collection on the rock surface after periods of rain.

Preservation of archaeological deposit in open contexts (i.e. artefact scatters and isolated finds) occurs sporadically across the plateau. Elevated locations on hilltops and ridge crests such as those located within the current study area, tend to display sparse artefact distribution and less evidence for ‘everyday’ or utilitarian activities, suggesting that these areas were often used in a transitory capacity. Artefacts identified in archaeological deposits in the wider region are typically of chert, silcrete, indurated mudstone/tuff, quartz and quartzite raw materials.

The preservation of Aboriginal archaeological material in the region has been variably impacted by natural processes and land use practices. The construction of roads and drainage infrastructure in addition to land use activities related to agricultural practices disturb subsurface deposits and Aboriginal objects are unlikely to survive in situ within these contexts. The study area comprises a highly disturbed road corridor. Within this context Aboriginal objects are unlikely to survive in situ and the archaeological potential of such sites is generally low. Based on information from previous archaeological investigations, landscape context and regional character, site predictions for the study area include the following:

- Rock shelter sites are likely to occur where suitable overhangs have formed in the local sandstone bedrock. Overhangs are more likely to occur on steep slopes bordering incised watercourses.
- Shelters may contain engraved or painted art executed in charcoal or ochre, and may contain archaeological deposit where disturbance to the shelter floor has been limited and some depth of sediment exists.
- Grinding grooves may exist on suitable sandstone outcroppings that occur in proximity to creeklines or collect water after rain.
- Clearance of original vegetation across the plateau lessens the likelihood of identifying culturally modified trees, but old growth trees may be present in the more heavily vegetated parts of the study area and have the potential to display scars of Aboriginal origin.
- Open artefact scatters / isolated artefacts are more likely to be identified in areas that have been subject to less intensive disturbance. Conversely, identification of open context sites may be aided by some measure of ground disturbance where this has increased the visibility and exposure of archaeological material.
- Artefact raw materials are likely to consist of chert, silcrete, indurated mudstone/tuff, quartz and quartzite raw materials. The site types most likely to be encountered are low density open context artefact sites including surface scatters and isolated artefacts.
- The identification of archaeological sites is likely to be affected by differential visibility of the ground surface, but successful assessment of areas of potential archaeological deposit can be made based on landform and other environmental factors such as disturbance, degree of slope and distance to water.



## 6 Sampling strategy and field methods

The aim of the archaeological survey was to conduct a full coverage, pedestrian survey of the study area and to record any Aboriginal archaeological objects, sites or areas with potential to contain Aboriginal objects. The study area was divided into two survey units based on the locations of the study area (Figure 7).

Survey Unit 1 consisted of the northern portion of the study area, running from an unnamed bridge over the Hume Highway near Bingara Gorge Golf Course to the Moolgun Creek Bridge crossing Allens Creek gorge. The survey unit spanned approximately 790 metres of road corridor on either side of the highway and the steep slopes of the Allens Creek gorge underneath the bridge crossing to the Allens Creek channel. The road verge measured approximately 23-25 metres from the road surface to property fencing. The survey unit comprised the flat, slope and open depression landforms across the edge of the plateau and the steep slopes descending north into the Allens Creek gorge. Disturbance was present in the form of road and fencing construction and vegetation clearance along the road corridor, with regrowth vegetation present throughout the survey unit. The steep slopes were vegetated with Grey gums, native Cherry shrubs and Narrow leaved Geebung, with frequent outcrops of sandstone bedrock.

Survey Unit 2 consisted of the southern portion of the study area, running from the Picton Road onramp to Pheasants Nest Bridge over the Nepean River gorge. The survey unit spanned approximately 950 metres of road corridor on the eastern side of Hume Highway and 670 metres for the western side of the road corridor. The road corridor ranged from 18 metres on the western side to 30 metres on the eastern side, from road surface to property fencing. The survey unit comprised the slope, flat and open depression landforms across the edge of the plateau and the steep slopes descending south into the Nepean River gorge. Disturbance was present in the form of road and fencing construction and vegetation clearance. Regrowth vegetation was present throughout the survey unit in the road corridor. Steep slopes were vegetated with Grey gums, native Cherry shrubs and Narrow leaved Geebung. Sandstone outcrops were frequent.

Based on the archaeological background and landform context of the study area, the survey team closely inspected any areas of surface exposure for artefacts, evidence of intact soils and any mature trees for evidence of Aboriginal bark removal. The study area was also inspected for any suitable sandstone outcrops in the form of benches, vertical faces, boulders and overhang utilised for rock shelter sites with archaeological deposit and/or art, grinding groove sites and engraving sites. Assessments of soil disturbance were also made during the survey.

The archaeological survey was conducted on 21 September 2022. The survey team comprised Mark Rawson (KNC) and Shazda Brown (TLALC).

The survey team were equipped with high resolution aerial photography and topographic maps showing the study area, proposed work locations, and the location of previously recorded Aboriginal archaeological sites. A non-differential GPS receiver was used for spatial recordings. All GPS recordings were made using the Geocentric Datum of Australia (GDA) coordinate system. Detailed notes on the condition of the survey unit were compiled by the survey team including an assessment of surface visibility, vegetation coverage, and disturbance.





Figure 7. Survey units and landform



## 7 Survey results

No Aboriginal archaeological objects, sites or potential archaeological deposits were identified within the study area.

The study area exhibited substantial ground disturbance with low potential for intact archaeological deposits due to motorway construction, vegetation removal, water related infrastructure and utilities installation. Survey coverage is discussed below.

### 7.1 Survey coverage

The archaeological survey commenced in Survey Unit 1, along the western road verge of the Hume Highway. Ground surface visibility within this portion of the survey unit was very low, with ground covered by tall grasses, weeds or native plant regrowth.

Disturbance was present in the form of uneven ground; sandstone boulders were present at various intervals along the road verge, indicating previous earthmoving activities. Sandstone outcrops were present within closer proximity to Allens Creek. A minor tributary was crossed within proximity to Allens Creek, sandstone outcrops bordering the creek were inspected for grinding groove and rock engraving sites, however none were identified. Two small outcrops were identified close to the property fenceline and inspected for suitable overhangs; none were identified. Native vegetation within the area consisted of Grey Gum trees and native Cherry and Narrow leaved Geebung shrub species.



**Plate 1.** View to north-west. Study area comprised road reserve at left, next to M31 Hume Motorway.



**Plate 2.** View to north-east. Western side of M31 Hume Motorway. Study area width was 23 metres between road edge at right, and property fence at left.



**Plate 3.** View to north-east. Nearer to Allens Creek, a minor tributary and outcropping sandstone were inspected.



**Plate 4.** View to north-east. Moolgun Creek Bridge. Western side. Upper valley slopes.

The survey team encountered very steep slopes descending to Allens Creek on the approach to Moolgun Creek Bridge. The ground surface under the bridge appeared disturbed with sandstone rubble talus. Halfway downslope, an overgrown vehicle access track was identified, running to the creek below. Slopes on both sides of the twin bridges were inspected for possible sandstone overhangs, however none were identified. The ground surface was steep and at times unstable, with rubble and soil washed downslope from recent rain events. Sandstone outcrops were present in the form of small benches or contained vertical surfaces.

A recently inundated levelled area was present above the Allens Creek watercourse. A vertical rock face present in this area had been cut to fit two bridge pylons. The creek bed and immediate banks contained sandstone boulders, angular cobbles and recent flood debris.



Flood debris was noted to extend at least 20-30 metres back from the creek channel. The abundance of sandstone rubble under the bridge indicated disturbance during bridge construction. No Aboriginal objects or areas of archaeological potential were identified within the western verge of the Hume Highway or within the Allens Creek gorge in Survey Unit 1.



**Plate 5.** View to west, Moolgun Creek Bridge. This level area next to Allens Creek had been inundated from recent flooding. Pylons at left had been fitted into a cavity cut into sandstone bedrock.



**Plate 6.** View to south-west. Steep talus slopes above Allens Creek. East side of Moolgun Creek Bridge.



**Plate 7.** View to south-west. East side of M31, south of Moolgun Creek Bridge. The road reserve included a buried fibre optic cable. Visibility was poor due to grass and shrub cover.



**Plate 8.** View to south-west. East side of M31. This section was overgrown with weed grasses. Some larger Grey Box trees were present. A drainage ditch ran through the centre of photo.

Survey proceeded back up the steep talus slopes to the top of the Allens Creek gorge to the eastern road verge of the Hume Highway. This section of the survey unit was covered by tall grasses, weeds and native shrub growth. Small patches of soil exposures were present with visibility on exposures up to 10-20%. Soil exposures contained yellowish sand and sandstone rubble. No Aboriginal objects were identified on exposures. Posts marking a buried fibre optic cable were present along the property fence and indicated subsurface disturbance. Ground surfaces were uneven throughout the road verge and included a drainage ditch. No Aboriginal objects, areas of archaeological potential or Aboriginal archaeological sites were identified within Survey Unit 1.

Survey continued within Survey Unit 2, on the eastern side of the Hume Highway at the Picton Road on-ramp. This part of the study area was defined by a bend down towards a minor drainage depression. Gentle slopes ran downslope towards a disturbed road siding with blue metal. A buried fibre optic cable easement was identified running along the property fence boundary. Ground surface visibility within this part of the survey unit was zero; impeded by long grasses and blue metal materials.

Native vegetation was encountered further south along the road verge, with some large Eucalypts such as Ironbarks and Greys Gums present, as well as Native Cherry and Geebung shrubs. Mature trees were inspected for any evidence of culturally modified (scarred) trees, however none were identified. Ground surfaces displayed evidence of disturbance, with uneven ground surfaces and dumped sandstone present. A bitumen covered road siding was also present within this part of the survey unit, however this was locked and closed to public access at the time of survey. No Aboriginal objects were identified within this part of the study area.

The survey team continued south towards a steep embankment leading down to the abutment of Pheasants Nest Bridge. Precipitous valley slopes with sandstone boulders and cliff lines were present underneath the bridge. Some level sandstone benches with views of the Nepean River valley were present.



An attempt was made to look below these for overhangs. One overhang with a large sloping boulder floor was inspected; the sandstone here was highly fractured and precarious, resting above a sheer cliff edge. The study area down to the edge of the Nepean River comprised steep and hazardous terrain.



**Plate 9.** View to south-west on eastern side of the motorway. Pheasants Nest stockpile site. This part of the study area was highly disturbed.



**Plate 10.** View to south-west on eastern side of the motorway. The road reserve became more vegetated within proximity to the Nepean River.



**Plate 11.** View to south-west at Pheasants Nest Bridge. Under northern abutment.



**Plate 12.** View of Pheasants Nest Bridge. Western side of M31. Upper valley slopes included sandstone boulders, and sheer cliffs.

Inspection within Survey Unit 2 continued along the western road verge leading up to the Picton Road off-ramp, within the study area corridor. The road verge was divided by steep road embankment to the east and thick bushland to the west. Mature trees were closely inspected for evidence of cultural modification. No scarred trees were identified within this part of the surveyed study area. Some evidence of lopping was present within areas containing regrowth native vegetation. Dumped materials from the construction of the highway were present across the embankment. Further north, the embankment was reinforced with high retaining walls of sandstone boulders. A concrete lined drain was also present along the property fence and ran to the end of the study area at Picton Road. This portion of the survey unit was found to be either disturbed from road construction or did not contain landform elements with archaeological potential.



**Plate 13.** View to north-east. Western side of M31, upslope of Pheasants Nest Bridge. Half of the road reserve is steep road embankment, now regrown with native trees and shrubs.



**Plate 14.** View to north-east. Western side of M31. To end of study area. This is all embankment adjacent to the Picton Road off ramp.

No Aboriginal archaeological sites, Aboriginal objects or areas of archaeological potential were identified within the study area as a result of survey. The study area either displayed evidence of extensive disturbance resulting from road construction, drainage infrastructure and utilities installation. Archaeologically unfavourable landforms such as steep slopes with evidence of soil movement and widespread erosion were also present. These areas were considered to display low to no archaeological potential for intact subsurface deposit. No suitable sandstone outcrops utilised for rock shelter sites with archaeological deposit and/or art, grinding groove sites and engraving sites were identified during the archaeological survey.

## 7.2 Survey coverage analysis

Surface exposure across the study area was low and visibility within surface exposures varied from low to moderate. Surface exposure varied considerably within each survey unit and was dependant on vegetation density, natural processes such as erosion and modern land use practices. Despite the overall lack of surface visibility, it was still possible to assess each proposed work location based on landform and visible disturbance.

All survey units contained generally low levels of exposure; however visibility varied between survey units as a result of varied land use activities across the study area. Visibility was primarily impeded by loose introduced gravels or colluvial materials from upper slopes. Less disturbed upper slopes contained limited exposures. Both exposure and visibility was generally improved on slope and open depression landforms across the study area.

The survey found that the majority of study area had been heavily disturbed by previous road construction and modern land use. Outside of the identified site and PAD area, the remainder of the study area was considered to display low archaeological potential for intact subsurface deposit.

**Table 3. Survey coverage**

Survey Unit	Landform	Area (m <sup>2</sup> )	Exposure (%)	Visibility (%)	Effective Coverage (m <sup>2</sup> )	Effective Coverage (%)
1	Flat	12085	20	30	725	6
1	Slope	18530	30	30	1667	9
1	Open Depression	11535	40	50	2307	20
2	Flat	18390	20	30	1103	6
2	Slope	25310	30	30	2278	9
2	Open Depression	7040	40	20	563	8

**Table 4. Landform coverage**

Landform	Area (m <sup>2</sup> )	Area Effectively Surveyed (m <sup>2</sup> )	% of Landform Effectively Surveyed	# of Sites
Flat	30475	1828	6	0
Slope	43840	3945	9	0
Open Depression	18575	2870	15	0

## 8 Analysis and discussion

Background research, AHIMS records and archaeological field survey did not identify any Aboriginal archaeological sites, Aboriginal objects or areas of archaeological potential within the study area. Several sites were identified within proximity to the study area. 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.

Ground surface visibility occurred in areas where natural processes, such as erosion, or land use practices had removed vegetation or restricted its growth. Limitations to visibility within these areas included leaf litter, rubbish, vegetation growth and introduced gravels.

The ground surface was not visible within the majority of the study area due to remnant and regrowth vegetation, exotic grasses and weeds in addition to road surfaces. Despite the lack of surface visibility, it was still possible to assess the archaeological potential based on topographic location and visible subsurface disturbance.

The survey found that the study area contained low potential for subsurface archaeology due to ground surface disturbance from modern land use practices including motorway construction activities, drainage infrastructure and utilities installation. Natural processes such as erosion have also contributed to disturbance within the study area.

### 8.1 Aboriginal settlement history of the study area

The physical evidence of Aboriginal landscape use in the local area consists primarily of artefact scatters and isolated artefacts. Artefact scatter sites and isolated artefacts have been identified in low densities across the plateau. These sites have generally been interpreted as representing the movement of Aboriginal people between more permanent areas of occupation bordering creek systems and drainage channels.

Archaeological investigations in the surrounding area have shown that while artefact scatters and isolated finds occur, artefact density is generally low. This likely reflects a temporary use of the area by past Aboriginal people. The archaeological evidence indicates that the creeks and tributaries draining to the Nepean River were a focus for Aboriginal occupation.

No Aboriginal archaeological sites, Aboriginal objects or areas of archaeological potential were identified within the study area.

## 9 Significance assessment

No Aboriginal archaeological sites, Aboriginal objects or areas of archaeological potential were identified by the Stage 2 PACHCI assessment within the study area.

## 10 Impact assessment

No Aboriginal archaeological sites, Aboriginal objects or areas of archaeological potential were identified within the study area. It is unlikely that the proposed works would impact on Aboriginal archaeological objects, sites or potential archaeological deposits.

## 11 Legislative considerations

The National Parks and Wildlife Act 1974 (NPW Act) is the primary statutory control dealing with Aboriginal heritage in New South Wales. Items of Aboriginal heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the Act.

Under the Act, an “Aboriginal object” is defined as “any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains”. As such, Aboriginal objects are confined to physical evidence and are commonly referred to as Aboriginal sites.

Aboriginal objects are protected under section 86 of the Act. It is an offence to harm or desecrate an Aboriginal object, either knowingly [section 86 (1)] or unknowingly [section 86 (2)].

There are offences and penalties relating to harm to, or desecration of, an Aboriginal object or declared Aboriginal place. Harm includes to destroy, deface, damage or move. Penalties are tiered according to offences, which include:

- a person must not harm or desecrate an Aboriginal object that the person knows is an Aboriginal object;
- a person must not harm or desecrate an Aboriginal object (strict liability offence);
- a person must not harm or desecrate an Aboriginal place (strict liability offence);
- failure to notify Office of Environment and Heritage of the location of an Aboriginal object (existing offence and penalty); and
- contravention of any condition of an Aboriginal Heritage Impact Permit.

Under section 87 (1) it is a defence if “(a) the harm or desecration concerned was authorised by an Aboriginal heritage impact permit, and (b) the conditions to which that Aboriginal heritage impact permit was subject were not contravened”.

Section 87 (2) of the Act provides a defence against prosecution under section 86 (2) if “the defendant exercised due diligence to determine whether the act or omission constituting the alleged offence would harm an Aboriginal object and reasonably determined that no Aboriginal object would be harmed”.

Under section 90 (1) of the Act “the Director-General may issue an Aboriginal heritage impact permit”. The regulation of Aboriginal heritage impact permits is provided in Part 6 Division 2 of the Act, including regulations relating to consultation (section 90N).

An Aboriginal Heritage Impact Permit (AHIP) is required for an activity which will harm an Aboriginal object.



## 12 Management and recommendations

No Aboriginal archaeological sites, Aboriginal objects or areas of potential archaeological deposit were identified within the study area. No Aboriginal cultural features were identified by TLALC as a result of archaeological survey.

No further assessment of Aboriginal heritage is warranted for the proposed works undertaken within the current study area boundary. Stage 3 PACHCI assessment is not required at this stage as no impact to Aboriginal heritage has been identified.

Should future design exceed the current study area boundary (the existing road corridor) and extend into additional areas not assessed as part of the current Stage 2 PACHCI assessment, additional assessment in accordance with the Stage 2 requirements of the TfNSW *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime 2011) and the Heritage NSW *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Heritage NSW 2010) would be required.

## References

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- Hazelton, PA & Tille, PJ 1990, Soil landscapes of the Wollongong-Port Hacking 1:100 000 Sheet, Soil Conservation Service of NSW, Sydney.
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- Kayandel Archaeological Services, 2018. Proposed Rezoning “Wilton Town Centre Precinct” Wilton, Wollondilly Shire LGA, NSW: Aboriginal Cultural Heritage Assessment and Historic Heritage Assessment. Report prepared for Macarthur Development on behalf of the NSW Department of Planning and Environment.
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- Navin Officer Heritage Consultants, 2003. Proposed “Wilton Park” Residential Development, Wilton, NSW: Archaeological Assessment. Report prepared for Bradcorp Holdings Pty Limited.
- National Parks and Wildlife Service (NPWS), 2003. *The Bioregions of New South Wales: Their Biodiversity, Conservation and History*. National Parks and Wildlife Service NSW, Hurstville NSW
- Heritage NSW, 2010. *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales: Part 6 National Parks and Wildlife Act 1974*. Department of Environment, Climate Change and Water NSW, Sydney.
- Stroud W.J., Sherwin L., Roy H.N. and Baker C.J., 1985, Wollongong - Port Hacking 1:100 000 Geological Sheet 9029-9129, 1st edition. Geological Survey of New South Wales, Sydney.
- Transport for NSW, November 2011. *Procedure for Aboriginal cultural heritage consultation and investigation*.

## **Appendix A Aboriginal stakeholder cultural heritage survey report**

[To be appended]

## Appendix B AHIMS Search Results





## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : 2208.1

Client Service ID : 727152

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
52-2-4027	BG-IF-02	GDA	56	286634	6211180	Open site	Partially Destroyed	Artefact :-		103104
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Austral Archaeology - Wollongong, Miss.Stephani							
52-2-3034	Wilton Park 10, BC10	AGD	56	286740	6210853	Open site	Valid	Artefact :-, Potential Archaeological Deposit (PAD) :-	4944	103104
	<b>Contact</b>	<b>Recorders</b>	Doctor,Julie Dibden							
52-2-4030	BG-PAD-03	GDA	56	287365	6211329	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-4033	BG-PAD-06	GDA	56	287724	6211688	Open site	Valid	Potential Archaeological Deposit (PAD) : 1, Stone Arrangement : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-4093	WJ-IF-03	GDA	56	286635	6211643	Open site	Valid	Artefact : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Mr.Tom Knight							
52-2-4715	Bingara Gorge OS1	GDA	56	287004	6211683	Open site	Valid	Artefact :-		
	<b>Contact</b>	<b>Recorders</b>	Austral Archaeology - Wollongong, Miss.Nicole Monk							
52-2-4434	BG-IF-03	GDA	56	287411	6211546	Open site	Valid	Artefact : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-4432	BG-IF-04	GDA	56	287519	6211412	Open site	Valid	Artefact : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-4340	BG-RS-07	GDA	56	287683	6211417	Closed site	Valid	Habitation Structure : 1, Potential Archaeological Deposit (PAD) : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-4026	BG-IS-01	GDA	56	286557	6211349	Open site	Partially Destroyed	Artefact : 1		103104
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Austral Archaeology - Wollongong, Miss.Stephani							
52-2-3070	BC14, Bradcorp	AGD	56	287311	6211962	Closed site	Valid	Art (Pigment or Engraved) : 4		
	<b>Contact</b>	<b>Recorders</b>	Doctor,Julie Dibden,Mrs.Caryll Sefton							
52-2-4081	WJ-ST-01	GDA	56	286115	6211991	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Mr.Tom Knight							
52-2-4098	WJ-AS-02	GDA	56	286544	6212296	Open site	Valid	Artefact : 1		

Report generated by AHIMS Web Service on 27/10/2022 for Matthew Kelleher for the following area at Datum :GDA, Zone : 56, Eastings : 286050.0 - 287732.0, Northings : 6210968.0 - 6212592.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 22

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## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : 2208.1

Client Service ID : 727152

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Mr.Tom Knight							
52-2-4153	BG-AS-001	GDA	56	286893	6211117	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) :-		
	<b>Contact</b>	<b>Recorders</b>	Mr.Lance Syme							
52-2-4099	WJ-AS-03	GDA	56	286539	6212398	Open site	Valid	Artefact : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Mr.Tom Knight							
52-2-4028	BG-PAD-01	GDA	56	287050	6211759	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		103104
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-3071	BC13, Bradcorp	AGD	56	287225	6211090	Closed site	Valid	Art (Pigment or Engraved) : 6	4944	
	<b>Contact</b>	T Russell	<b>Recorders</b>	Doctor,Julie Dibden,Mrs.Caryll Sefton						
52-2-4029	BG-PAD-02	GDA	56	287346	6211768	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-4338	BG-ST-01	GDA	56	287448	6211483	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services							
52-2-4082	WJ-ST-02	GDA	56	286330	6212128	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Mr.Tom Knight							
52-2-3036	Wilton Park 12, BC12	AGD	56	286827	6210950	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) :-		103104
	<b>Contact</b>	<b>Recorders</b>	Doctor,Julie Dibden							
52-2-4433	BG-AS-004	GDA	56	287344	6211472	Open site	Partially Destroyed	Artefact : 1		
	<b>Contact</b>	<b>Recorders</b>	Kayandel Archaeological Services,Austral Archaeology - Wollongong,Miss.Stephani							

**\*\* Site Status****Valid** - The site has been recorded and accepted onto the system as valid**Destroyed** - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.**Partially Destroyed** - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground**Not a site** - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 27/10/2022 for Matthew Kelleher for the following area at Datum :GDA, Zone : 56, Eastings : 286050.0 - 287732.0, Northings : 6210968.0 - 6212592.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 22

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## AHIMS Web Services (AWS)

### Extensive search - Site list report

Your Ref/PO Number : 2208.2

Client Service ID : 727171

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status **	SiteFeatures	SiteTypes	Reports
52-2-3954	M2D PAD 1	GDA	56	285469	6208528	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	<b>Contact</b>							<b>Permits</b>	4642	
52-2-3880	Wilton Zone Substation	GDA	56	285599	6210114	Open site	Valid	Artefact : 1		103104
	<b>Contact</b>							<b>Permits</b>	3497	
52-2-4079	WJ-ST-04	GDA	56	285232	6210155	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	<b>Contact</b>							<b>Permits</b>		
		<b>Recorders</b>	Navin Officer Heritage Consultants Pty Ltd							
		<b>Recorders</b>	Ms.Deirdre Lewis-Cook							
		<b>Recorders</b>	Kayandel Archaeological Services,Mr.Tom Knight							

**\*\* Site Status****Valid** - The site has been recorded and accepted onto the system as valid**Destroyed** - The site has been completely impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There is nothing left of the site on the ground but proponents should proceed with caution.**Partially Destroyed** - The site has been only partially impacted or harmed usually as consequence of permit activity but sometimes also after natural events. There might be parts or sections of the original site still present on the ground**Not a site** - The site has been originally entered and accepted onto AHIMS as a valid site but after further investigations it was decided it is NOT an aboriginal site. Impact of this type of site does not require permit but Heritage NSW should be notified

Report generated by AHIMS Web Service on 27/10/2022 for Matthew Kelleher for the following area at Datum :GDA, Zone : 56, Eastings : 284165.0 - 285778.0, Northings : 6208517.0 - 6210352.0 with a Buffer of 0 meters.. Number of Aboriginal sites and Aboriginal objects found is 3

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# Appendix F

## Aboriginal heritage assessment of modified trees





**Kelleher  
Nightingale Consulting Pty Ltd**  
ABN 26 120 187 671 ACN 120 187 671

Suite 505-507  
155 King Street  
Sydney NSW 2000  
p 02 9232 5373

12 October 2023

Joseph Fanous  
Senior Environment and Sustainability Manager (Asset and Operations)  
Transport for NSW

Dear Joseph,

**RE. ABORIGINAL ARCHAEOLOGICAL ASSESSMENT OF POTENTIAL MODIFIED TREES  
HUME MOTORWAY, WILTON NSW**

Kelleher Nightingale Consulting was requested by Transport for NSW to assess two potential Aboriginal modified trees identified within the road reserve adjacent to the Hume Motorway at Wilton, NSW. The aim of the assessment was to examine the trees and determine if they were Aboriginal objects as defined under the *National Parks and Wildlife Act 1974* (the Act).

Under the Act, an 'Aboriginal object' is defined as "any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains". As such, Aboriginal objects are confined to physical evidence and are commonly referred to as Aboriginal sites. Aboriginal objects are protected under section 86 of the Act. It is an offence to harm or desecrate an Aboriginal object, either knowingly [section 86 (1)] or unknowingly [section 86 (2)].

A visual inspection was undertaken by Tristram Miller (Archaeologist, KNC) on 14 September 2023. Both trees were located within the road reserve adjacent to the north-bound carriageway on the western side of the Hume Motorway, approximately 310 metres south west of the Moolgun Creek Bridge over Allens Creek (Figure 1).

Tree 1 (Plates 1 and 2) was located near the base of a north sloping gully approximately 20 metres west of the Hume Motorway bitumen edge. The tree comprised a double-trunked, smooth-barked Eucalypt (likely *E. punctata*) with three oval-shaped plate scars. The maximum age of the tree was estimated at 50-100 years. The larger trunk (stem 60cm diameter at scar) had two scars, one facing east (Scar 1) and one west (Scar 2), while the smaller trunk (stem 34cm diameter at scar) had one scar facing east (Scar 3). All three scars were slightly occluded and displayed relatively recent cuts through bark evident around entire edge of scar and steel axe cuts evident on exposed wooden part of trunk

Tree 2 (Plate 3) was approximately 25 metres from Tree 1, located on the eastern side of the north sloping gully, approximately 30 metres west of the Motorway bitumen edge. The tree comprised a single-trunked smooth-barked Eucalypt (likely *E. Punctata*) with one oval-shaped plate scar (Scar 4). The maximum age of the tree was estimated at 50-100 years. The stem was 40cm diameter at the scar and the scar faced east. The scar was slightly occluded and displayed relatively recent (c. last 20 years) cuts through bark evident around the entire edge of scar, and steel axe cuts evident on the exposed wooden part of the trunk on all edges of scar.

The visual inspection and detailed assessment of the scars confirmed that they comprise contemporary modifications, and the trees do not constitute Aboriginal objects under the Act. Evidence for the contemporaneity of the modifications includes: a) the freshness of the scars and slight occlusion of the bark (lack of substantial regrowth); b) the steel axe cuts evident on the exposed wooden trunks and around the scar edges; c) relatively recent age of the modern axe marks (c. last 20 years), and; d) the young age of the trees, both being estimated at less than 100 years old.



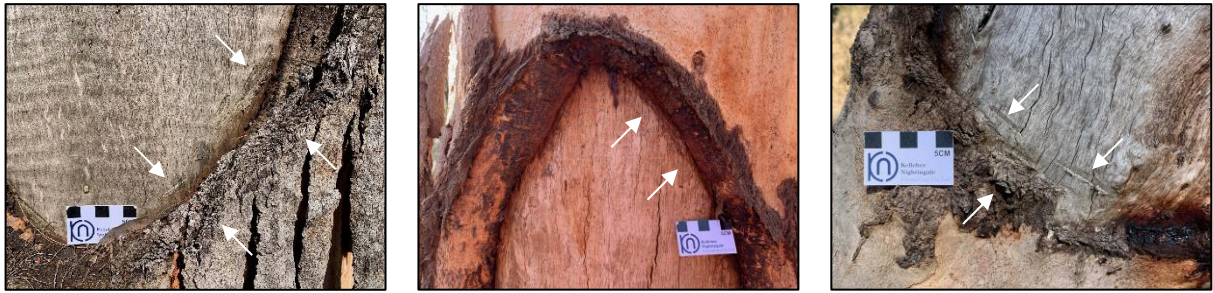


Figure 1. Location of Tree 1 and Tree 2 west of Hume Motorway



Plate 1. Tree 1 location, view west. Insets show (Top) Scars 1 and 3 facing east and (Bottom) Scar 2 facing west.





**Plate 2. Detail of steel axe marks on Tree 1 trunk wood and scar margins (L-R) Scars, 1, 2 and 3**



**Plate 3. Tree 2 location, view west. Insets show (Top) Scar 4 and (Bottom) Detail of steel axe marks around base of scar and on trunk wood**

This section of the road reserve was previously investigated as part of Stage 2 assessment under the Transport for NSW *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* and the *Heritage NSW Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* for proposed koala fencing (KNC 2023). The trees were not identified as Aboriginal objects/archaeological sites during this assessment. Review of the background information and heritage register databases contained within the report confirmed that the trees have not been previously identified as Aboriginal objects or archaeological sites. An updated search of the Heritage NSW Aboriginal Heritage Information Management System (AHIMS) database in October 2023 confirmed that no registered Aboriginal sites are present at this location (Appendix A).

In sum, review of background information and a detailed visual inspection of the scars confirmed that they comprise contemporary modifications. The trees do not constitute Aboriginal archaeological heritage sites or Aboriginal objects under the *National Parks and Wildlife Act 1974*. If you have any questions, please do not hesitate to contact me on 02 9232 5373.

Yours sincerely,

Dr Matthew Kelleher  
 Director/Archaeologist  
 Kelleher Nightingale Consulting Pty Ltd

Appendix A – AHIMS Search Results



**AHIMS Web Services (AWS)**  
Search Result

Your Ref/PO Number : 2208 Trees

Client Service ID : 827958

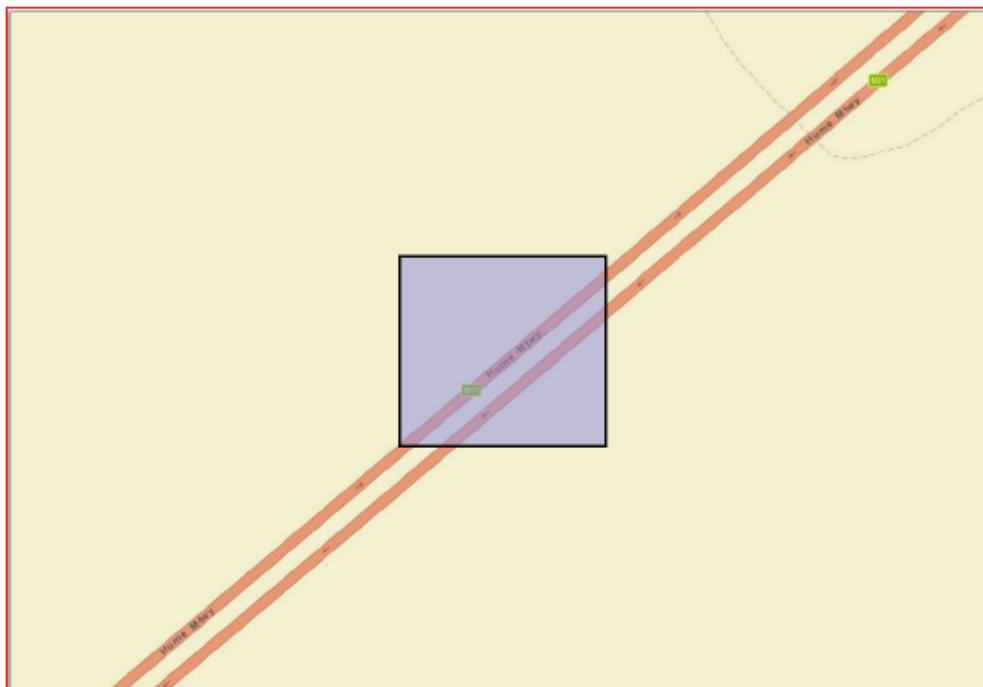
Kelleher Nightingale Consulting Pty Ltd (Generic users)  
Kelleher Nightingale Consulting Pty Ltd Level 10, 25 Blight Street  
Sydney New South Wales 2000  
Attention: Matthew Kelleher  
Email: knc.ahims@gmail.com

Date: 12 October 2023

Dear Sir or Madam:

**AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 286737.0 - 286966.0, Northings : 6211673.0 - 6211886.0 with a Buffer of 0 meters, conducted by Matthew Kelleher on 12 October 2023.**

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *



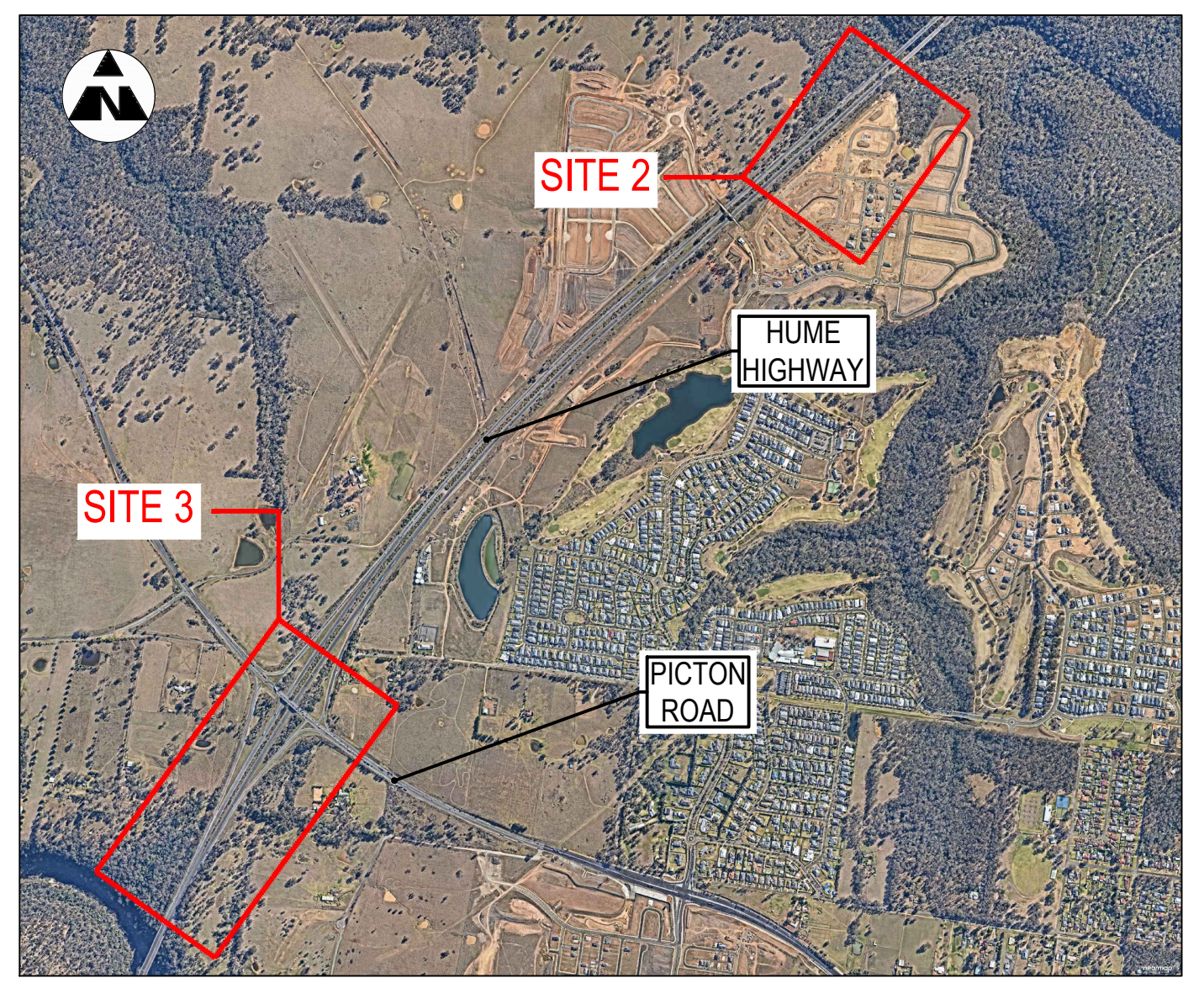
# Appendix G

## 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

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FOR CONSTRUCTION

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**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.

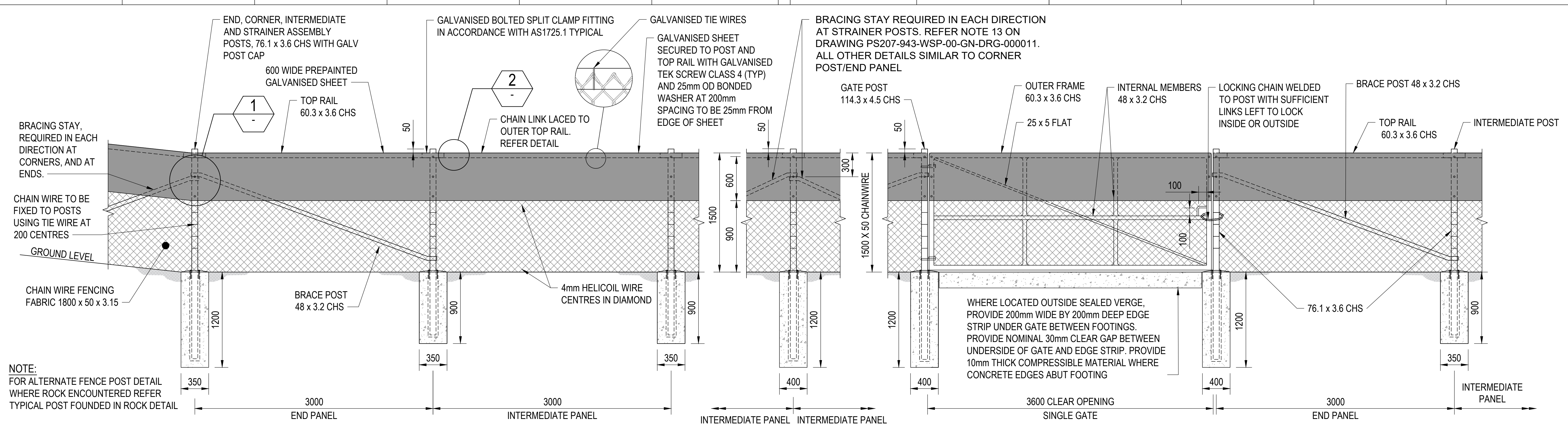
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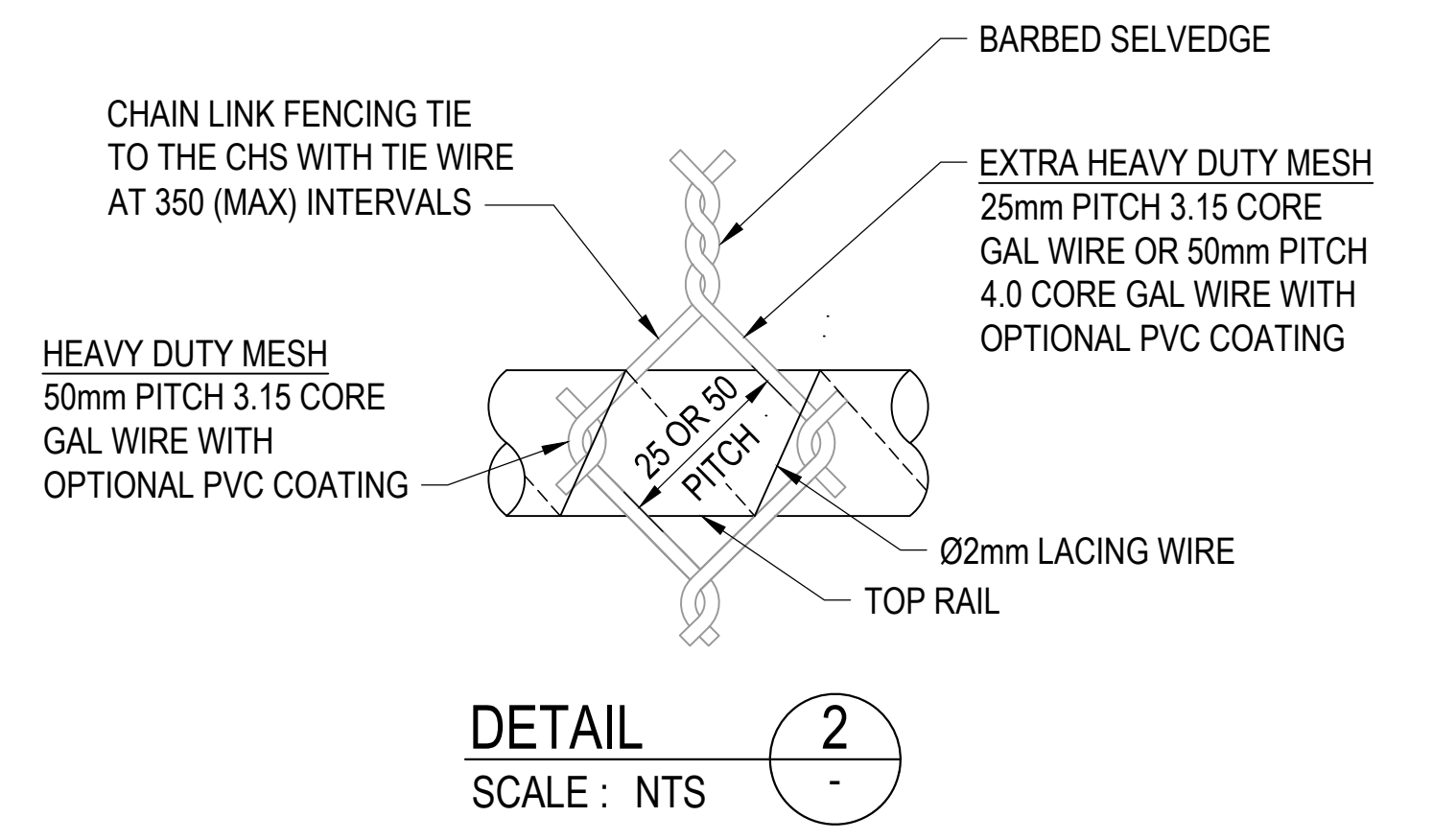
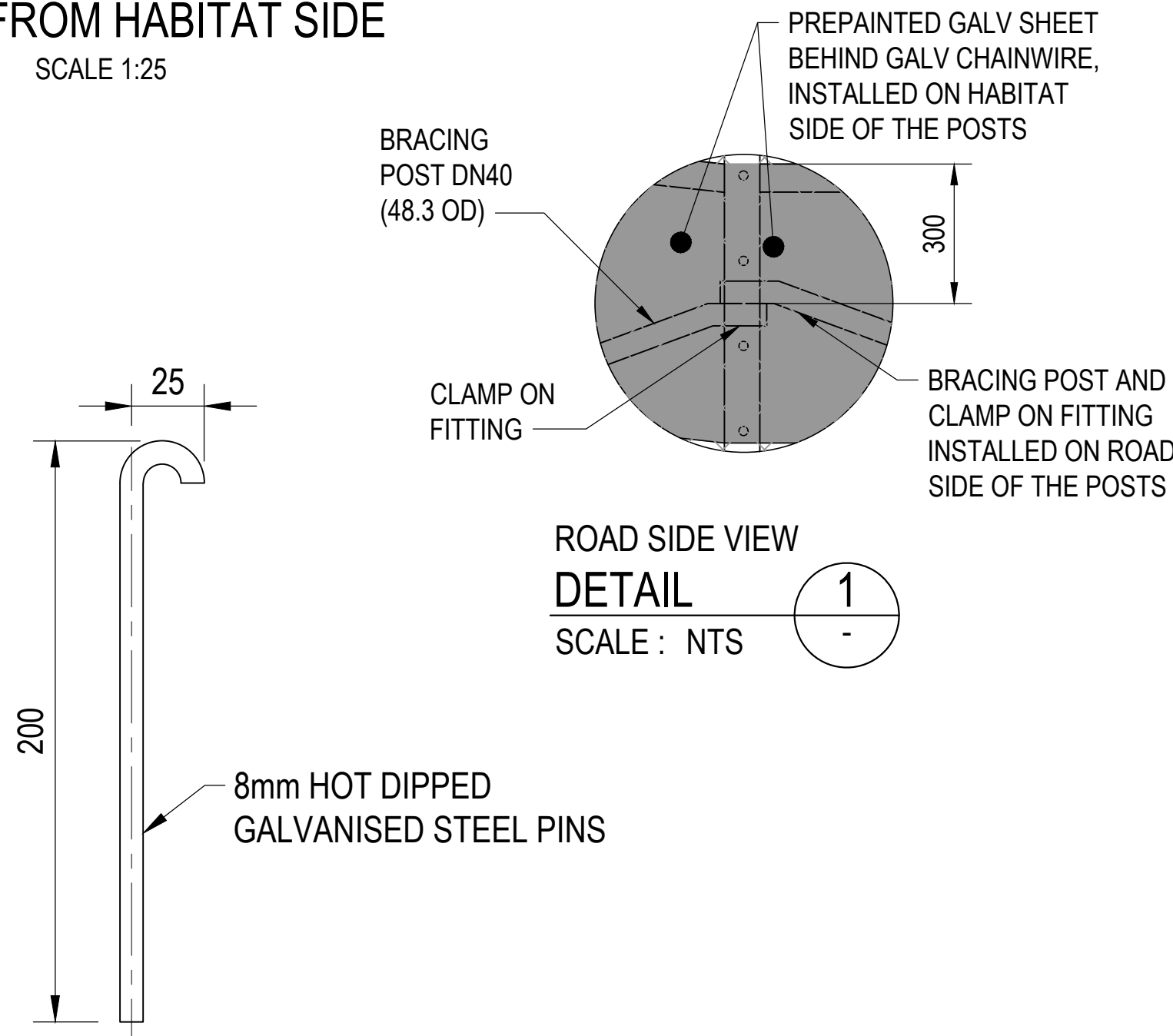
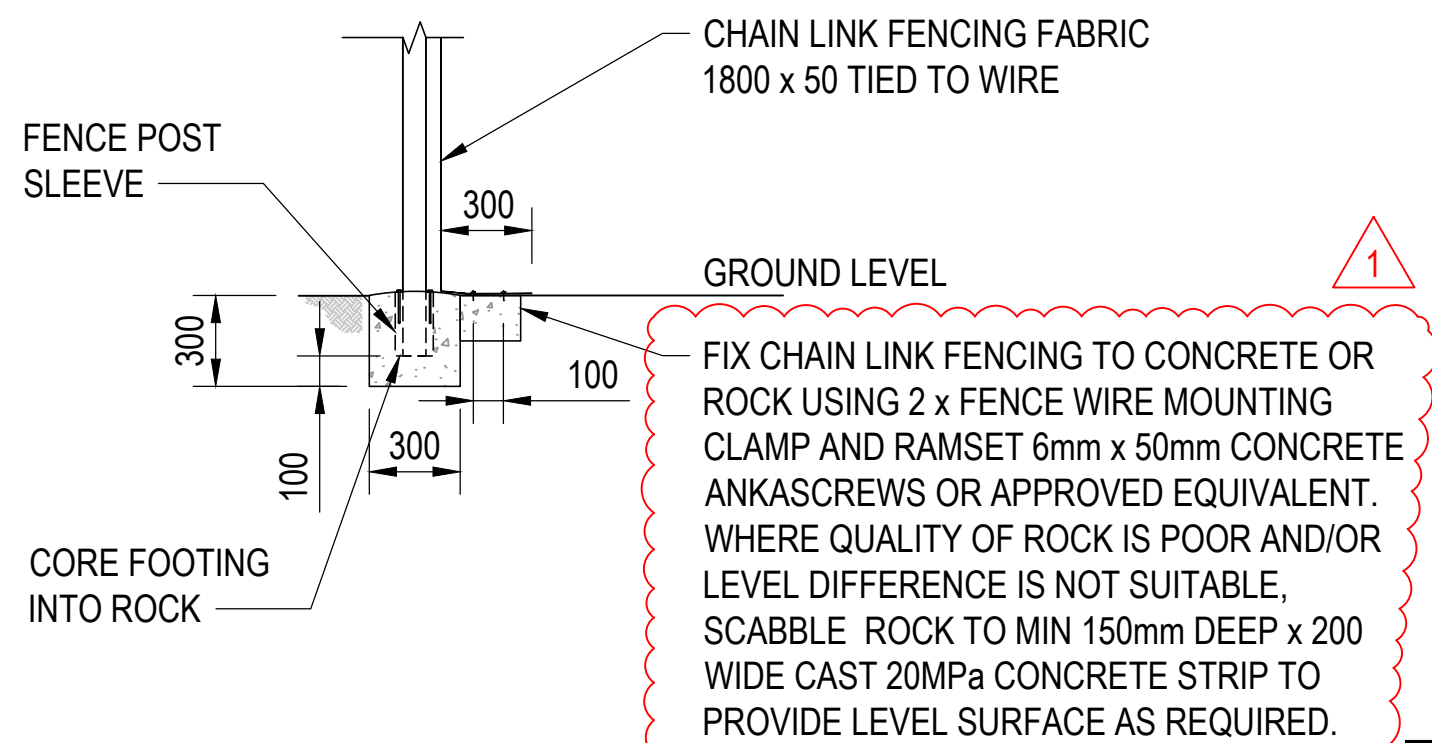
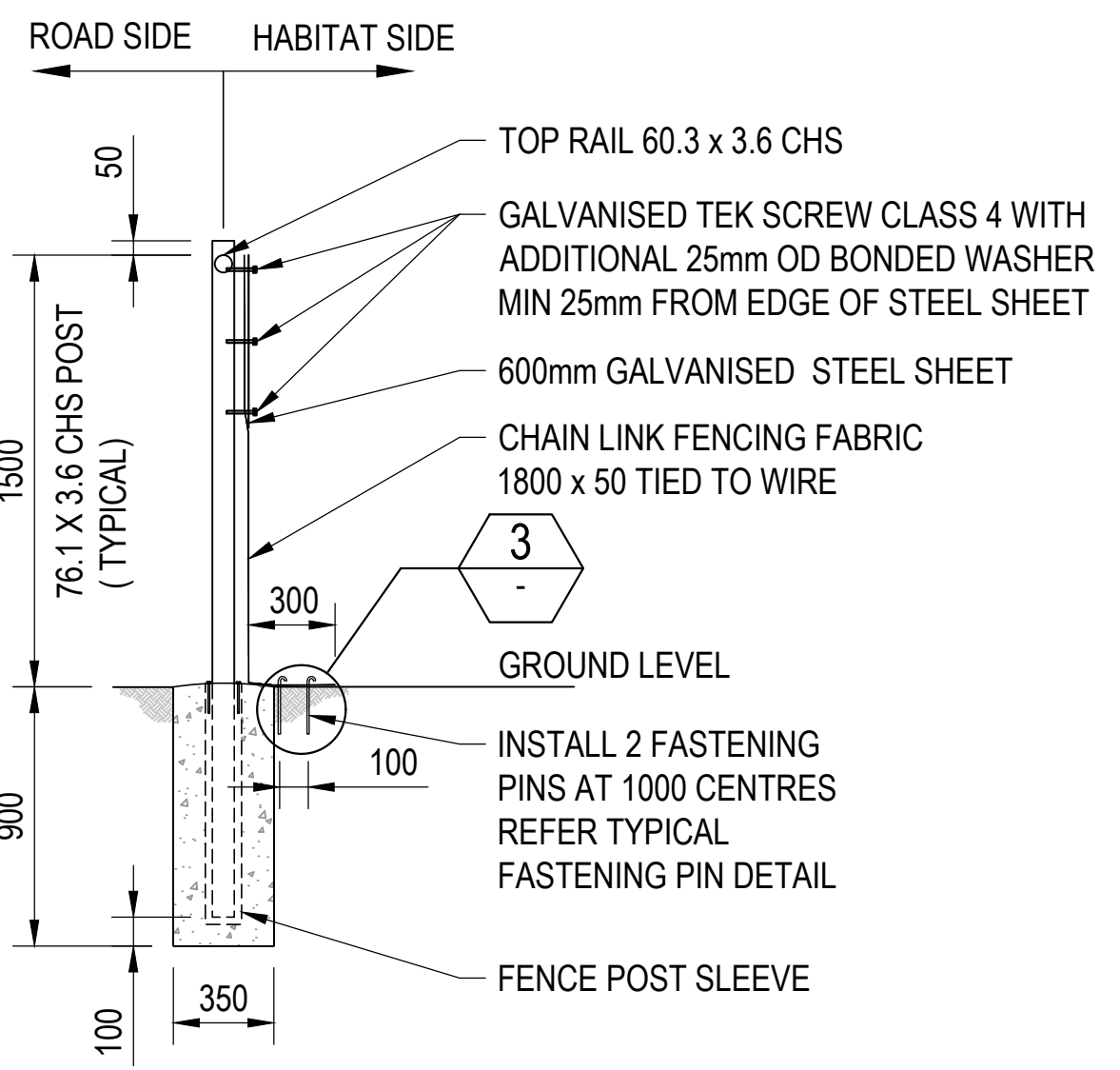




**KOALA PROOF FENCE TYPICAL ARRANGEMENT VIEWED FROM HABITAT SIDE**  
SCALE 1:25

**TYPICAL INTERMEDIATE STRAINER POST ASSEMBLY VIEWED FROM HABITAT SIDE**  
SCALE 1:25

**KOALA PROOF FENCE AT GATE VIEWED FROM HABITAT SIDE**  
SCALE 1:25



- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING PS207943-WSP-00-GN-DRG-000011
  - FOR KOALA FENCE END TIE BACK REFER TO DRAWING PS207943-WSP-00-GN-DRG-000023

**INTERMEDIATE POST FOUNDED IN CLAY SIDE ELEVATION**  
SCALE 1:25

**POST FOUNDED IN ROCK SIDE ELEVATION**  
SCALE 1:25

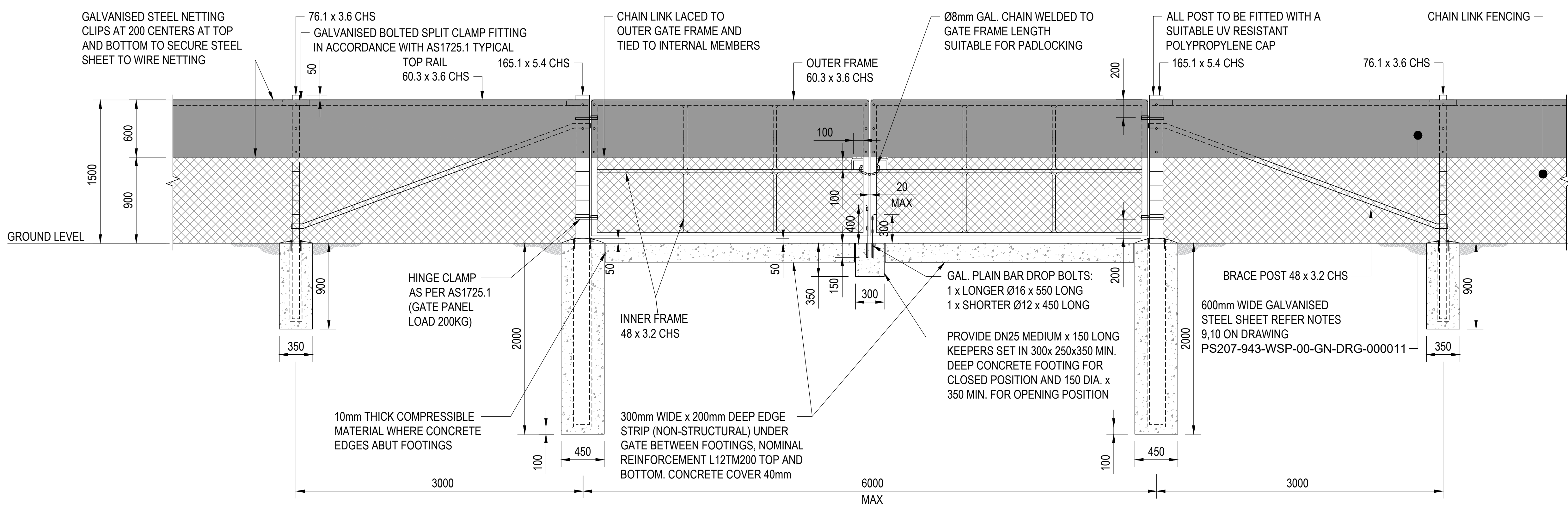
**TYPICAL FASTENING PIN DETAIL**  
**DETAIL 3**  
SCALE 1:5

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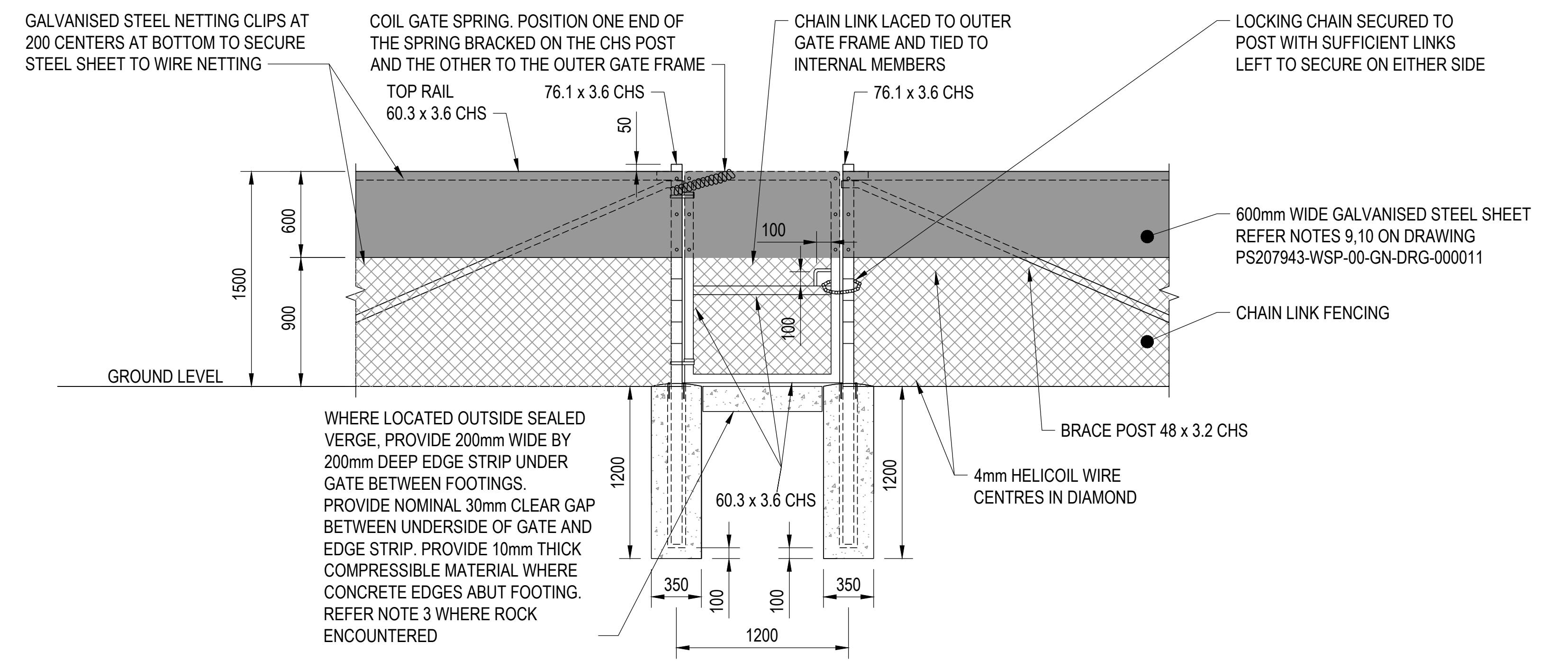
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6.0m WIDE MAINTENANCE VEHICLE ACCESS GATE DETAIL  
ELEVATION VIEWED FROM HABITAT SIDE  
SCALE 1:25



1.2m WIDE MAINTENANCE GATE DETAIL  
ELEVATION VIEWED FROM HABITAT SIDE  
SCALE 1:25

- NOTES:**
- FOR TYPICAL FENCE ELEVATIONS REFER TO DRAWING PS207943-WSP-00-GN-DRG-000021
  - FOR GENERAL NOTES REFER TO DRAWING PS207943-WSP-00-GN-DRG-000011
  - 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

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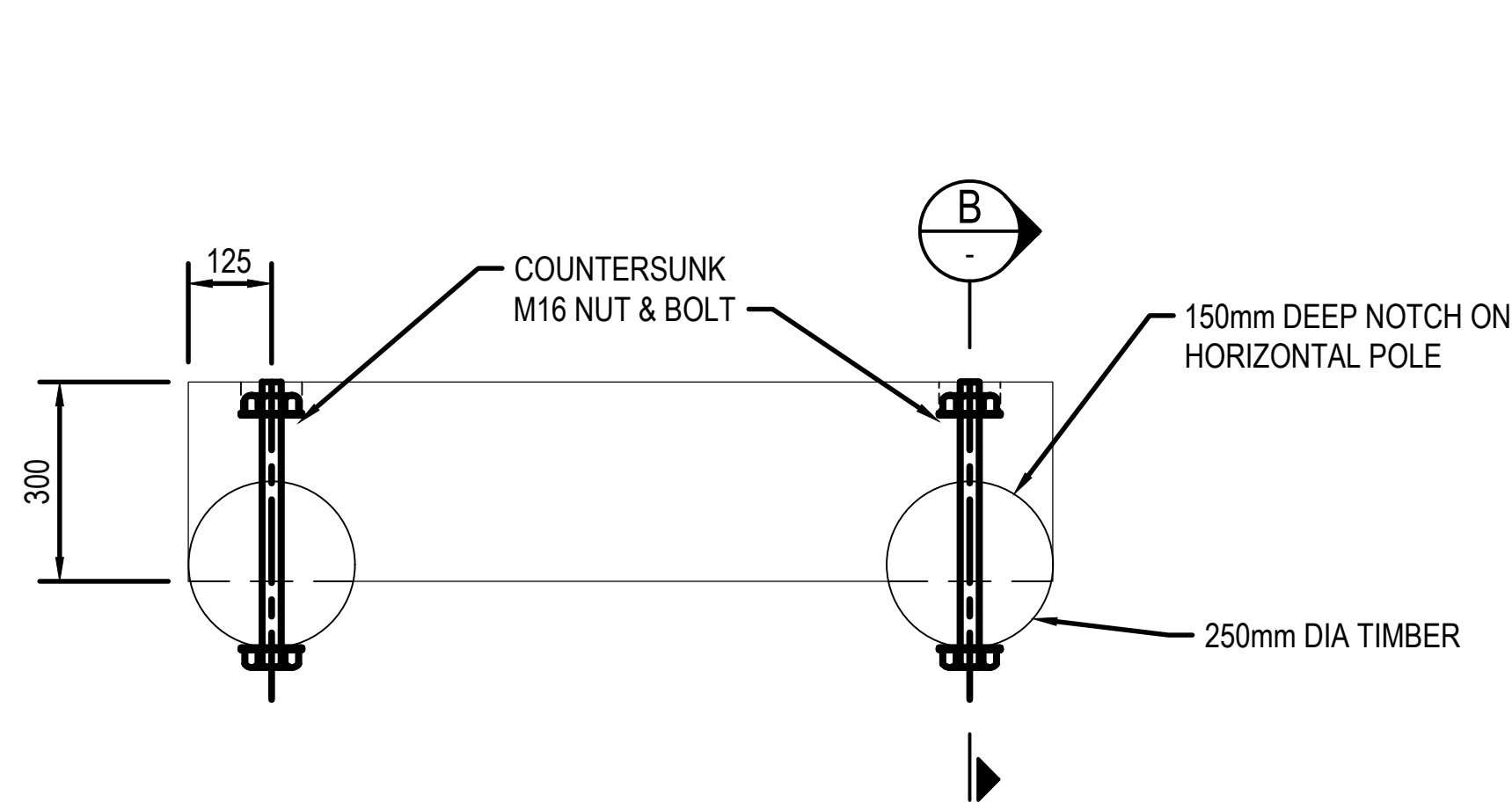
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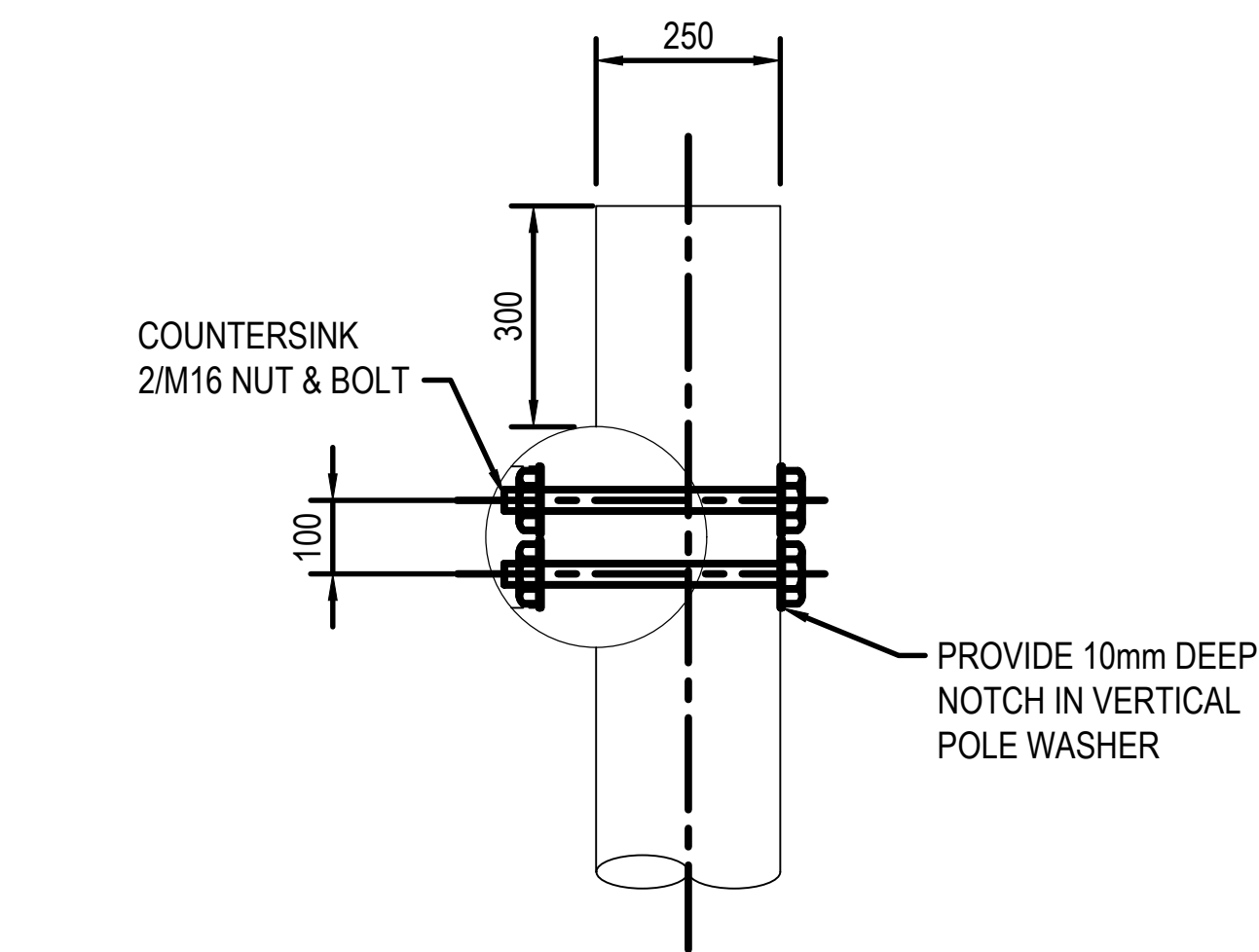
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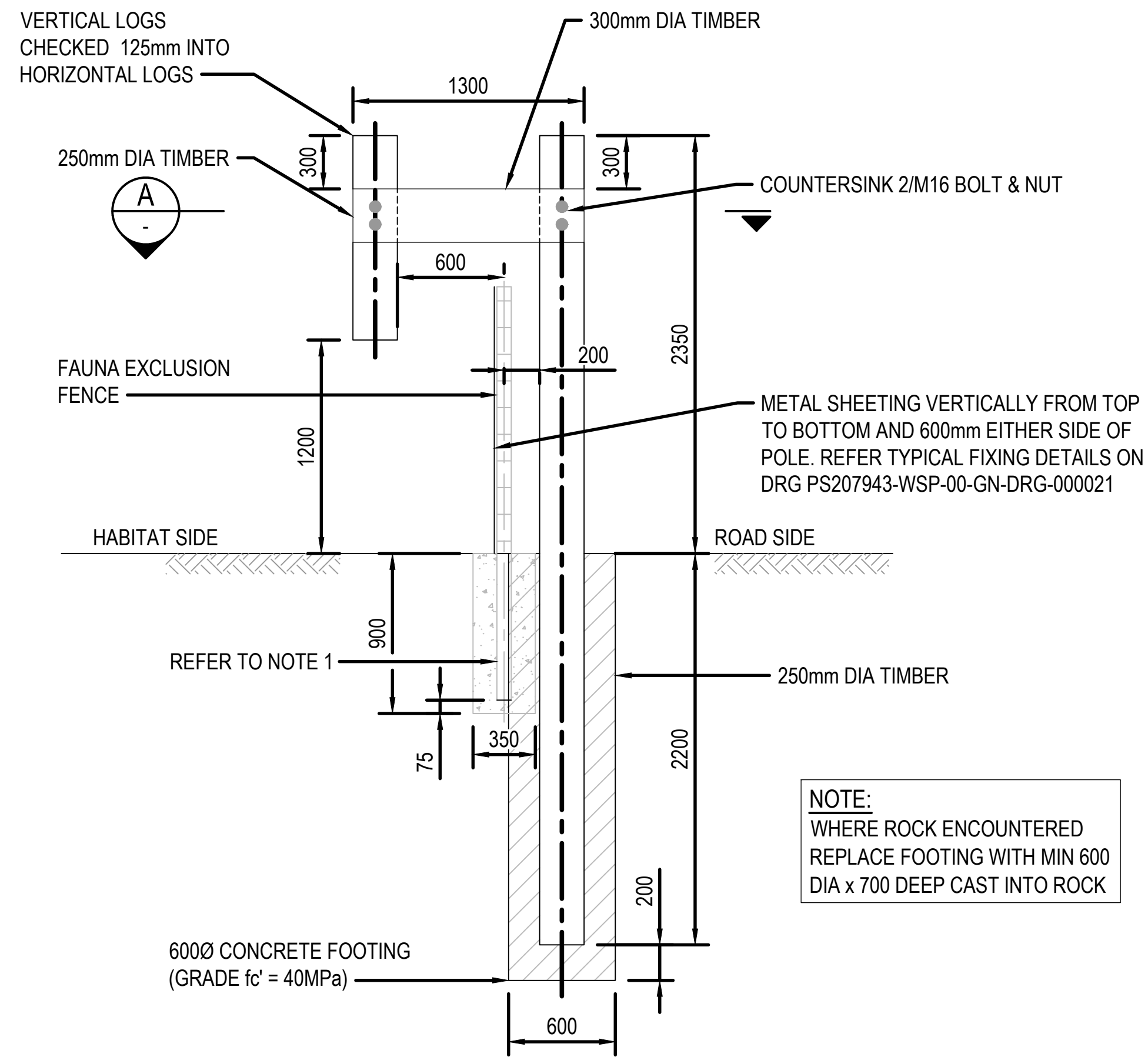




SECTION A  
SCALE 1:10

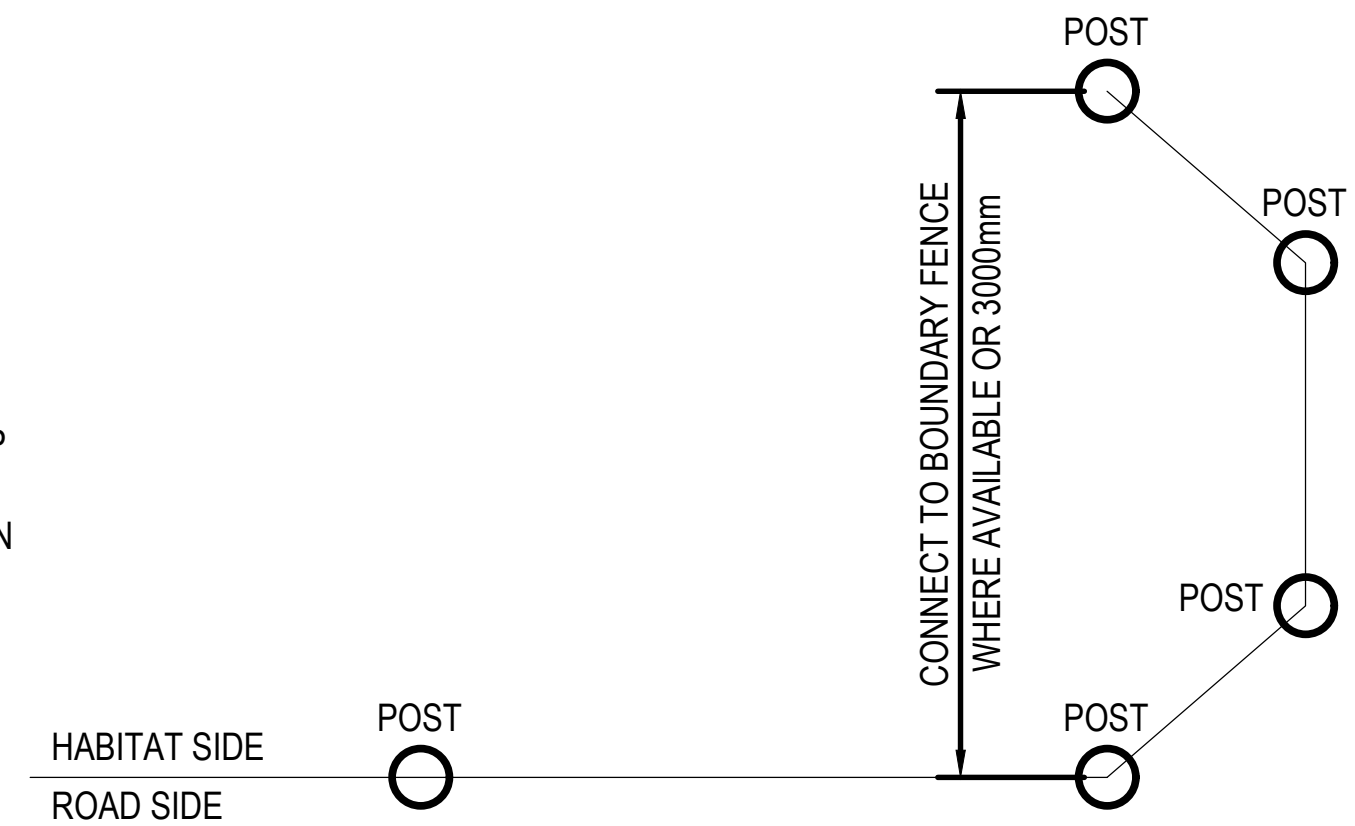


SECTION B  
SCALE 1:10



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

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 TNSW B240

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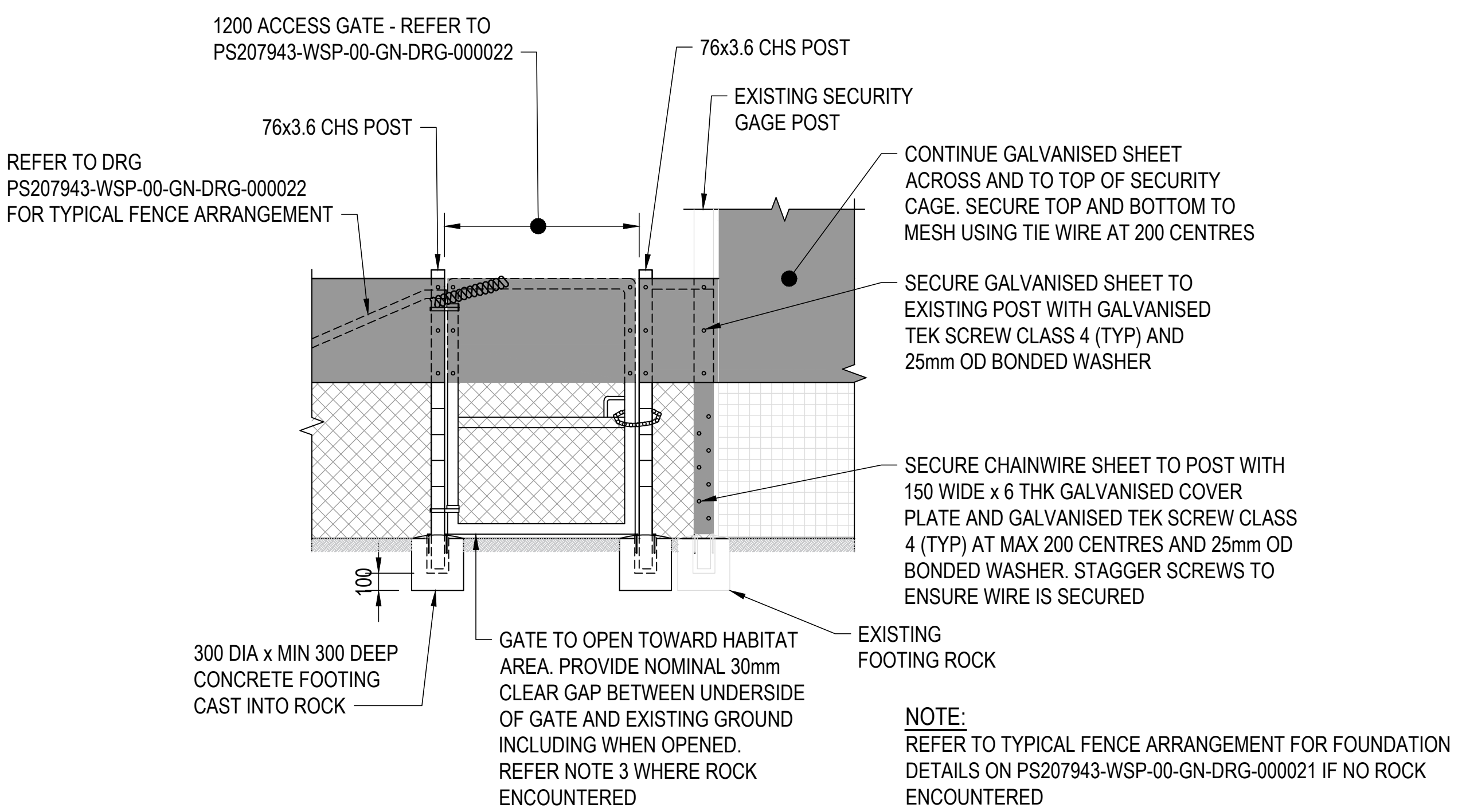
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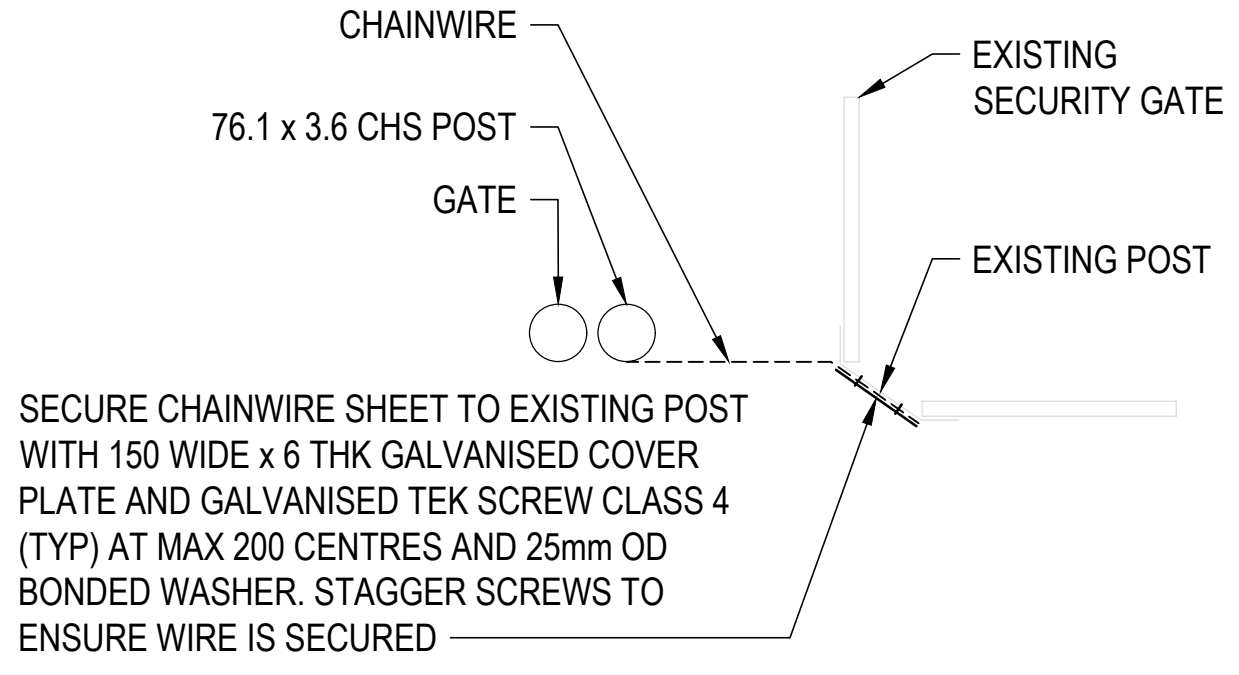
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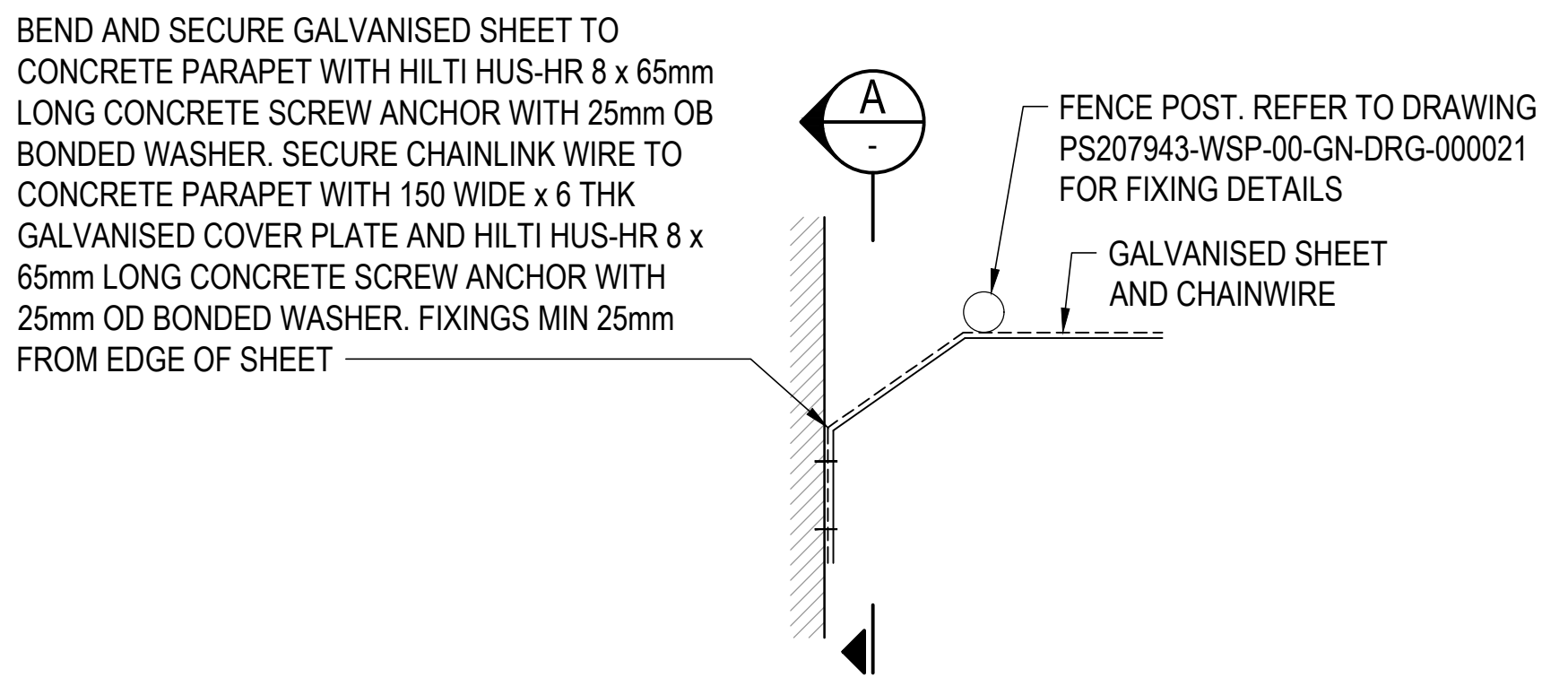




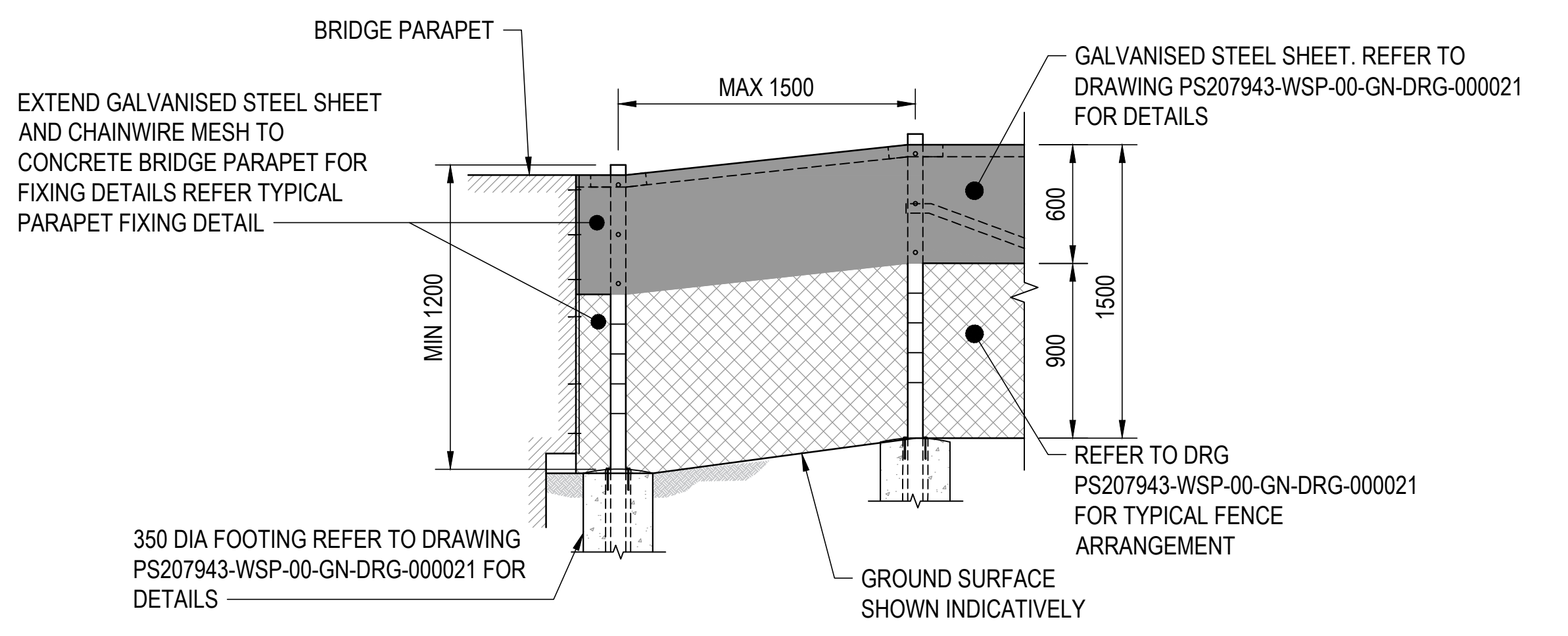
**SITE 2 - TYPICAL ACCESS GATE AT NORTHBOUND SECURITY FENCE (SOUTHBOUND SIMILAR)**  
SCALE 1:25



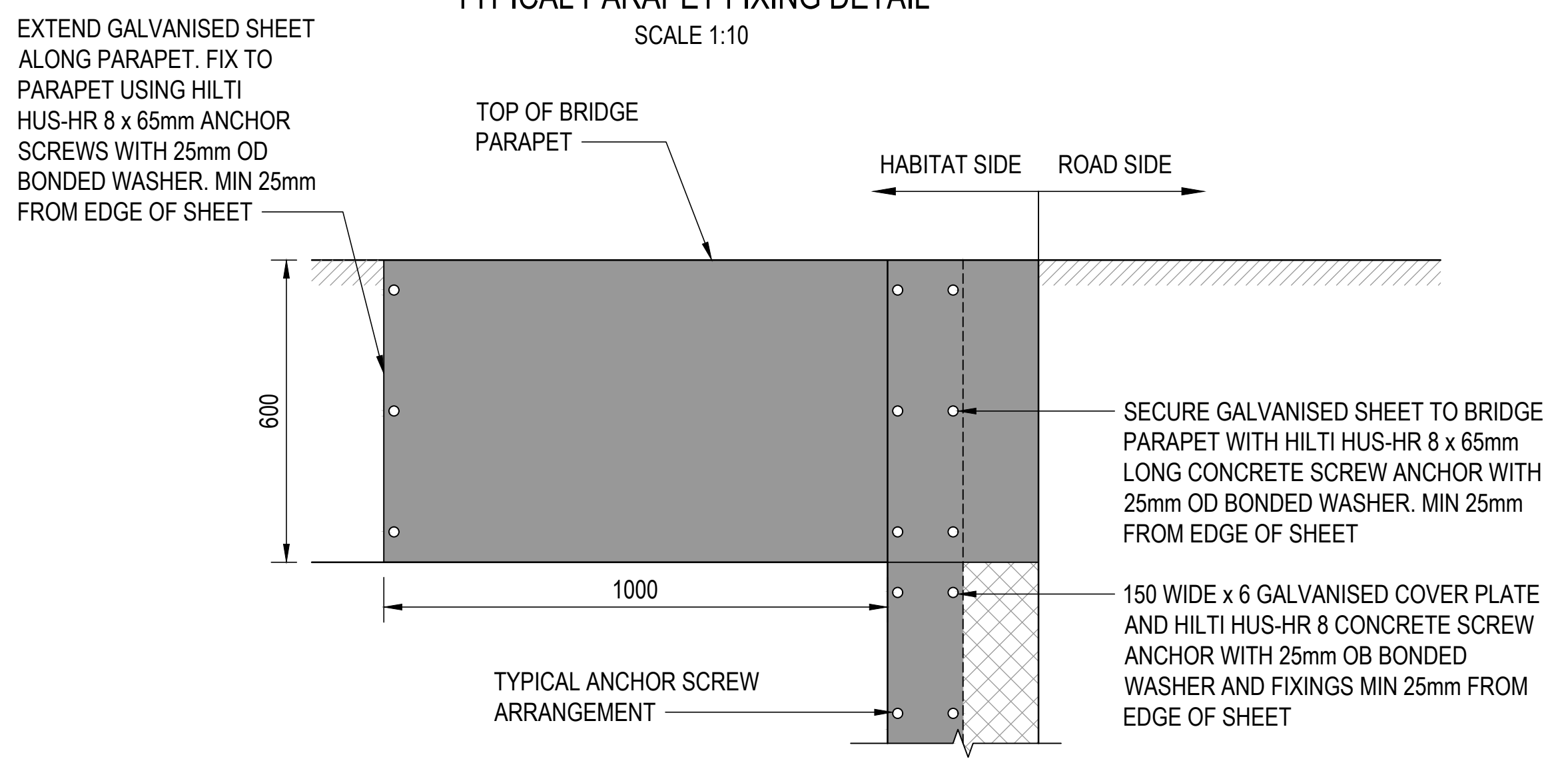
**TYPICAL FIXING TO EXISTING SECURITY FENCE POST**  
SCALE 1:10



**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:**

- FOR GENERAL NOTES REFER TO DRAWING PS207943-WSP-00-GN-DRG-000011
- FOR FENCE DETAILS REFER TO DRAWINGS PS207943-WSP-00-GN-DRG-000021 AND PS207943-WSP-00-GN-DRG-000022
- 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**

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