Transport for NSW

Richmond Road Upgrade between M7 Motorway and Townson Road, Marsden Park

Biodiversity assessment report for review of environmental factors (REF)

November 2024

NSW GOVERNMENT

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Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which the Richmond Road Upgrade between M7 Motorway and Townson Road, Marsden Park project is proposed.

We pay our respects to 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	Richmond Road Upgrade between M7 Motorway and Townson Road, Marsden Park: Biodiversity Assessment Report
Accepted on behalf of Transport for NSW by:	Maddy Mukerjee, Project Development Manager
Signed	Maddy Mukerjee
Date:	27/11/2024

Document review tracking

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Introduction

The North West Growth Area (NWGA) has been identified by the NSW Government as a key component to support urban growth in the greater Sydney region. In response to the NWGA there is need for a transport network plan. Transport for NSW (Transport) has developed the NWGA Transport Strategy that aims to establish a sustainable and integrated transport system that caters to the rising population. As part of the NWGA Transport Strategy, Transport is proposing to upgrade Richmond Road to six lanes between the M7 Motorway and Townson Road with the ultimate objectives of relieving the current corridor congestion and providing road capacity that supports growth. The key design features of the Richmond Road upgrade include:

- Widening Richmond Road between the M7 Motorway and Townson Road to six lanes, adding an additional lane in each direction
- building a new flyover bridge from the M7 Motorway Rooty Hill Road North off-ramp to Richmond Road northbound to allow road users to bypass two sets of traffic lights, reducing congestion and queuing onto the motorway and allowing uninterrupted flow of traffic
- retaining the existing bridge structure over Bells Creek for southbound traffic on Richmond Road
- constructing a new concrete bridge structure over Bells Creek for the northbound carriageway that would include a separated pedestrian and bike path and travel lanes
- new staged pedestrian crossings on Richmond Road at Alderton Drive and Townson Road making it easier for pedestrian and bike riders to move safely in and around the area
- intersections upgrade along Richmond Road between the M7 Motorway and Townson Road.

The study area includes areas of certified land under the *State Environmental Planning Policy (Precincts—Central River City) 2021,* within the North West Growth Area, and Cumberland Plain Conservation Plan (CPCP). Areas of certified- major transport corridor under the CPCP have been certified for development under the BC Act and strategically assessed and approved under the EPBC Act. Within the Western Sydney Growth Centres, the requirements of the Western Sydney Growth Centres Strategic Assessment (2011) applies and no further assessment under the EPBC Act is required in these areas, provided that the development occurs in accordance with the Growth Centre requirements. As such, further assessment under the *Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is not required in these areas, provided that the development occurs in accordance with the relevant biocertification order.

Native vegetation

The proposal is located within the Greater Sydney Local Government Area (LGA) of Blacktown City Council, within the Cumberland Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the Sydney Basin IBRA bioregion. This region is important for biodiversity, supporting several endemic flora and fauna species found only on the Cumberland Plain. The study area is located in an area of significant urban change, including residential subdivisions, industrial development and upgrades to strained transport infrastructure. The proposal is located along the existing road corridor of Richmond Road, consisting of a 3 kilometre section between the M7 Motorway and Townson Road where biodiversity values are sparse. Two Plant Community Types (PCTs) were present across four vegetation zones within the study area. Both PCTs within the study area are listed as Threatened Ecological Communities (TECs) under the BC Act and/or the EPBC Act. Each vegetation zone was assessed using detailed floristic vegetation integrity plots in accordance with the Biodiversity Assessment Method (BAM). Other vegetation present in the study area, which could not be reasonably assigned to a PCT, included planted native trees, landscaped natives, mixed native exotic instream vegetation and exotic vegetation. The table below summarises the vegetation zones, PCTs, listing status and area.

Veg zone	Plant Community Type (PCT)	Threatened Ecological Community (TEC)	Study area (ha)			
			Certified areas within the proposal footprint		Study area not biocertified	Total
			North West Growth Area	Certified – Major Transport Corridor		
Zone 1	PCT 3320: Cumberland Shale Plains Woodland	Moderate	0.92	0.25	1.24	2.41
Zone 2	PCT 3320: Cumberland Shale Plains Woodland	Moderate-Good	0.00	0.00	1.07	1.08
Zone 3	PCT 4025: Cumberland Red Gum Riverflat Forest	Moderate	0.43	0.00	2.42	2.85
Zone 4	PCT 4025: Cumberland Red Gum Riverflat Forest	Low	0.00	0.00	0.51	0.51

Threatened species

Stantec undertook a systematic survey of the study area to map and identify significant habitat features. Field surveys 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). Habitat features, as well as floristic data, were input into the BAM calculator (BAM-C) to provide a list of threatened species that would be further assessed as part of the biodiversity assessment. The species considered for targeted surveys were those generated by the BAM-C and/or considered likely to occur in the study area based on a habitat suitability assessment.

Threatened flora and fauna surveys were conducted in accordance with Chapter 5 of the Biodiversity Assessment Method (BAM) to determine presence within the study area. Targeted threatened species surveys were conducted between August 2023 and May 2024. Targeted surveys outside of certified lands (i.e. within non-certified and uncertified lands of the study area) were completed for the following groups:

- Threatened flora survey transects for the non-certified and uncertified study area in its entirety
- Diurnal birds - dedicated diurnal surveys in areas of suitable habitat within the non-certified and uncertified study area
- Amphibians- active aural-visual surveys of suitable habitat within the non-certified and uncertified study area
- *Phascolarctos cinereus* (Koala) - spot assessment technique was deployed across habitat containing suitable feed trees within the non-certified and uncertified study area
- *Meridolum corneovirens* (Cumberland Plain Land Snail) surveys undertaken in conjunction with Koala spot assessment technique
- Nocturnal fauna – stag-watching, spotlighting and call playback surveys within areas of potential habitat of the non-certified and uncertified study area
- Microbats - ANABAT units were deployed in areas identified as potential microbat habitat
- All groups - opportunistic surveys were conducted for all fauna groups during all phases of works.

An assessment of aquatic habitat within the study area was also conducted and included an assessment of riparian and aquatic habitat, fish biodiversity and water quality. Two sites were established along Bells Creek (BC-1 and BC-2) and have been classified as Class 2 moderate fish habitat. Water quality physiochemical parameters were normal for pH and electrical conductivity, however dissolved oxygen (DO) was above the guideline range for site BC-1 but was low for site BC-2 with a reading below the guideline range at these two sites. One site on an unnamed tributary of Bells Creek (UC-1) was established

and is representative of a highly disturbed being identified as Class 3 minimal fish habitat. No water quality testing was completed at UC-1 due to low water levels.

Six threatened species were recorded in the study area during field surveys:

- *Grevillea juniperina* subsp. *juniperina* – listed as vulnerable under the BC Act
- *Meridolum corneovirens* (Cumberland Plain Land Snail)– listed as endangered under the BC Act
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)– listed as vulnerable under the BC Act
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)– listed as vulnerable under the BC Act
- *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox) – listed as vulnerable under the BC Act and EPBC Act.

An additional eight threatened flora species identified as candidate species could not be surveyed in accordance with seasonal requirements. These species will be surveyed and, if applicable, subject to further assessment prior to the determination of the project.

Following field surveys, a total of 26 threatened species were considered to have a moderate or higher likelihood of occurring within the study area. Assessments of significance under the BC Act and/or EPBC Act were undertaken for these species.

Impact assessment

The proposal would require the removal of up to 1.76 hectares of native vegetation and 60 planted native trees outside of certified areas. This includes 1.76 hectares of vegetation commensurate with TECs listed under the BC Act and 1.07 hectares of vegetation commensurate with TECs listed under the EPBC Act. Direct impacts to fauna habitat would be limited to a narrow band of disturbed habitat adjacent to the existing road corridor. No active breeding features for any threatened fauna species were detected within the study area and direct impacts would be limited to foraging habitat and hollow bearing trees not currently occupied by any threatened species. Appropriate mitigation measures, including pre-clearance surveys and stop work procedures, would be implemented to reduce the risk of injury and mortality to any fauna species occupying the area during construction. Up to 0.44 hectares of known habitat for *Grevillea juniperina* subsp. *juniperina* would be impacted by the proposal.

Due to seasonal requirements, targeted surveys for eight threatened flora species have not yet been undertaken, however will be completed prior to determination of the project.

The proposal would also result in impacts to up to 0.35 hectares of native vegetation and potential threatened species habitat within certified lands.

These impacts have previously been offset under the North West Growth Centre Biodiversity Certification process and CPCP. As such, no further assessment of these areas is required, provided that the development occurs in accordance with the relevant biocertification order.

The proposal would require the construction of a bridge over Bells Creek, determined to be a Class 2 fish habitat waterway. Although the bridge would span the width of the creek, temporary work for bridge construction may obstruct fish passage. Under NSW legislation considerations are to be made for the design and implementation of waterway crossings that may create a permanent or temporary barrier to a waterway to ensure minimal impacts to the fish passage.

The requirement for a permit under section 219 of the *Fisheries Management Act 1994* (FM Act) would be determined during detailed design. Consultation with DPI Fisheries under section 199 of the FM Act to undertake dredging and reclamation works will be undertaken.

Impact avoidance and minimisation

The proposal has been located to relieve current corridor congestion and provide road capacity to support growth as part of the NWGA Transport Strategy. Due to the nature of the proposal (i.e. widening of existing road corridor) impacts to biodiversity are unavoidable, however the proposal footprint has been limited, as far as practicable, to avoid unnecessary clearing of vegetation.

Biodiversity values have been included as constraints during the design process and avoiding unnecessary impact has been achieved where possible. The removal of a shared pathway on Richmond Road and the steepening of road batters at the M7 flyover have retained over 40 mature trees and minimised existing vegetation community impact in those areas.

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

Offsetting

Impacts to biodiversity values within the subject land have been assessed against Transport offset guideline documents to determine if biodiversity offsetting would be required as part of the proposal. Preliminary offsetting estimates indicate 51 ecosystem credits would be required to offset the proposal impacts that trigger the Transport offsetting thresholds. Remaining vegetation has been considered against the requirements of the *Tree and Hollow Replacement Guidelines* (Transport, 2023b). Preliminary estimates of tree and hollow replacement indicate that approximately 164 trees would be required to be planted to meet the obligations of the guidelines. Three species credit species have been recorded within the subject land, however they do not require offsetting as per the *No Net Loss Guidelines* (Transport 2023a) thresholds. Under the environmental safeguards for the proposal, a Biodiversity Offset Strategy and Tree and Hollow Replacement Plan would be prepared to detail offset obligations under the *Biodiversity Policy* (Transport, 2022).

1. Introduction

1.1 Proposal background

The North West Growth Area (NWGA) has been identified by the New South Wales (NSW) Government as a key area to support urban growth in the greater Sydney region. When developed (2056 forecasts), the NWGA will provide approximately 90,000 homes accommodating 250,000 people. A key part of the identification of the NWGA was its proximity and connection to transport nodes including the M7 Motorway and ease of connection to the M4 Motorway, Sydney Metro and the new Western Sydney Airport.

To unlock the potential of the NWGA, upgrades to transport infrastructure must align with current and forecasted needs, while considering forecasted population and economic growth. Richmond Road already experiences significant congestion, impacting travel times and hindering the potential for economic growth in the area. As the NWGA continues to grow there will be increasing pressure on Richmond Road and the transport network.

As part of the NWGA Transport Strategy, Transport for NSW (Transport) is proposing to upgrade Richmond Road between the M7 Motorway and Townson Road (the proposal). The proposal has the ultimate objectives of relieving the current corridor congestion and providing road capacity that supports growth.

The section of Richmond Road to be upgraded is located in the Blacktown City Council LGA and traverses the suburbs of Marsden Park, Colebee, Hassall Grove, Oakhurst, Dean Park and Glendenning.

1.2 The proposal

Transport is proposing to upgrade Richmond Road between the M7 Motorway and Townson Road (the proposal) (refer to Figure 1-1). Key features of the proposal include:

Key features of the proposal would include:

- Upgrade of Richmond Road between the M7 Motorway and Townson Road to six lanes (three lanes in each direction). This would include:
  - road widening between the M7 Motorway and the Alderton Drive / Langford Drive intersection including a new bridge structure over Bells Creek
  - widening into the median from the Alderton Drive / Langford Drive intersection to 250 metres north of the Hollinsworth Road / Townson Road intersection.
- Building a new flyover bridge from the M7 Motorway Rooty Hill Road North off-ramp landing on Richmond Road around 300 metres prior to Bells Creek. This would include:
  - a single lane bridge structure around 250 metres long and 8.4 metres wide for traffic heading northbound on Richmond Road
  - 170 metre embankment at the southern end of the bridge beginning at the M7 Motorway Rooty Hill Road North off-ramp, roughly five metres above the existing ground level
  - 150 metre long retaining wall located at the northern end of the bridge within the median of Richmond Road. At its highest point the retaining wall would be 8.4 metres high
  - minor re-surfacing of the existing M7 Motorway Rooty Hill Road North off-ramp where the ramp ties into the new flyover
  - no changes to existing gantry, exit lanes or lane functions on the M7 Motorway.
- Upgrades to the intersection of Richmond Road, Hollinsworth Road and Townson Road including:
  - an additional northbound through lane along Richmond Road (providing three through lanes towards Richmond)
  - an additional dedicated right turn lane from Richmond Road southbound onto Hollinsworth Road
  - a new left turn slip lane from Hollinsworth Road onto Richmond Road including a pedestrian island and crossing
  - staged pedestrian crossings across Richmond Road on the north and south sides of the intersection, with a pedestrian refuge in the median.

- Upgrades to the intersection of Richmond Road, Langford Drive and Alderton Drive including:
  - additional northbound and southbound through lanes along Richmond Road (providing three through lanes in both directions)
  - staged pedestrian crossings across Richmond Road on the north and south sides of the intersection, with a pedestrian refuge in the median.
- Upgrades to the intersection of Richmond Road, Rooty Hill Road North and the M7 Motorway ramps including:
  - two dedicated lanes on Richmond Road heading onto the M7 Motorway (southbound on-ramp)
  - two dedicated southbound through lanes on Richmond Road (towards Blacktown)
  - an additional right turn lane from Richmond Road southbound onto Rooty Hill Road North (providing two dedicated right turn lanes onto Rooty Hill Road North)
  - extension of 10 metres for the left turn lane from Richmond Road southbound onto M7 Motorway northbound on-ramp
  - relocation of the existing pedestrian crossing on Richmond Road approximately 160 metres south. This would be a new staged pedestrian crossing across Richmond Road, with a pedestrian refuge in the median at the intersection of Richmond Road and the M7 Motorway southbound on-ramp.
- Active transport provisions throughout the proposal area including:
  - moving the existing shared pedestrian and bike path on the western side of Richmond Road to be further west. This would be a four metre wide shared pedestrian and bike path on the western side of Richmond Road (between the M7 Motorway to approximately 150 metres south of the Richmond Road / Langford Drive / Alderton Drive intersection) where it would connect to the existing shared path.
- Building a new concrete bridge structure over Bells Creek for the northbound carriageway located approximately 14 metres west of the existing Bells Creek bridge. This would include:
  - a bridge structure around 29 metres long and 18 metres wide
  - three northbound travel lanes
  - a shared pedestrian and bike path on the western side, which replaces the existing boardwalk bridge next to the northbound Richmond Road carriageway.
- Retention of the five bus stops on Richmond Road between Yarramundi Drive and the Richmond Road / Hollinsworth Road / Townson Road intersection. The dedicated bus lanes at the intersection of Richmond Road with Langford Drive / Alderton Drive and Hollinsworth Road / Townson Road are also retained.
- Drainage and water quality structures along the proposal including:
  - adjustments to the pits and pipes of the existing stormwater network
  - two gross pollutant traps to the north and south of Bells Creek
  - open flooding channel on the eastern side of Richmond Road roughly between the M7 Motorway northbound on-ramp and Bells Creek for flood mitigation purposes. The channel would be around 425 metres long and 10 metres wide and would discharge into Bells Creek.
- Roadside furniture including safety barriers, signage, line marking, lighting and fencing.
- Earthwork cutting, embankments and retaining walls to accommodate the widened road alignment, flyover bridge and open flooding channel.
- Modified formal access to four properties along the upgraded sections of Richmond Road.
- Installation of a formal driveway access to the Blacktown Native Institution property within the Rooty Hill Road North road corridor, and removal of the informal access track to the property from Richmond Road.
- Property acquisition including full acquisition of one property and partial acquisition of two properties.
- Rehabilitation of disturbed areas and landscaping.
- Establishment and use of three temporary ancillary facilities during construction.

1.2.1 Assessment areas

The following key terms are used in this report:

- The proposal – refers to the proposed upgrades and improvements to Richmond Road (as described in Section 1.2) between Yarramundi Drive and Townson Road (see Figure 1-2)
- Proposal footprint - the area directly impacted by proposed work, including the removal of structures and installation of new structures
- Subject land – the non-certified and uncertified (i.e. outside of the NWGA) areas of the proposal footprint used to calculate the direct impacts of the proposal (see Figure 1-2)
- Study area – the land on which field surveys were undertaken as part of this report. This includes the proposal footprint and subject land (see Figure 1-1)
- Landscape assessment area - the subject land and the area of land within the 500 metre buffer zone that is determined as per Subsection 3.1.2 of the BAM
- Locality – land within 10 kilometres of the study area used for desktop analysis of potential biodiversity values

Bioregion – the Interim Biogeographic Regionalisation for Australia (IBRA) region and subregion in which the subject land is located. The subject land is located within the Cumberland IBRA subregion of the Sydney Basin IBRA bioregion (see Figure 1-1).

Figure 1-1 Proposal context

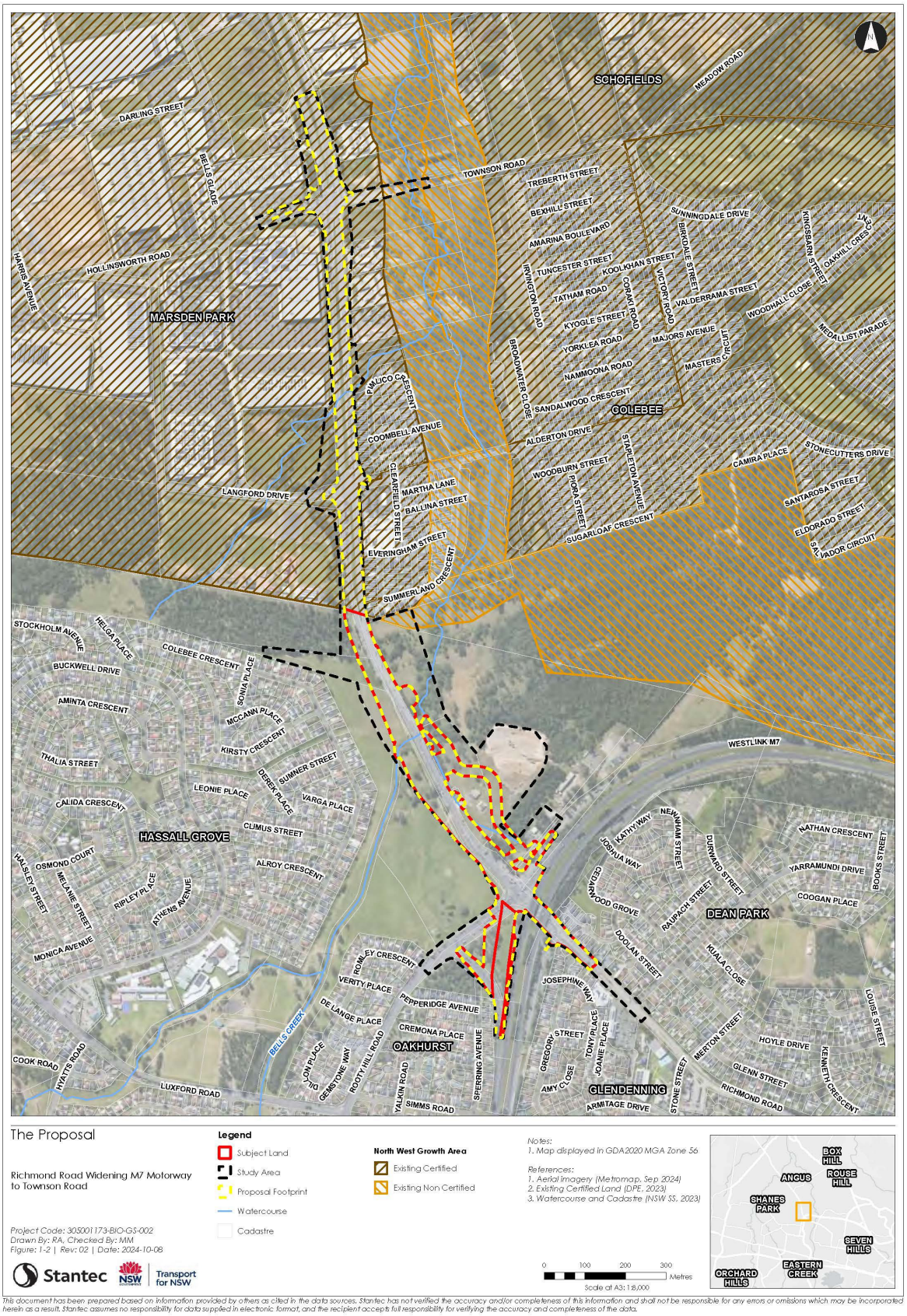


Figure 1-2 The proposal

1.3 Legislative context

A Review of Environmental Factors (REF) is prepared to satisfy Transport's duties under s.5.5 of the 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 biodiversity impact assessment forms part of the REF being prepared for the Richmond Road Widening Project and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

The BC Act requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using the test listed in Section 7.3 of the BC Act. Similarly, Part 7A of the FM Act requires that significance assessments are undertaken in accordance with Division 12 of the FM 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 (BAM) (DPIE 2020a).

In September 2015, a 'strategic assessment' approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Transport road activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Transport 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, 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.

Assessments of 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).

The northern portion (see Figure 1-1) of the study area falls within the NWGA and includes certified areas under the *State Environmental Planning Policy (Precincts—Central River City) 2021*, within the Colebee Precinct and the Marsden Park Industrial Precinct. Under Part 8 of the BC Act, an activity proposed to be carried out on biodiversity certified land is taken to be an activity that is not likely to significantly affect any threatened species. Biocertification does not apply to threatened biota listed under the FM Act and EPBC Act. As such, there is a requirement to assess impacts with respect to the FM Act in both certified and non-certified land.

The EPBC Act strategic assessment approval for Transport Division 5.1 road activities does not apply to road projects being undertaken within the Western Sydney Growth Centres. In those locations, the requirements of the Western Sydney Growth Centres Strategic Assessment (2011) will continue to apply. As such, no further assessment under the EPBC Act is required in these areas, provided that the development occurs in accordance with the Growth Centre requirements. This applies to areas of the proposal footprint within the NWGA. The subject land occurs outside the NWGA and further assessment under the EPBC Act is required in this area.

Certified lands, under the Cumberland Plain Conservation Plan (CPCP) are also present within the study area (see Figure 1-1). Strategic biodiversity certification was conferred under Section 8.2 of the BC Act and applies to 'certified-urban capable land' and 'certified-major transport corridors' in each nominated area. Development can proceed in these certified areas without further NSW biodiversity approvals if the necessary development consent is obtained, prescriptions or conditions of approval are met, and any unavoidable impacts are addressed through the conservation program. On 26 March 2024, the minister approved all actions associated with the Western Sydney Strategic Assessment. These actions are described in the Cumberland Plain Conservation Plan (DPE, 2022b) and include the Western Sydney major transport corridors. No approval under the EPBC Act is required for impacts on threatened species and communities listed the EPBC Act within certified areas.

With regards to mapped lands in the proposal footprint, the following is noted:

- Certified – major transport corridor. Major transport corridors within nominated areas (with the exception of the tunnel sections) that have been certified for development under the BC Act. Certified-major transport corridors have been strategically assessed and approved under the EPBC Act, in this case the M7 / Ropes Crossing Link Road.
- Excluded land. Excluded land is land that has been excluded from the CPCP and for which NSW strategic biodiversity certification and approval through the federal strategic assessment will not be sought.

- Major transport corridor (strategically assessed only). Major transport corridors outside of nominated areas, and the tunnels both inside and outside of the nominated areas are not certified under the BC Act through the CPCP. However, all of the major transport corridors included in the CPCP (including tunnel sections) have been strategically assessed and approved under the EPBC Act.

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
Adriana Corona Mothe	• Field ecologist	• PhD • M Sc • B Sc • BAM Accredited Assessor BAAS18113
Annabelle McTaggart	• Field ecologist • Report preparation	• B Sc (Conservation Biology) • BAM Accredited Assessor BAAS24024
Jackson McCutchen	• Field ecologist	• Bachelor of Natural Environment and Wilderness Studies
Kate Sloss	• Field ecologist • Report preparation	• B Sc (Double Major in Marine Science and Environmental Science)
Elly Baker	• Field ecologist • Report preparation	• Bachelor of Environment
Dane Fogliada	• Field ecologist • Report review	• B Sc (Environment) • Certificate II (Conservation Land Management) • BAM Accredited Assessor (BAAS23010)
Kevin Roberts	• Technical review	• B Sc (Hons) • M Env St (Environment) • Executive Masters (Public Administration) • BAM Accredited Assessor (BAAS1707)

2.2 Background research

A review of information and data was completed in between July 2023 and October 2023 to gain an understanding of biodiversity values within the study area and broader study locality. Reviewed sources are outlined in Table 2-2.

Table 2-2 Reviewed sources

Source	Date Accessed	Search Area
NSW DPE BioNet Species sightings: http://www.bionet.nsw.gov.au/	18/09/2024	10 kilometres

Source	Date Accessed	Search Area
NSW DPI Fisheries Spatial Data Portal: https://www.dpi.nsw.gov.au/about-us/science-and-research/spatial-data-portal	18/09/2024	Bells Creek (south) in the Hawkesbury-Nepean Catchment
BAM Calculator (BAM-C)	12/09/2024	NA
SEED datasets including Biodiversity Values Map and available native vegetation community mapping (SVTM C1.1.M1.1): (https://www.seed.nsw.gov.au/)	18/09/2024	10 kilometres
The DAWE's Protected Matters Search Tool: https://pmst.awe.gov.au/	18/09/2024	10 kilometres
The Commonwealth Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE): http://www.bom.gov.au/water/groundwater/gde/map.shtml	09/08/2024	N/A
National Flying-fox monitoring viewer: http://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf	09/08/2024	N/A
Threatened biodiversity profile search. Profiles for NSW listed species: (https://www.environment.nsw.gov.au/threatenedspeciesapp/) and nationally listed species at (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)	12/09/2024	N/A
Current and preliminary BC Act and EPBC Act listings: • NSW Threatened Species Scientific Committee preliminary and provisional determinations • Annual Final Priority Assessment list (for the assessment period commencing 1 October 2023) approved for assessment by the Minister responsible for the EPBC Act.	12/09/2024	N/A

A search radius of 10 kilometers around the study area (the locality) 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
- Areas of outstanding biodiversity value.

Background research included a review of the Preliminary Environmental Investigation (PEI) (Hills Environmental and Transport 2022) and *Ecological investigation and assessment – Richmond Road widening project – Richmond Road, Marsden Park, NSW* (Lesryk Environmental 2023).

2.3 Vegetation assessment

Vegetation survey and assessment was completed in accordance with Chapter 4 of the Biodiversity Assessment Method (DPIE 2020a). The vegetation assessment consisted of vegetation mapping and BAM plots undertaken on the 10 - 11 August 2023 and the 30-31 January 2024.

2.3.1 Vegetation mapping

Prior to surveys, a review of existing vegetation mapping relevant to the study area was undertaken. The NSW State Vegetation Type Map was used to ground-truth vegetation, as this provides the most recent and relevant mapping of plant community types (PCTs).

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

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

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 LLS Act, native vegetation means any of the following types of plants native to NSW: (a) trees (including any sapling or shrub or any scrub), (b) understory plants, (c) groundcover (being any type of herbaceous vegetation), (d) plants occurring in a wetland
- 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. Where the determination of native vegetation was difficult, plot data was collected in these areas to provide evidence for the classification of the vegetation. Native trees which could not reasonably be assigned to a PCT were identified, counted, and mapped to provide an estimate of replacement requirements in accordance with the *Biodiversity Policy* (Transport, 2022).

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).

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 database and the Threatened Species Scientific Committee final determinations of TECs. Potential EPBC Act 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.

2.3.3 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. Areas of low condition vegetation were identified based on vegetation integrity scores. As per the BAM (DPIE 2020a), vegetation integrity is a metric-based assessment used to measure the condition of native vegetation against a benchmark, based on survey data collected by the assessor. In accordance with Section 9.2.1 of the BAM, low condition vegetation (i.e. vegetation that is not in moderate to good condition) is equivalent to vegetation zones that have a:

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

'Moderate to good' condition vegetation is any vegetation zones with VI scores above these thresholds.

2.3.4 Plot-based vegetation survey

Plot-based floristics and vegetation integrity surveys were completed in accordance with subsection 4.3.4 of the BAM (DPIE, 2020a). Each plot-based survey was comprised of a 20 metre x 50 metre plot, established to collect qualitative data for vegetation integrity scores, and nested sub-plots consisting of a 20 metre x 20 metre plot (vegetation survey plot) and five evenly spaced 1 metre x 1 metre quadrats (litter plots). Additionally, as per Transport requirements, the number of trees in each stem size class were counted in each plot. This data can be used to provide a representative sample of tree counts in each vegetation zone and an estimate of tree replacement requirements where applicable in accordance with the *Tree and Hollow Replacement Guidelines* (Transport 2023b).

Plot-based vegetation survey was limited to non-certified and uncertified lands within the study area. The minimum number of plots required per vegetation zone was determined in accordance with Table 3 of the BAM (DPIE, 2020a). Table 2-3 details the number of plots completed for each vegetation zone and the associated plot identified. The location of each plot is illustrated in Figure 2-1.

Table 2-3 Minimum number of plots required and completed per vegetation zone

Veg zone	PCT	Condition	Area (ha)		No. plots required	No. plots completed (plot IDs)
			Study Area	Study Area not biocertified		
Zone 1	PCT 3320: Cumberland Shale Plains Woodland	Moderate	2.41	1.24	1 plot	2 Plots (Plots: 5, 7)
Zone 2	PCT 3320: Cumberland Shale Plains Woodland	Moderate-Good	1.08	1.08	1 plot	2 Plots (Plots: 6, 8)
Zone 3	PCT 4025: Cumberland Red Gum Riverflat Forest	Moderate	2.85	2.42	2 plots	3 Plots (Plots: 2, 3, 4)
Zone 4	PCT 4025: Cumberland Red Gum Riverflat Forest	Low	0.51	0.51	1 plot	1 Plot (Plot: 1)

2.3.5 Patch size

Patch size refers to an area of native vegetation that occurs on the development site and includes native vegetation that has a gap of less than 100 metres from the next area of native vegetation (or ≤30 metres for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a). Patch size is used to assess habitat suitability on the subject land for threatened species.

For each vegetation zone, patch size was calculated in accordance with Section 4.3.2 of the BAM. Vegetation zones located within 100 metres of one another and boundaries of adjoining native vegetation, extending beyond the limits of the study area, were identified based on available vegetation mapping and aerial imagery. Each patch was digitised and allocated to a patch size class. Results are provided in Section 3.1.

2.3.6 Native vegetation cover

Percent native vegetation cover refers to the amount of native vegetation (woody and non-woody) that is estimated to remain in the landscape proximal to the assessment area. The percent native vegetation cover was assessed in accordance with Section 3.2 of the BAM. A 500 metre buffer was applied around the edge of the subject land and the total area of native vegetation cover within this area (based on ground-truthed vegetation within the study area and available desktop mapping within the broader landscape assessment area) was calculated. Results are included in Table 2-4.

Table 2-4 Native vegetation cover in the assessment area

Assessment area (ha)	368.52
Total area of native vegetation cover (ha)	107.48
Percentage of native vegetation cover (%)	29.16%
Class (0-10, >10-30, >30-70 or >70%)	>10-30

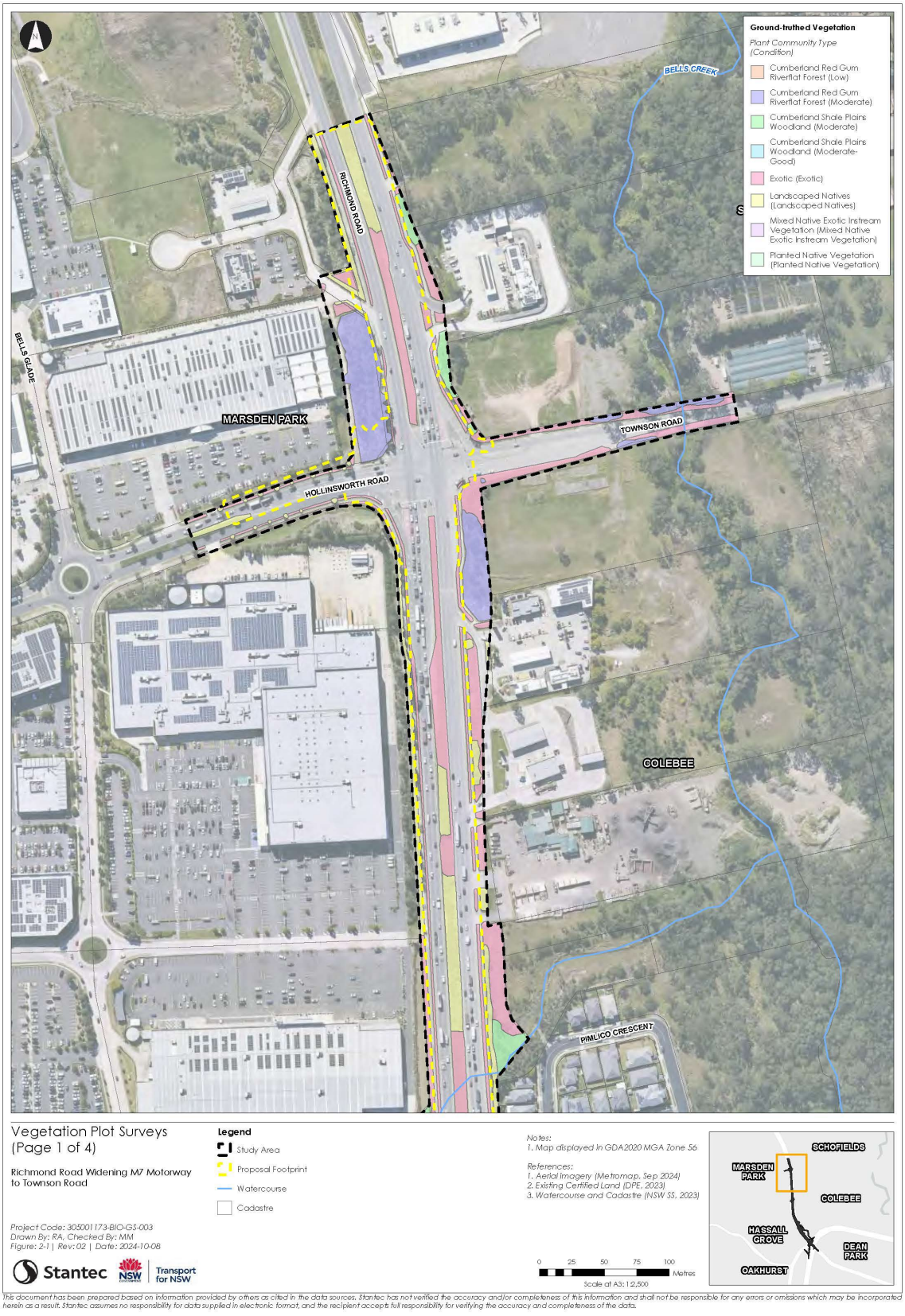
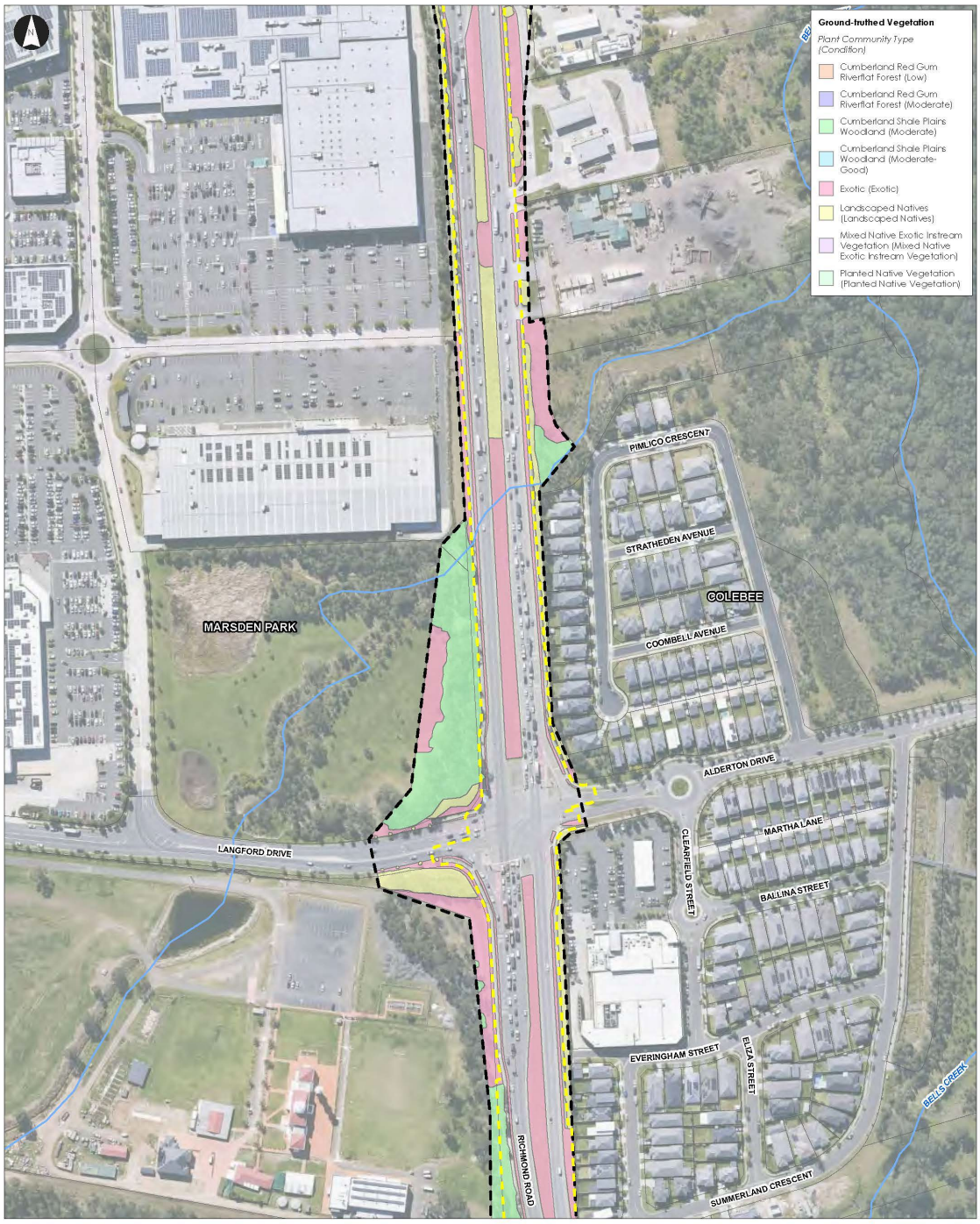


Figure 2-1 Vegetation plot surveys



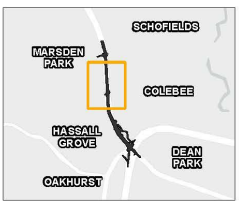
Vegetation Plot Surveys
(Page 2 of 4)

Richmond Road Widening M7 Motorway to Townson Road

Legend
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

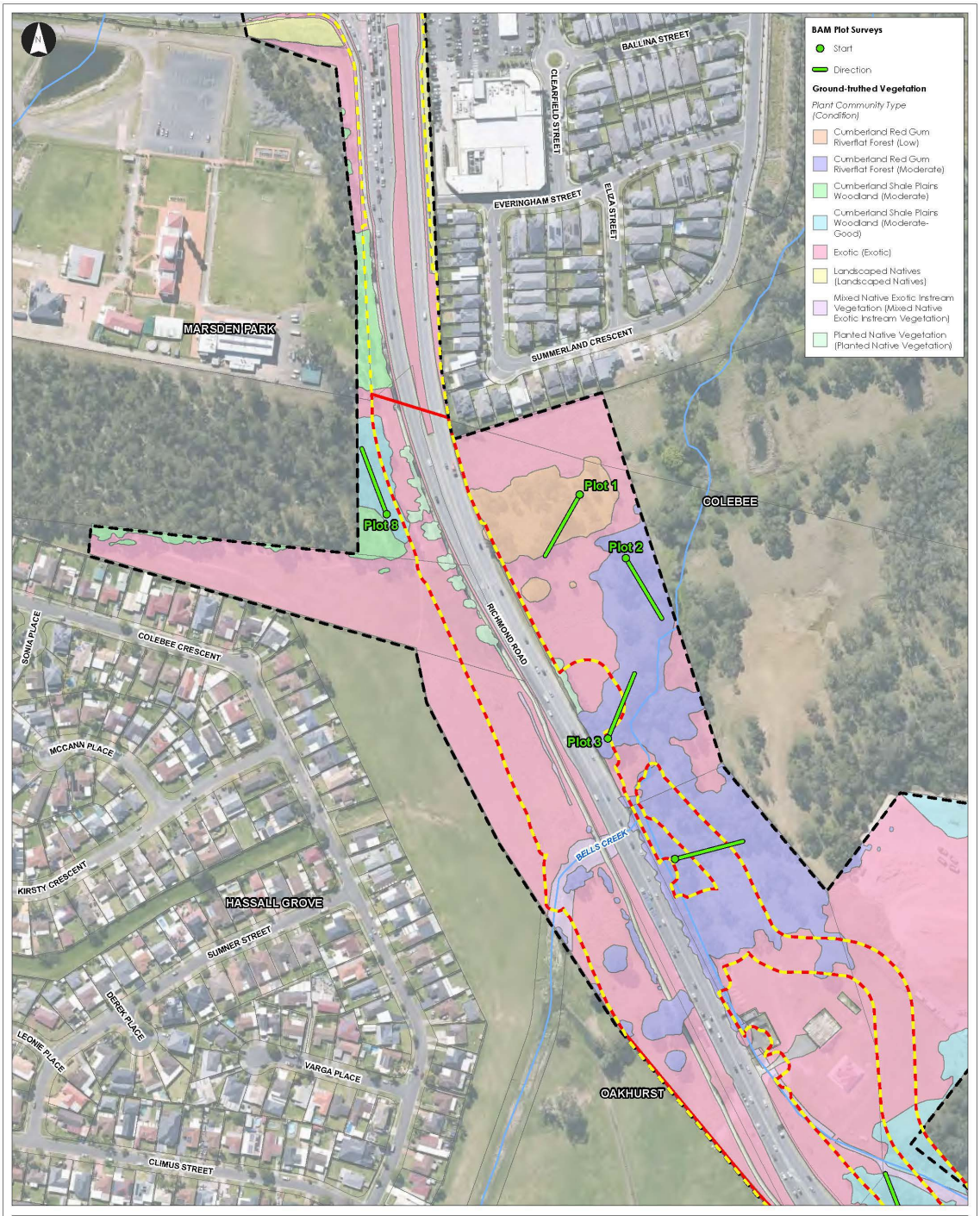
References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Existing Certified Land (DPE, 2023)
3. Watercourse and Cadastre (NSW SS, 2023)

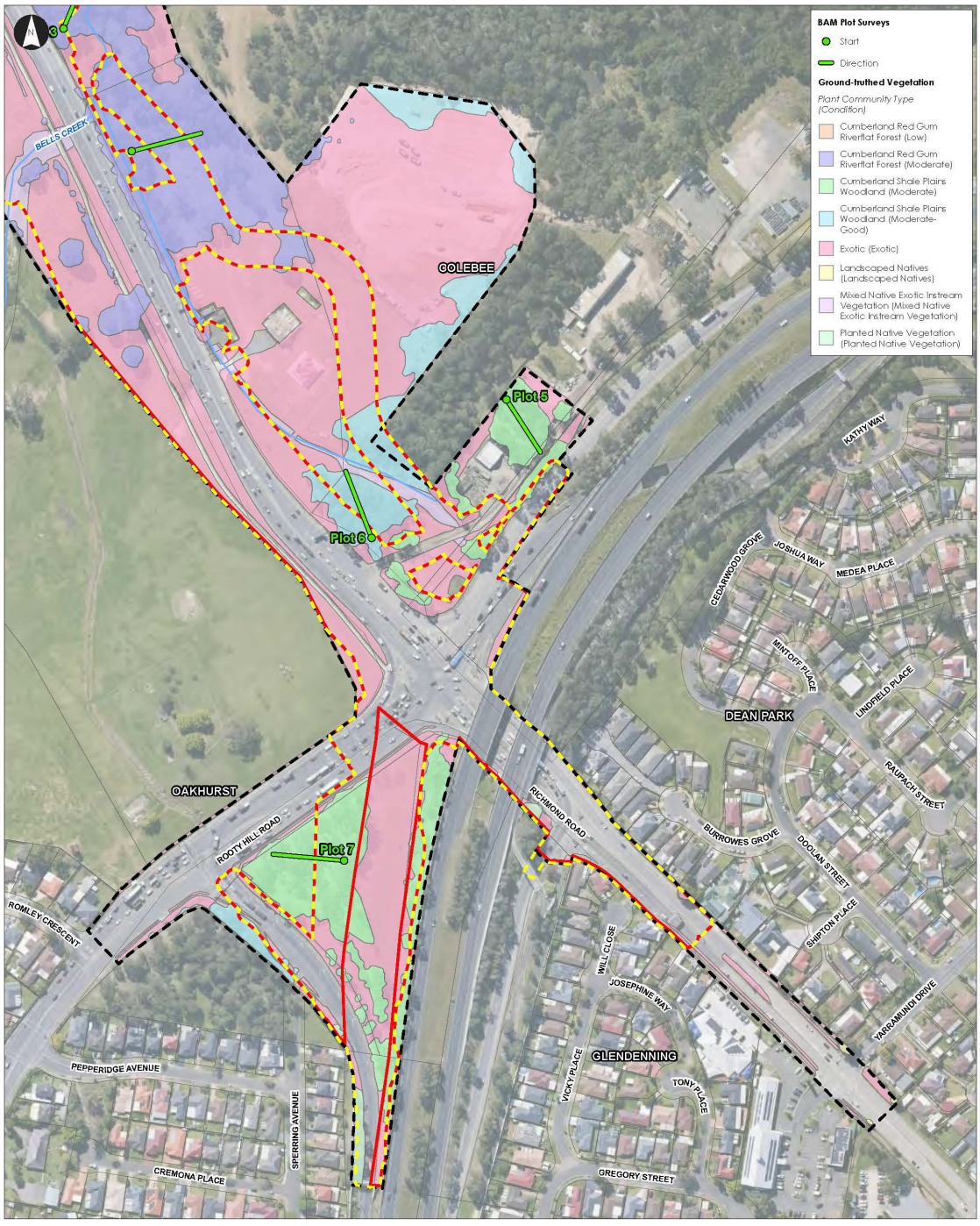


0 25 50 75 100 Metres
Scale at A3: 1:2,500

Project Code: 305001173-BIO-GIS-003
Drawn By: RA, Checked By: MM
Figure: 2-1 | Rev: 02 | Date: 2024-10-08

Stantec | NSW | Transport for NSW





2.4 Threatened species assessment

Field surveys were completed between August 2023 and May 2024. 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 Chapter 5 of the BAM to determine presence within the study area. The species considered for targeted surveys were those generated by the BAM-C and/or considered likely to occur in the study area based on the likelihood of occurrence assessment (Appendix B).

Under Part 8 of the BC Act an activity proposed to be carried out on biodiversity certified land is taken to be an activity that is not likely to significantly affect any threatened species. As such, targeted surveys have not been undertaken in certified land within the study area.

There are three classes of threatened species under the BAM:

- Ecosystem credit species (ECS), or predicted species, are species (listed only under the BC Act) where presence can generally be predicted by vegetation and/or landscape surrogates, or that have a low probability of detections during targeted surveys. These species are assessed by habitat suitability assessment. 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 (listed under the BC Act and/or EPBC Act) for which vegetation and/or landscape surrogates cannot reliably predict their presence or components of their habitat. For Transport projects, where these species are associated with PCTs (as defined by the Threatened Biodiversity Data Collection (TBDC) and BAM-C being impacted by the proposal and have a moderate to high likelihood of occurrence (Appendix B) targeted surveys, in accordance with the applicable guidelines, are required to determine their presence. This is a slight variation to Chapter 5 of the BAM that requires targeted survey for all species-credit species identified by the BAM-C
- 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.

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

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 have not yet been surveyed will be surveyed prior to the determination of the project.

2.4.1 Habitat suitability assessment

A habitat suitability 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, including 'predicted' (ecosystem-credit) and 'candidate' (species-credit) species identified by the BAM-C. In assessing the likelihood of occurrence for each species, consideration was given to PCTs 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 B.

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
- the species is associated with the PCTs identified within the subject land
- 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)
- has been recorded recently (previous 10 years) in the locality
- is known or likely to maintain resident populations in the locality
- the proposal footprint contains habitat features or components associated with the species

- 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 B). The assessment was based on information provided in the habitat profile for the species and any other habitat information in the TBDC and BAM-C, including the potential presence of breeding habitat for 'species-credit' and 'dual-credit' species. Habitat assessment surveys targeted the identification of any 'habitat constraints' for each candidate species as defined by the BAM-C and TBDC (e.g. specific sized hollow-bearing trees, large stick nests, caves, etc.).

Tests of significance (under the BC Act or FM Act) and/or assessments of significance (under the EPBC Act) for species considered 'likely to occur' by the habitat assessment have been completed (Appendices D and 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). Surveys were undertaken for all threatened flora species identified as requiring survey following the habitat suitability assessment (section 2.4.1). The timing of surveys adhered to the survey season requirements, as detailed in the TBDC, for all the targeted flora species (Table 2-5).

Table 2-6 outlines the dates, survey method and environmental conditions for the threatened flora surveys. Threatened flora survey locations are displayed in Figure 2-2.

Where insufficient survey (i.e. survey that is not in accordance with seasonal requirements and survey guidelines) was completed for any identified species, the species has been assumed present and assessed accordingly, unless sufficient evidence can be provided to determine otherwise (e.g. habitat is substantially degraded, or the species is a vagrant to the IBRA subregion).

Table 2-5 Targeted threatened flora survey details

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements*	Survey completed
Acacia pubescens	Downy Wattle	January – December	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Threatened flora transects completed in January 2024.
Deyeuxia appressa		December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 5 metres in dense vegetation.	Targeted surveys to be completed prior to determination of the project.
Dillwynia tenuifolia		August – October	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Targeted surveys to be completed prior to determination of the project.
Eucalyptus benthamii	Camden White Gum	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 20 metres in dense vegetation.	Threatened flora transects completed in March 2024.
Eucalyptus glaucina	Slaty Red Gum	January – December	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 20 metres in dense vegetation.	Threatened flora transects completed in March 2024.
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Threatened flora transects completed in January 2024.

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements*	Survey completed
Hibbertia puberula		October – December	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Targeted surveys to be completed prior to determination of the project.
Hibbertia sp. *Bankstown*		September – December	PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Targeted surveys to be completed prior to determination of the project.
Marsdenia viridiflora subsp. *viridiflora*	*Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs.	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 5 metres in dense vegetation.	Threatened flora transects completed in January 2024.
Micromyrtus minutiflora		January – December	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation	Threatened flora transects completed in March 2024.
Persoonia hirsuta	Hairy Geebung	January – December	PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation	Threatened flora transects completed in March 2024.
Persoonia nutans	Nodding Geebung	January – December	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Threatened flora transects completed in January 2024.
Pimelea curviflora var. curviflora		October – March	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Threatened flora transects completed in January 2024.
Pimelea spicata	Spiked Rice-flower	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation. A minimum of three surveys must be undertaken at least one month apart (unless the species is found). Each survey event occurs four weeks after a 30 mm rainfall event.	Survey 1: completed in January 2024, following a 97.8 mm rainfall event recorded at Richmond RAAF {station 067105} on 15/01/2024. Survey 2: completed in March 2024, following a 48.4 mm rainfall event recorded at Richmond RAAF {station 067105} on 06/02/2024. Survey 3: completed in April/May 2024, following

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements*	Survey completed
					a 133.2 mm rainfall event recorded at Richmond RAAF {station 067105} on 06/04/2024.
Pomaderris brunnea		August – October	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Targeted surveys to be completed prior to determination of the project.
Pterostylis saxicola	Sydney Plains Greenhood	October	PCT 3320 - 0.80 ha	Parallel Field Traverse, maximum separation width of 5 metres in dense vegetation	Targeted surveys to be completed prior to determination of the project.
Pultenaea parviflora		September – November	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Targeted surveys to be completed prior to determination of the project.
Pultenaea pedunculata		September – November	PCT 3320 – 0.80 ha	Parallel Field Traverse, maximum separation width of 10 metres in dense vegetation.	Targeted surveys to be completed prior to determination of the project.
Syzygium paniculatum	Magenta Lilly Pilly	April - June	PCT 4025 – 0.95 ha	Parallel Field Traverse, maximum separation width of 20 metres in dense vegetation.	Threatened flora transects completed in April and May 2024.
* Based on BAM survey guidelines (DPIE 2020c)					

Table 2-6 Targeted threatened flora survey details

Surveys undertaken	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
Threatened Flora Transects	30/01/2024	23.5	27.2	0.2	N/A
Threatened Flora Transects	31/01/2024	22.1	27.7	3.0	Light rainfall recorded in afternoon.
Threatened Flora Transects	06/03/2024	14.6	32.4	0	Sunny conditions during afternoon.
Threatened Flora Transects	13/03/2024	16.3	30.3	N/A	Sunny conditions during afternoon.
Threatened Flora Transects	14/03/2024	16.4	34.5	0	Sunny conditions during afternoon.
Threatened Flora Transects	17/04/2024	16.2	23.9	0	Sunny conditions during afternoon.
Threatened Flora Transects	07/05/2024	11.8	20.3	0.4	Heavy rainfall recorded on previous day.

Surveys undertaken	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
Threatened Flora Transects	08/05/2024	9.8	19.8	0.2	N/A

Data as per Bureau of Meteorology (BoM) nearest meteorological station with daily temperature and rainfall data (Station 067105) Richmond RAAF at http://www.bom.gov.au/climate/dwo/202401/html/IDCJDW2119.202401.shtml.

2.4.3 Targeted fauna surveys

Targeted surveys were undertaken for all species-credit fauna species identified as requiring survey following the habitat suitability assessment (Section 2.4.1). Survey locations are included in Figure 2-3.

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

NSW survey guidelines:

- DPIE (2021), 'Species credit' threatened bats and their habitats - NSW guide for the Biodiversity Assessment Method
- DPIE (2020b), NSW Survey Guide for Threatened Frogs - A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method.
- DPE (2022b), Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide | NSW Environment and Heritage
- DPE (2022c), Threatened reptiles: Biodiversity Assessment Method Survey Guide | NSW Environment and Heritage
- Department of Environment and Conservation Threatened biodiversity survey and assessment - Guidelines for developments and activities (2004 working draft).

Commonwealth survey guidelines

- Commonwealth of Australia (2010a), Survey Guidelines for Australia's Threatened Bats.
- Commonwealth of Australia (2010b), Survey Guidelines for Australia's Threatened Birds.
- Commonwealth of Australia (2011a), Survey Guidelines for Australia's Threatened Frogs.
- Commonwealth of Australia (2011b), Survey Guidelines for Australia's Threatened Mammals.
- Commonwealth of Australia (2011c), Survey Guidelines for Australia's Threatened Reptiles.

Survey methods are detailed further below.

2.4.3.1 Diurnal bird surveys

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 hectare for at least 20 minutes, whilst actively listening and looking for bird species. Diurnal bird surveys were completed between 6.00 am and 9.00 am 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. Survey locations were selected using a grid with 150 metre spacings. The centre of the grid was placed over each area of suitable habitat, with areas of discontinuous habitat considered independently when determining survey effort. The SAT protocol was undertaken at the grid intersections.

At each site, the SAT protocol involved:

1. Locating and marking the nearest tree to the grid intersection (the centre tree).
2. Identifying the nearest 29 trees to the centre tree.

3. Undertaking a minimum 2 minute radial search for koala scat at the base of each tree.

Where the minimum sampling effort of 30 trees could not be met, the highest number possible were sampled.

Koalas were also targeted during spotlighting transects of the study area and opportunistically during all surveys.

2.4.3.3 Microbat surveys

Microbat surveys were conducted in accordance with 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method' (OEH 2018). 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 Amy Rowles (Corymbia Ecology).

Roost searches were also conducted and involved looking for bats or signs of bats (urine stains, droppings, remains, and bat fly casings) in suitable roost habitat during the daytime.

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).

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.

Nocturnal call playback surveys and spotlighting transects were undertaken in areas of suitable habitat. Each site was surveyed over two separate nights (DEC 2004; DSEWPaC 2011). Call playback surveys were undertaken to target *Petaurus norfolcensis* (Squirrel Glider) and *Burhinus grallarius* (Bush Stone-curlew). Calls were broadcast in areas of suitable habitat and visibility by using an amplifier speaker. The calls for the target species were played intermittently, in accordance with timings specified within the relevant guidelines (DEC 2004). Following the broadcast of calls, a further period of active listening and spotlighting was conducted. Spotlighting transects were conducted on foot throughout the study area. At least one transect was undertaken in each distinct area of vegetation under five hectares in size and two transects were undertaken within patches of native vegetation over five hectares (DPE 2022b). In accordance with the 'Koala (*Phascolarctos cinereus*): Biodiversity Assessment Method Survey Guide' (DPE 2022b) and the 'Survey guidelines for Australia's threatened mammals: guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*' (DSEWPaC 2011), transects were at least 200 metres in length, where possible.

2.4.3.5 Amphibian surveys

Targeted surveys for *Litoria aurea* (Green and Golden bell frog; GGBF) were undertaken over four nights, in accordance with the 'NSW Survey Guide for Threatened Frogs' (DPE 2020). During each survey night, aural-visual surveys were conducted along the edge of suitable habitat. Each aural-visual survey consisted of a combination of listening for calls and searching along a 500 metre transect. At each 50 metre point on the transect, two surveyors undertook a five-minute period of active listening (aural survey). Each aural survey was followed by the continuous broadcast of a GGBF call for two-minutes and then a two-minute listening period. Suitable habitat between each aural survey point was scanned for frogs and eyeshine (visual survey).

2.4.3.6 Cumberland Plain Land Snail Searches

Targeted searches for *Meridolum corneovirens* (Cumberland Plain Land Snail; CPLS) 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.

Sufficient survey (i.e. survey in accordance with survey guidelines) has been completed for all fauna SCS considered likely to occur in the study area based on the likelihood of occurrence assessment (Appendix B).

Table 2-7 Targeted threatened fauna survey details

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements*	Survey completed
Burhinus grallarius	Bush Stone-curlew	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Diurnal habitat flushes and bird surveys. Call playback surveys completed 2-4 kilometres apart.	Seven diurnal bird surveys conducted across the study area in January 2024. Diurnal habitat flushes completed in conjunction with threatened flora transects. Call playback and spotlighting undertaken across five transects, for a total effort of 10 surveys across two nights.
Callocephalon fimbriatum	Gang-gang cockatoo	October – January	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Diurnal bird surveys. Searches for signs of breeding on site (i.e. lone males during breeding season October to January, occupied nests). Monitoring of potential nest trees (at least 3 metres above ground with hollow diameter of 7 centimetres or larger) during breeding season to confirm presence of actual nest trees.	Seven diurnal bird surveys conducted across the study area in January 2024. Habitat searches conducted in January 2024. No potential nest locations identified.
Litoria aurea	Green and Golden Bell Frog	November - March	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Aural visual surveys over four nights in accordance with the 'NSW Survey Guide for Threatened Frogs' (DPE 2020).	Four nights of surveys undertaken.
Meridolum corneovirens	Cumberland Plain Land Snail	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Targeted searches. Presence of snail shells can be detected all year round. For the purpose of survey, the presence of shells equals the presence of this species. Identification of live specimens is required early morning or in the evening during or after rain, while the ground and vegetation surfaces are still wet from the rain.	Targeted searches undertaken in conjunction with seven Koala SATs undertaken across the study area.
Myotis macropus	Southern Myotis	October – March	PCT 3320 - 0.80 ha	16 nights of passive acoustic detection per	Survey effort was insufficient (13 nights of

Species name	Common name	Required survey period	Associated PCTs in the subject land	Minimum survey requirements*	Survey completed
			PCT 4025 - 0.95 ha	<2.5 kilometres riparian length of potential habitat.	passive detection completed) however, the species was confirmed within the study area and all potential habitat (i.e. associated PCTs within 200 metres of Bells Creek) within the subject land has been included within the species polygon.
Petaurus norfolcensis	Squirrel Glider	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Spotlighting and call playback over a minimum of two nights.	Call playback and spotlighting undertaken across five transects, for a total effort of 10 surveys across two nights.
Phascolarctos cinereus	Koala	January – December	PCT 3320 - 0.80 ha PCT 4025 - 0.95 ha	Total effort to be met for two survey methods in accordance with the 'Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide' (DPE 2022b). Where a scat detection method is used (e.g. Spot Assessment Technique (SAT)), this must be paired with a non-scat detection method (e.g. spotlighting). Required survey effort for SAT is one SAT site per 2.25 hectares of suitable habitat. One spotlighting transect is required for each area of suitable habitat <5 hectares. For areas >5 hectares, two transects are required. Surveys should be repeated for a second night.	Call playback and spotlighting undertaken across five transects, for a total effort of 10 surveys across two nights. Seven Koala SATs undertaken across the study area.
* Based on BAM survey guidelines and any relevant Commonwealth survey guideline.					

Table 2-8 Targeted threatened fauna survey details

Surveys undertaken (number of surveys)	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
Koala SAT (1) Cumberland Plain Land Snail search (completed in conjunction with Koala SAT)	10/08/2023	2.6	24.7	0	Most recent rainfall event recorded on 06/08/2023.
Diurnal Bird Survey (2)	30/01/2024	23.5	27.2	0.2	N/A
Diurnal Bird Survey (5)	31/01/2024	22.1	27.7	3.0	Light rainfall recorded in afternoon. Fine conditions during morning bird surveys.
Green and Golden Bell Frog Survey (4) ANABAT recording (4 units)	05/03/2024	16.1	27.5	0.2	Fine conditions during nocturnal frog survey.
Green and Golden Bell Frog Survey (4) ANABAT recording (4 units)	06/03/2024	14.6	32.4	0	Fine conditions during nocturnal frog survey.
Koala SAT (2) Cumberland Plain Land Snail search (completed in conjunction with Koala SAT)	13/03/2024	16.3	30.3	N/A	Sunny conditions during afternoon.
Green and Golden Bell Frog Survey (4) ANABAT recording (3 units)	13/03/2023	16.3	30.3	N/A	Fine conditions during nocturnal frog survey.
Green and Golden Bell Frog Survey (4) ANABAT recording (2 units)	14/03/2024	16.4	30.3	0	Light rain during nocturnal frog survey.
Koala SAT (1) Cumberland Plain Land Snail search (completed in conjunction with Koala SAT)	17/04/2024	16.2	23.9	0	Sunny conditions during afternoon.
Nocturnal Surveys (call playback and spotlighting transects) (2)	17/04/2024	16.2	23.9	0	Fine conditions during nocturnal survey.
Nocturnal Surveys (call playback and spotlighting transects) (2)	18/04/2024	15	25.2	6.4	Fine conditions during nocturnal survey.
Nocturnal Surveys (call playback and spotlighting transects) (3)	07/05/2024	11.8	20.3	0.4	Heavy rainfall recorded on previous day.
Koala SAT (2) Cumberland Plain Land Snail search (completed in conjunction with Koala SAT)	07/05/2024	11.8	20.3	0.4	Heavy rainfall recorded on previous day.

Surveys undertaken (number of surveys)	Date	Temperature (°C)		Rainfall (mm)	Other observations
		Min	Max		
Nocturnal Surveys (call playback and spotlighting transects) (3)	08/05/2024	9.8	19.8	0.2	N/A
Koala SAT (1) Cumberland Plain Land Snail search (completed in conjunction with Koala SAT)	08/05/2024	9.8	19.8	0.2	N/A
Data as per Bureau of Meteorology (BoM) nearest meteorological station with daily temperature and rainfall data (Station 067105) Richmond RAAF at http://www.bom.gov.au/climate/dwo/202401/html/IDCJDW2119.202401.shtml.					

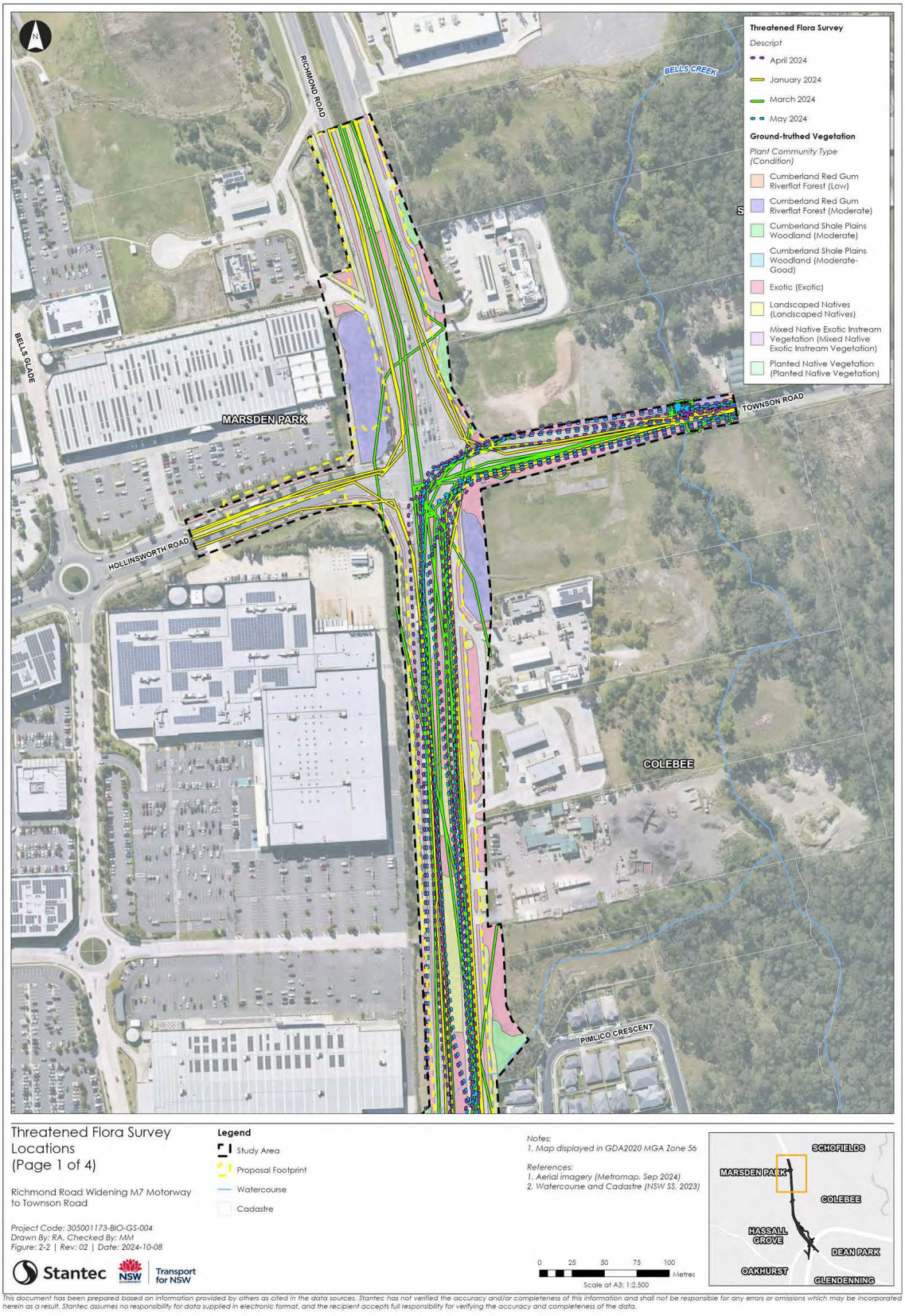
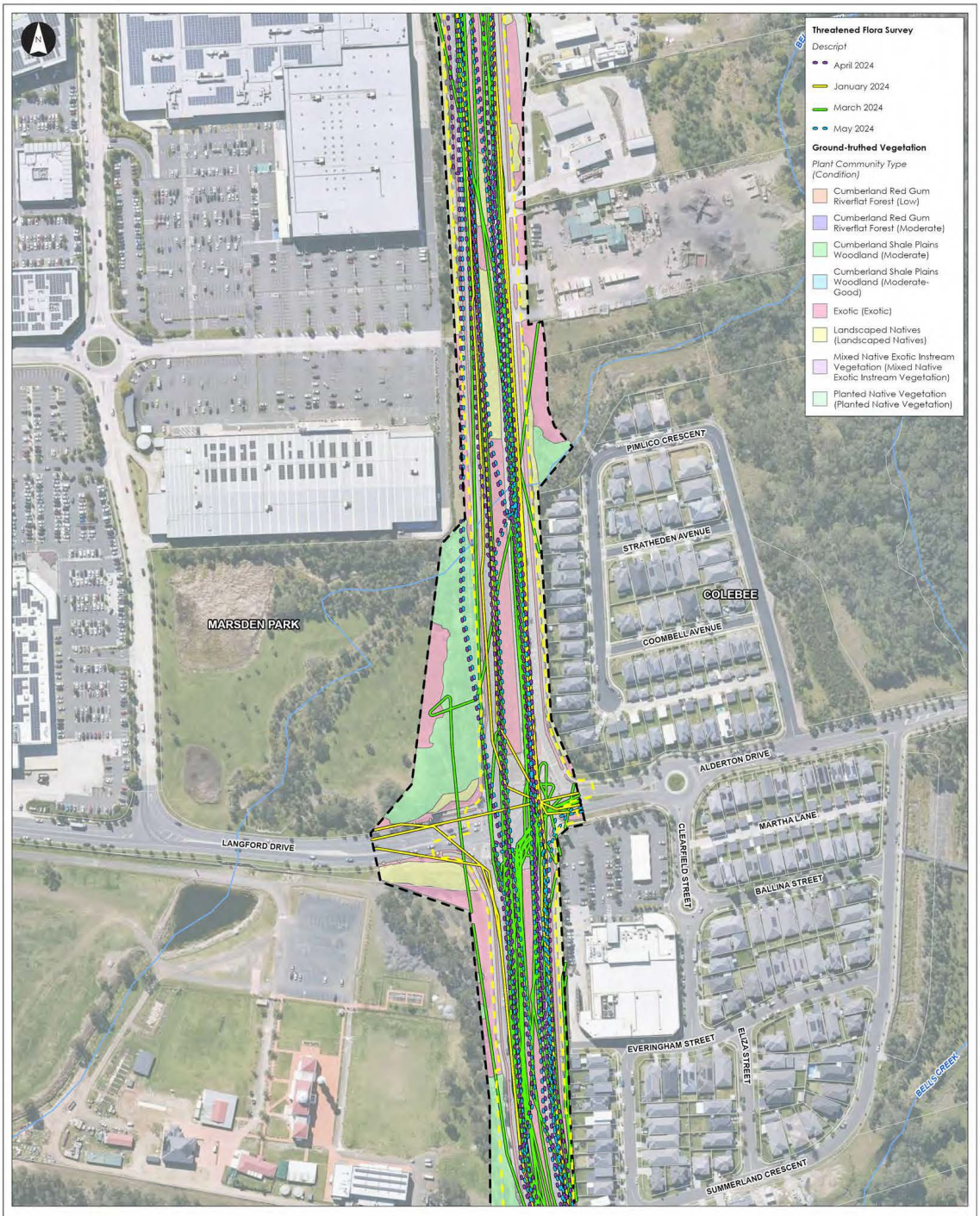


Figure 2-2 Threatened flora survey locations


Threatened Flora Survey
Descript
April 2024
January 2024
March 2024
May 2024
Ground-truthed Vegetation
Plant Community Type (Condition)
Cumberland Red Gum Riverflat Forest (Low)
Cumberland Red Gum Riverflat Forest (Moderate)
Cumberland Shale Plains Woodland (Moderate)
Cumberland Shale Plains Woodland (Moderate-Good)
Exotic (Exotic)
Landscaped Natives (Landscaped Natives)
Mixed Native Exotic Instream Vegetation (Mixed Native Exotic Instream Vegetation)
Planted Native Vegetation (Planted Native Vegetation)
PIMLICO CRESCENT
STRATHEDEN AVENUE
COLEBEE
COOMBELL AVENUE
MARSDEN PARK
ALDERTON DRIVE
MARTHA LANE
LANGFORD DRIVE
CLEARFIELD STREET
BALLINA STREET
EVERINGHAM STREET
ELIZA STREET
BELLS CREEK
SUMMERLAND CRESCENT
Threatened Flora Survey Locations (Page 2 of 4)
Richmond Road Widening M7 Motorway to Townson Road
Project Code: 305001173-BIO-GS-004
Drawn By: RA. Checked By: MM
Figure: 2-2 | Rev: 02 | Date: 2024-10-08
Legend
Study Area
Proposal Footprint
Watercourse
Cadastre
Notes:
1. Map displayed in GDA2020 MGA Zone 56
References:
1. Aerial imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW 3S, 2023)
0 25 50 75 100
Metres
Scale at A3: 1:2,500
SCHOFIELDS
MARSDEN PARK
COLEBEE
HASSALL GROVE
DEAN PARK
OAKHURST
GLENDENNING
Stantec
NSW
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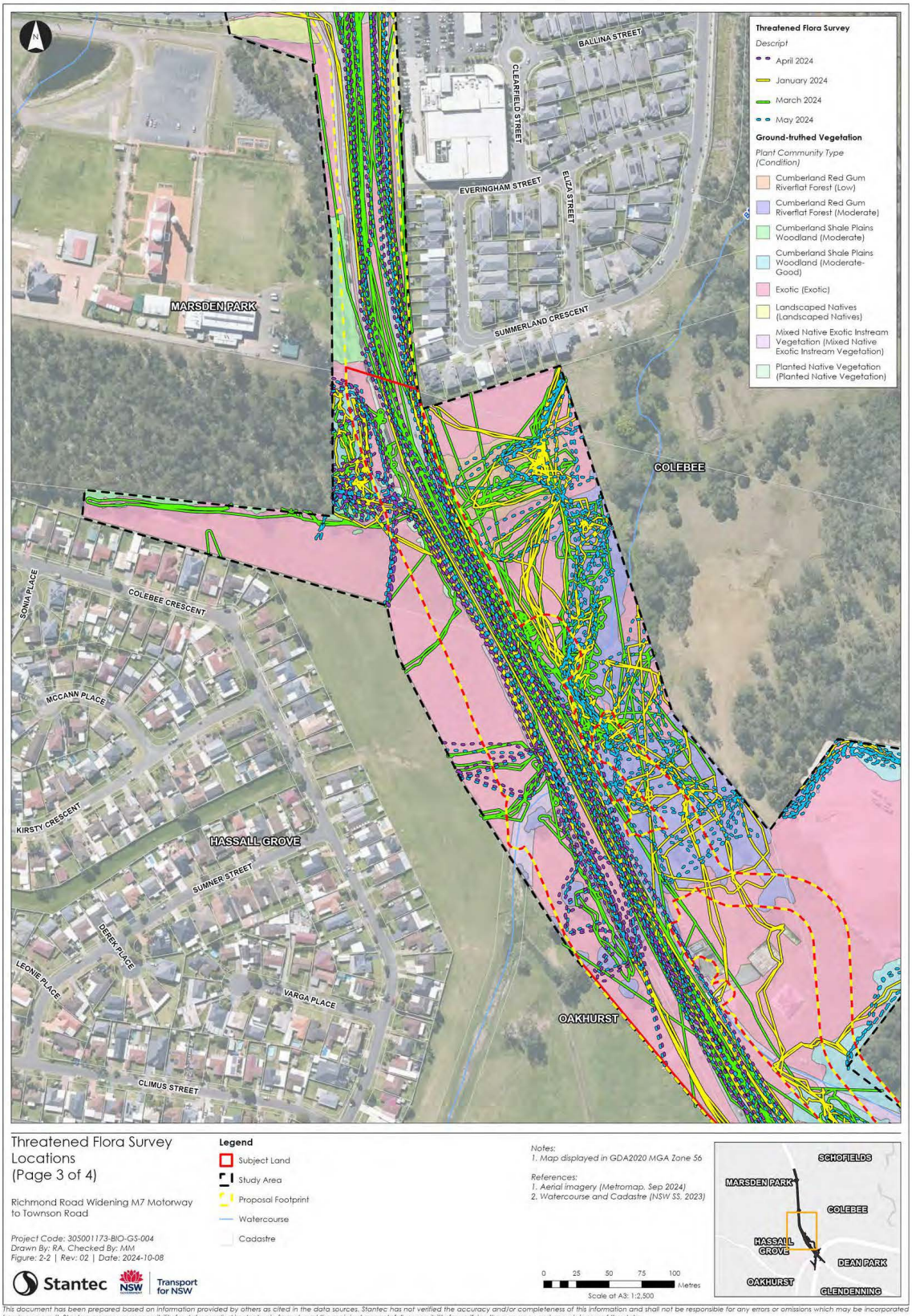
Threatened Flora Survey
Descript
April 2024
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Ground-truthed Vegetation
Plant Community Type (Condition)
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Cumberland Shale Plains Woodland (Moderate-Good)
Exotic (Exotic)
Landscaped Natives (Landscaped Natives)
Mixed Native Exotic Instream Vegetation (Mixed Native Exotic Instream Vegetation)
Planted Native Vegetation (Planted Native Vegetation)
BALLINA STREET
CLEARFIELD STREET
EVERINGHAM STREET
ELIZA STREET
SUMMERLAND CRESCENT
MARSDEN PARK
COLEBEE
SONIA PLACE
COLEBEE CRESCENT
MCCANN PLACE
KIRSTY CRESCENT
HASSALL GROVE
SUMNER STREET
DEREK PLACE
LEONIE PLACE
VARGA PLACE
OAKHURST
CLIMUS STREET
Threatened Flora Survey Locations (Page 3 of 4)
Richmond Road Widening M7 Motorway to Townson Road
Project Code: 305001173-BIO-GS-004
Drawn By: RA, Checked By: MM
Figure: 2-2 | Rev: 02 | Date: 2024-10-08
Legend
Subject Land
Study Area
Proposal Footprint
Watercourse
Cadastre
Notes:
1. Map displayed in GDA2020 MGA Zone 56
References:
1. Aerial imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW 3S, 2023)
0 25 50 75 100
Metres
Scale at A3: 1:2,500
SCHOFIELDS
MARSDEN PARK
COLEBEE
HASSALL GROVE
DEAN PARK
OAKHURST
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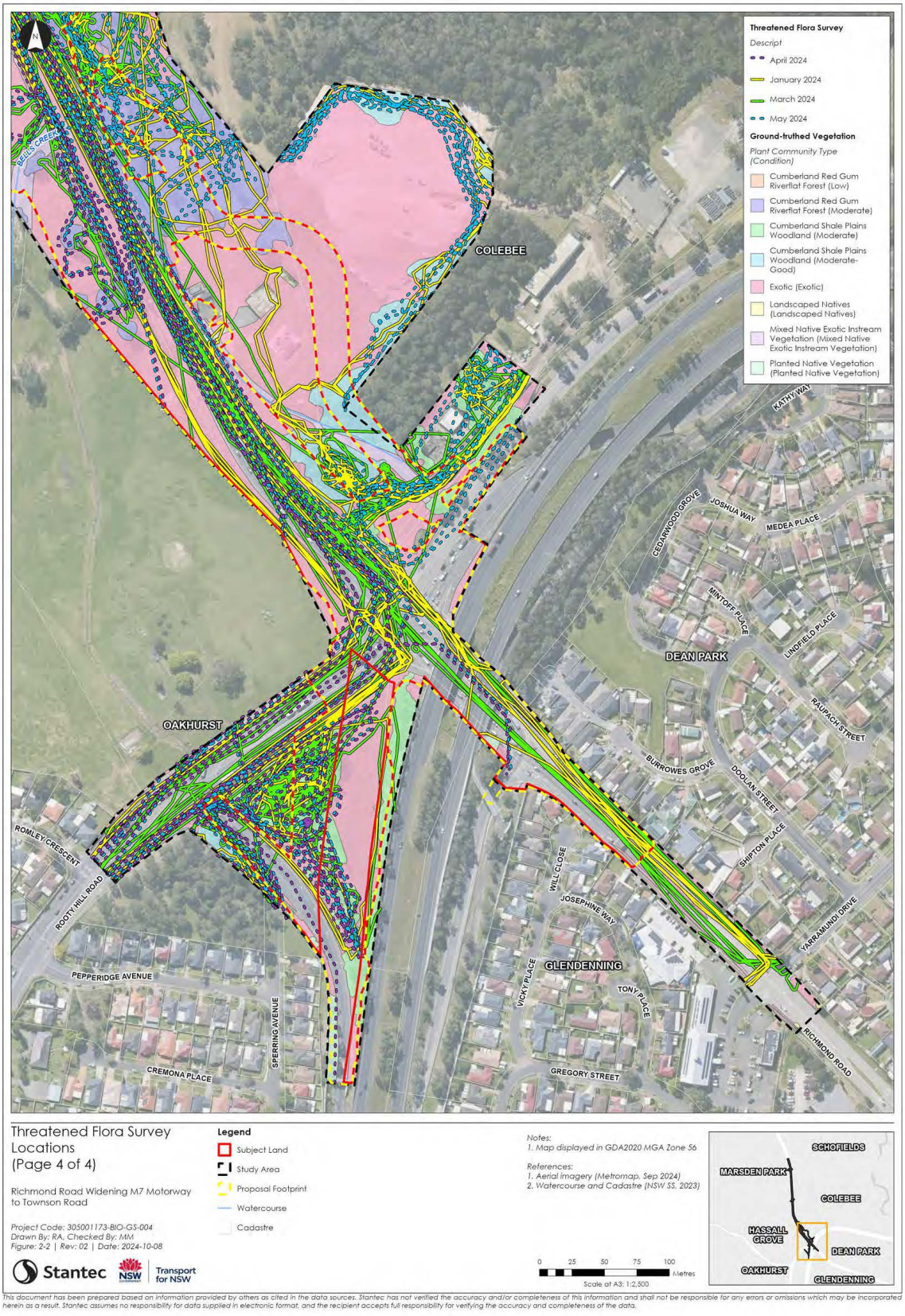


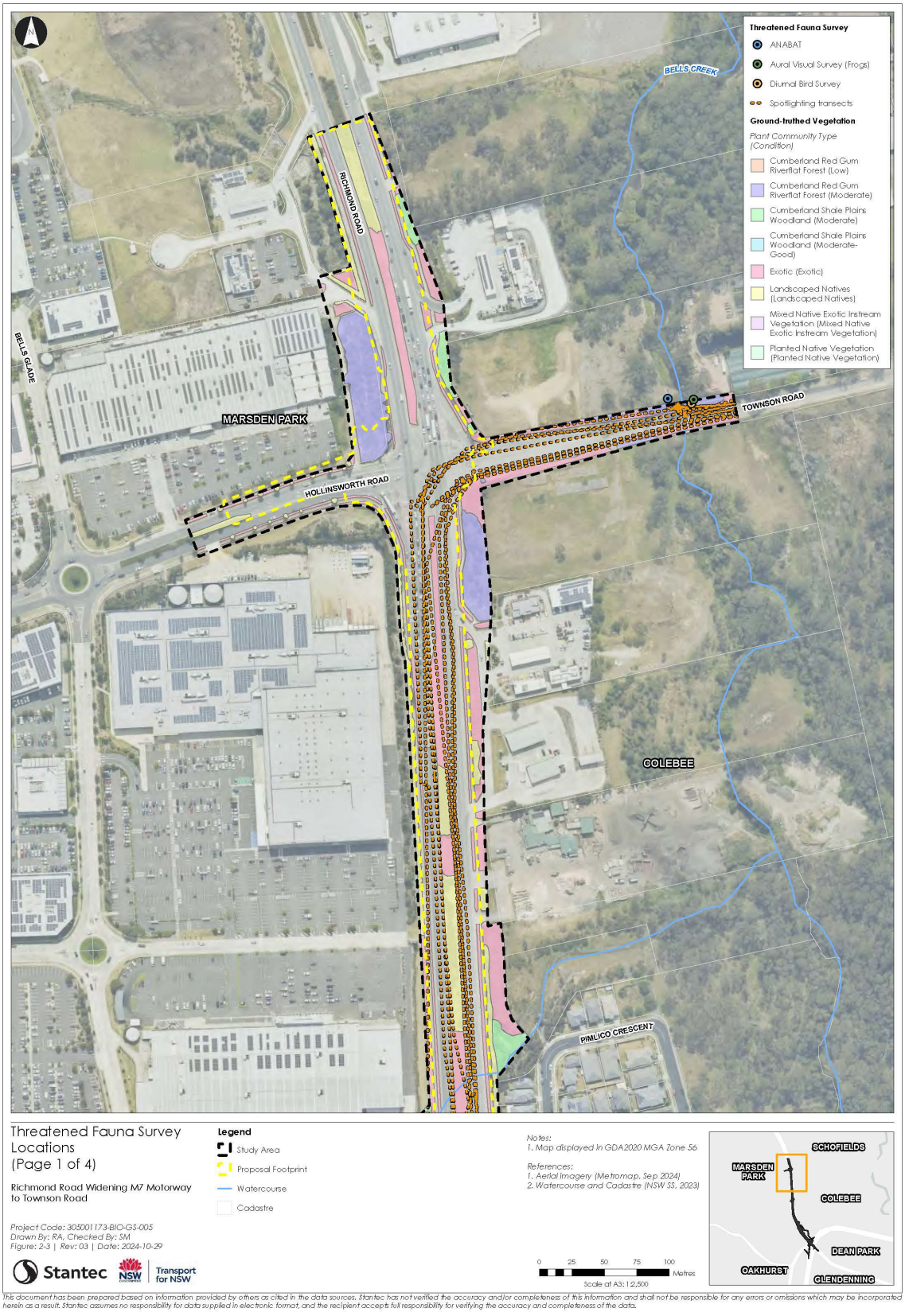
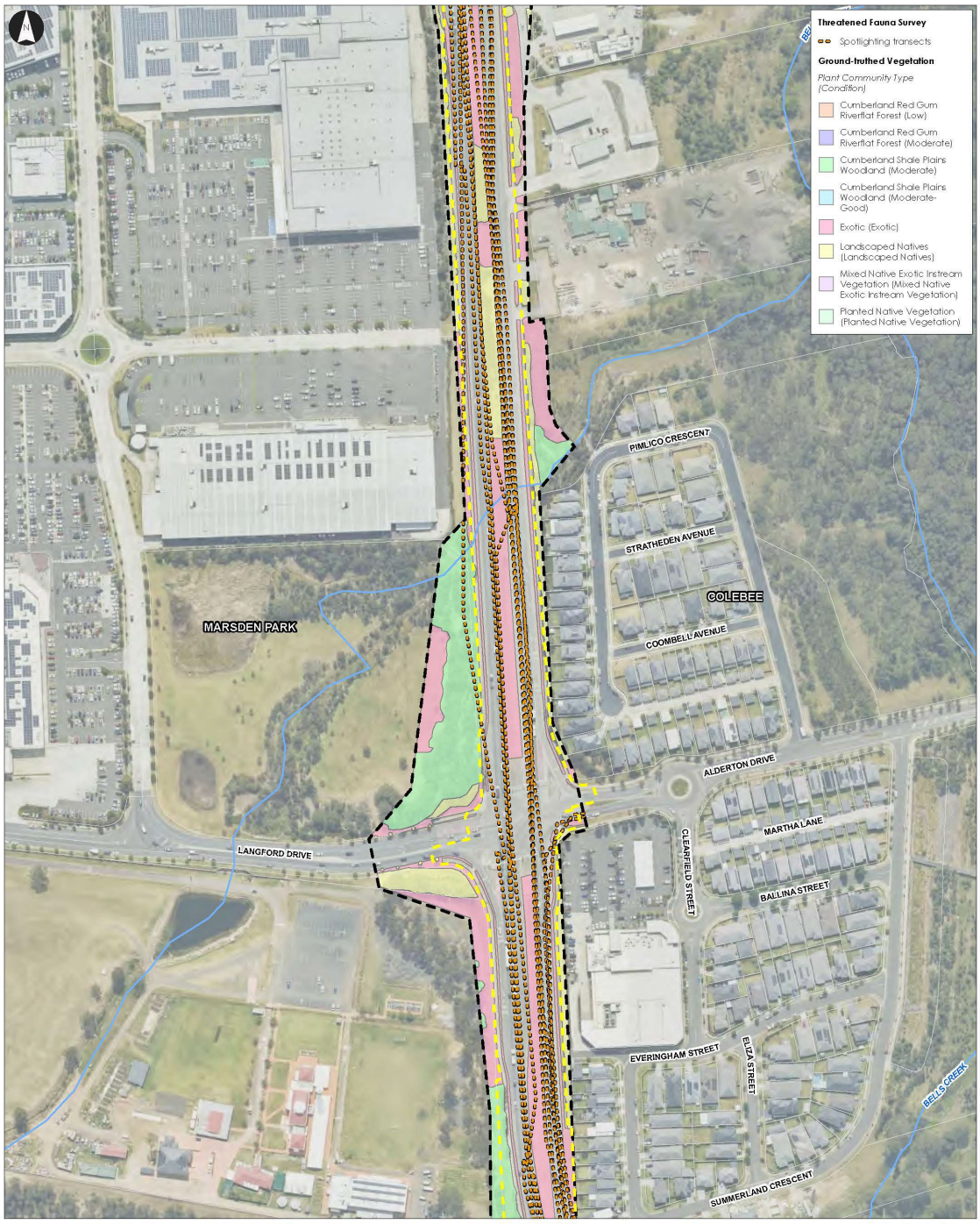
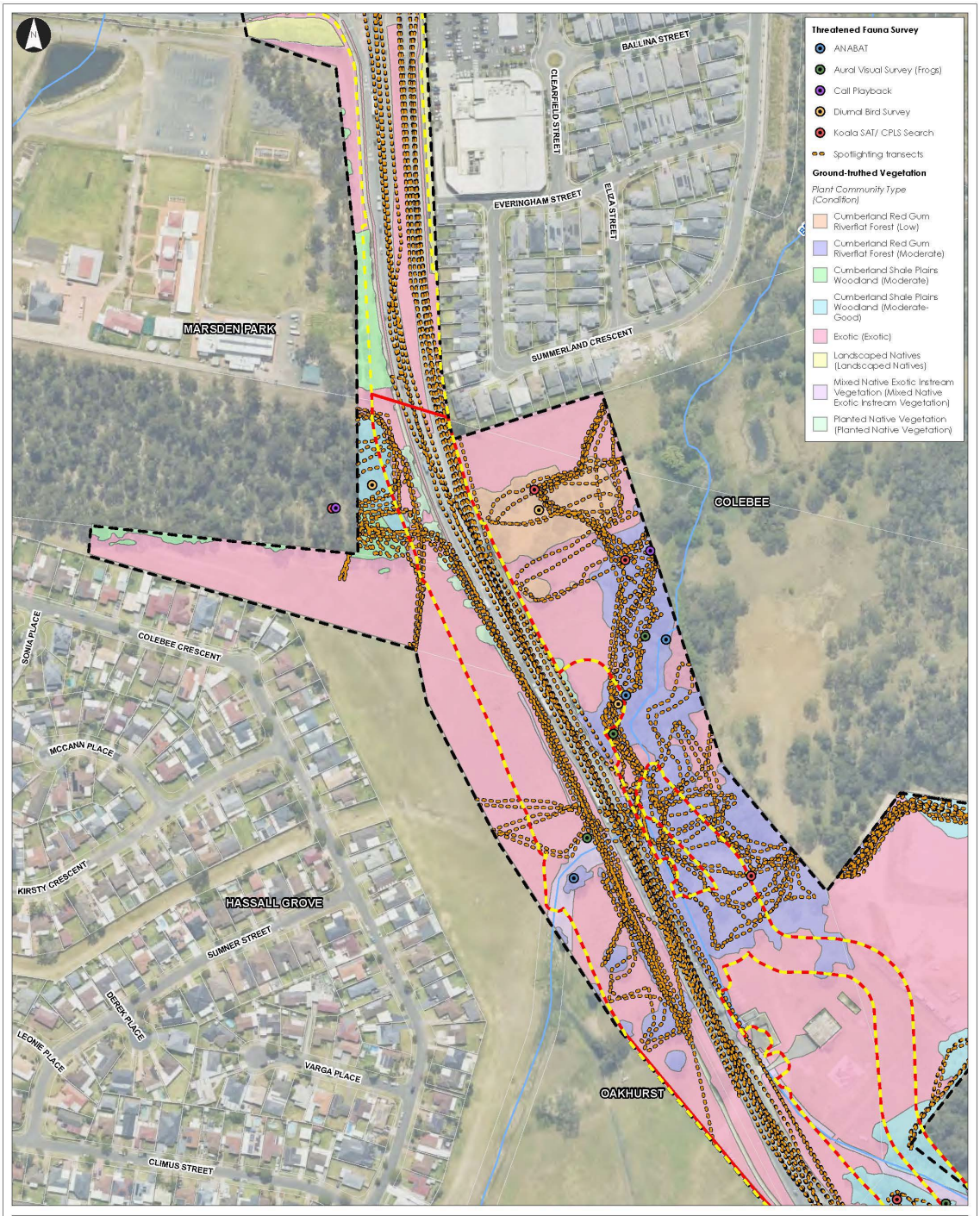
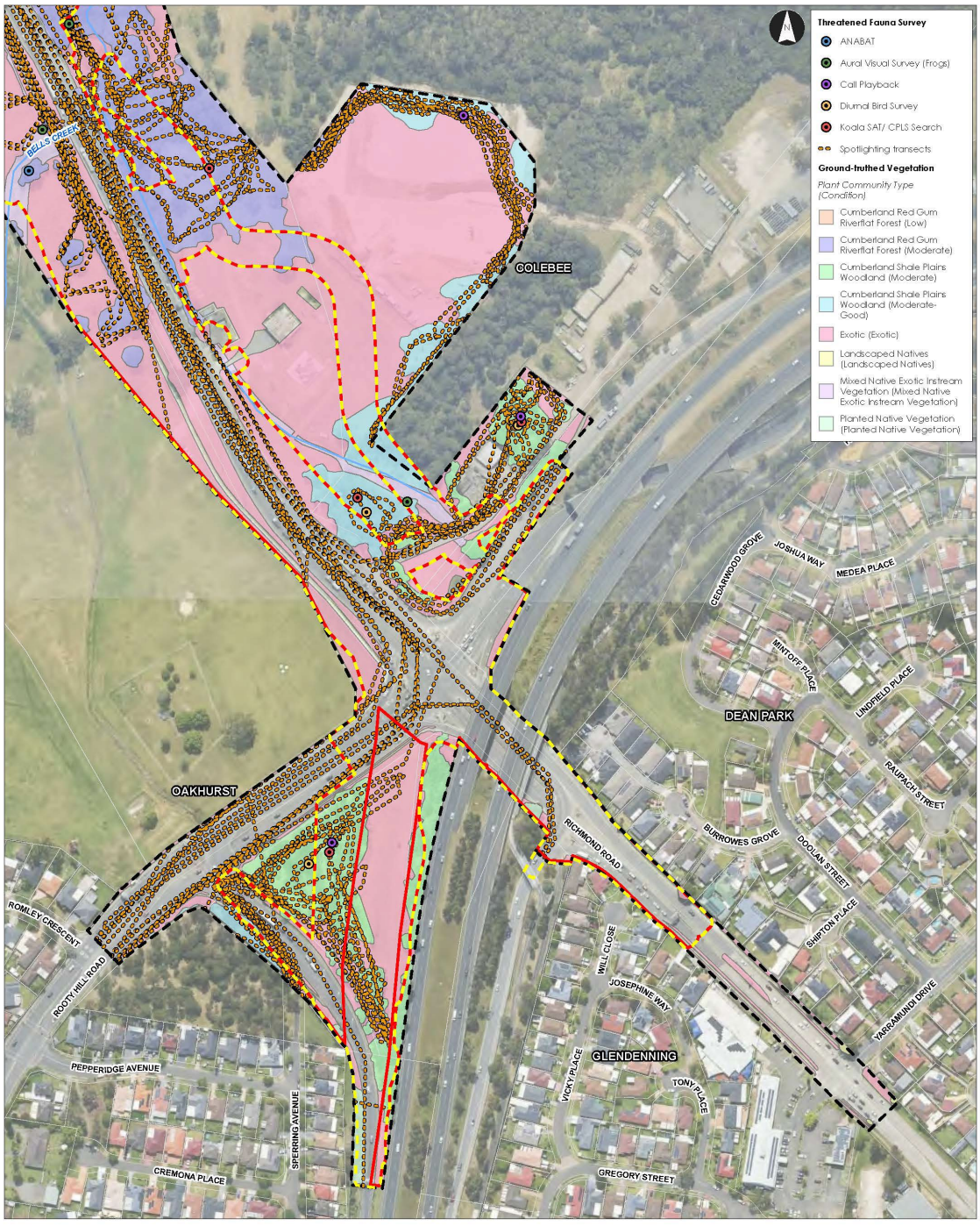


Figure 2-3 Threatened fauna survey locations







2.5 Aquatic surveys

2.5.1 Survey sites

Three sites were assessed for aquatic habitat and biodiversity during the field survey. These sites were chosen at points where a watercourse intersected the study area. The sites and locations are described in Table 2-9 and shown in Figure 2-4.

Table 2-9 Survey site names and locations

Site	Name	Waterway	Location
1	BC-1	Bells Creek	Located along Bells Creek at its intersection with Townson Road. Site located on the northern side of Townson Road.
2	BC-2	Bells Creek	Located along Bells Creek at its intersection with Richmond Road. Site located on the eastern side of Richmond Road.
3	UC-1	Unnamed Creek	Located along an unnamed creek that crosses through a culvert under Richmond Road. The unnamed creek is a tributary of Bells Creek.

Figure 2-4 Aquatic survey locations

2.5.2 Site walkover

An aquatic field survey was undertaken on the 31 January 2024 at three sites within the study area to assess aquatic biodiversity including fish, riparian and aquatic habitat and water quality. The survey was carried out in accordance with the NSW DPI Fisheries Fish Management Guidelines and the assessment requirements outlined in '*Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings'* (Fairfull and Witheridge, 2003).

2.5.3 Riparian and aquatic habitat

Riparian and aquatic habitat and habitat condition were assessed in the study area according to the Riparian Channel and Environment Inventory (RCE) methodology. This assessment involves evaluation and scoring of the characteristics of the condition of the riverbanks, channel and bed of the watercourse, the adjacent land use and the degree of disturbance evident at each site. The maximum score (52) indicates stream health with little or no obvious physical disruption and the lowest score (13) indicates a heavily channelled stream without any riparian vegetation. RCE scores for sites BC-1, BC-2 and UC-1 were used to derive an overall condition score for each site.

Habitat characteristics assessed at each site included:

- geomorphological characteristics of the waterway (e.g. gully, intermittent stream, major river; deep pools or gravel beds; waterways interconnecting with other waterways or wetlands upstream or downstream)
- flow regime of the waterway (e.g. intermittent or permanently flowing)
- type of land use (e.g. industries associated with the river, recreational uses)
- riparian vegetation and instream vegetation (e.g. presence/absence, native or exotic, condition)
- presence of instream or off-stream wetlands
- substratum type (e.g. rock, sand, gravel, alluvial substrata)
- presence of refuge areas (e.g. wetlands nearby that could be interlinked by the waterway during flow)
- presence of spawning areas (e.g. gravel beds, riparian vegetation, snags)
- presence of natural or artificial barriers to fish passage both upstream and downstream (e.g. weirs, dams, waterfalls, causeways).

2.5.4 Water quality

Water quality was measured in-situ using a calibrated YSI water quality probe. Two replicate readings were taken in accordance with A*ustralian and New Zealand Guidelines for Fresh Water and Marine Water Quality 2000* (Australian Water Quality Guidelines) (ANZECC/ARMCANZ 2000). A standard suite of variables was measured and included:

- electrical Conductivity (µs/cm)
- salinity (ppt)
- temperature (°C)
- turbidity (NTU)
- dissolved oxygen (DO) (mg/L and % saturation)
- pH
- oxidation Reduction Potential (mV).

Water quality measurements were assessed against the Australian Water Quality Guidelines default trigger values (DTV) for slightly disturbed freshwater streams in South-east Australia.

All works were carried out under the appropriate licences including the Scientific Licence required under Clause 22 of the National Parks and Wildlife Regulations 2002 and Section 132C of the NSW National Parks and Wildlife Act 1974, and the Animal Research Authority issued by the NSW DPI.

2.5.5 Fish biodiversity

Fish biodiversity was assessed using netting or bait traps with the appropriate methodology determined based on the size, depth and flow of the site at the time of survey. Fish surveys covered the length of the proposed study area using standardised effort (e.g. bait traps set for 1 hour). Any fish caught were measured, identified and photographed. After data recording, any pest species were humanely euthanised as per Animal Care and Ethics Committee guidelines for acceptable practices for fish handling.

Appropriate fisheries and animal ethics permits were in place and covered the duration of the aquatic surveying.

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 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).

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 has 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 surveys 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. Due to the timing of targeted flora surveys, several species could not be surveyed in accordance with seasonal requirements and survey guidelines. These species will be surveyed and assessed accordingly prior to the determination of the project.

3. Existing environment

The study area is located in Sydney's north west, within the Blacktown LGA. The Blacktown LGA falls within the Cumberland Interim Biogeographic Regionalisation for Australia (IBRA) subregion of the Sydney Basin IBRA bioregion. This region is important for biodiversity, supporting several endemic flora and fauna species found only on the Cumberland Plain.

The study area occurs within the catchment of Bells Creek which forms part of the Hawkesbury-Nepean Catchment. It occurs predominately within the Cumberland Plain NSW (Mitchell) landscapes regions, with a small portion of Hawkesbury-Nepean Channels and Floodplains occurring where Bells Creek crosses the study area.

The study area occurs predominantly within the Blacktown soil landscape which is characterised by gently undulating rises on Wianamatta Group shale. Soils from the Blacktown soil landscape are derived from Ashfield Shale (Bannerman and Hazelton 2011). Where Bells Creek traverses the study area, the soil landscape is mapped as the South Creek soil landscape. This soil landscape occurs along the floodplains, valley flats and drainage channels of the Cumberland Plain and is characterised by soils derived from Wianamatta Group shales and Hawkesbury Sandstone. The topography of the study area ranges from approximately 27 metres above sea level (ASL) to 46 metres ASL.

No conservation reserves occur within the study area. The nearest reserve to the study area is Yiraaldiya National Park, located approximately 2.7 kilometres to the west of the northern extent of the study area.

The proposal is located along the existing road corridor of Richmond Road, consisting of a 3 kilometre section between the M7 Motorway and Townson Road.

The current road consists of two lanes in each direction with a posted speed limit of 70 kilometres per hour in the south, near the M7 Motorway, and 80 kilometres per hour in the north. A range of signalised intersections, unsignalised intersections and a grade separated interchange are present within the three kilometre section. Current land uses within and adjacent to the study area include SP2 – Classified Road, R2 – Low Density Residential, R3 – Medium Density Residential, RU4 - Primary Production Small Lots and E1 – Environment Protection zone under the *Blacktown Local Environmental Plan 2015*. The study area includes existing certified land under the NWGA and CPCP (Figure 1-1) and includes land zoned SP2 - Classified Road, SP2 - Local Drainage, SP2 - Local Road, C2- Environmental Conservation, B5 -Business Development and R2 – Low Density Residential under the *State Environmental Planning Policy (Precincts—Central River City) 2021*.

3.1 Plant community types and vegetation zones

Table 3-1 lists all the PCTs identified within both the subject land and broader study area and includes patch size class and VI score for each vegetation zone. These values relate to habitat suitability for threatened species and vegetation condition, respectively (see Section 2.3.3 and 2.3.5)

Profiles for each mapped PCT are provided in the subsections below. Additional vegetation types, that cannot be reasonably assigned to a known PCT have also been included in Table 3-1.

Table 3-1 Plant community types and vegetation zones including patch size and vegetation integrity (VI) score

Veg Zone	Vegetation type	Threatened ecological community	Area (ha)						Patch size class	VI score
			Subject land	Proposal footprint	Certified areas within the proposal footprint		Study area not biocertified	Study Area		
					North West Growth Area	Certified – Major Transport Corridor				
Zone 1	PCT 3320: Cumberland Shale Plains Woodland (Moderate)	Critically Endangered (BC Act)	0.49	0.77	0.92	0.25	1.24	2.41	>100 ha	23.3
Zone 2	PCT 3320: Cumberland Shale Plains Woodland	Critically Endangered (BC Act)	0.31	0.31	0.00	0.00	1.07	1.08	>100 ha	41.8

Veg Zone	Vegetation type	Threatened ecological community	Area (ha)						Patch size class	VI score
			Subject land	Proposal footprint	Certified areas within the proposal footprint		Study area not biocertified	Study Area		
					North West Growth Area	Certified – Major Transport Corridor				
	(Moderate-Good)	Critically Endangered (EPBC Act) *								
Zone 3	PCT 4025: Cumberland Red Gum Riverflat Forest (Moderate)	Endangered (BC Act) Critically Endangered (EPBC Act)*	0.95	1.01	0.43	0.00	2.42	2.85	>100 ha	61.1
Zone 4	PCT 4025: Cumberland Red Gum Riverflat Forest (Low)	Endangered (BC Act)	0.01	0.01	0.00	0.00	0.51	0.51	>100 ha	44
Total area of vegetation assigned to PCTs			**1.76**	**2.10**	**1.35**	**0.25**	**5.24**	**6.85**	**-**	**-**
-	Planted Natives	-	0.13	0.16	0.00	0.05	0.13	0.18	-	-
-	Landscaped Natives	-	0.00	0.33	0.80	0.00	0.01	0.81	-	-
-	Exotic	-	3.29	5.16	2.19	1.40	8.68	12.30	-	-
-	Mixed Native Exotic Instream	-	0.19	0.19	0.00	0.00	0.27	0.27	-	-
Total			**5.37**	**7.94**	**4.34**	**1.70**	**14.33**	**20.41**	**-**	**-**

* Where the patch is greater than 0.5 ha in size.

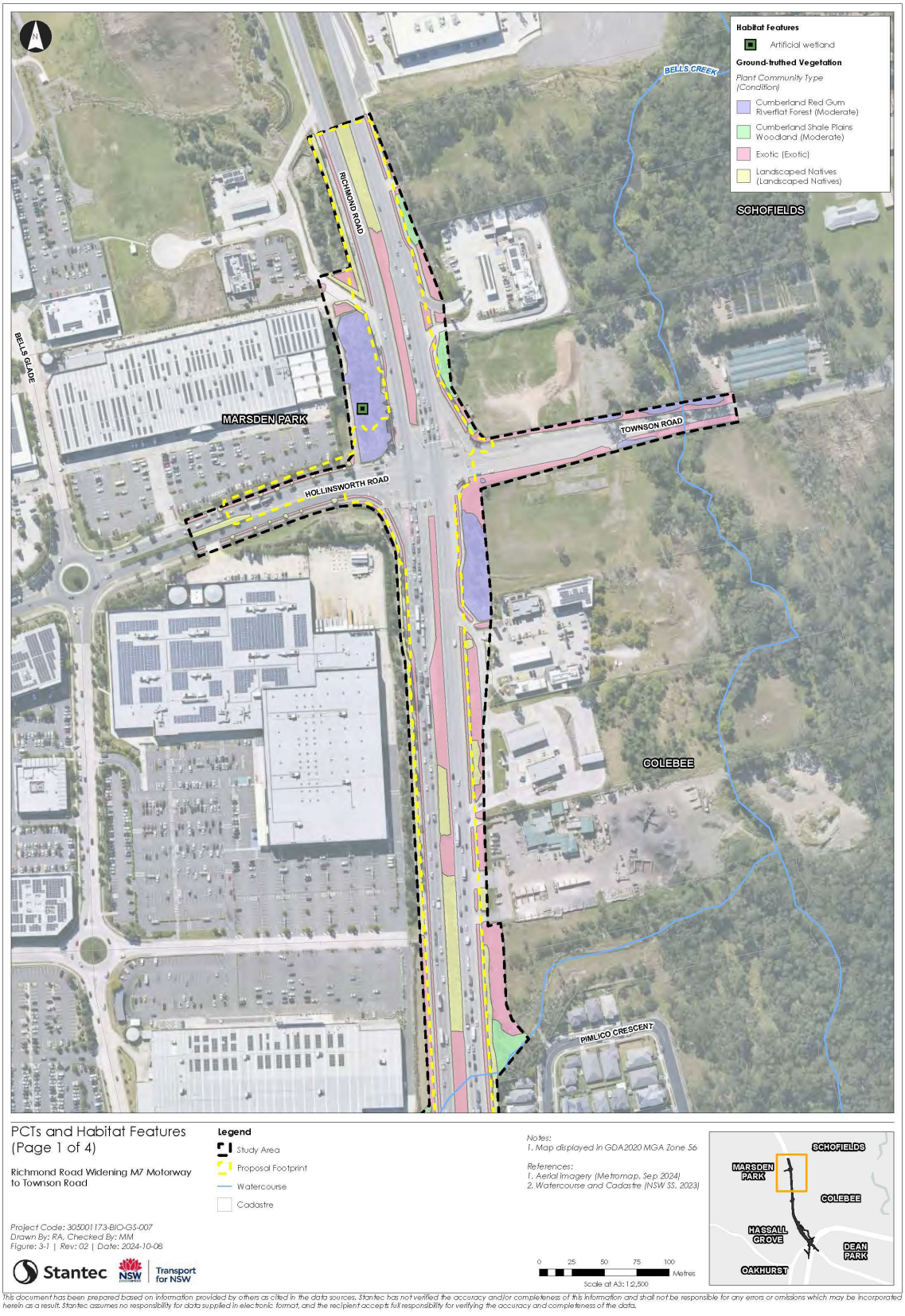
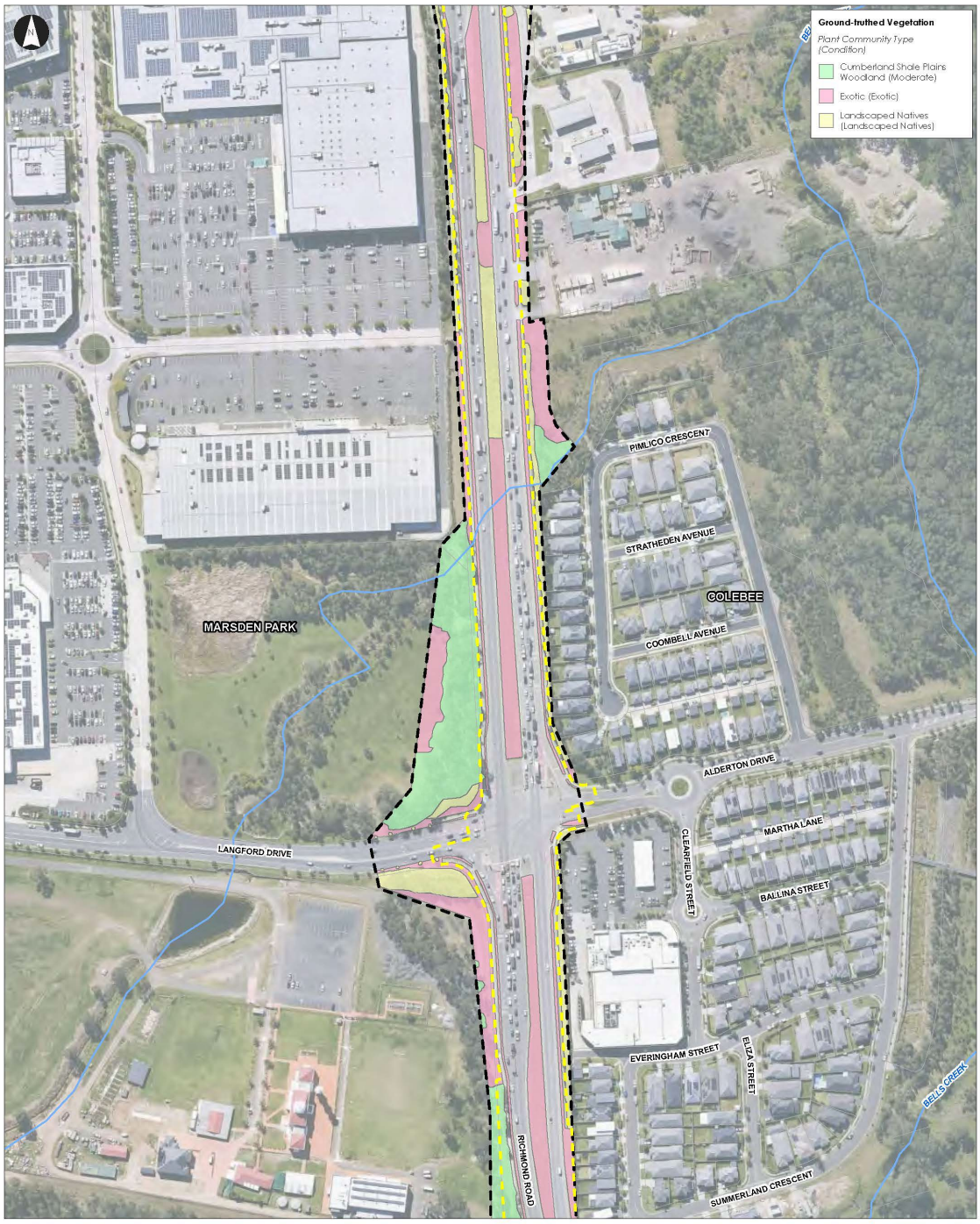


Figure 3-1 PCTs and Habitat Features



PCTs and Habitat Features
(Page 2 of 4)

Richmond Road Widening M7 Motorway to Townson Road

Legend
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

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Scale at A3: 1:2,500

Project Code: 305001173-BIO-GS-007
Drawn By: RA, Checked By: MM
Figure: 3-1 | Rev: 02 | Date: 2024-10-08

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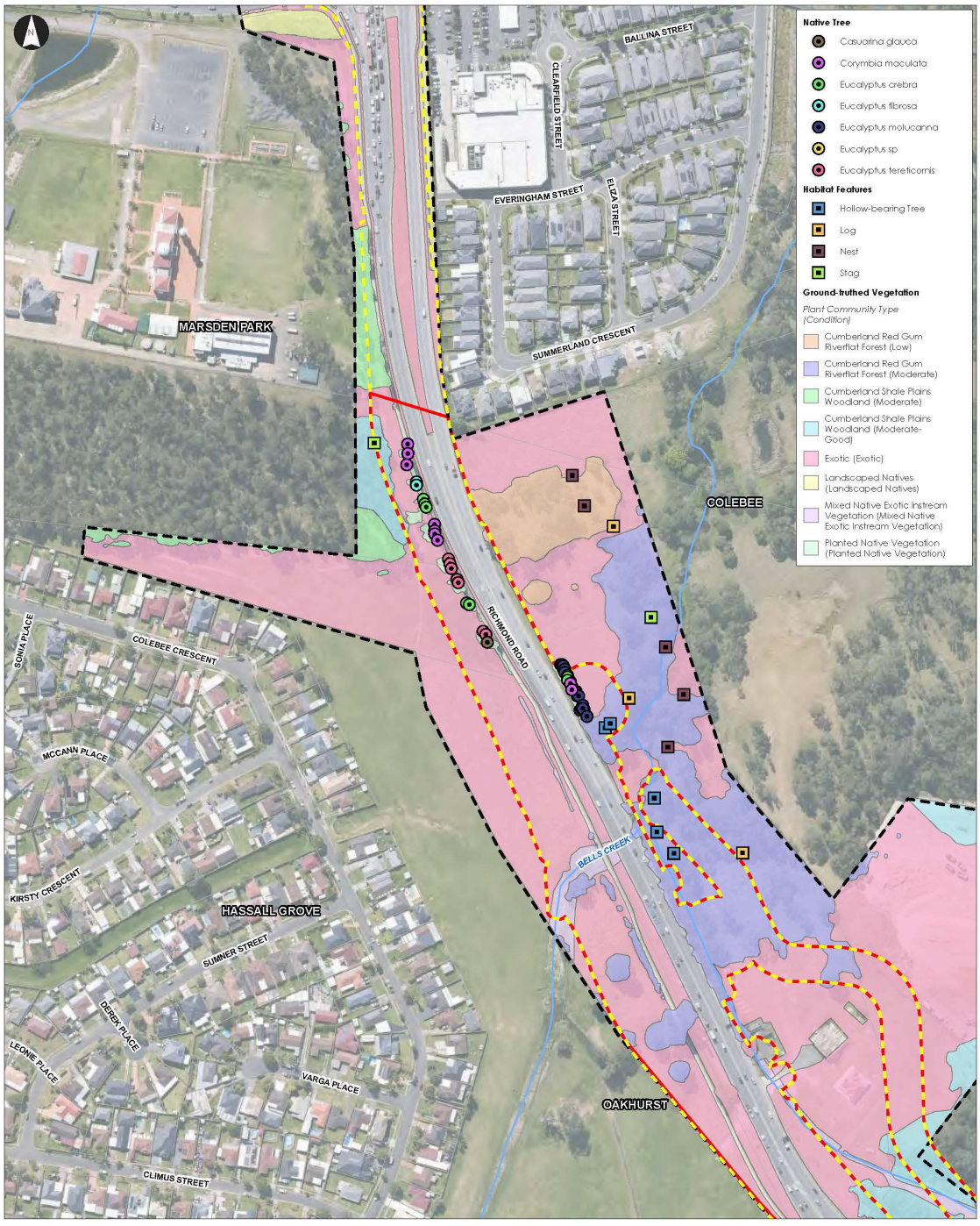

PCTs and Habitat Features
(Page 3 of 4)

Richmond Road Widening M7 Motorway to Townson Road

Legend
- Subject Land
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
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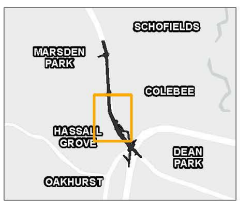

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Figure: 3-1 | Rev: 02 | Date: 2024-10-08

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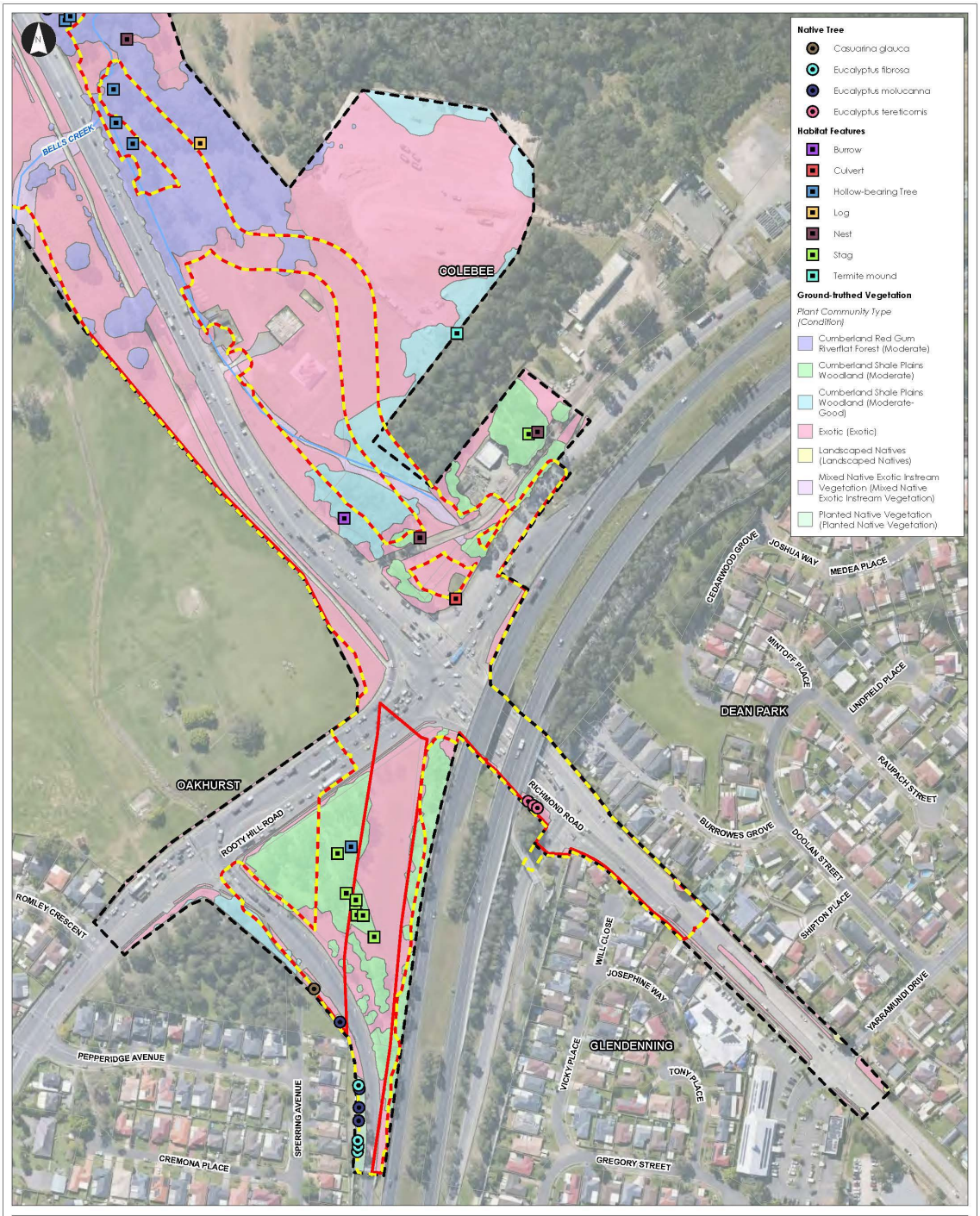

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3.1.1 PCT 3320: Cumberland Shale Plains Woodland

Description

PCT 3320 is a tall sclerophyll open forest or woodland community distributed on the undulating Wianamatta Group shale plains of western Sydney. The PCT occurs within the Wollemi, Cumberland and Yengo subregions of the Sydney Basin IBRA region, occupying much of the Cumberland Plain between Bankstown and the Hawkesbury and Nepean rivers. It typically occurs below 120 metres ASL in warm, moist climates, however, can occur up to 200 metres ASL. The community primarily occurs in small, disturbed patches within a rural or urban matrix. PCT 3320 is characterised by a canopy of *Eucalyptus tereticornis* and *Eucalyptus moluccana*, with ironbarks (*Eucalyptus crebra* and *Eucalyptus fibrosa*) occasionally present. The shrub layer is generally sparse, with species such as *Bursaria spinosa* and *Acacia* sp. (most frequently *Acacia parramattensis, Acacia decurrens* and *Acacia falcata*) occurring frequently. The ground-layer is typically mid-dense with grasses, forbs, twiners and hardy small ferns such as *Microlaena stipoides*, *Themeda triandra*, *Dichondra repens, Brunoniella australis, Cheilanthes sieberi* subsp. *sieberi*, *Desmodium varians, Aristida vagans and Glycine tabacina* common.

Within the study area, PCT 3320 consists of a canopy dominated by *Eucalyptus moluccana* and *Eucalyptus tereticornis,* with *Eucalyptus crebra* and *Casuarina glauca* also occurring. The density of the shrub layer varies throughout the study area, but typically includes *Bursaria spinosa.* Other species present throughout the study area include *Dillwynia sieberi, Grevillea juniperina* subsp. *juniperina* and *Melaleuca decora.* Common groundcover species include *Microlaena stipoides, Sporobolus creber, Brunoniella australis, Commelina cyanea, Dichondra repens, Glycine tabicina,* and *Lobelia purpurascens.* Dominant weed species within PCT 3320 include *Chloris gayana, Asparagus asparagoides, Eragrostis curvula, Onopordum acanthium* subsp*. acanthium, Senecio madagascariensis* and *Sida rhombifolia*.

Table 3-2 PCT 3320 Cumberland Shale Plains Woodland

PCT ID	3320
PCT name	Cumberland Shale Plains Woodland
Vegetation class	Coastal Valley Grassy Woodlands
Vegetation formation	Grassy Woodlands
Estimate of per cent cleared	93.03 %
Area in subject land	0.80 ha
Conservation status	PCT 3320 is associated with: • Cumberland Plain Woodland in the Sydney Basin Bioregion – listed as Critically Endangered under the BC Act • Shale Gravel Transition Forest in the Sydney Basin Bioregion – listed as Endangered under the BC Act • Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – listed as Critically Endangered under the EPBC Act. PCT 3320 occurring within the study area is commensurate with: • Cumberland Plain Woodland in the Sydney Basin Bioregion – listed as Critically Endangered under the BC Act (see Section 3.2.1) – where a patch is in a moderate or moderate-good condition • Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – listed as Critically Endangered under the EPBC Act – where a moderate-good condition patch is >0.5 hectares in size (see Section 3.9.1).
Vegetation zones (condition) and plots	Zone 1 (Moderate) – Plots 5,7 Zone 2 (Moderate – Good) – Plots 6, 8

Justification for PCT selection

Within the Cumberland Plain subregion, PCTs characterised by a dominant canopy of *Eucalyptus moluccana* and *Eucalyptus tereticornis* include Cumberland Shale Hills Woodland (PCT 3319) and Cumberland Shale Plains Woodland (PCT 3320). These PCTs have a similar assemblage and structure. PCT 3319 occurs in the hilly country to the west of the Nepean River and is

distinguished by the presence of *Acacia implexa* within the shrub layer. It overlaps with the distribution of PCT 3320 between Cecil Hills and the Nepean River, with PCT 3319 typically occurring on higher elevation hills and ridges. PCT 3319 typically occurs between 90-300 metres ASL, whilst PCT 3320 typically occurs below 120 metres ASL. The topography of the study area ranges from approximately 27 metres ASL to 46 metres ASL, consistent with the distribution of PCT 3320. PCT 3319 and PCT 3320 grade into Cumberland Shale-Sandstone Ironbark Forest (PCT 3321) on the edge of the Cumberland Plain, however *Eucalyptus moluccana* and *Eucalyptus tereticornis* are both rare within this PCT.

Table 3-3 Floristic and structural summary of PCT 3320 within the study area

Growth form	Typical species
Trees	*Eucalyptus moluccana, Eucalyptus tereticornis, Eucalyptus crebra, Acacia parramattensis*
Shrubs	*Bursaria spinosa, Dillwynia sieberi, Melaleuca decora, Grevillea juniperina* ssp. *Juniperina, Eremophila debilis*
Grass and grass-like	*Microlaena stipoides, Entolasia stricta, Paspalidium distans, Sporobolus creber, Echinopogon ovatus, Juncus subsecundus, Juncus usitatus*
Forb	*Brunoniella australis, Calotis cuneifolia, Commelina cyanea, Dichondra repens, Einadia nutans, Lobelia purpurascens, Oxalis perennans, Rumex tenax, Tricoryne elatior*
Fern	*Cheilanthes sieberi*
Other	*Glycine clandestine, Glycine tabicina, Cassytha glabella, Amyema gaudichaudii*
Exotic	*Aster subulatus, Brassica sp., Bromus sp., Conyza bonariensis, Hypochaeris radicata, Lysimachia arvensis, Onopordum acanthium* subsp. *acanthium, Plantago lanceolata, Poa annua, Setaria parviflora, Setaria pumila, Sida rhombifolia, Solanum sisymbriifolium, Syagrus romanzoffiana, Tagetes minuta, Trifolium repens, Verbena bonariensis*
High Threat Exotic	*Araujia sericifera, Asparagus aethiopicus, Asparagus asparagoides, Bidens pilosa, Bryophyllum delagoense, Cestrum parqui, Chloris gayana, Cyperus eragrostis, Ehrharta erecta, Eragrostis curvula, Lycium ferocissimum, Megathyrsus maximus, Paspalum dilatatum, Pinus radiata, Senecio madagascariensis*

Condition states

PCT 3320 occurs in two broad condition types within the study area:

- Moderate (vegetation zone 1) – this condition class is typically disturbed, with an intact canopy, sparse to absent shrub layer and high cover of exotic species within the understory layer. Over 30 per cent of perennial vegetation within the understory is comprised of native species
- Moderate – Good (vegetation zone 2) – this condition class consists of an intact canopy with a mid-dense to dense shrub layer dominated by native species. The vegetative ground cover includes exotic species, however, is dominated by native species (greater than 50 percent of perennial groundcover vegetation is comprised of native species).

Photo 3-1 Plot 5 showing vegetation zone 1 (PCT 3320 - Moderate)

Photo 3-2 Plot 8 showing vegetation zone 2 (PCT 3320 – Moderate-Good)

3.1.2 PCT 4025: Cumberland Red Gum Riverflat Forest

Description

PCT 4025 is a tall sclerophyll open forest distributed on the alluvial flats of streams draining the Cumberland Plain and, occasionally, the broad alluvial flats of the Hawkesbury and Nepean River systems west of Sydney. The PCT occurs within the Burragorang, Cumberland and Yengo subregions of the Sydney Basin IBRA region. It typically occurs at elevations of around 60 metres ASL but may occur up to 320 metres ASL in the south of the Cumberland Plain. The remaining extent of the PCT is focussed around smaller streams and typically exists as small, disturbed patches threatened by weed invasion intensified by flood events. The PCT is characterised by a canopy of red gums (*Eucalyptus tereticornis* and *Eucalyptus amplifolia*), with occasional apple gums (*Angophora floribunda* and *Angophora subvelutina*), with a sparse mid-stratum of soft-leaved shrubs and small trees and a dense, grassy ground layer. Species present within the sparse mid-stratum typically include *Bursaria spinosa* and one or more *Acacia* species (most frequently *Acacia parramattensis*). The ground layer is characterised by dense grass cover with forbs and ferns, with species such as *Microlaena stipoides*, *Dichondra repens, Oplismenus aemulus* and *Solanum prinophyllum* being common.

Within the study area, PCT 4025 consists of a canopy dominated by *Eucalyptus tereticornis,* with *Eucalyptus fibrosa, Eucalyptus moluccana* and *Casuarina glauca* also occurring. A sparse layer of shrubs typically includes species such as *Bursaria spinosa*, *Melaleuca decora* and *Melaleuca squarrosa.* Groundcover species include *Microlaena stipoides, Sporobolus creber, Brunoniella australis, Centella asiatica, Commelina cyanea, Dichondra repens, Glycine clandestina,* and *Lobelia purpurascens.* Dominant weed species within PCT 4025 include *Cenchrus clandestinus, Chloris gayana, Phalaris aquatica, Setaria pumila, Solanum pseudocapsicum* and *Xanthium occidentale.*

Table 3-4 PCT 4025: Cumberland Red Gum Riverflat Forest

PCT ID	4025
PCT name	Cumberland Red Gum Riverflat Forest
Vegetation class	Coastal Floodplain Wetlands
Vegetation formation	Forested Wetlands
Estimate of per cent cleared	88.84 %
Area in subject land	0.95 ha
Conservation status	PCT 4025 is associated with: • Elderslie Banksia Scrub Forest – listed as Critically Endangered under the BC Act; • River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions– listed as Endangered under the BC Act • Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion - listed as Critically Endangered under the EPBC Act • River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria - listed as Critically Endangered under the EPBC Act. PCT 4025 occurring within the study area is commensurate with: • River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions– listed as Endangered under the BC Act (see Section 3.2.3) • River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria - listed as Critically Endangered under the EPBC Act – where a patch is in moderate condition and is greater than 0.5 hectares in size (see Section 3.9.1).
Vegetation zones (condition) and plots	Zone 3 (Moderate) – Plots 2, 3, 4 Zone 4 (Low) – Plot 1

Justification for PCT selection

Within the study area, PCT 4025 is distributed adjacent to Bells Creek and is dominated by a canopy of *Eucalyptus tereticornis*. PCT 4025 grades into PCT 3320 as elevation or distance from the margin of the floodplain increases. PCT 3320 more commonly includes *Eucalyptus moluccana.*

Table 3-5 Floristic and structural summary of PCT 4025 within the study area

Growth form	Typical species
Trees	*Eucalyptus tereticornis, Eucalyptus moluccana, Eucalyptus fibrosa, Casuarina glauca, Corymbia maculata*
Shrubs	*Bursaria spinosa, Melaleuca decora, Melaleuca squarrosa*
Grass and grass-like	*Carex inversa, Cynodon dactylon, Eriochloa procera, Juncus usitatus, Microlaena stipoides, Sporobolus creber*
Forb	*Brunoniella australis, Centella asiatica, Commelina cyanea, Dichondra repens, Lobelia purpurascens, Oxalis perennans, Persicaria decipiens*
Fern	*Cheilanthes sieberi*
Other	*Glycine clandestine, Glycine tabicina*
Exotic	*Amaranthus viridis, Cenchrus clandestinus, Cyclospermum leptophyllum, Euphorbia peplus, Fraxinus excelsior, Fumaria officinalis, Galinsoga parviflora, Galium aparine, Hypochaeris radicata, Lagerstroemia indica, Lysimachia arvensis, Medicago polymorpha, Onopordum acanthium* subsp*. acanthium, Parietaria judaica, Phalaris aquatica, Plantago lanceolata, Setaria pumila, Sida rhombifolia, Solanum nigrum, Solanum pseudocapsicum, Solanum sisymbriifolium, Syagrus romanzoffiana, Trifolium repens, Yucca sp.*
High Threat Exotic	*Asparagus asparagoides, Cestrum parqui, Chloris gayana, Cyperus eragrostis, Eragrostis curvula, Hypericum perforatum, Ligustrum sinense, Lycium ferocissimum, Senecio madagascariensis, Vinca major, Xanthium occidentale*

Photo 3-3 Plot 2 showing vegetation zone 3 (PCT 4025 - Moderate)

Photo 3-4 Plot 1 showing vegetation zone 4 (PCT 4025 - Low)

Condition states

PCT 4025 occurs in two broad condition types within the study area:

- Moderate (vegetation zone 3) – this condition class is typically disturbed, with an intact canopy, sparse to absent shrub layer and high cover of exotic species within the understory layer. Over 30 percent of perennial vegetation within the understory is comprised of native species and the vegetation is commensurate with the associated EPBC listed TEC (see section 3.9.1.3)
- Low (vegetation zone 4) – this condition class is disturbed, with an intact canopy, sparse to absent shrub layer and high cover of exotic species within the understory layer, including a high proportion of High Threat Weeds (HTW). This condition class is not commensurate with the associated EPBC listed TEC (see section 3.9.1.3) on account of the dominant canopy species. Vegetation zone 4 has been assigned to PCT 4025 as a best fit based on the species composition and adjacent native patches.

3.1.3 Planted trees

In accordance with the *Tree and Hollow Replacement Guidelines* (Transport 2023b), trees and hollows that are not part of a recognisable PCT or are below the offset area thresholds are required to be replaced. An inventory of planted native trees within the study area and identification of individuals within the subject land is provided in Table 3-6. Locations of these trees are provided in Table 3-6.

Photo 3-5 Planted trees

Table 3-6 Inventory of trees within study area

Tree ID	Species Name	Common Name	Easting	Northing	'Native' or 'Amenity' tree	DBH* (cm)	Tree size category**	Located within the subject land
1	*Corymbia maculata*	Spotted Gum	300294.32	6266025.62	Native	19	Small	Yes
2	*Corymbia maculata*	Spotted Gum	300294.46	6266018.97	Native	15	Small	Yes
3	*Corymbia maculata*	Spotted Gum	300293.69	6266011.18	Native	25	Medium	Yes
4	*Eucalyptus fibrosa*	Red Ironbark	300300.44	6265999.12	Native	12	Small	Yes
5	*Eucalyptus fibrosa*	Red Ironbark	300300.48	6265996.9	Native	11	Small	Yes
6	*Eucalyptus crebra*	Narrow-leaved Ironbark	300305.32	6265987.02	Native	12	Small	Yes
7	*Eucalyptus crebra*	Narrow-leaved Ironbark	300306.32	6265983.71	Native	7	Small	Yes
8	*Eucalyptus crebra*	Narrow-leaved Ironbark	300307.29	6265981.51	Native	15	Small	Yes
9	*Corymbia maculata*	Spotted Gum	300313.11	6265969.43	Native	19	Small	Yes
10	*Corymbia maculata*	Spotted Gum	300313.2	6265964.99	Native	14	Small	Yes
11	*Corymbia maculata*	Spotted Gum	300313.25	6265962.77	Native	25	Medium	Yes
12	*Corymbia maculata*	Spotted Gum	300315.19	6265958.38	Native	19	Small	Yes
13	*Eucalyptus tereticornis*	Forest Red Gum	300322.89	6265945.22	Native	32	Medium	Yes
14	*Eucalyptus tereticornis*	Forest Red Gum	300323.88	6265941.91	Native	20	Medium	Yes
15	*Eucalyptus tereticornis*	Forest Red Gum	300324.88	6265938.61	Native	33	Medium	Yes
16	*Eucalyptus tereticornis*	Forest Red Gum	300328.75	6265930.92	Native	26	Medium	Yes
17	*Eucalyptus tereticornis*	Forest Red Gum	300328.75	6265930.92	Native	17	Small	Yes
18	*Eucalyptus tereticornis*	Forest Red Gum	300329.72	6265928.72	Native	23	Medium	Yes

Tree ID	Species Name	Common Name	Easting	Northing	'Native' or 'Amenity' tree	DBH* (cm)	Tree size category**	Located within the subject land
19	*Eucalyptus crebra*	Narrow-leaved Ironbark	300335.58	6265914.42	Native	9	Small	Yes
20	*Eucalyptus crebra*	Narrow-leaved Ironbark	300337.46	6265913.35	Native	17	Small	Yes
21	*Eucalyptus tereticornis*	Forest Red Gum	300347.12	6265894.69	Native	24	Medium	Yes
22	*Eucalyptus tereticornis*	Forest Red Gum	300347.12	6265894.69	Native	22	Medium	Yes
23	*Eucalyptus tereticornis*	Forest Red Gum	300349.02	6265892.51	Native	32	Medium	Yes
24	*Casuarina glauca*	Swamp Oak	300350.06	6265886.98	Native	24	Medium	Yes
25	*Eucalyptus molucanna*	Grey Box	300401.37	6265871.41	Native	10	Small	No
26	*Eucalyptus molucanna*	Grey Box	300402.3	6265871.43	Native	14	Small	No
27	*Eucalyptus molucanna*	Grey Box	300403.25	6265870.34	Native	17	Small	No
28	*Eucalyptus tereticornis*	Forest Red Gum	300403.3	6265868.13	Native	13	Small	No
29	*Eucalyptus molucanna*	Grey Box	300404.22	6265868.15	Native	4	Small	No
30	*Eucalyptus molucanna*	Grey Box	300404.27	6265865.93	Native	15	Small	No
31	*Eucalyptus tereticornis*	Forest Red Gum	300405.22	6265864.84	Native	4	Small	Yes
32	*Eucalyptus molucanna*	Grey Box	300406.17	6265863.75	Native	15	Small	Yes
33	*Eucalyptus crebra*	Narrow-leaved Ironbark	300406.19	6265862.64	Native	7	Small	Yes
34	*Eucalyptus sp*		300406.22	6265861.53	Native	3	Small	Yes
35	*Eucalyptus crebra*	Narrow-leaved Ironbark	300406.24	6265860.42	Native	11	Small	Yes
36	*Eucalyptus molucanna*	Grey Box	300407.17	6265860.44	Native	8	Small	Yes
37	*Eucalyptus molucanna*	Grey Box	300408.12	6265859.35	Native	14	Small	Yes

Tree ID	Species Name	Common Name	Easting	Northing	'Native' or 'Amenity' tree	DBH* (cm)	Tree size category**	Located within the subject land
38	*Corymbia maculata*	Spotted Gum	300408.14	6265858.24	Native	6	Small	Yes
39	*Eucalyptus molucanna*	Grey Box	300409.11	6265856.04	Native	8	Small	Yes
40	*Corymbia maculata*	Spotted Gum	300409.16	6265853.82	Native	18	Small	Yes
41	*Eucalyptus molucanna*	Grey Box	300411.03	6265852.75	Native	9	Small	Yes
42	*Eucalyptus tereticornis*	Forest Red Gum	300410.08	6265853.84	Native	6	Small	Yes
43	*Eucalyptus molucanna*	Grey Box	300411.96	6265852.77	Native	15	Small	Yes
44	*Eucalyptus molucanna*	Grey Box	300411.98	6265851.66	Native	12	Small	Yes
45	*Eucalyptus molucanna*	Grey Box	300413.88	6265849.49	Native	22	Medium	Yes
46	*Eucalyptus tereticornis*	Forest Red Gum	300412.96	6265849.47	Native	7	Small	Yes
47	*Eucalyptus molucanna*	Grey Box	300416.8	6265842.89	Native	21	Medium	Yes
48	*Eucalyptus molucanna*	Grey Box	300416.85	6265840.67	Native	7	Small	Yes
49	*Eucalyptus tereticornis*	Forest Red Gum	300415.02	6265839.52	Native	22	Medium	Yes
50	*Eucalyptus molucanna*	Grey Box	300415.92	6265840.65	Native	9	Small	Yes
51	*Eucalyptus molucanna*	Grey Box	300416.85	6265840.67	Native	11	Small	Yes
52	*Eucalyptus tereticornis*	Forest Red Gum	300416.85	6265840.67	Native	5	Small	Yes
53	*Eucalyptus tereticornis*	Forest Red Gum	300417.8	6265839.58	Native	24	Medium	Yes
54	*Eucalyptus molucanna*	Grey Box	300419.74	6265835.18	Native	26	Medium	Yes
55	*Eucalyptus tereticornis*	Forest Red Gum	300761.8212	6265271.337	Native	-	Medium	Yes
56	*Eucalyptus tereticornis*	Forest Red Gum	300765.6848	6265268.406	Native	-	Small	Yes

Tree ID	Species Name	Common Name	Easting	Northing	'Native' or 'Amenity' tree	DBH* (cm)	Tree size category**	Located within the subject land
57	*Eucalyptus tereticornis*	Forest Red Gum	300768.4016	6265266.614	Native	-	Small	Yes
58	*Eucalyptus fibrosa*	Red Ironbark	300640.3809	6265021.983	Native	-	Small	Yes
59	*Eucalyptus fibrosa*	Red Ironbark	300640.8742	6265025.829	Native	-	Medium	Yes
60	*Eucalyptus fibrosa*	Red Ironbark	300640.5878	6265029.925	Native	-	Small	Yes
61	*Eucalyptus molucanna*	Grey Box	300641.2806	6265043.998	Native	-	Medium	Yes
62	*Eucalyptus molucanna*	Grey Box	300641.4433	6265053.443	Native	-	Small	Yes
63	*Eucalyptus fibrosa*	Red Ironbark	300641.1202	6265069.226	Native	-	Small	Yes
64	*Eucalyptus molucanna*	Grey Box	300641.6851	6265066.729	Native	-	Small	Yes
65	*Eucalyptus molucanna*	Grey Box	300628.0193	6265114.262	Native	-	Medium	Yes
66	*Casuarina glauca*	Swamp Oak	300609.5665	6265137.821	Native	-	Small	Yes

**DBH= Diameter at breast height*

*** Tree size category corresponds with the replacement ratios under the Tree and Hollow Replacement Guidelines (Transport 2023b):*

- *Very large tree (DBH greater than 100 cm) – Plant a minimum 16 trees and provide three artificial hollows for every occupied hollow removed (assuming a 20% occupancy rate).*
- *Large tree (DBH between 50 cm and 100 cm) - Plant minimum eight trees and provide three artificial hollows for every occupied hollow removed (assuming a 20% occupancy rate).*
- *Medium tree (DBH greater than 20 cm, but less than 50 cm) - Plant minimum four trees and provide three artificial hollows for every occupied hollow removed (assuming a 20% occupancy rate).*
- *Small tree (DBH greater than 5 cm, but less than 20 cm) – Provide at least two trees*

Note: tree size category has been estimated for trees planted along the M7 Motorway exit that could not be accessed during field survey.

3.1.4 Other vegetation

Other vegetation within the study area consists of vegetation that cannot be reasonably assigned to an existing PCT.

3.1.4.1 Landscaped

Landscaped areas consist of native plantings of shrubs, forbs and grasses in designated areas of landscaping adjacent to Richmond Road, including median strip plantings. These areas occur predominantly in the north of the study area, within biocertified lands.

3.1.4.2 Mixed native exotic instream vegetation

Within the study area, mapped patches of mixed native exotic instream vegetation consist predominantly of dense stands of *Typha orientalis* within both permanently and ephemerally wet areas such as the tributaries of Bells Creek and drainage lines adjacent to Richmond Road.

Photo 3-6 Mixed native exotic instream vegetation within the study area

3.1.4.3 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 55 exotic species were recorded in the study area (see Appendix A). Twenty of the exotic species recorded in the study area have a listing at National, State and/or local level (see Section 5.2.5) 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
- 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 Blacktown LGA is part of the Greater Sydney LLS region.

Photo 3-7 Exotic vegetation within the study area

3.1.4.4 Cleared land

Cleared land within the study area includes all hardstand areas, such as Richmond Road and associated infrastructure, footpaths and driveways.

3.2 Threatened ecological communities

Table 3-7 outlines TECs, under the BC Act, which are associated with PCTs occurring within the study area. It provides an assessment of the commensuration of PCTs within the study area with the definition of each TEC, including justification of how the PCT meets the relevant final determination for each TEC. Where vegetation within the study area is commensurate with a TEC listed under the BC Act, an assessment of significance had been undertaken as per Part 7.3 of the BC Act (Appendix D).

Table 3-7 BC Act listed TECs associated with PCTs occurring in the study area

PCT ID	PCT Name	Associated TEC (BC Act)	TEC Status (BC Act)	Vegetation within study area commensurate with TEC?	Justification
3320	Cumberland Shale Plains Woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered	Yes	See Table 3-8. PCT 3320 Primarily relates to the NSW Cumberland Plain Woodland TEC (CPW). Paragraphs 2 (substrate) and 7 (diagnostic species) of the CPW Final Determination assist in distinguishing the Shale Plains Woodland component of CPW from the Shale Gravel Transition Forest TEC.

PCT ID	PCT Name	Associated TEC (BC Act)	TEC Status (BC Act)	Vegetation within study area commensurate with TEC?	Justification
3320	Cumberland Shale Plains Woodland	Shale Gravel Transition Forest in the Sydney Basin Bioregion	Endangered	No	See Table 3-9. A component of PCT 3320 relates to the NSW Shale Gravel Transition Forest TEC (SGTF). Paragraphs 5 (substrate) and 6 (diagnostic species) of the SGTF Final Determination assist in distinguishing SGTF from the Shale Plains Woodland component of the Cumberland Plain Woodland TEC.
4025	Cumberland Red Gum Riverflat Forest	Elderslie Banksia Scrub Forest	Critically Endangered	No	PCT 4025 relates to the NSW Elderslie Banksia Scrub Forest TEC where it occurs on the Tertiary alluvium of Spring Farm Elderslie area as per Section 4.3 of the Final Determination (NSW Scientific Committee 2015). The study area occurs outside of this distribution.
4025	Cumberland Red Gum Riverflat Forest	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	Endangered	Yes	See Table 3-10. PCT 4025 relates to the NSW River-Flat Eucalypt Forest on Coastal Floodplains TEC where it occurs within stated elevation range as per paragraph 1 of the Final Determination (NSW Scientific Committee 2015).

3.2.1 Cumberland Plain Woodland in the Sydney Basin Bioregion

As per Table 3-7, Cumberland Shale Plains Woodland (PCT 3320) meets the definition of the TEC Cumberland Plain Woodland in the Sydney Basin Bioregion, listed as Critically Endangered under the BC Act. A description of how PCT 3320 meets each element of the final determination for the TEC (NSW Scientific Committee 2010) is provided in Table 3-8.

Table 3-8 Final determination description review for Cumberland Plain Woodland in the Sydney Basin Bioregion

Characteristics	Final determination reference	Characteristics of PCT 3320 within the study area
Location	*Paragraph 2:* Cumberland Plain Woodland is the name given to the ecological community in the Sydney Basin bioregion associated with clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates, on the Cumberland Plain, a rain shadow area to the west of Sydney's Central Business District. *Paragraph 11:* Cumberland Plain Woodland is restricted to the Sydney Basin Bioregion and is currently known to occur within the LGAs of Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd,	Meets the final determination. The study area occurs within the Blacktown LGA within the Sydney Basin bioregion.

Characteristics	Final determination reference	Characteristics of PCT 3320 within the study area
	Liverpool, Parramatta, Penrith and Wollondilly, but may occur elsewhere within the bioregion.	
Soil and landscape	*Paragraph 2:* Associated with clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates. The community typically occurs on flat to undulating or hilly terrain up to about 350 metres elevation but may also occur on locally steep sites and at slightly higher elevations.	Meets the final determination. The study area occurs predominantly within the Blacktown soil landscape which is characterised by gently undulating rises on Wianamatta Group shale. Soils from the Blacktown soil landscape are derived from Ashfield Shale. The topography of the study area ranges from approximately 27 metres above sea level (asl) to 46 metres ASL.
Floristic composition	*Paragraph 2:* Cumberland Plain Woodland is characterised by the assemblage of species listed in paragraph 3 and typically comprises an open tree canopy, a near-continuous groundcover dominated by grasses and herbs, sometimes with layers of shrubs and/or small trees. Shrubs may sometimes occur in locally dense stands. *Paragraph 7:* Cumberland Plain Woodland belongs to the Coastal Valley Grassy Woodlands vegetation class.	Partially meets the final determination. With the exception of low condition areas, PCT 3320 within the study area occurs as a grassy woodland. Of the 112 native species commonly occurring within the TEC, 21 were present within PCT 3320 plots in the study area.
Characteristic tree species	*Paragraph 5*: Cumberland Plain Woodland is characterised by an upper-storey that is usually dominated by *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum), often with *E. crebra* (Grey Ironbark), *E. eugenioides* (Narrow-leaved Stringybark), *Corymbia maculata* (Spotted Gum) or other less frequently occurring eucalypts, including *Angophora floribunda*, *A. subvelutina* (Broad-leaved Apple), *E. amplifolia* (Cabbage Gum) and *E. fibrosa* (Broad-leaved Ironbark).	Meets the final determination. The canopy of PCT 3320 is dominated by *Eucalyptus moluccana* and *E. tereticornis.*
Disturbance	*Paragraph 6:* Contemporary tree-dominated stands of the community are largely relics or regrowth of originally taller forests and woodlands, which are likely to have had scattered shrubs and a largely continuous grassy groundcover. *Paragraph 19:* Weed invasion also poses a major threat to the Cumberland Plains Woodland.	Meets the final determination. PCT 3320 within the study area consists of remnants within a disturbed landscape. Most areas have existing disturbances such as clearing, tracks, weeds and illegal dumping.

3.2.2 Shale Gravel Transition Forest in the Sydney Basin Bioregion

As per Table 3-7, Cumberland Shale Plains Woodland (PCT 3320) does not meet the definition of the TEC Shale Gravel Transition Forest in the Sydney Basin Bioregion, listed as Endangered under the BC Act. An assessment of PCT 3320, within the study area, against each element of the final determination for the TEC (NSW Scientific Committee 2011a) is provided in Table 3-9.

Table 3-9 Final determination description review for Shale Gravel Transition Forest in the Sydney Basin Bioregion

Characteristics	Final determination reference	Characteristics of PCT 3320 within the study area
Location	*Paragraph 1:* All sites are within the Sydney Basin Bioregion. *Paragraph 7:* Shale Gravel Transition Forest is or has been known to occur in the Auburn, Bankstown, Baulkham Hills, Blacktown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta and Penrith LGAs, but may occur elsewhere in the Sydney Basin Bioregion.	Meets the final determination. The study area occurs within the Blacktown LGA within the Sydney Basin bioregion.
Soil and landscape	*Paragraph 5:* Shale Gravel Transition Forest occurs primarily in areas where shallow deposits of Tertiary alluvium overlie shale soils but may also occur in association with localised concentrations of iron-indurated gravel. Shale Gravel Transition Forest grades into Cumberland Plain Woodland as alluvial and ironstone influences decline.	Does not meet the final determination. The study area occurs predominantly within the Blacktown soil landscape which is characterised by gently undulating rises on Wianamatta Group shale. Soils from the Blacktown soil landscape are derived from Ashfield Shale.
Floristic composition	*Paragraph 2*: Shale Gravel Transition Forest is characterised by the list of species in Paragraph 2 of the final determination. *Paragraph 6*: Shale Gravel Transition Forest is described in NSW NPWS (2000a&b) which lists diagnostic plant species for the community.	Partially meets the final determination. Of the 43 species listed in Paragraph 2 of the final determination, 15 were present within PCT 3320 plots in the study area.
Characteristic tree species	*Paragraph 4*: Shale Gravel Transition Forest is predominantly of open-forest structure, usually with trees of *Eucalyptus fibrosa* sometimes with *E. moluccana* and *Eucalyptus tereticornis*. *Melaleuca decora* is frequently present in a small tree stratum. A sparse shrub stratum is usually present with species such as *Bursaria spinosa, Daviesia ulicifolia* and *Lissanthe strigosa*.	Partially meets final determination. The canopy of PCT 3320 does not include *Eucalyptus fibrosa*, however is dominated by *Eucalyptus moluccana* and *E. tereticornis.*
Disturbance	*Paragraph 8:* Disturbed Shale Gravel Transition Forest remnants are considered to form part of the community including where the vegetation would respond to assisted natural regeneration, such as where the natural soil and associated seedbank is still at least partially intact. *Paragraph 11:* Much of the remaining area of Shale Gravel Transition Forest has been disturbed by clearing, tracks, weeds invasion and soil disturbance. Continuing threats include invasion of exotic species, illegal dumping, unauthorised access, fragmentation and clearing for urban, rural residential recreational and industrial development.	Meets the final determination. PCT 3320 within the study area consists of remnants within a disturbed landscape. Most areas have existing disturbances such as clearing, tracks, weeds and illegal dumping.

3.2.3 River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

As per Table 3-7, Cumberland Red Gum Riverflat Forest (PCT 4025) meets the definition of the TEC River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions, listed as Endangered under the BC Act. A description of how PCT 4025 meets each element of the final determination for the TEC (NSW Scientific Committee 2011b) is provided in Table 3-10. Although some characteristics only partially meet the final determination, PCT 4025 relates to the NSW River-Flat Eucalypt Forest on Coastal Floodplains TEC where it occurs within stated elevation range as per paragraph 1 of the Final Determination (NSW Scientific Committee 2015).

Table 3-10 Final determination description review for River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

Characteristics	Final determination reference	Characteristics of PCT 4025 within the study area
Location	*Paragraph 1:* occurs in the NSW North Coast, Sydney Basin and South East Corner bioregions. *Paragraph 3:* River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is known from parts of the LGAs of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Eastern Capital City Regional, Eurobodalla and Bega Valley.	Meets the final determination. The study area occurs within the Blacktown LGA in the Sydney Basin bioregion.
Soil and landscape	*Paragraph 1:* Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less. River-Flat Eucalypt Forest on Coastal Floodplains generally occurs below 50 metres elevation but may occur on localised river flats up to 250 metres above sea level (ASL).	Meets the final determination. PCT 4025 is distributed adjacent to Bells Creek, coinciding with the South Creek soil landscape. This soil landscape occurs along the floodplains, valley flats and drainage channels of the Cumberland Plains. The topography of the study area ranges from approximately 27 metres ASL to 46 metres ASL.
Floristic composition	*Paragraph 1:* the structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. The community is characterised by the assemblage of species listed in the final determination.	Meets the final determination. PCT 4025 within the study area occurs as both a grassy woodland and scattered trees. 14 of the 88 species listed in the final determination were recorded within the plots undertaken in PCT 4025.
Characteristic tree species	*Paragraph 4*: River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has a tall open tree layer of eucalypts, which may exceed 40 metres in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple).	Partially meets the final determination. PCT 4025 within the study area is typically dominated by a canopy of *Eucalyptus tereticornis,* with the exception of the low condition areas.
Disturbance	*Paragraph 11:* The remaining stands are severely fragmented by past clearing and are further threatened by a range of threats. Clearing of native vegetation, alteration to the natural flow regimes of rivers, streams, floodplains and wetlands, invasion of native plant communities by exotic perennial grasses, predation, habitat destruction, competition and disease transmission by feral pigs, anthropogenic climate change, high frequency fire, and removal of dead wood and dead trees are listed as 'Key Threatening Processes'. *Paragraph 12:* Very few examples of River-Flat Eucalypt Forest on Coastal Floodplains remain unaffected by weeds. The causes of weed invasion include physical disturbance to the vegetation	Meets the final determination. PCT 4025 within the study area occurs within a fragmented urban landscape and include a high cover of weeds and anthropogenic waste.

Characteristics	Final determination reference	Characteristics of PCT 4025 within the study area
	structure of the community, dumping of landfill rubbish and garden refuse, polluted run-off from urban and agricultural areas, construction of roads and other utilities, and grazing by domestic livestock. A list of principal weed species affecting River-Flat Eucalypt Forest on Coastal Floodplains is included in Paragraph 12 of the final determination.	

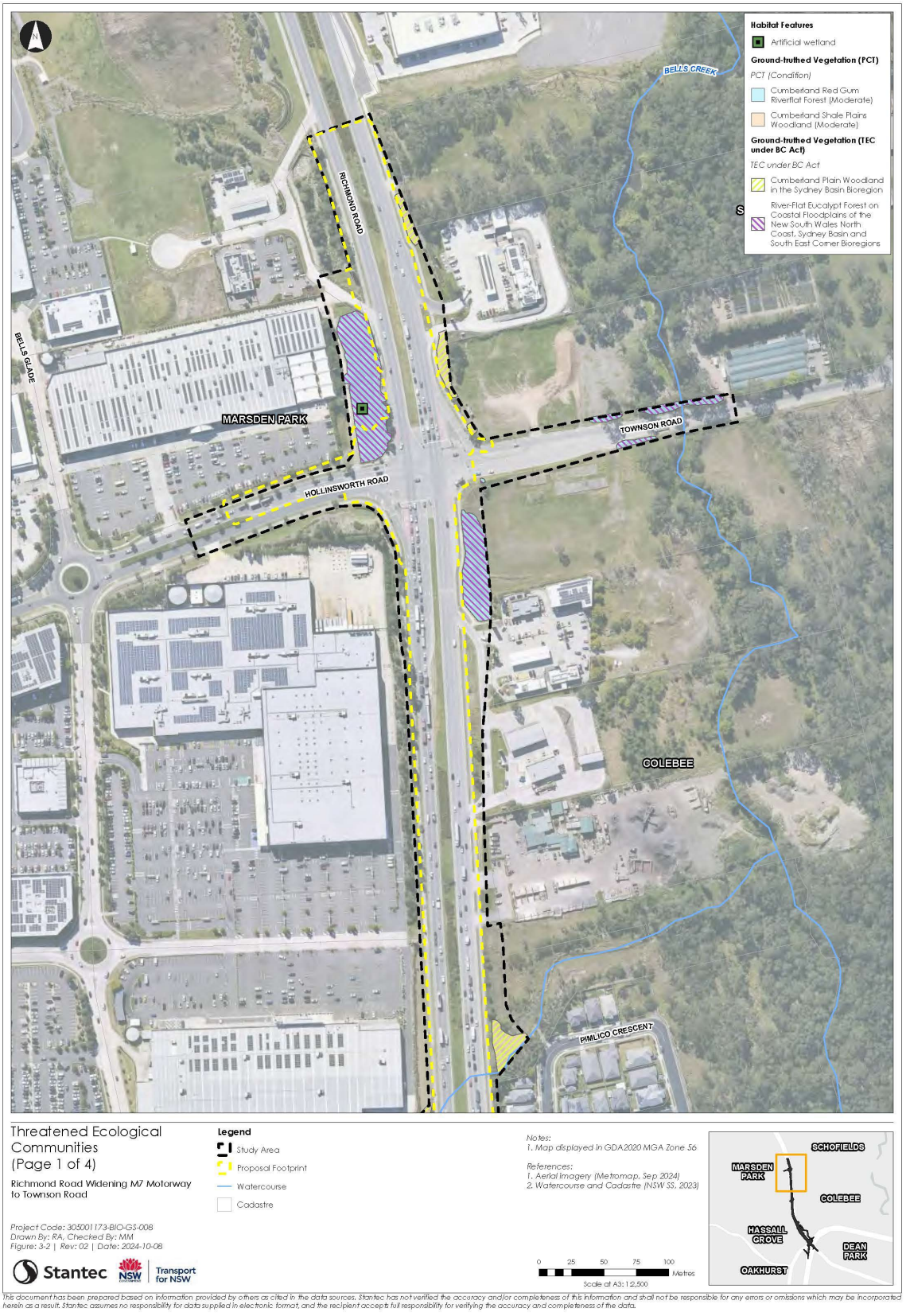

Figure 3-2 Threatened ecological communities

Threatened Ecological Communities
(Page 2 of 4)

Richmond Road Widening M7 Motorway to Townson Road

Legend
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

0 25 50 75 100 Metres
Scale at A3: 1:2,500

Project Code: 305001173-BIO-GIS-008
Drawn By: RA, Checked By: MM
Figure: 3-2 | Rev: 02 | Date: 2024-10-08

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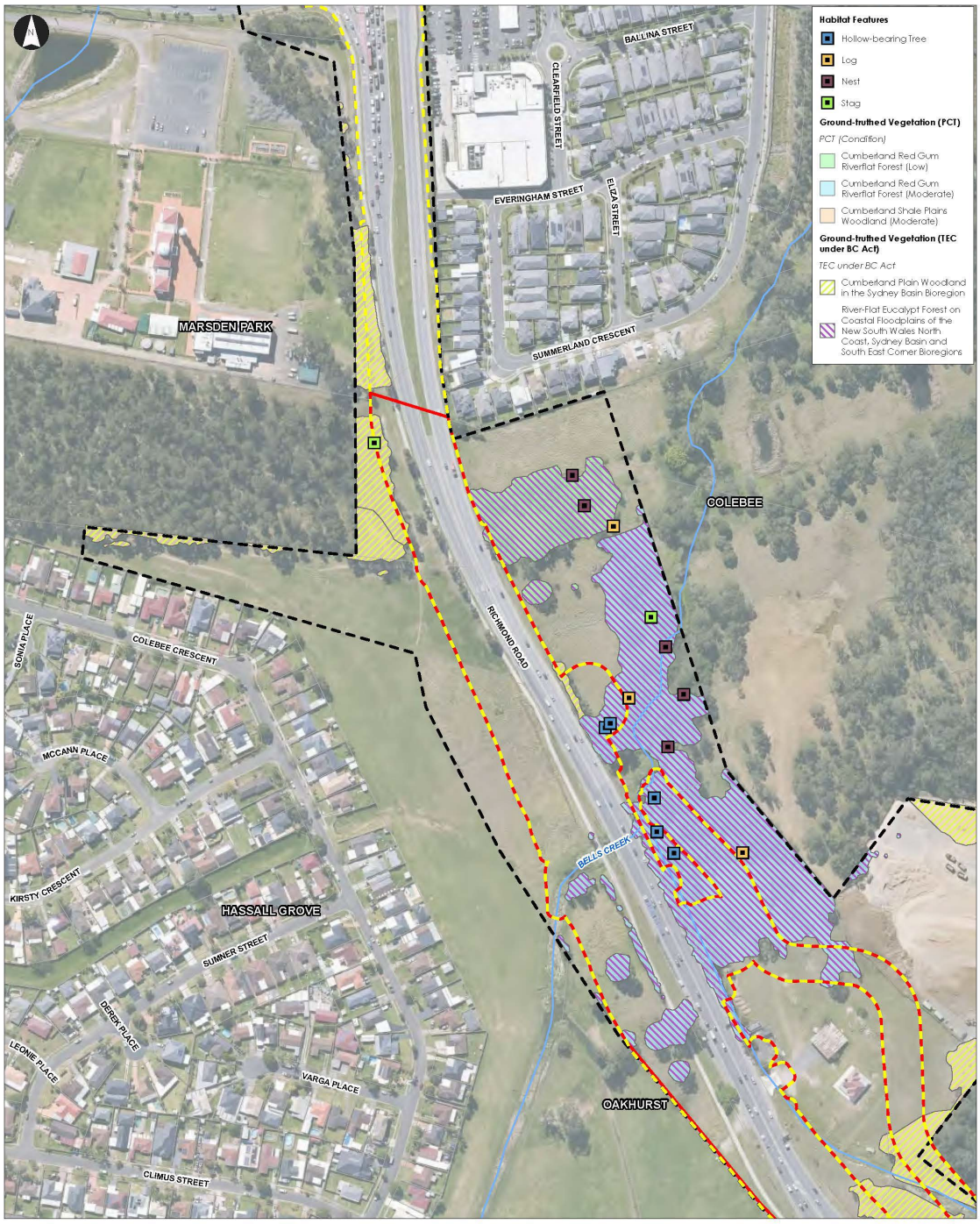


Threatened Ecological Communities
(Page 3 of 4)

Richmond Road Widening M7 Motorway to Townson Road

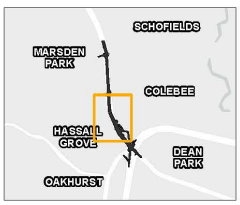
Project Code: 305001173-BIO-GIS-008
Drawn By: RA, Checked By: MM
Figure: 3-2 | Rev: 02 | Date: 2024-10-08

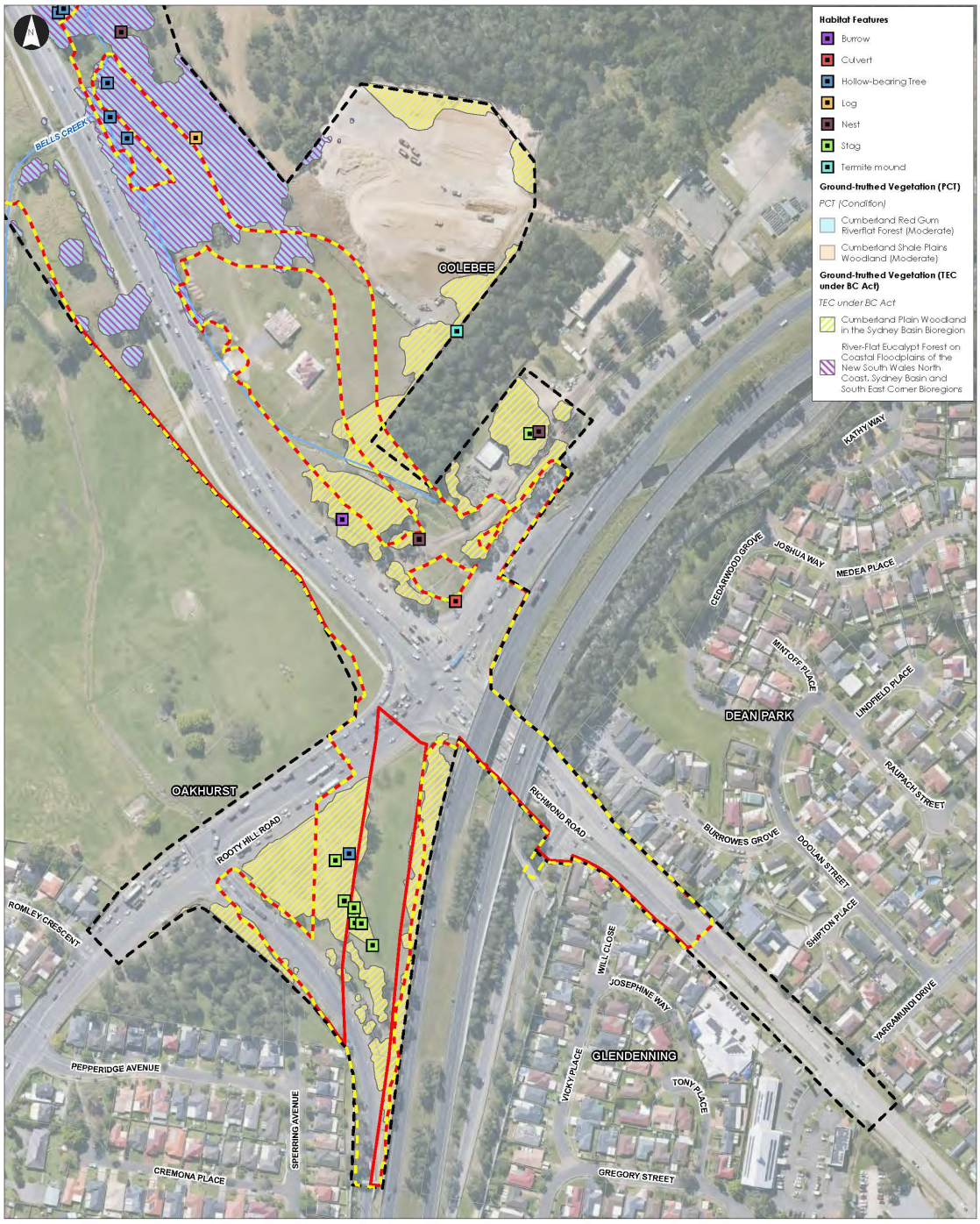
Legend
- Subject Land
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

0 25 50 75 100 Metres
Scale at A3: 1:2,500





3.3 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 NSW and the ACT (Keith, 2004), were used to determine and categorise GDEs in the study area. Cumberland Shale Plains Woodland is mapped as a high potential GDE at the northern and southern extremities of the study area. An area of Cumberland Shale Plains Woodland within the central portion of the study area is mapped as a moderate potential GDE (Figure 3-3).

Figure 3-3 Groundwater dependent ecosystems

Groundwater Dependent Ecosystems
(Page 2 of 4)

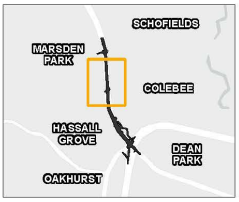
Richmond Road Widening M7 Motorway to Townson Road

Legend
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Groundwater Dependent Ecosystems
- High
- Low

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)
3. Groundwater Dependent Ecosystems (DCCEEW, 2022)



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Scale at A3: 1:2,500

Project Code: 305001173-BIO-GIS-009
Drawn By: RA, Checked By: SM
Figure: 3-3 | Rev: 03 | Date: 2024-10-08

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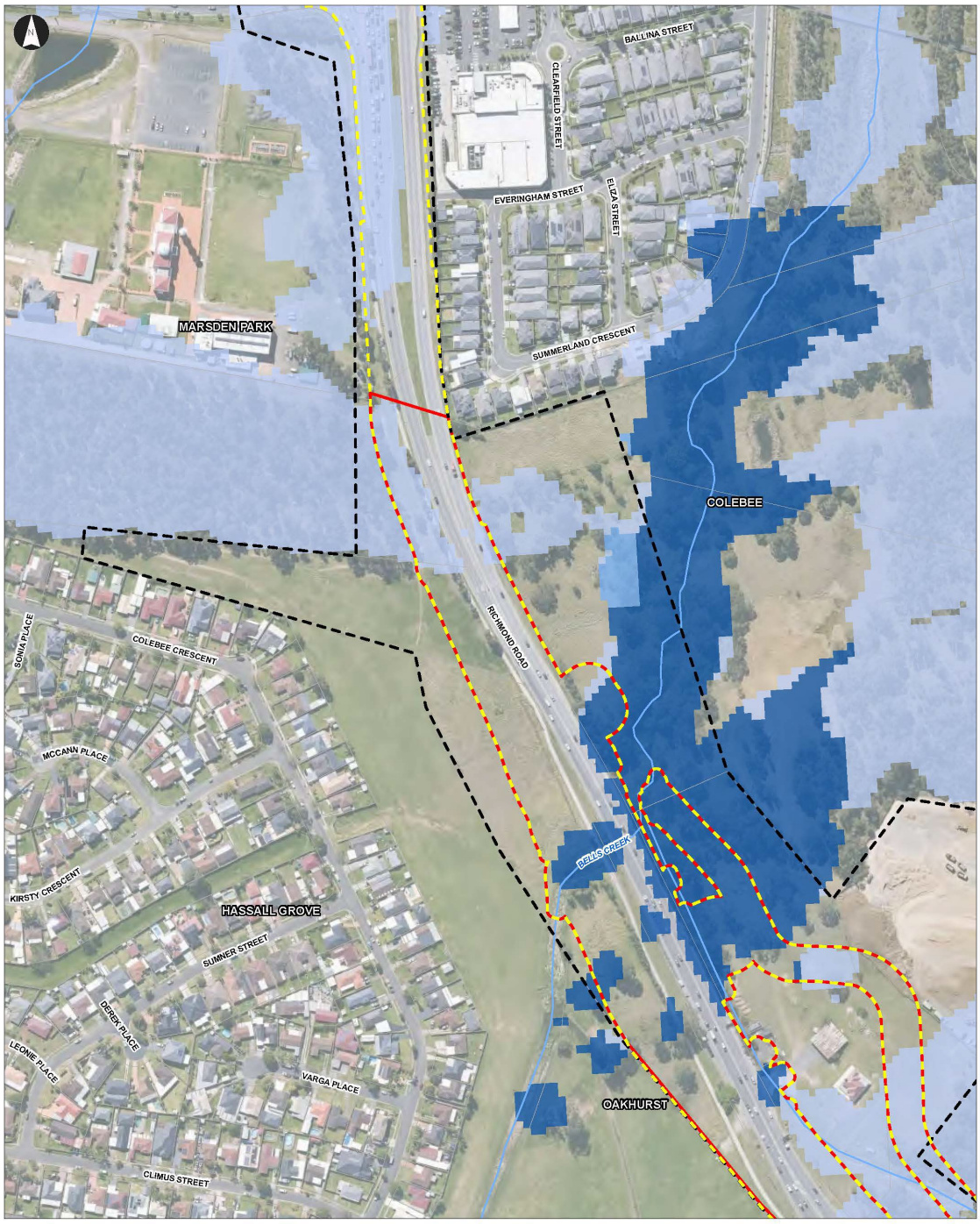


Groundwater Dependent Ecosystems
(Page 3 of 4)

Richmond Road Widening M7 Motorway to Townson Road

Project Code: 305001173-BIO-GIS-009
Drawn By: RA, Checked By: SM
Figure: 3-3 | Rev: 03 | Date: 2024-10-08

Legend
- Subject Land
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

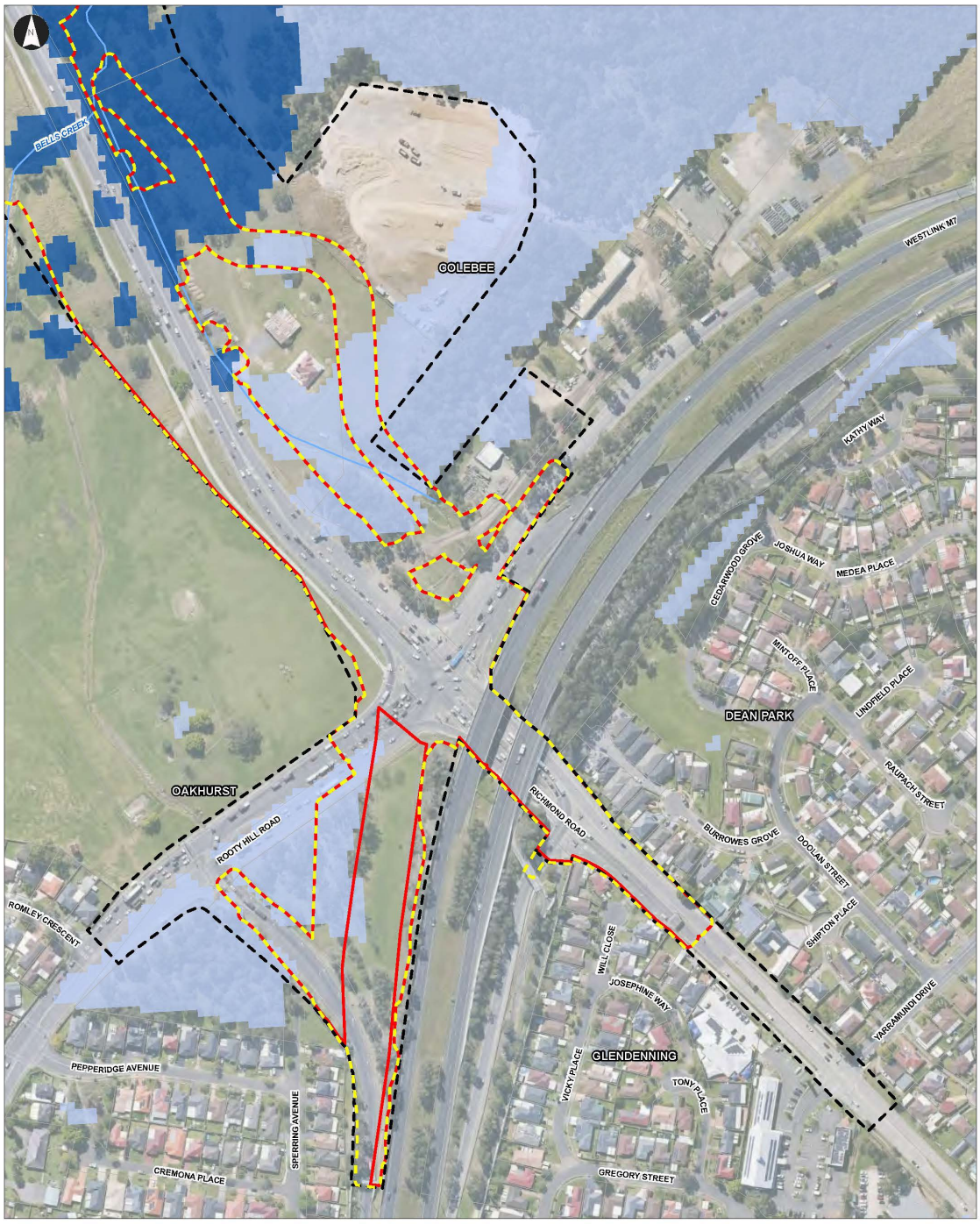
Groundwater Dependent Ecosystems
- High
- Medium
- Low

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)
3. Groundwater Dependent Ecosystems (DCCEEW, 2022)

0 25 50 75 100 Metres
Scale at A3: 1:2,500

Stantec | NSW | Transport for NSW



Groundwater Dependent Ecosystems
(Page 4 of 4)

Richmond Road Widening M7 Motorway to Townson Road

Project Code: 305001173-BIO-GIS-009
Drawn By: RA, Checked By: SM
Figure: 3-3 | Rev: 03 | Date: 2024-10-08

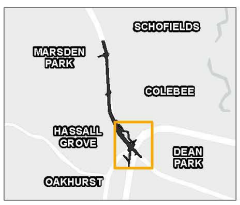
Legend
- Subject Land
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Groundwater Dependent Ecosystems
- High
- Low

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)
3. Groundwater Dependent Ecosystems (DCCEEW, 2022)

0 25 50 75 100 Metres
Scale at A3: 1:2,500



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3.4 Threatened species

3.4.1 Likelihood of occurrence results

A review of the NSW DPE BioNet Atlas, NSW DPI Fisheries Spatial data portal, the DAWE Protected Matters Search Tool and BAM-C (Table 2-2) identified 128 threatened species with potential to occur in the study area. Species were inclusive of 55 flora, 44 birds, 19 mammals, three amphibians, three reptiles, two invertebrates and two fish species.

Migratory species listed under the EPBC Act are discussed in Section 3.9.3.

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 B.

Due to the presence of suitable habitat in the study area, 48 species were considered to have a moderate or higher likelihood of occurrence prior to survey. These species are outlined in Table 3-11.

Table 3-11 Threatened species with a moderate or high likelihood of occurrence prior to survey

Species name	Common name	BC Act	EPBC Act	Records in study area/Source	Credit type	Likelihood of occurrence prior to survey
Flora						
Acacia pubescens	Downy Wattle	V	V	26 (BioNet) (PMST-K) BAM-C	Species	Moderate
Deyeuxia appressa	*Deyeuxia appressa*	E	E	BAM-C	Species	Moderate
Dillwynia tenuifolia		V	-	764 (BioNet) BAM-C	Species	High
Eucalyptus benthamii	Camden White Gum	CE	V	BAM-C	Species	Moderate
Eucalyptus glaucina	Slaty Red Gum	V	V	BAM-C	Species	Moderate
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V	-	2418 (BioNet) BAM-C	Species	Known
Hibbertia puberula		E	-	3 (BioNet) BAM-C	Species	Moderate
Hibbertia sp. Bankstown		CE	CE	27 (BioNet) BAM-C	Species	Moderate
Marsdenia viridiflora subsp. viridiflora	*Marsdenia viridiflora* R. Br. *subsp. viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs	EP	-	32 (BioNet) BAM-C	Species	Moderate
Micromyrtus minutiflora		E	V	75 (BioNet) (PMST-K) BAM-C	Species	Moderate

Species name	Common name	BC Act	EPBC Act	Records in study area/Source	Credit type	Likelihood of occurrence prior to survey
Persoonia hirsuta	Hairy Geebung	E	E	3 (BioNet) (PMST-K) BAM-C	Species	Moderate
Persoonia nutans	Nodding Geebung	E	E	506 (BioNet) (PMST-K) BAM-C	Species	Moderate
Pimelea curviflora var. curviflora		V	V	21 (BioNet) (PMST-K) BAM-C	Species	Moderate
Pimelea spicata	Spiked Rice-flower	E	E	304 (BioNet) (PMST-K) BAM-C	Species	Moderate
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	E	V	(PMST-L) BAM-C	Species	Moderate
Pterostylis saxicola	Sydney Plains Greenhood	E	E	1 (BioNet) (PMST-L)	Species	Moderate
Pultenaea parviflora		E	V	897 (BioNet) (PMST-K) BAM-C	Species	Moderate
Pultenaea pedunculata	Matted Bush-pea	E		BAM-C	Species	Moderate
Syzygium paniculatum	Magenta Lilly Pilly	E	V	8 (BioNet) (PMST-K) BAM-C	Species	Moderate
Birds						
Anthochaera phrygia	Regent Honeyeater	CE	CE	23 (BioNet) (PMST-K) BAM-C	Species/ Ecosystem	Moderate
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	67 (BioNet) BAM-C	Ecosystem	Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo	E	E	3 (BioNet) (PMST-K) BAM-C	Species/ Ecosystem	Moderate
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	10 (BioNet) (PMST-K) BAM-C	Species/ Ecosystem	Moderate
Chthonicola sagittata	Speckled Warbler	V	-	16 (BioNet) BAM-C	Ecosystem	Moderate
Circus assimilis	Spotted Harrier	V	-	3 (BioNet) BAM-C	Ecosystem	Moderate
Daphoenositta chrysoptera	Varied Sittella	V	-	79 (BioNet) BAM-C	Ecosystem	Moderate

Species name	Common name	BC Act	EPBC Act	Records in study area/Source	Credit type	Likelihood of occurrence prior to survey
Falco subniger	Black Falcon	V	-	3 (BioNet) BAM-C	Ecosystem	Moderate
Glossopsitta pusilla	Little Lorikeet	V	-	27 (BioNet) BAM-C	Ecosystem	Moderate
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	6 (BioNet) BAM-C	Species/ Ecosystem	Moderate
Hieraaetus morphnoides	Little Eagle	V	-	30 (BioNet) BAM-C	Species/ Ecosystem	Moderate
Lathamus discolor	Swift Parrot	E	CE	88 (BioNet) (PMST-K) BAM-C	Species/ Ecosystem	Moderate
Lophoictinia isura	Square-tailed Kite	V	-	13 (BioNet) BAM-C	Species/ Ecosystem	Moderate
Neophema pulchella	Turquoise Parrot	V	-	3 (BioNet) BAM-C	Ecosystem	Moderate
Ninox strenua	Powerful Owl	V	-	35 (BioNet) BAM-C	Species/ Ecosystem	Moderate
Petroica phoenicea	Flame Robin	V	-	5 (BioNet) BAM-C	Ecosystem	Moderate
Tyto novaehollandiae	Masked Owl	V	-	9 (BioNet) BAM-C	Species/ Ecosystem	Moderate
Mammals						
Dasyurus maculatus	Spotted-tailed Quoll	V	E	8 (BioNet) (PMST-K) BAM-C	Ecosystem	Moderate
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	40 (BioNet) BAM-C	Ecosystem	Moderate
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	103 (BioNet) BAM-C	Ecosystem	Moderate
Myotis macropus	Southern Myotis	V	-	87 (BioNet) BAM-C	Species	Known
Petaurus australis	Yellow-bellied Glider	V	V	8 (BioNet) (PMST-K) BAM-C	Ecosystem	Moderate
Petaurus norfolcensis	Squirrel Glider	V	-	1 (BioNet) BAM-C	Species	Moderate
Phascolarctos cinereus	Koala	E	E	831 (BioNet) (PMST-K) BAM-C	Species	Moderate
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	913 (BioNet) (PMST-K) BAM-C	Species/ Ecosystem	High

Species name	Common name	BC Act	EPBC Act	Records in study area/Source	Credit type	Likelihood of occurrence prior to survey
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	24 (BioNet) BAM-C	Ecosystem	Moderate
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	62 (BioNet) BAM-C	Ecosystem	Moderate
Amphibians						
Litoria aurea	Green and Golden Bell Frog	E	V	24 (BioNet) (PMST-K) BAM-C	Species	Moderate
Invertebrates						
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	621 (BioNet) BAM-C	Species	Known

Key:
BC Act= Biodiversity Conservation Act 2016, EPBC Act = Environment Protection and Biodiversity Conservation Act 1999
V= vulnerable, E= endangered, CE= critically endangered

Following field surveys, 26 threatened species were considered to have a moderate or higher likelihood of occurring within the study area (Appendix B). This included six species recorded within the study area during field surveys. These species are detailed further in section 3.4.3 and 3.4.4. Assessments of significance were completed for these species and are provided in Appendix D. An additional eight threatened flora species will be surveyed and, if applicable, subject to further assessment prior to determination of the project.

3.4.2 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. Under the BAM, 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. Section 3.3 of the Biodiversity Assessment Guidelines (Transport, 2022) details that only candidate species that have at least a moderate likelihood of occurrence require targeted survey. As such, some candidate species have been removed from targeted surveys due to a low likelihood of occurrence on site. These species and justification for removal have been included in Table 3-12 and Appendix B. Where there are no obvious constraints that may have influenced the detection of a species, these species have been assigned a low likelihood of occurrence and excluded from further assessment. Table 3-12 identifies all species credit species and dual credit species considered as part of this assessment and the results of targeted surveys. Where species-credit species were recorded, species polygons have been prepared to accurately assess the impact of the proposal and assist in the preliminary offset calculations (see sections 3.4.3 and 3.4.4).

Table 3-12 Candidate species and threatened species surveys results

Species name	Common Name	BC Act	EPBC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
Flora						
Acacia pubescens	Downy Wattle	V	V	Not recorded	Yes	Species credit species. This species is associated with PCT 3320. The species was not detected during targeted surveys and has been excluded from further assessment.
Deyeuxia appressa		E	E	Surveys to be completed	No	Species credit species. This species is associated with PCT 3320 and PCT 4025. This species will be surveyed prior to the determination of the project.
Dillwynia tenuifolia		V	-	Surveys to be completed	No	Species credit species. This species is associated with PCT 3320. This species will be surveyed prior to the determination of the project.
Eucalyptus benthamii	Camden White Gum	V	V	Not recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. The species was not detected during targeted surveys and has been excluded from further assessment.
Eucalyptus glaucina	Slaty Red Gum	V	V	Not recorded	Yes	Species credit species. This species is associated with PCT 3320. The species was not detected during targeted surveys and has been excluded from further assessment.
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V	-	Recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. The species was detected during targeted surveys and has been considered further in this assessment.
Hibbertia puberula		E	-	Surveys to be completed	No	Species credit species. This species is associated with PCT 3320.

Species name	Common Name	BC Act	EPBC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
						This species will be surveyed prior to the determination of the project.
Hibbertia sp. Bankstown		CE	CE	Surveys to be completed	No	Species credit species. This species is associated with PCT 4025. This species will be surveyed prior to the determination of the project.
Marsdenia viridiflora subsp. *viridiflora*	*Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs.	EP	-	Not recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. The species was not detected during targeted surveys and has been excluded from further assessment.
Micromyrtus minutiflora		E	V	Not recorded	Yes	Species credit species. This species is associated with PCT 3320. The species was not detected during targeted surveys and has been excluded from further assessment.
Persoonia hirsuta	Hairy Geebung	E	E	Not recorded	Yes	Species credit species. This species is associated with PCT 4025. The species was not detected during targeted surveys and has been excluded from further assessment.
Persoonia nutans	Nodding Geebung	E	E	Not recorded	Yes	Species credit species. This species is associated with PCT 3320. The species was not detected during targeted surveys and has been excluded from further assessment.
Pimelea curviflora var. curviflora		V	V	Not recorded	Yes	Species credit species. This species is associated with PCT 3320. The species was not detected during targeted surveys and

Species name	Common Name	BC Act	EPBC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
						has been excluded from further assessment.
Pimelea spicata	Spiked Rice-flower	E	E	Not recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. The species was not detected during targeted surveys and has been excluded from further assessment.
Pomaderris brunnea		E	V	Surveys to be completed	No	Species credit species. This species is associated with PCT 3320 and PCT 4025. This species will be surveyed prior to the determination of the project.
Pomaderris prunifolia – endangered population	*Pomaderris prunifolia* in the Parramatta, Auburn, Strathfield and Bankstown LGAs.	EP	-	N/A	N/A	Excluded from targeted surveys due to geographic limitations. The study area is located within the Blacktown LGA which is not listed within the LGAs within the final determination.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Surveys to be completed	No	Species credit species. This species is associated with PCT 3320. This species will be surveyed prior to the determination of the project.
Pultenaea parviflora		E	V	Surveys to be completed	No	Species credit species. This species is associated with PCT 3320. This species will be surveyed prior to the determination of the project.
Pultenaea pedunculata		E	-	Surveys to be completed	No	Species credit species. This species is associated with PCT 3320. This species will be surveyed prior to the determination of the project.
Syzygium paniculatum	Magenta Lilly Pilly	E	V	Not recorded	Yes	Species credit species. This species is associated with PCT 4025. The species was not detected during targeted surveys and has been excluded from further assessment.

Species name	Common Name	BC Act	EPBC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
Wahlenbergia multicaulis - endangered population	Tadgell's Bluebell in the LGAs of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	EP	-	N/A	N/A	Excluded from targeted surveys due to geographic limitations. The study area is located within the Blacktown LGA which is not listed within the LGAs within the final determination.
Amphibians						
Litoria aurea	Green and Golden Bell Frog	E	V	Not recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. Suitable breeding and non-breeding shelter habitat, consisting of waterbodies with emergent aquatic vegetation, is present within the study area, however this potential habitat is poor quality (poor water quality, high level of anthropogenic litter, *Gambusia holbrooki* present). The species was not detected during targeted surveys and has been excluded from further assessment.
Birds						
Anthochaera phrygia	Regent Honeyeater	CE	CE	N/A	N/A	Excluded from targeted surveys due to habitat constraints. The study area does not occur within the Important Habitat Map.
Burhinus grallarius	Bush Stone-curlew	E	-	Not recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025 and fallen/standing dead timber, including logs. The species was not detected during targeted surveys and has been excluded from further assessment.
Callocephalon fimbriatum	Gang-gang cockatoo	E	E	Not recorded	Yes	Dual credit species. This species is associated with PCT 3320 and PCT 4025. One suitable hollow bearing tree, with hollows >7 centimetres in diameter

Species name	Common Name	BC Act	EPBC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
						at least 3 metres above the ground, was detected within the study area. The species was not detected during targeted surveys and has been excluded from further assessment.
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	N/A	N/A	Excluded from targeted surveys due to habitat constraints. There are no suitable hollow bearing trees (i.e. with hollows greater than 15 centimetres in diameter and higher than 8 metres above the ground) in the study area.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of large stick nests within the tree canopy of the study area.
Hieraaetus morphnoides	Little Eagle	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of large stick nests within the tree canopy of the study area.
Lathamus discolor	Swift Parrot	E	CE	N/A	N/A	Excluded from targeted surveys due to habitat constraints. The study area does not occur within the Important Habitat Map.
Limosa limosa	Black-tailed Godwit	V	-	N/A	N/A	Excluded from targeted surveys due to habitat constraints. The study area does not occur within the Important Habitat Map.
Lophoictinia isura	Square-tailed Kite	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of large stick nests within the tree canopy of the study area.
Ninox connivens	Barking Owl	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of suitable hollows (i.e. >20 centimetres in diameter and 4 metres above the ground).
Ninox strenua	Powerful Owl	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of suitable hollows (i.e.

Species name	Common Name	BC Act	EPBC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
						>20 centimetres in diameter and 4 metres above the ground).
Pandion cristatus	Eastern Osprey	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of large stick nests within the tree canopy of the study area.
Tyto novaehollandiae	Masked Owl	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of suitable hollows (i.e. >20 centimetres in diameter and 4 metres above the ground).
Bats						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	N/A	N/A	Excluded from targeted surveys due to the absence of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or old mines or tunnels within 2 kilometres of the study area, based on review of aerial imagery and available databases (e.g. MinView).
Miniopterus australis	Little Bent-winged Bat	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of known or suspected breeding structures.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	N/A	N/A	Excluded from targeted surveys due to the absence of known or suspected breeding structures.
Myotis macropus	Southern Myotis	V	-	Recorded	No	Species credit species. This species is associated with PCT 3320 and PCT 4025 within 200 metres of the bank of any medium to large permanent creeks, rivers, lakes or other waterways. The species was detected during targeted surveys (Appendix C) and has been considered further in this assessment.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	N/A	N/A	Excluded from targeted surveys due to the absence of breeding camps within the study area.

Species name	Common Name	BC Act	EPBC Act	Identification method (not recorded, assumed, recorded, expert report)	Survey effort compliant?[1]	Results
Invertebrates						
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	Recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. The species was detected during targeted surveys and has been considered further in this assessment.
Marsupials						
Cercartetus nanus	Eastern Pygmy-possum	V	-	N/A	N/A	Excluded from targeted surveys due a low likelihood of occurrence (see Appendix B). The species has not been recorded in the locality in the last 10 years on BioNet.
Petaurus norfolcensis	Squirrel Glider	V	-	Not recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. The species was not detected during targeted surveys and has been excluded from further assessment.
Phascolarctos cinereus	Koala	E	E	Not recorded	Yes	Species credit species. This species is associated with PCT 3320 and PCT 4025. The study area occurs within the Central Coast Koala Management Area. Food tree species, such as *Eucalyptus tereticornis* (primary) and *Eucalyptus moluccana* (secondary), are present within the study area. The species was not detected during targeted surveys and has been excluded from further assessment.

Note: 1. As identified in Section 2.4 of this BAR.

3.4.3 Threatened flora

One threatened flora species, *Grevillea juniperina* subsp. *juniperina,* listed as vulnerable under the BC Act, was recorded in the study area during targeted surveys. One hundred and fourteen individuals of *Grevillea juniperina* subsp. *juniperina* (Photo 3-8) were recorded within the study area. Seventeen individuals occur within the subject land and would be directly impacted by the proposal. The locations of these records are provided in Figure 3-4. This species is associated with PCT 3320 and PCT 4025 (Figure 3-5) and was noted to occur along the disturbed edges of these communities. As per the BAM, the species polygon for *Grevillea juniperina* subsp. *juniperina* was established by adding a 30 metre buffer around individuals recorded on the subject land.

Photo 3-8 G*revillea juniperina* subsp. *juniperina* recorded within the study area

An additional eight threatened flora species identified as candidate species could not be surveyed in accordance with seasonal requirements (Table 3-13). These species will be surveyed prior to the determination of the project.

Table 3-13 Threatened flora species to be surveyed prior to determination

Species name	Common name	BC Act	EPBC Act	Associated habitat
Deyeuxia appressa	*Deyeuxia appressa*	E	E	PCT 3320, PCT 4025
Dillwynia tenuifolia		V	-	PCT 3320
Hibbertia sp. Bankstown		CE	CE	PCT 3320
Hibbertia puberula		E	-	PCT 4025
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	E	V	PCT 3320, PCT 4025
Pterostylis saxicola	Sydney Plains Greenhood	E	E	PCT 3320
Pultenaea parviflora		E	V	PCT 3320
Pultenaea pedunculata	Matted Bush-pea	E	-	PCT 3320

3.4.4 Threatened fauna

Five threatened fauna species were recorded within the study area during field surveys (Table 3-14). A "possible" recording for one additional species, *Miniopterus australis* (Little Bent winged Bat) was detected by ANABAT units deployed within the study area. As only one short unclear pass was recorded (Appendix C), this species has been included in further assessment due to a moderate likelihood of occurrence (Appendix D). Habitat constraints for *Miniopterus australis* are consistent with those of *Miniopterus orianae oceanensis* (Large-Bent winged Bat) (see below).

Table 3-14 Threatened fauna species recorded within the study area during field surveys

Species name	Common name	BC Act	EPBC Act	Credit type
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	Species
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	Ecosystem
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/Ecosystem
Myotis macropus	Southern Myotis	V	-	Species
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/Ecosystem

Two species credit species (*Meridolum corneovirens* and *Myotis macropus*) were recorded in the study area. The locations of these detections are provided in Figure 3-4). Species polygons have been created for all species-credit fauna species recorded within the subject land, in accordance with the BAM and specific requirements listed within the corresponding TBDC profile.

***Myotis macropus* (Southern Myotis)**

Three culverts within the Bells Creek Bridge on Townson Road provide roosting habitat for *Myotis macropus* (Photo 3-9). Microbats were observed roosting within scuppers within the culverts and were identified based on roosting habitats, observed foraging patterns, foot size and definite calls recorded on an ANABAT in close proximity to the bridge. At least 20 individuals were observed roosting within several scuppers. This roost was previously recorded in the Biodiversity Assessment Report for Townson Road between Richmond Road and Jersey Road – Stage 1 (Transport for NSW 2020) and was identified as a maternity roost based on the presence of young during surveys. This species was also observed foraging over the pool in Bells Creek, adjacent to the roost. The species was also recorded on ANABAT devices located to the west of Richmond Road (Figure 3-4). Suitable habitat for the species within the subject land includes all areas of PCT 3320 and PCT 4025 within 200 metres of the bank of Bells Creek. The species polygon for *Myotis macropus* includes all areas of associated PCTs (PCT 3320 and PCT 4025) within 200 metres of the high bank of Bells Creek, as per DPIE (2021) (Figure 3-6).

Photo 3-9 *Myotis macropus* roosting within the study area

Meridolum corneovirens (Cumberland Plain Land Snail)

Six shells of *Meridolum corneovirens* were recorded within the study area during field surveys (Photo 3-10, Figure 3-4). No live snails were detected during targeted surveys. No records occur within the subject land, however the TBDC identifies the unit of measurement for this species as area of connected suitable habitat. This species is associated with PCT 3320 and PCT 4025 and the species polygon has been mapped as all areas of PCT 3320 and PCT 4025 contiguous with records of the species (Figure 3-7).

Photo 3-10 *Cumberland Plain Land Snail (Meridolum corneovirens)* recorded within the study area

Dual credit species

Two dual credit species (*Miniopterus orianae oceanensis* (Large Bent-winged Bat) and *Pteropus poliocephalus* (Grey-headed Flying-fox)) were also recorded within the study area during targeted surveys (Figure 3-4). These species were excluded from targeted surveys based on the absence of breeding habitat and identification of habitat constraints for the species. As breeding habitat for these species has not been identified in the subject land, species polygons are not required.

Habitat constraints for *Miniopterus orianae oceanensis*, as per the TBDC, include the presence of a "cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding". *Miniopterus orianae oceanensis* was excluded from the candidate species list as no records of roosting or breeding habitat (e.g. caves, tunnels, mines, culverts) occur within the 10 kilometre locality (from BioNet). Suitable habitat for the species within the study area is restricted to foraging habitat.

As per the TBDC, habitat constraints for *Pteropus poliocephalus* include breeding camps. No active breeding camps are present within the study area and the nearest camp to the study area occurs approximately 6.4 kilometres to the south west of the study area at Ropes Creek. One individual *Pteropus poliocephalus* was recorded foraging in the study area, while several others were observed flying over the study area. Suitable habitat for the species within the study area consists of areas of native and planted vegetation that include species suitable for foraging.

Ecosystem credit species

One ecosystem credit species, *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat), was recorded within the study area during field surveys (Figure 3-4), Appendix C). Potential habitat for this species within the study area includes roosting (hollows) and foraging habitat.

Following field surveys, an additional 19 fauna species, consisting of two mammal species and 17 bird species, were considered to have a moderate likelihood of occurring within the study area based one the presence of potential habitat (Appendix B). In general, these species may seasonally use resources within the study area opportunistically or during migration, however, are unlikely to maintain sedentary populations. They are unlikely to be dependent (i.e. for breeding or important life cycle periods) on habitat within the study area. Assessments of significance were completed for these species and are provided in Appendix D.

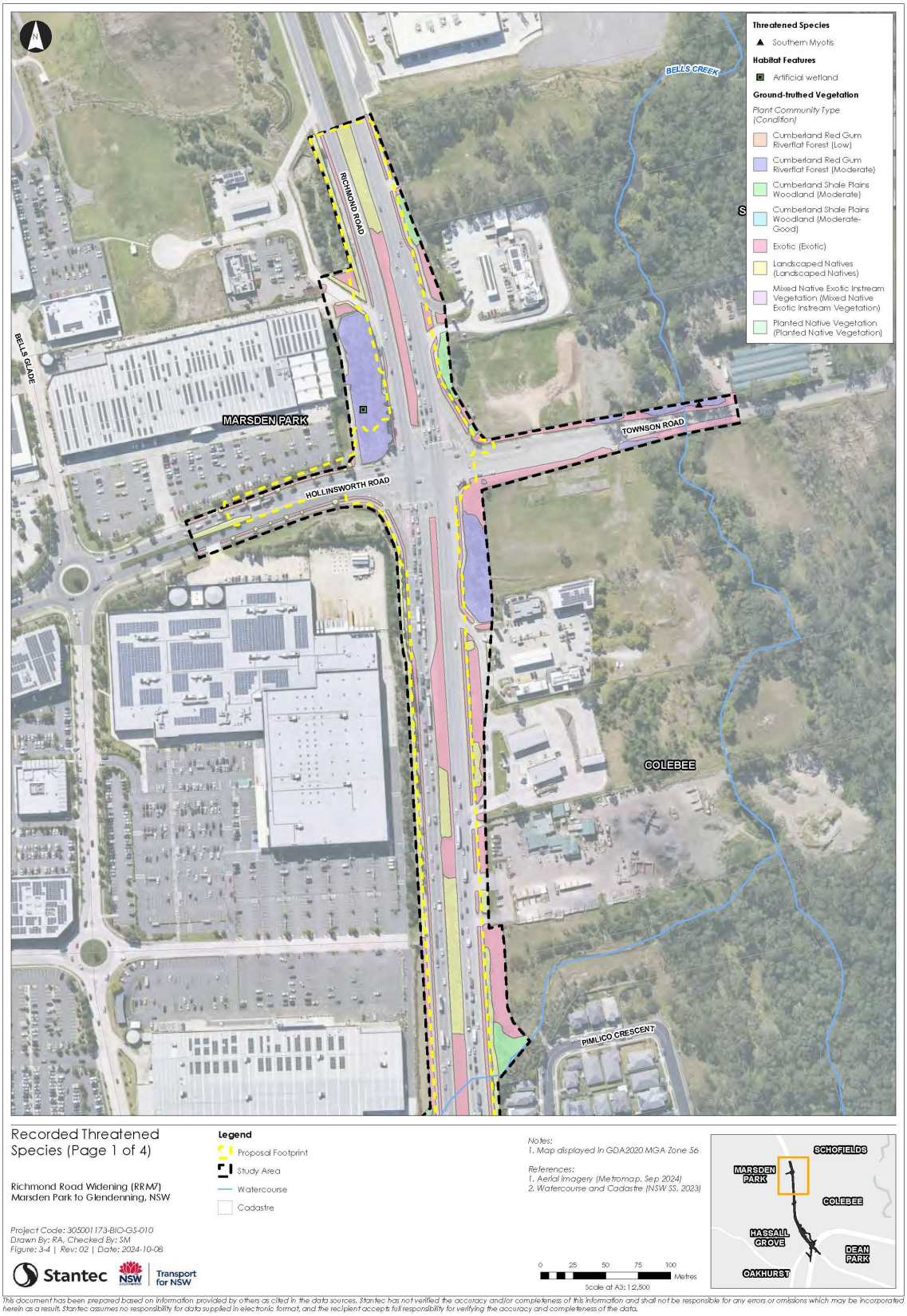
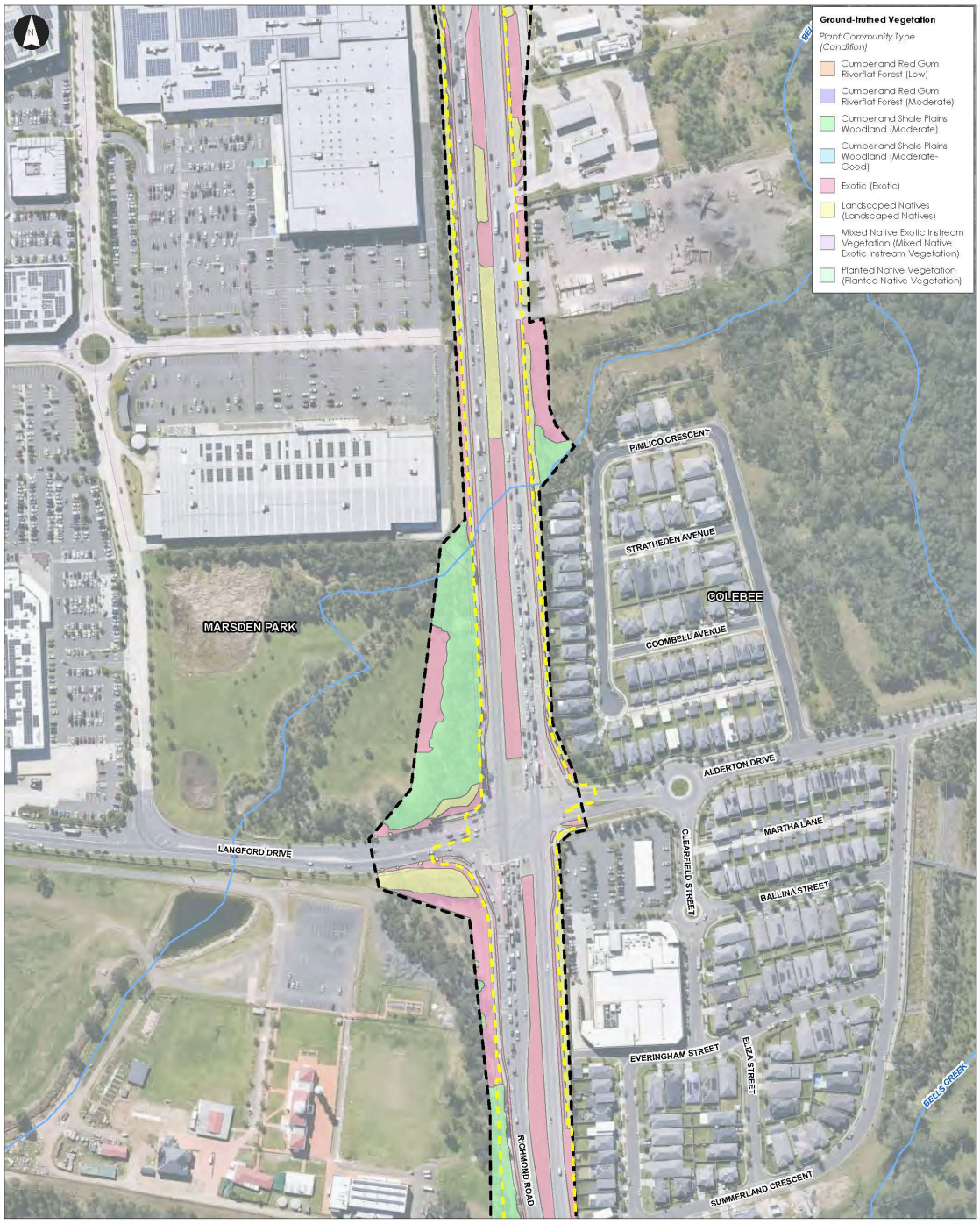


Figure 3-4 Recorded threatened species



Recorded Threatened Species (Page 2 of 4)

Richmond Road Widening (RRM7)
Marsden Park to Glendenning, NSW

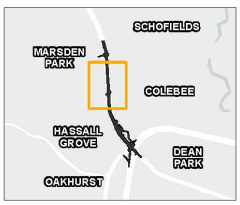
Project Code: 305001173-BIO-GIS-010
Drawn By: RA, Checked By: SM
Figure: 3-4 | Rev: 02 | Date: 2024-10-08

Legend
- Proposal Footprint
- Study Area
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

0 25 50 75 100 Metres
Scale at A3: 1:2,500



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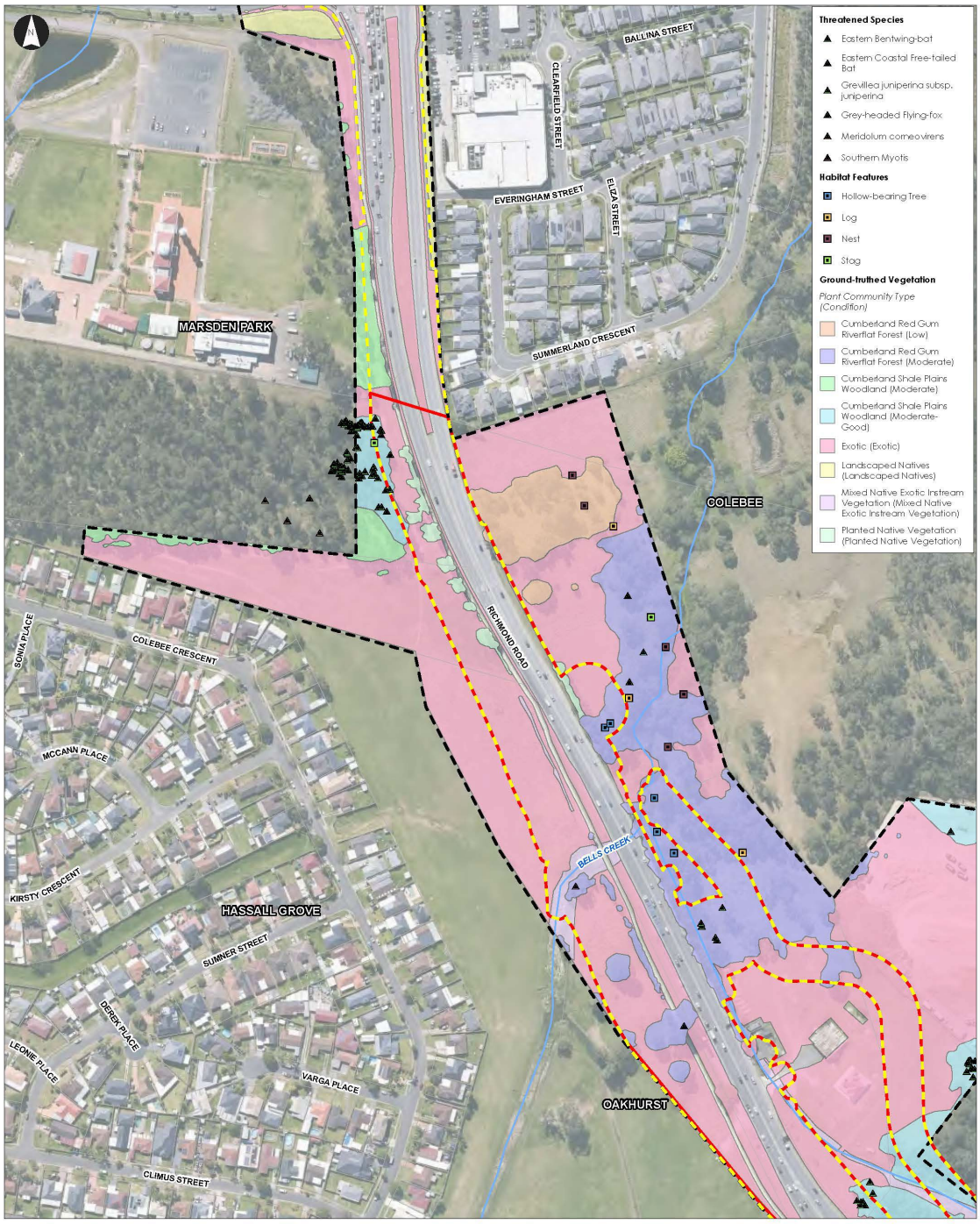

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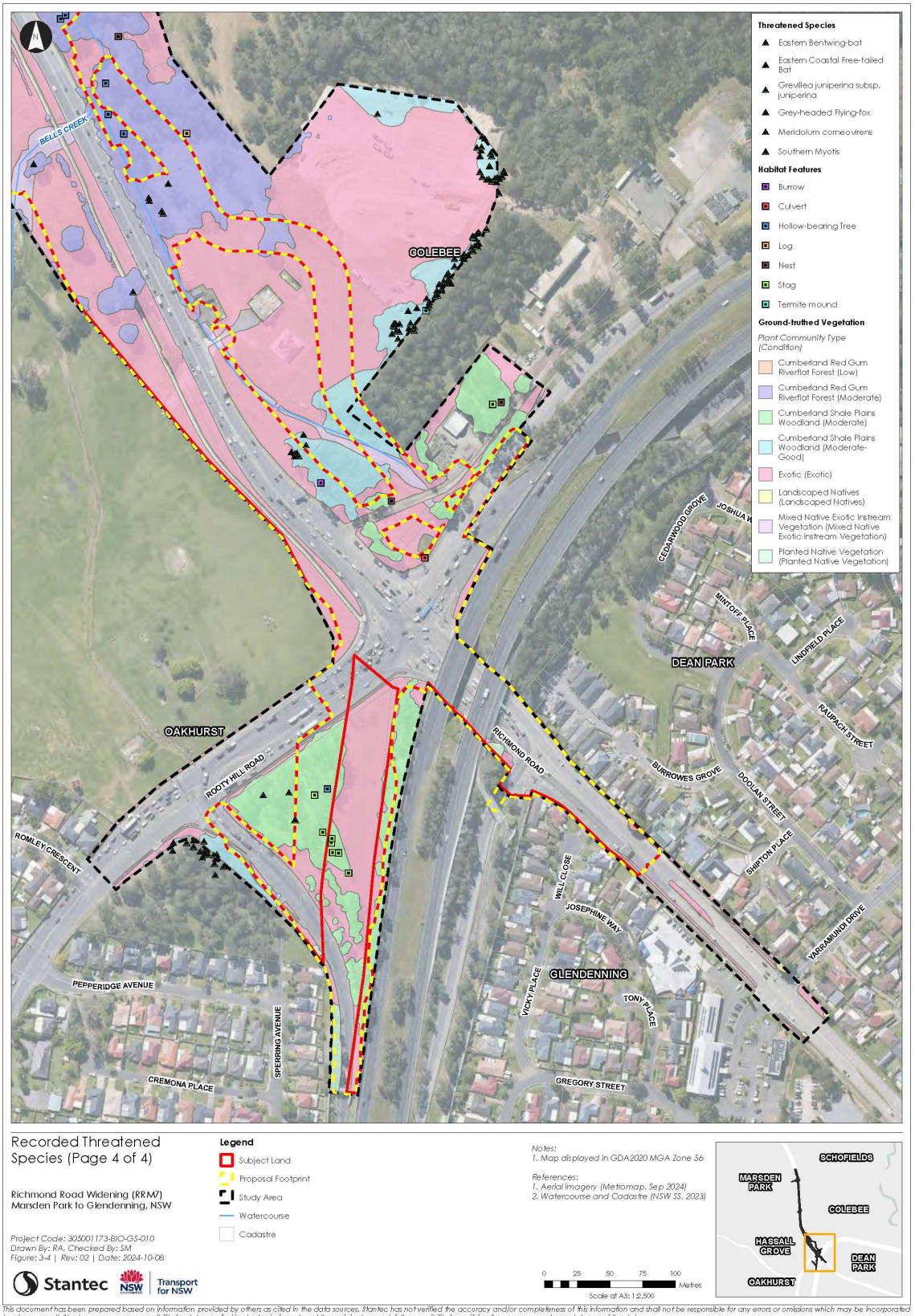


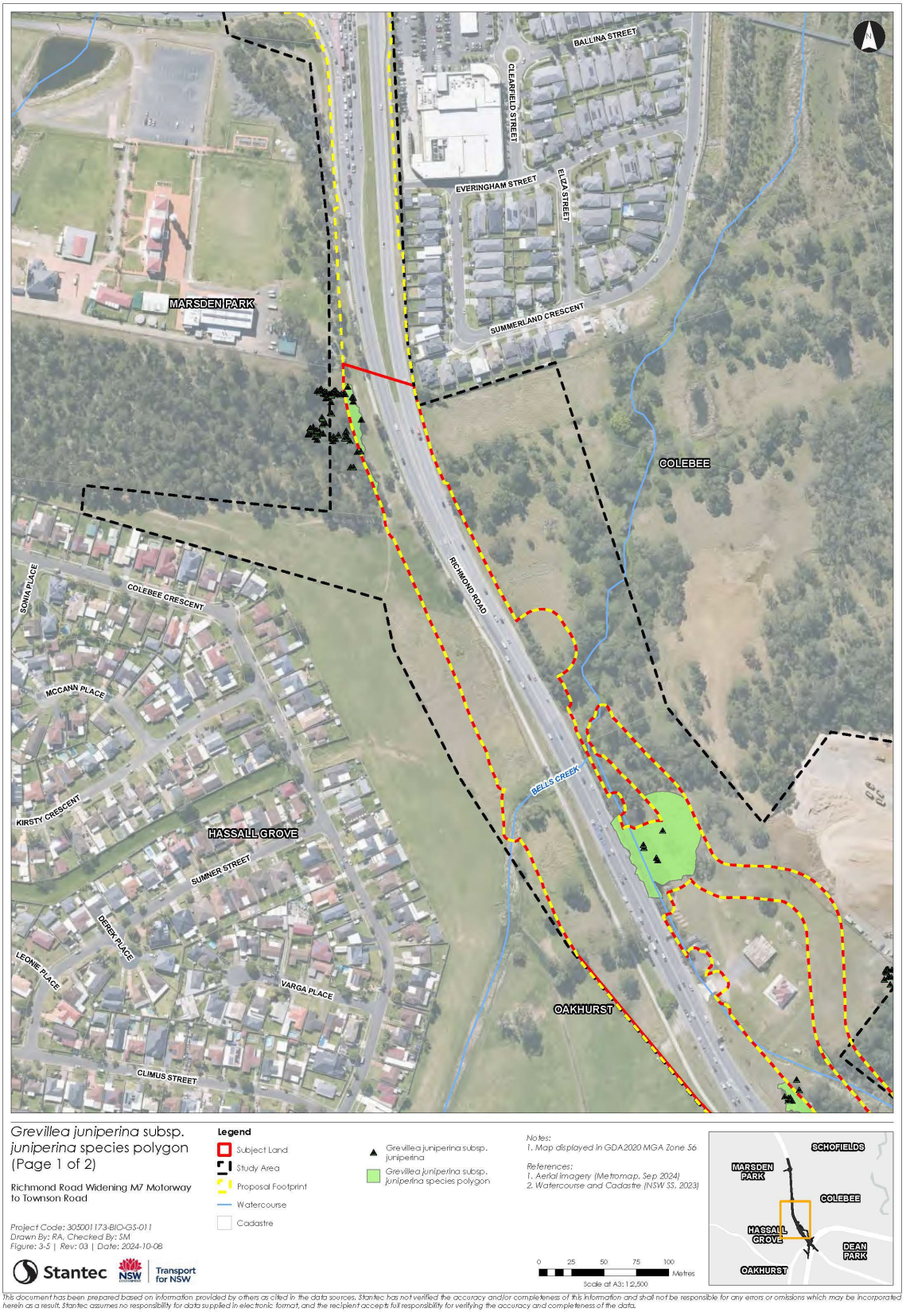
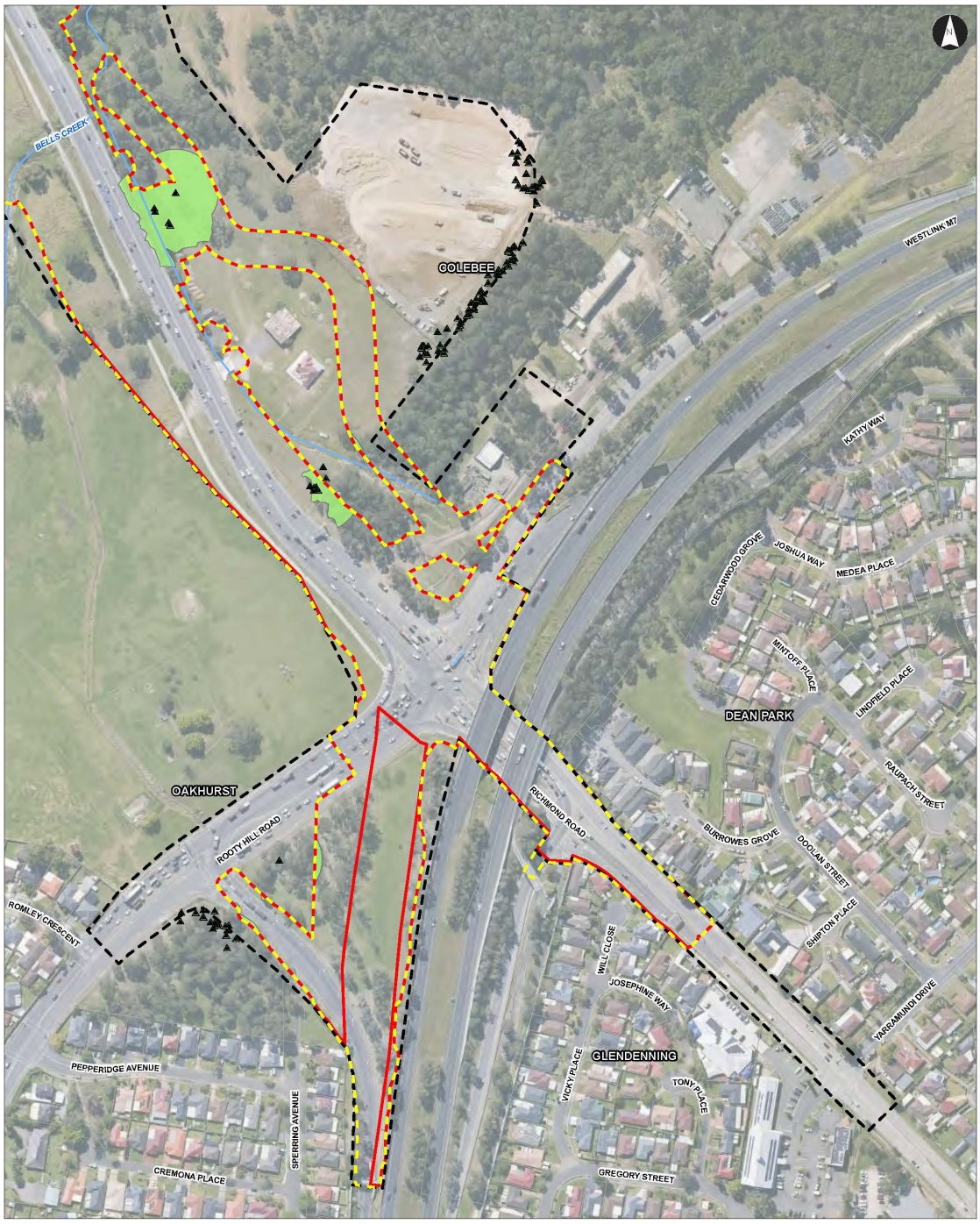


Figure 3-5 *Grevillea juniperina* subsp. *juniperina* species polygon



Grevillea juniperina subsp. *juniperina* species polygon (Page 2 of 2)

Richmond Road Widening M7 Motorway to Townson Road

Project Code: 305001173-BIO-GIS-011
Drawn By: RA, Checked By: SM
Figure: 3-5 | Rev: 03 | Date: 2024-10-08

Legend

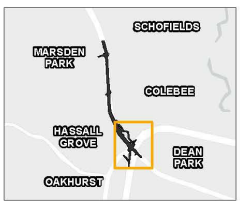
- Subject Land
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre
- *Grevillea juniperina* subsp. *juniperina*
- *Grevillea juniperina* subsp. *juniperina* species polygon

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

0 25 50 75 100 Metres

Scale at A3: 1:2,500



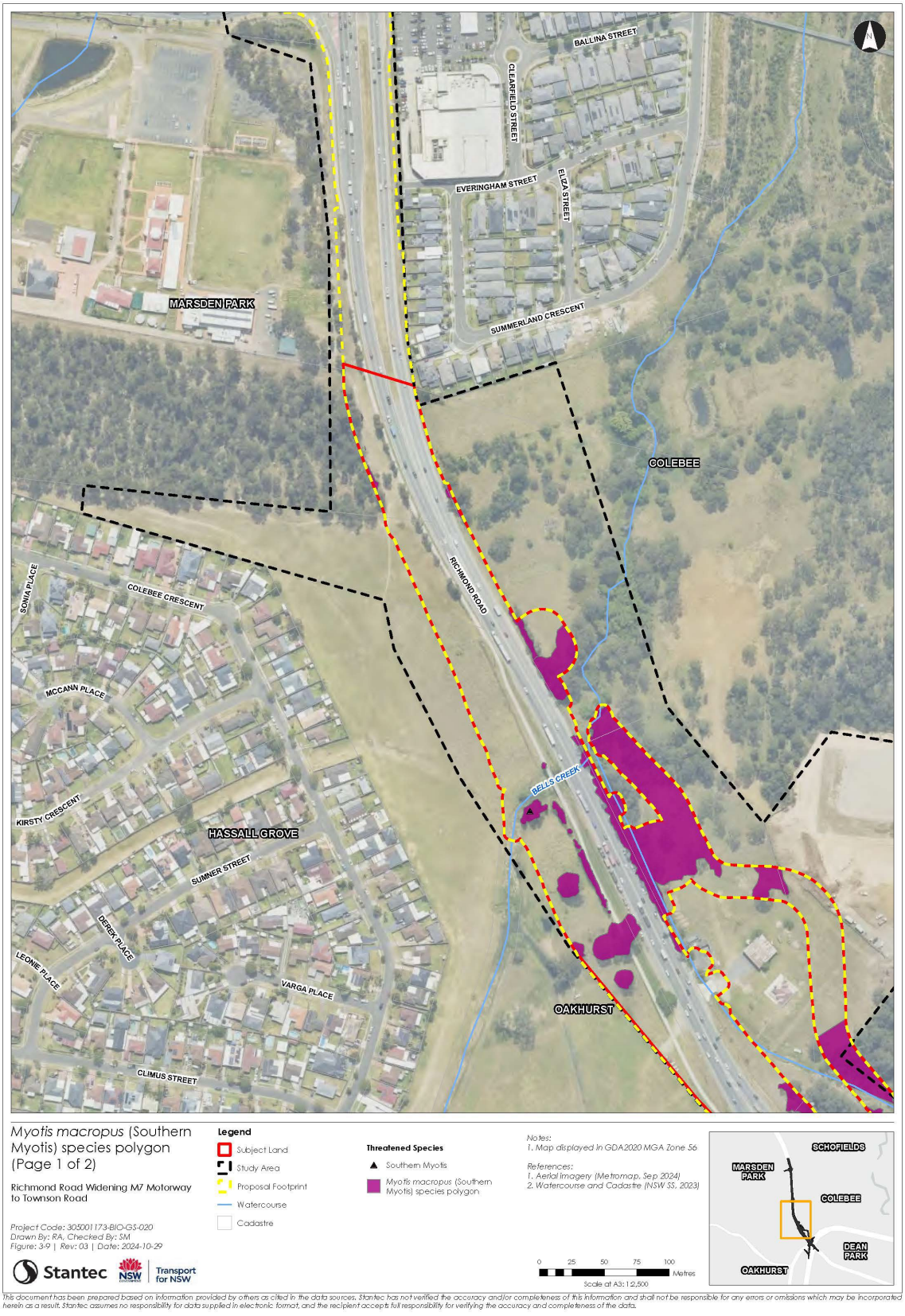
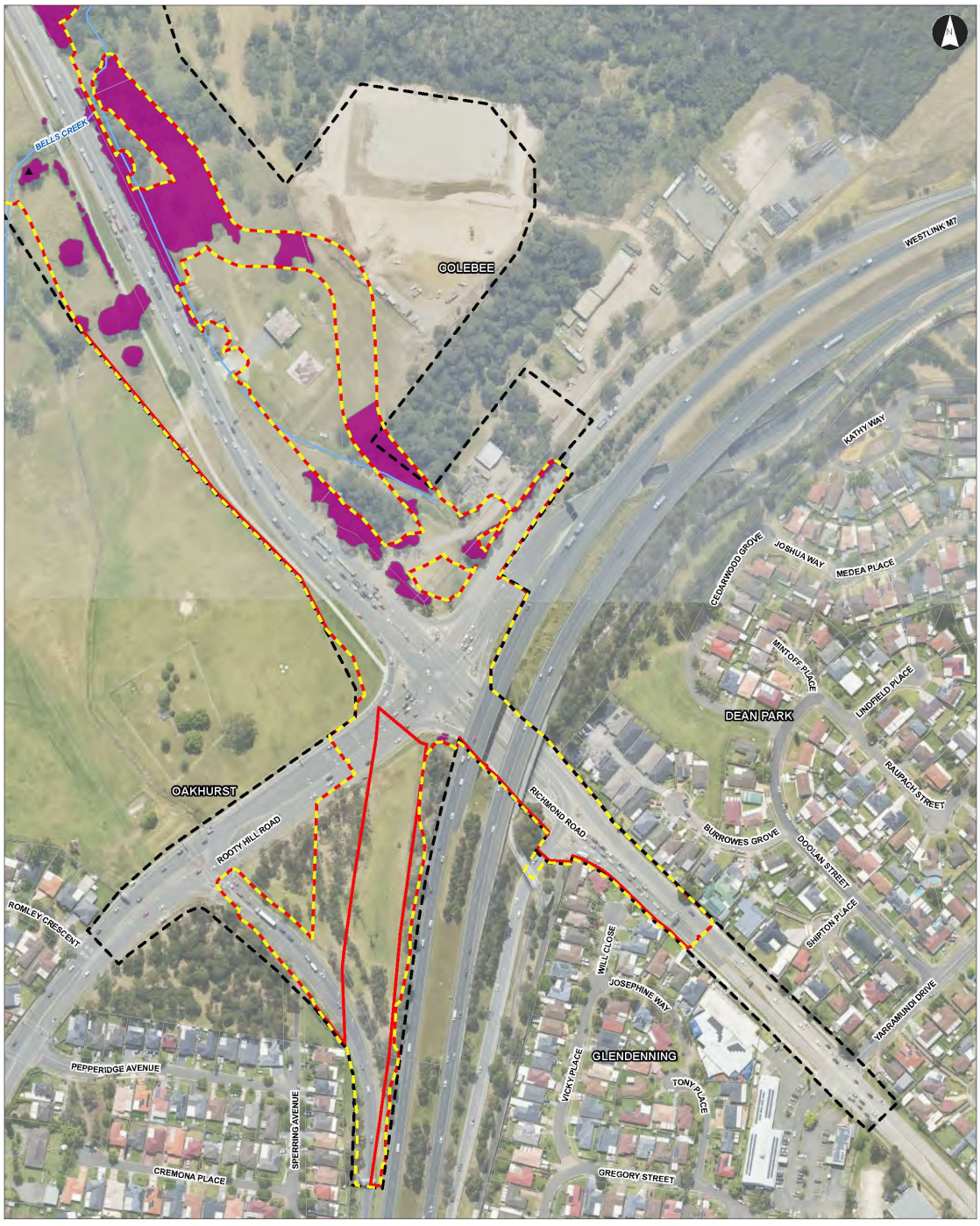


Figure 3-6 Southern Myotis species polygon



Myotis macropus (Southern Myotis) species polygon (Page 2 of 2)

Richmond Road Widening M7 Motorway to Townson Road

Project Code: 305001173-BIO-GIS-020
Drawn By: RA, Checked By: SM
Figure: 3-9 | Rev: 03 | Date: 2024-10-29

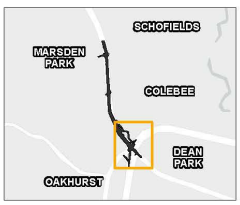
Legend
- Subject Land
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Threatened Species
- Southern Myotis
- *Myotis macropus* (Southern Myotis) species polygon

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

0 25 50 75 100 Metres
Scale at A3: 1:2,500



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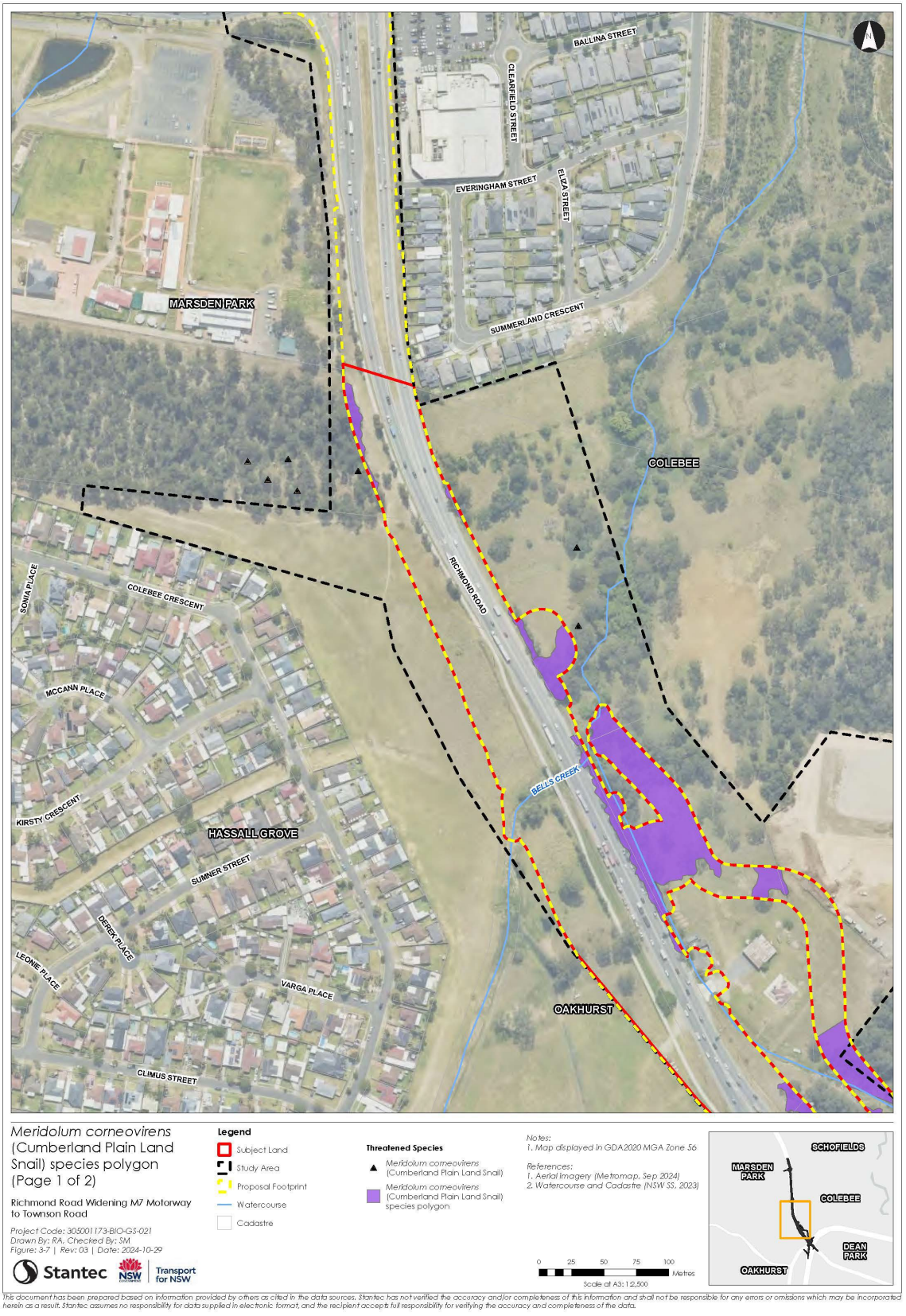
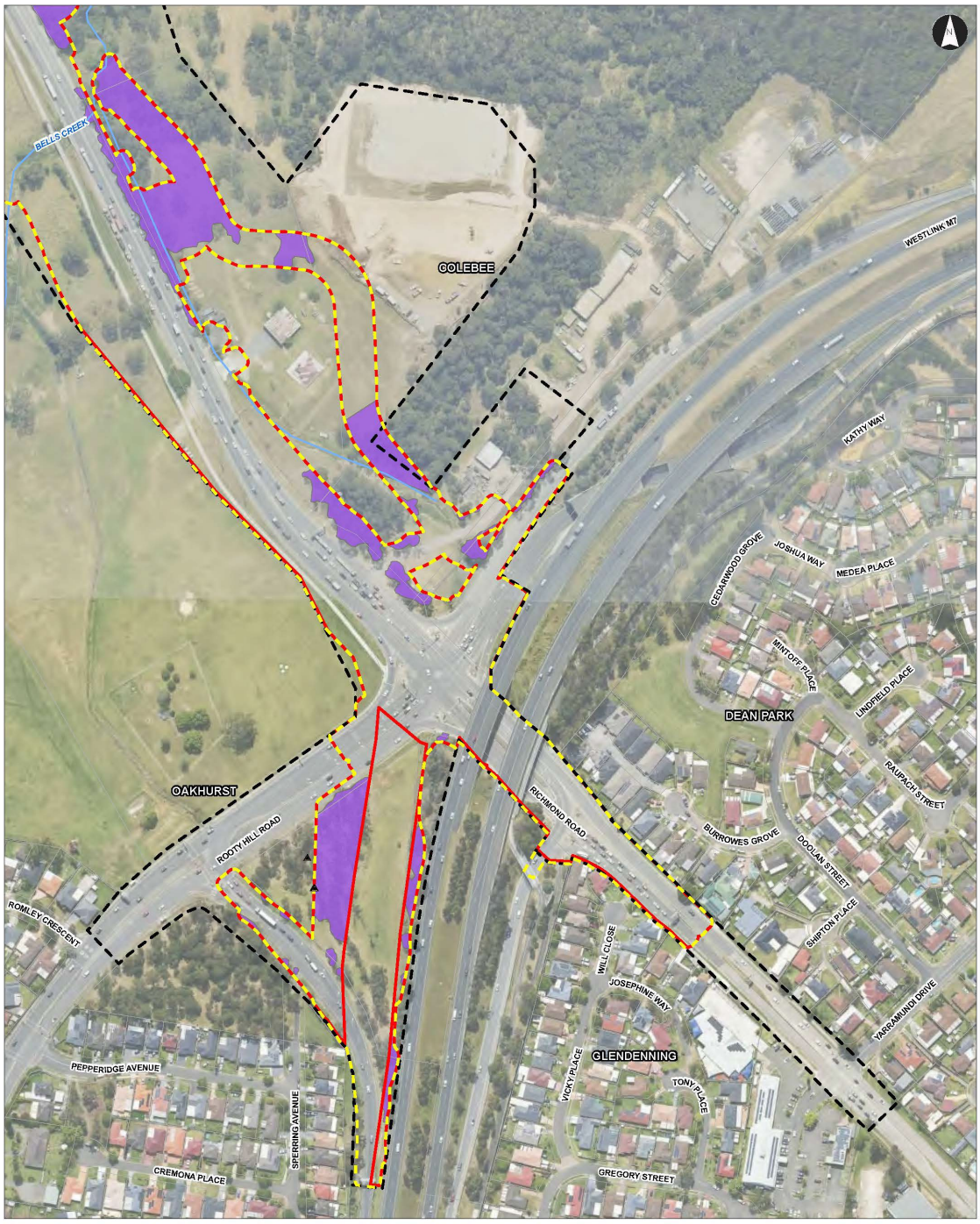


Figure 3-7 Cumberland Plain Land Snail species polygon



Meridolum corneovirens (Cumberland Plain Land Snail) species polygon (Page 2 of 2)

Richmond Road Widening M7 Motorway to Townson Road

Project Code: 305001173-BIO-GIS-021
Drawn By: RA, Checked By: SM
Figure: 3-7 | Rev: 03 | Date: 2024-10-29

Stantec | NSW | Transport for NSW

Legend

- Subject Land
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Threatened Species

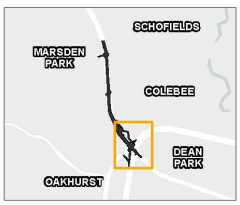
- *Meridolum corneovirens* (Cumberland Plain Land Snail)
- *Meridolum corneovirens* (Cumberland Plain Land Snail) species polygon

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

0 25 50 75 100 Metres

Scale at A3: 1:2,500



3.5 Aquatic results

3.5.1 Watercourses

Bells Creek is an urban watercourse in the western suburbs of Sydney that forms part of the Hawkesbury-Nepean catchment. It is approximately nine kilometres in length flowing north to north-east, to its confluence with Eastern Creek. Bells Creek runs through urban landscapes with the surrounding landscape at the upstream extent predominantly urban residential and the landscape at the downstream extent predominantly light industry and semi-rural lots.

A drainage culvert and channel are located to the east of Richmond Road at the intersection with the M7 Motorway which drain water from the road towards Bells Creek. This channel is mapped as an unnamed watercourse.

3.5.2 Key fish habitat

A review of the key fish habitat (KFH) mapping on the NSW DPI Fisheries Spatial Data Portal showed that no KFH was mapped within the study area. The closest mapped KFH is Eastern Creek which is located approximately 3.5 kilometres downstream from site BC-1.

3.5.3 Field survey results

3.5.3.1 Site descriptions

Site BC-1

Site BC-1 was located on Bells Creek at the downstream extent from site BC-2. The site was a long pool with width varying from 4 to 7 metres and shallow depth of up to 1 metre. The substratum was dominated by bedrock and cobbles, with soft sediment predominantly of silt and clay. Some finer gravel and pebble substrate was also observed in the waterway near where the road bridge crossed the water. The bank on the eastern side was gently sloped and stable than the western edge which was more steeply sloped and comprised of looser sediments with a large piece of geotextile fabric covering a portion of the bank edge. The approximate bank height on both sides was 2 metres. Water visibility was clear with no odour or scum observed, however, towards the end of the survey there was a small rainfall event and a large plume of an unknown substance drained into the waterway from the stormwater drain situated at the upstream end of the site near the road crossing (Photo 3-12).

The riparian zone was in fair condition with greater riparian tree cover on the eastern bank. An unbroken strip of *Casuarina sp*. with a few mixed exotics extended along the bank edge on the eastern side of the creek and provided moderate shading over the creek. On the western side, riparian tree vegetation was sparse, and the groundcover was dominated by a very large patch of *Persicaria decipens* (Slender Knotweed), at the downstream end of the site. Small patches of *Juncus usitatus* (Common Rush) were dispersed amongst exotic herbs and grasses, present along the western bank edge, at the upstream end of the site. A moderate amount of *Cladophora sp.* (filamentous green algae) (~20 per cent) was observed along the edge of the western bank and covering submerged rocks within the waterway.

Land use in the area is urban. A nursery is located on the eastern side of the creek and on the western side is a cleared lot of land and petrol station. A road bridge crosses the creek to the south with a box culvert structure for water flow. At the upstream end of the site just next to the bridge there is a large concrete stormwater pipe.

The site scored a 36 out of a possible 52 in the RCE assessment and is classified as moderately disturbed. The waterway is identified as being a Class 2 moderate fish habitat.

Photo 3-11 Site BC-1 looking upstream

Photo 3-12 Site BC-1 looking downstream (photo taken after rainfall event)

Site BC-2

Site BC-2 was located on Bells Creek at the upstream extent from site BC-1. The site was a long pool with varying width and little to no flow. The creek was wider upstream near the road bridge where it spanned to a maximum width of 10 metres and then narrowed out downstream to an approximate width of 2 metres. The depth of the waterway ranged from 0.5 metres to approximately 2 metres. The substratum was dominated by soft sediment, predominantly of silt and clay, with some finer gravel and pebble substrate. There was a moderate amount of macrophyte coverage and detritus along the bank with some overhanging vegetation. The bank was predominantly flat with a maximum bank height of 0.5 metres. The bank was stable over most of the site with small patches of visible erosion. Underneath the bridge, artificial boulders are present for bank and bridge stabilisation. The water was a brown murky colour with poor water visibility, however, no odour or scum was observed.

The riparian zone was in fair condition with greater riparian tree cover downstream from the site. Upstream the riparian cover was minimal due to urban land clearing for Richmond Road and surrounding residential housing on the western side. Large tree coverage was dominated by exotic species including *Ulmus parvifolia* (Chinese Elm), *Ligustrum sinense* (Narrow-leaved Privet) and *Fraxinus sp.* Few *Eucalyptus sp.* and *Casuarina sp*. were spread sparsely along the bank. The groundcover was dominated by Slender Knotweed and Common Rush, amongst a mix of native and exotic grasses. A small amount of *Cladophora sp.* (~5%) was observed covering submerged rocks within the waterway. On the western side of the bridge the creek, upstream from the site, the vegetation was dominated by in-stream aquatic species including *Typha orientalis* and *Persicaria decipens* (Photo 3-15).

Land use in the area was urban. Richmond road and its associated road bridge were situated just west of the site and to the east was a woodland area, dense with tree coverage. Anthropogenic disturbance was high from urban infrastructure (e.g roadway), weed ingress and a moderate amount of litter.

The site scored a 32 out of a possible 52 in the RCE assessment and was classified as moderately disturbed. The waterway was identified as being a Class 2 moderate fish habitat.

Photo 3-13 Site BC-2 looking upstream

Photo 3-14 Site BC-2 looking downstream

Photo 3-15 Wetland vegetation within Bells Creek just upstream from BC-2

Site UC-1

Site UC-1 was located on an unnamed creek that is a tributary of Bells Creek. The confluence of the unnamed creek with Bells Creek is located in between the location of site BC-1 and site BC-2. The stream channel was a combination of a natural and artificial channel due to an existing concrete culvert that runs under Richmond Road. Water was stagnant and water levels were low, with poor water visibility. On the western side of Richmond Road at the culvert outlet, an orange slime/rust was observed on the water, which was iron oxide that has likely been produced from iron bacteria in the water. The natural substrate was dominated by soft silty sediment and wetland vegetation, which had a dense coverage extending along the

whole channel on both sides of the culvert. Litter and organic debris were built up around the culvert entrances at both the inlet and outlet ends.

The riparian vegetation was fair, with a mix of exotic and native tree coverage. To the east there is a large cleared area of trees along the banks. Aquatic vegetation dominated the site and included *Typha orientalis*, *Persicaria decipens*, *Juncus usitatus* and *Schoenoplectus validus* (River Club Rush).

The land use surrounding the waterway was highly urbanised including an artificial culvert, roadway, residential housing and commercial spaces. Anthropogenic disturbance was high based on the urban infrastructure, weed ingress and litter.

The site scored a 26 out of a possible 52 in the RCE assessment which was representative of a highly disturbed habitat. The waterway was identified as being a Class 3 minimal fish habitat.

Photo 3-16 Site UC-1 (on the eastern side of Richmond Road) looking upstream

Photo 3-17 Site UC-1 (on eastern side of Richmond Road) looking downstream

Photo 3-18 Photo taken looking upstream on the western side of Richmond Road standing above the concrete culvert

Photo 3-19 Photo taken on the western side of Richmond Road looking downstream towards site UC-1

3.5.3.2 Water quality

The mean of the physio-chemical parameters recorded are presented in Table 3-15. Water quality was only measured at sites BC-1 and BC-2, as site UC-1 did not have sufficient water to undertake readings. The recorded measurements were assessed against the Australian Water Quality Guidelines DTV.

The pH and electrical conductivity were within the guideline range for the DTV for both sites. Dissolved oxygen (DO) was above the guideline range for site BC-1 but was low for site BC-2 with a reading below the guideline range. Turbidity at site BC-1 was below the guideline range and within range at site BC-2.

Table 3-15 Water quality parameters measured during the field survey in January 2024

	Ecosystem type	Temperature (°C)	Electrical conductivity (µS/cm)	Salinity (ppt)	pH	ORP (mV)	Dissolved oxygen (% saturation)	Turbidity (NTU)
ANZECC/ ARMCANZ 2000 DTV	Lowland River	-	125-2200	-	6.5-8	-	85-110	6-50
BC-1	Lowland River	23.22	1298	0.65	7.4	151.35	127.3	1
BC-2	Lowland River	24.64	667	0.33	7.17	98.15	59.6	12.35

3.5.3.3 Fish biodiversity

Bait traps were set up at sites BC-1 and BC-2. None were set up at UC-1 as water was too shallow. No fish were captured in any of the bait traps set up at either site.

During the survey at site BC-1 approximately five small fish, likely *Retropinna semoni* (Australian Smelt), were observed swimming in the water. *Retropinna semoni* are common in freshwater creeks and are widespread through south-east Australia. They are not listed as a threatened species.

Downstream of site BC-2 a medium sized *Cyperus carpio* (Black Carp) was noted swimming in the waterway. *Cyperus carpio* are an invasive species that are widely distributed throughout freshwater waterways across Australia and are commonly found in urban creeks such as Bells Creek.

3.6 Areas of outstanding biodiversity value

Areas of outstanding biodiversity value (AOBV) are special areas with irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Declared AOBV in NSW are included within the Register of Declared Areas of Outstanding Biodiversity Value. At the time of writing, 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 40 kilometres east of the study area.

3.7 Wildlife connectivity corridors

Wildlife connectivity across the study area is limited by the existing road corridor and industrial and urban development in the north and south, respectively. The Biodiversity Values map includes mapped 'biodiverse riparian land' along the riparian corridor of Bells Creek which would facilitate the movement of wildlife throughout the broader locality. Larger patches of remnant vegetation occur to the east of Bells Creek and, on the west of Richmond Road, north of Colebee Cresent, Hassall Grove, also providing connectivity corridors for the movement of fauna throughout the locality. Most patches of native vegetation within the study area are contiguous with a larger area of native vegetation consisting of mapped native vegetation and regional corridors under the Cumberland Plain Recovery Plan (Figure 3-8). Isolated patches of vegetation within the study area, including planted vegetation, provide 'stepping stones' to facilitate the movement of mobile fauna species, such as birds, between these more intact patches of vegetation. The existing road corridor limits connectivity between the open spaces and remnant vegetation to the east and west of Richmond Road, particularly for larger animals, such as *Macropus giganteus* (Eastern Grey Kangaroo). Eastern Grey Kangaroo were observed foraging within the open space to the west of the study area.

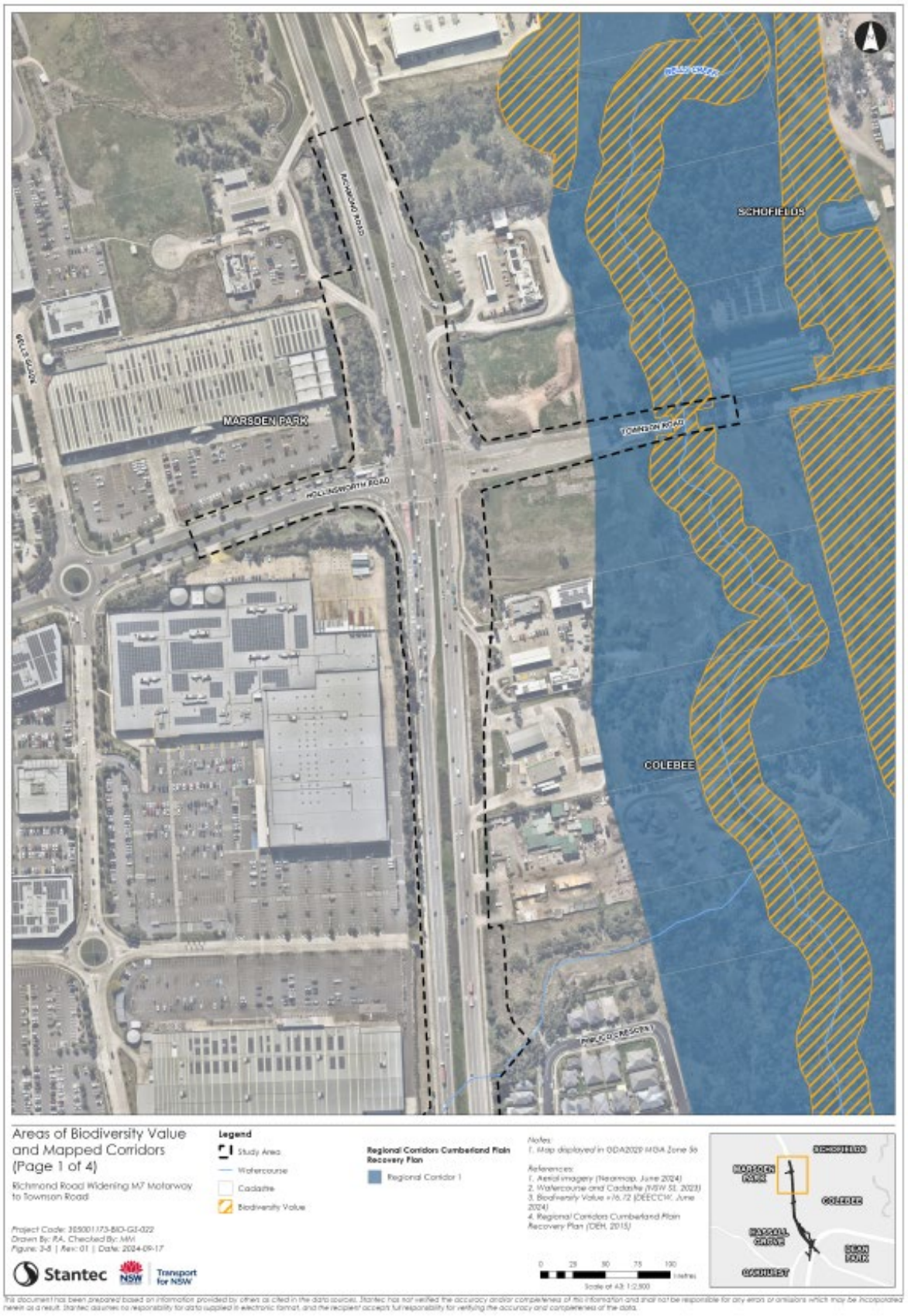
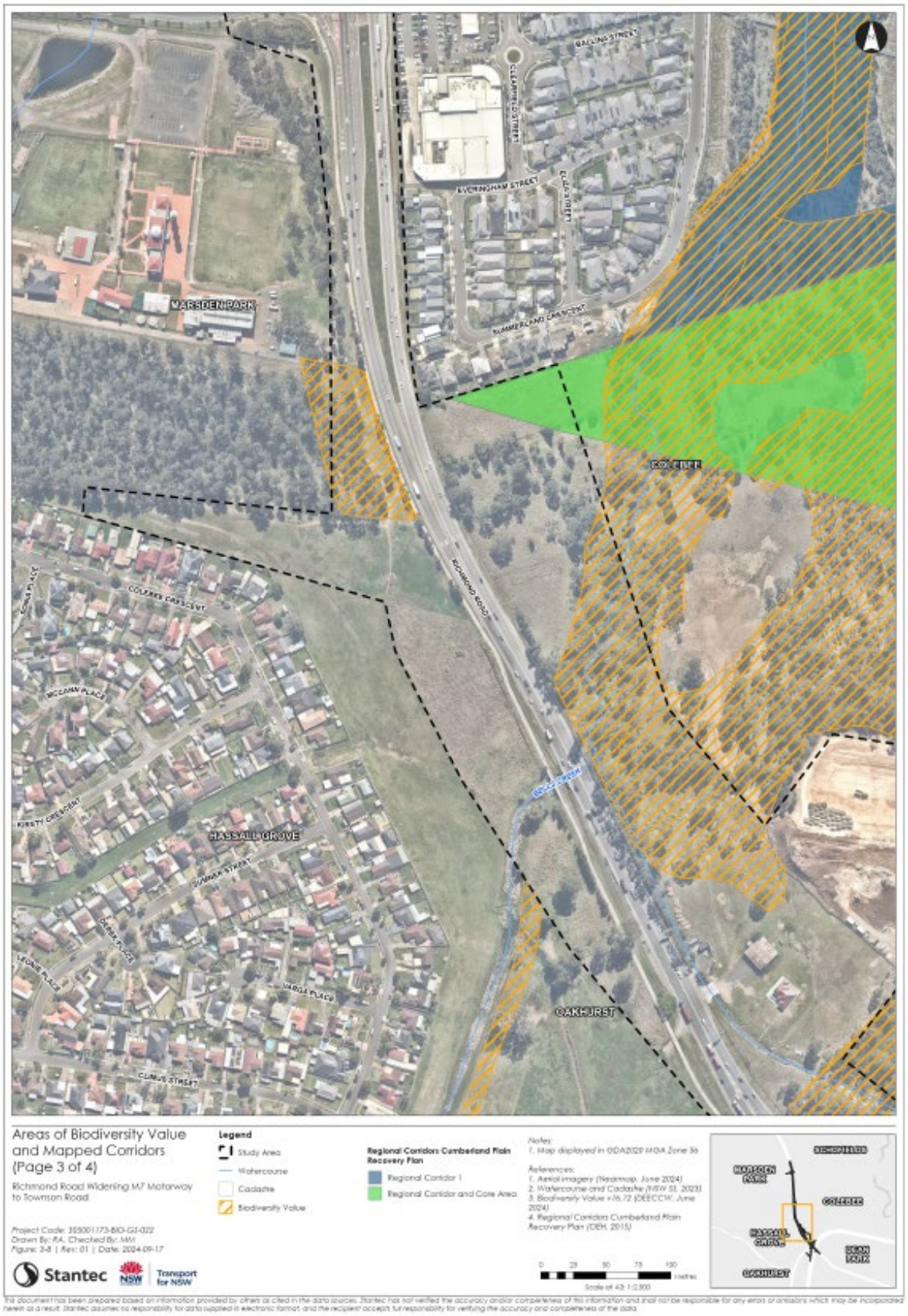


Figure 3-8 Areas of Biodiversity Value and mapped corridors

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.



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3.8 SEPPs

3.8.1 Biodiversity and Conservation SEPP

The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity SEPP) came into effect on 1 March 2022 and includes provisions for Koala habitat protection (Chapter 4) that aims to:

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

Schedule 2 of the Biodiversity SEPP includes land to which Chapter 4 applies. Blacktown LGA is not included in the list of LGAs to which Chapter 4 applies.

3.8.2 Resilience and Hazards SEPP

The study area is located outside the coastal management areas of the *State Environmental Planning Policy (Resilience and Hazards) 2021* (Resilience and Hazards SEPP). Therefore, consideration of the Resilience and Hazards SEPP has not been included as part of this BAR.

3.8.3 State Environmental Planning Policy (Precincts – Central River City) 2021

The *State Environmental Planning Policy (Precincts – Central River City) 2021* (Central River City SEPP) includes provisions relation to development within the North West Growth Area. The northern portion of the study area falls within the North West Growth Area and includes a certified area, under the Central River City SEPP, within the Colebee Precinct and the Marsden Park Industrial Precinct. Under Clause 3.24 of the Central River City SEPP, notification to the Department of Planning and Environment of the clearing of existing native vegetation is required for 'non certified' land within a growth area. A small area of non-certified land occurs within the northern portion of the study area, where Bells Creek crosses Townson Road, however the proposal footprint does not extend into this area (Figure 1-2). All land within the proposal footprint that falls within the North West Growth Area is 'existing certified' and therefore the written notice requirement under Clause 3.24 of the Central River City SEPP does not apply to the proposal.

3.9 Matters of National Environmental Significance

There are nine types of Matters of National Environmental Significance (MNES) listed under the EPBC Act. Typically, 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). As a result of a 'strategic assessment' approval granted by the Federal Minister in accordance with the EPBC Act, in September 2015, Transport road proposals assessed via an REF do not require referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for these matters, even if the activity is likely to have a significant impact. This applies to the subject land.

Within the Western Sydney Growth Centres, the requirements of the Western Sydney Growth Centres Strategic Assessment (2011) applies and no further assessment under the EPBC Act is required in these areas, provided that the development occurs in accordance with the Growth Centre requirements.

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

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A).

Threatened species and ecological communities listed under the EPBC Act are considered as MNES and are considered in the below sections. Table 3-16 summarises MNES and their applicability to the subject land as per the Protected Matters Search Tool (PMST). MNES within the study area are presented in Figure 3-9.

Table 3-16 MNES and their applicability to the subject land

MNES	PMST Predicted	Applicability to subject land
World Heritage Places	None	N/A
National Heritage Places	None	N/A
Wetlands of International Importance	None	N/A
Great Barrier Reef Marine Park	None	N/A
Commonwealth Marine Area	None	N/A
Threatened Ecological Communities (TECs)	A total of eight Threatened Ecological Communities (TECs) are predicted as likely or may occur within 10 kilometres of the subject land.	Further assessment is presented in 3.2 and 3.9.1.
Threatened Species	A total of 72 listed threatened species were predicted to occur within the subject land.	Further assessment is presented in 3.4 and 3.9.2.
Migratory Species	A total of 17 migratory species were predicted to occur within 10 kilometres of the subject land.	Further assessment is presented in Section 3.9.3.

3.9.1 Threatened ecological communities

Table 3-17 outlines TECs, under the EPBC Act, which are associated with PCTs occurring within the study area. It provides an assessment of the commensuration of PCTs in the study area with the definition of each TEC. Where vegetation within the study area is commensurate with a TEC listed under the EPBC Act, an assessment of significance had been undertaken as per the Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013) (Appendix E).

Table 3-17 EPBC Act listed TECs associated with PCTs within the study area

PCT ID	PCT Name	Associated TEC (EPBC Act)	TEC status (EPBC Act)	Vegetation within study area commensurate with TEC?	Justification
3320	Cumberland Shale Plains Woodland	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Yes^	See Table 3-18 and Table 3-19. PCT 3320 relates to the Commonwealth Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest TEC where a patch satisfies key diagnostic characteristics and condition thresholds as per Sections 4 and 5 of the Listing Advice.
4025	Cumberland Red Gum Riverflat Forest	Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion	Critically Endangered	No	See Table 3-20. PCT 4025 relates to the Commonwealth Elderslie Banksia Scrub Forest TEC where it occurs on the Tertiary alluvium of

PCT ID	PCT Name	Associated TEC (EPBC Act)	TEC status (EPBC Act)	Vegetation within study area commensurate with TEC?	Justification
					Spring Farm Elderslie area as per Section 3.5.1 of the Conservation Advice. The study area occurs outside of this distribution.
4025	Cumberland Red Gum Riverflat Forest	River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria	Critically Endangered	Yes*	See Table 3-21 and Table 3-22. Relates to the Commonwealth River-flat Eucalypt Forest on Coastal Floodplains TEC where it occurs at elevations below 250 metres ASL and satisfies condition thresholds as per section 5.2 of the Conservation Advice.

^ For PCT 3320 in Moderate-Good condition.

* PCT 4025 meets the minimum condition threshold where the patch is in moderate condition and over 0.5 hectares in size.

3.9.1.1 Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

PCT 3320 is associated with Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – listed as Critically Endangered under the EPBC Act. PCT 3320 relates to the Commonwealth Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest TEC where a patch satisfies key diagnostic characteristics and condition thresholds as per Sections 4 and 5 of the Listing Advice. Table 3-18 provides an assessment of PCT 3320 within the study area against the key diagnostic characteristics of the TEC.

Table 3-18 Review of key diagnostic characteristics for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (TSSC 2009) – listed as Critically Endangered under the EPBC Act

Key diagnostic characteristic	Characteristics of PCT 3320 within the study area
Distribution is limited to the Sydney Basin Bioregion with most occurrences in the Cumberland Sub-region. This covers a geographic area commonly known as the Cumberland Plain, a rainshadow coastal valley in western Sydney.	Meets the key diagnostic characteristic. The study area occurs within the Cumberland subregion within the Sydney Basin IBRA Bioregion.
Most occurrences are on clay soils derived from Wianamatta Group geology, with limited to rare occurrences on soils derived from Tertiary Alluvium, Holocene Alluvium, the Mittagong Formation, Aeolian Deposits and Hawkesbury Sandstone.	Meets the key diagnostic characteristic. The study area occurs predominantly within the Blacktown soil landscape which is characterised by gently undulating rises on Wianamatta Group shale. Where Bells Creek traverses the study area, the soil landscape is mapped as the South Creek soil landscape. This soil landscape is characterised by soils derived from Wianamatta Group shales and Hawkesbury Sandstone.
Upper tree layer species must be present with these features: • *The minimum projected foliage cover of canopy trees is 10% or more; and* • *The tree canopy is typically dominated by Eucalyptus moluccana (Grey Box), E.*	Meets the key diagnostic characteristic. Canopy cover of all plots within PCT 3320 exceeds 30% and is dominated by *Eucalyptus moluccana* and *E. tereticornis.*

Key diagnostic characteristic	Characteristics of PCT 3320 within the study area
tereticornis (Forest Red Gum) and/or E. fibrosa (Red Ironbark). Other canopy species may occur in association with the typical dominants and may be locally dominant at some sites.	
A sparse lower tree layer may be present, typically with young eucalypts of upper tree canopy species and species of *Acacia*, *Exocarpos* and *Melaleuca*.	Partially meets the key diagnostic characteristic. Some areas of PCT 3320 within the study area have a sparse cover of *Eucalyptus* regeneration and other species such as *Acacia parramattensis* and *Melaleuca decora*.
The understory typically is dominated by the ground layer and shows these features: • *The ground layer typically comprises a variety of perennial native graminoids and forbs;* • *Native graminoid species that are often present include: the grasses Aristida ramosa (Purple Wiregrass), A. vagans (Threeawn Speargrass), Cymbopogon refractus (Barbed Wire Grass), Dichelachne micrantha (Plumegrass), Echinopogon caespitosus var. caespitosus (Tufted Hedgehog Grass), Eragrostis leptostachya (Paddock Lovegrass), Microlaena stipoides subsp. stipoides (Weeping Grass), Paspalidium distans and Themeda triandra (Kangaroo Grass), and other graminoids Carex inversa (Knob Sedge), Cyperus gracilis (Slender Sedge), Lomandra filiformis subsp. filiformis (Wattle Mat-rush) and L. multiflora subsp. multiflora (Many flowered Mat-rush);* • *Native forb and other herb species present include: Asperula conferta (Common Woodruff), Brunoniella australis (Blue Trumpet), Cheilanthes sieberi (Poison Rock-Fern), Desmodium varians (Slender Tick-trefoil), Dianella longifolia (Blue Flax-Lily), Dichondra repens (Kidney Weed), Glycine spp., Hardenbergia violacea (Native Sarsparilla), Opercularia diphylla (Stinkweed), Oxalis perennans, Pratia purpurascens (Whiteroot) and Wahlenbergia gracilis (Australian Bluebell); and* • *A shrub layer may be present, to variable extent, and is often dominated by Bursaria spinosa (Blackthorn) while other species include: Daviesia ulicifolia (Gorse Bitter Pea), Dillwynia sieberi, Dodonaea viscosa subsp. cuneata (Wedge-leaf Hop-bush), Indigofera australis (Native Indigo) and Lissanthe strigosa (Peach Heath).*	Partially meets the key diagnostic characteristic. Within the study area, moderate to moderate- good condition PCT 3320 includes a ground layer with native perennial species such as *Microlaena stipoides* subsp. *stipoides, Paspalidium distans, Carex inversa, Brunoniella australis, Cheilanthes sieberi, Dichondra repens, Glycine spp., Oxalis perennans,* and *Pratia purpurascens* present. Where present, the shrub layer is dominated by *Bursaria spinosa,* with other species such as *Dillwynia sieberi* also present.

In order to be considered a MNES under the EPBC Act, areas of PCT 3320 within the study area must meet:

- Key diagnostic characteristics (as in the Listing Advice and Table 3-18).
- One of the four categories of condition thresholds set out in Table 1 of the Conservation Advice.

Table 3-19 provides the condition thresholds for the Commonwealth Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest TEC. As per the Conservation Advice, the condition thresholds are the minimum level at which patches are to be considered under the EPBC Act for actions that may require referral to the Australian Government.

Table 3-19 Review of condition thresholds for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (TSSC 2009) – listed as Critically Endangered under the EPBC Act

Category	Threshold	Characteristics of PCT 3320 within the study area
A. Core thresholds that apply under most circumstances: patches with an understory dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW.	Minimum patch size is ≥0.5 hectares **AND** ≥50 percent of the perennial understory vegetation cover is made up of native species.	**Moderate Condition** Does not meet condition threshold. The perennial understory vegetation cover consists of <50 percent native vegetation.
		Moderate – Good Condition Meets condition threshold. The perennial understory vegetation cover consists of >50 percent native vegetation. Patches (relating to plots 6 and 8) extend outside of the study area and are >5 hectares in size. All patches are at least 0.5 hectare in size.
OR		
B. Larger patches which are inherently valuable due to their rarity.	The patch size is ≥5 hectares **AND** ≥30 percent of the perennial understory vegetation cover is made up of native species.	**Moderate Condition** Does not meet condition threshold. The perennial understory vegetation cover consists of <30 percent native vegetation.
		Moderate – Good Condition Meets condition threshold. The perennial understory vegetation cover consists of >50 percent native vegetation. Patches (relating to plots 6 and 8) extend outside of the study area and are >5 hectares in size. Where patch size is <5 hectares, the patches are still consistent with Category A TEC.
OR		
C. Patches with connectivity to other large native vegetation remnants in the landscape.	The patch size is ≥0.5 hectares **AND** ≥30 percent of the perennial understory vegetation cover is made up of native species **AND** The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥5 hectares in area.	**Moderate Condition** Does not meet condition threshold. The perennial understory vegetation cover consists of <30 percent native vegetation.
		Moderate – Good Condition Meets condition threshold where contiguous patches ≥5 hectares occur. The perennial understory vegetation cover consists of >50 percent native vegetation. All patches are >0.5 hectares and are contiguous with a larger area of native vegetation ≥ 5 hectares consisting of mapped native vegetation and regional corridors under the Cumberland Plain Recovery Plan (see Section 2.3.5 and Section 3.7).

Category	Threshold	Characteristics of PCT 3320 within the study area
OR		
D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥0.5 hectares **AND** ≥30 percent of the perennial understory vegetation cover is made up of native species **AND** the patch has at least one tree with hollows per hectare or at least one large tree (≥80 centimetres dbh) per hectare from the upper tree layer species outlined in the Description and Appendix A.	**Moderate Condition** Does not meet condition threshold. The perennial understory vegetation cover consists of <30 percent native vegetation.
		Moderate – Good Condition Partially meets condition threshold. No large trees were recorded in plots 6 or 8, however the patches are contained within larger patches that likely contain large trees. Regardless, moderate-good condition PCT 3320 still meets another condition threshold for the TEC (where patches >5 hectares). The small patch to the east of Rooty Hill Road is approximately 1 hectare in size and contains one large tree.

To be considered a MNES under the EPBC Act, areas of PCT 3320 within the study area must meet the minimum condition threshold as per Table 3-19. To be representative of the EPBC Act listed TEC, patches must be greater than the minimum patch size of 0.5 hectares. As per Table 3-19, patches of moderate-good condition PCT 3320 within the study area that are over 0.5 hectares meet the minimum condition threshold for the Commonwealth Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest TEC.

3.9.1.2 Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion

PCT 4025 is associated with Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion– listed as Critically Endangered under the EPBC Act. PCT 4025 relates to the Commonwealth Elderslie Banksia Scrub Forest TEC where it occurs on the Tertiary alluvium of Spring Farm Elderslie area as per Section 3.5.1 of the Conservation Advice. Table 3-20 provides an assessment of PCT 4025 within the study area against the key diagnostic characteristics of the TEC.

Table 3-20 Review of key diagnostic characteristics for Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion (DAWE 2020a) – listed as Critically Endangered under the EPBC Act

Key Diagnostic Characteristic	Characteristics of PCT 4025 within the study area
The Elderslie Banksia Scrub Forest ecological community is limited to the Cumberland IBRA Subregion of the Sydney Basin Bioregion: • *It occurs near the Nepean River typically in association with deep (≥1 metre) sand deposition areas from past river flows; typically where Tertiary alluvium overlies another substrate, usually Triassic age sedimentary strata of the Wianamatta Group* • *It currently occurs upstream of the confluence of the Nepean River with the Warragamba River, particularly around the location of Spring Farm.*	Does not meet the key diagnostic characteristic. The study area occurs within the Cumberland IBRA Subregion, however does not occur in association with Tertiary sand deposit in the locality of Spring Farm.
The ecological community occurs at moderately low altitude, around 60 to 100 m ASL. It typically lies above the 1 in 100 year flood level, with possible exceptions including regrowth on mined sand deposits that are now artificially within the current floodplain.	Does not meet the key diagnostic characteristic. The topography of the study area ranges from approximately 27 metres ASL to 46 metres ASL.

Key Diagnostic Characteristic	Characteristics of PCT 4025 within the study area
The canopy is or was dominated by *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), but can also be dominated by *Eucalyptus botryoides (Bangalay) x E. saligna* (Sydney Blue Gum) and may contain other tall canopy species such as *Angophora subvelutina* (Broad-leaved Apple), *Eucalyptus baueriana* (Blue Box), *Eucalyptus amplifolia* (Cabbage Gum), and *Eucalyptus tereticornis* (Forest Red Gum).	Does not meet the key diagnostic characteristic. The canopy of PCT 4025 within the study area is not dominated by *Banksia integrifolia* subsp. *integrifolia* or *Eucalyptus botryoides (Bangalay) x E. saligna*.

Based on the above assessment, PCT 4025 within the study area is not commensurate with Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion and the TEC is not considered to be present within the study area.

3.9.1.3 River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria

PCT 4025 is associated with River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria– listed as Critically Endangered under the EPBC Act. PCT 4025 relates to the Commonwealth River-flat Eucalypt Forest on Coastal Floodplains TEC where it occurs at elevations below 250 metres ASL and satisfies condition thresholds as per section 5.2 of the Conservation Advice. Table 3-21 provides an assessment of PCT 4025 within the study area against the key diagnostic characteristics of the TEC.

Table 3-21 Review of key diagnostic characteristics for River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria (DAWE 2020b) – listed as Critically Endangered under the EPBC Act

Key diagnostic characteristic	Characteristics of PCT 4025 within the study area
Occurs in the South East Corner and Sydney Basin IBRA7 Bioregions, in eastern Victoria and south eastern NSW.	Meets the key diagnostic characteristic. The study area occurs within the Sydney Basin IBRA Bioregion.
Occurs within catchments of the eastern and southern watershed of the Great Dividing Range.	Meets the key diagnostic characteristic. The study area occurs within the Hawkesbury-Nepean catchment, east of the Great Dividing Range.
Occurs at elevations up to 250 metres above sea level (ASL), but most typically below 50 metres ASL.	Meets the key diagnostic characteristic. The topography of the study area ranges from approximately 27 metres ASL to 46 metres ASL.
Occurs on alluvial landforms related to coastal river floodplains and associated sites where transient water accumulates, including floodplains, riverbanks, riparian zones, lake foreshores, creek lines (including the floors of tributary gullies), floodplain pockets, depressions, alluvial flats, fans, terraces, and localised colluvial fans.	Meets the key diagnostic characteristic. PCT 4025 is distributed adjacent to Bells Creek, coinciding with the South Creek soil landscape. This soil landscape occurs along the floodplains, valley flats and drainage channels of the Cumberland Plain.
Occurs on alluvial soils of various textures including silts, clay loams, sandy loams, gravel and cobbles. Does not occur on soils that are primarily marine sands, or aeolian sands.	Meets the key diagnostic characteristic. The study area occurs predominantly within the Blacktown soil landscape which is characterised by gently undulating rises on Wianamatta Group shale. Where Bells Creek traverses the study area, the soil landscape is mapped as the South Creek soil landscape. This soil landscape is characterised by soils derived from Wianamatta Group shales and Hawkesbury Sandstone. Dominant soils within these soil landscapes are clay loams.
Occurs as a tall closed-forest, tall open-forest, closed forest, open forest, tall woodland, or woodland. The canopy has a crown cover of at least 20 percent.	Meets the key diagnostic characteristic. PCT 4025 within the study area occurs predominantly as a grassy woodland. Canopy cover of all plots within PCT 4025 exceeds 40 percent.

Key diagnostic characteristic	Characteristics of PCT 4025 within the study area
Has a canopy dominated by one or a combination of the following species: *Angophora floribunda, A. subvelutina, Eucalyptus amplifolia, E. baueriana, E. benthamii, E. bosistoana, E. botryoides, E. botryoides x E. saligna, E. elata, E. grandis, E. longifolia, E. moluccana, E. ovata, E. saligna, E. tereticornis, E. viminalis.*	Partially meets the key diagnostic characteristic. The canopy of PCT 4025 within the study area is dominated by *E. tereticornis* and *E. moluccana,* with the exception of the low condition areas.

Based on the above assessment, low condition PCT 4025 within the study area is not commensurate with River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria.

In order to be considered an MNES under the EPBC Act, areas of PCT 4025 within the study area must meet:

- key diagnostic characteristics (as in Section 5.1.1 of the Conservation Advice and Table 3-21).
- at least the minimum condition thresholds (as in Section 5.2.1 of the Conservation Advice).

Table 3-22 provides the condition thresholds for the Commonwealth River-flat Eucalypt Forest on Coastal Floodplains TEC. As per the Conservation Advice, the broadest area that meets the key diagnostic characteristics of the ecological community should be used in determining patch condition.

Table 3-22 Condition thresholds for River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria (DAWE 2020b) – listed as Critically Endangered under the EPBC Act

Category	Biotic threshold	Condition Classes		
		Large Patch Patch size ≥ 2 hectares	Small Contiguous Patch Patch size ≥ 0.5 hectares within a larger area of native vegetation ≥ 5 hectares	Small patch Patch size ≥ 0.5 hectares
High condition	≥ 80 percent of its total perennial understory vegetation cover is comprised of native species **AND** Ground cover richness ≥ 10 native species per sample plot **AND** ≥ 20 large trees per hectare.	Class A1: Large or contiguous patch in high condition.		Class B1: Small patch in high condition.
Good condition with arboreal mammals	≥ 50 percent of its total perennial understory vegetation cover is comprised of native species **AND** ground cover richness ≥6 native species per sample plot **AND** at least 10 large trees per hectare **AND**	Class A2: Large or contiguous patch in good condition with arboreal mammals.		Class B2: Small patch in good condition with arboreal mammals.

Category	Biotic threshold	Condition Classes		
		Large Patch Patch size ≥ 2 hectares	Small Contiguous Patch Patch size ≥ 0.5 hectares within a larger area of native vegetation ≥ 5 hectares	Small patch Patch size ≥ 0.5 hectares
	evidence of 4 or more species of arboreal mammals detected in the patch.			
Good condition	≥ 50 percent of its total perennial understory vegetation cover is comprised of native species **AND** ground cover richness ≥ 6 native species per sample plot **AND** at least 10 large trees per hectare.	Class B3: Large or contiguous patch in good condition.		Class C1: Small patch in good condition.
Moderate condition	≥ 30% of its total perennial understory vegetation cover is comprised of native species **AND** ground cover richness ≥ 4 native species per sample plot.	Class C2: Large or contiguous patch in moderation condition.		

To be considered a MNES under the EPBC Act, areas of PCT 4025 within the study area must meet the minimum condition threshold as per Table 3-22. To be representative of the EPBC Act listed TEC, moderate condition patches must be greater than 0.5 hectares and within a larger area of native vegetation ≥ 5ha. Plots undertaken within moderate condition PCT 4025 demonstrated a perennial understory vegetation cover with at least 30 percent native cover and a ground cover richness ranging from 9 to 13 species per plot. Most patches of native vegetation within the study area are contiguous with a larger area of native vegetation ≥ 5 hectares consisting of mapped native vegetation and regional corridors under the Cumberland Plain Recovery Plan (see Section 2.3.5 and Section 3.7). As such, all patches of moderate condition PCT 4025 that are over 0.5 hectares meet the minimum condition threshold for the Commonwealth River-flat Eucalypt Forest on Coastal Floodplains TEC. The Conservation Advice defines a patch as a discrete and mostly continuous area of the ecological community, which may include small-scale (<30 metres) gaps and disturbances. Patches of the community to the west of Richmond Road have not been considered within the larger patch due to the disturbance created by the existing road corridor and have been excluded from the community as they do not meet the area threshold. It should be noted that some patches within the study area also fit within higher condition classes due to a higher cover of native perennial understory species and the presence of large trees. As per the conservation advice, areas of high, good or moderate quality may be identified within patches if that is useful to further conservation decision making.

3.9.2 Threatened species

One EPBC listed threatened fauna species, *Pteropus poliocephalus* (Grey-headed Flying-fox), listed as vulnerable under the EPBC Act was recorded within the study area. One individual was recorded foraging in the study area, while several others were observed flying over the study area. No active breeding camps are present within the study area and the nearest camp to the study area occurs approximately 6.4 kilometres to the south west of the study area at Ropes Creek.

No EPBC listed flora species were detected within the study area during targeted surveys. The study area contains potential habitat for five EPBC listed species, which have not yet been surveyed for:

- *Deyeuxia appressa* – listed as endangered under the EPBC Act
- *Hibbertia* sp. *Bankstown* – listed as critically endangered under the EPBC Act
- *Pomaderris brunnea* – listed as vulnerable under the EPBC Act
- *Pterostylis saxicola* – listed as endangered under the EPBC Act
- *Pultenaea parviflora* – listed as vulnerable under the EPBC Act.

These species will be surveyed prior to the determination of the project.

Following field surveys, an additional five EPBC listed species were considered to have a moderate likelihood of occurring within the study area (Appendix B):

- *Anthochaera phrygia* (Regent Honeyeater) – listed as critically endangered under the EPBC Act
- *Callocephalon fimbriatum* (Gang-gang Cockatoo) – listed as endangered under the EPBC Act
- *Calyptorhynchus lathami lathami* (South-eastern Glossy Black-Cockatoo) – listed as vulnerable under the EPBC Act
- *Lathamus discolor* (Swift Parrot) – listed as critically endangered under the EPBC Act
- *Dasyurus maculatus (*Spotted-tailed Quoll*)* – listed as endangered under the EPBC Act.

Assessments of significance were completed for these species and are provided in Appendix E.

3.9.3 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.

No listed migratory species were detected within the study area.

The PMST indicated 17 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 B). No migratory species were considered to have a moderate or higher likelihood of occurrence.

Figure 3-9 Matters of national environmental significance recorded

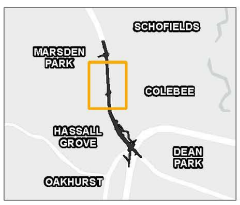
Matters of National Environmental Significance Recorded (Page 2 of 4)

Richmond Road Widening M7 Motorway to Townson Road

Legend
- Study Area
- Proposal Footprint
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial Imagery (Metromap, Sep 2024)
2. Watercourse and Cadastre (NSW SS, 2023)

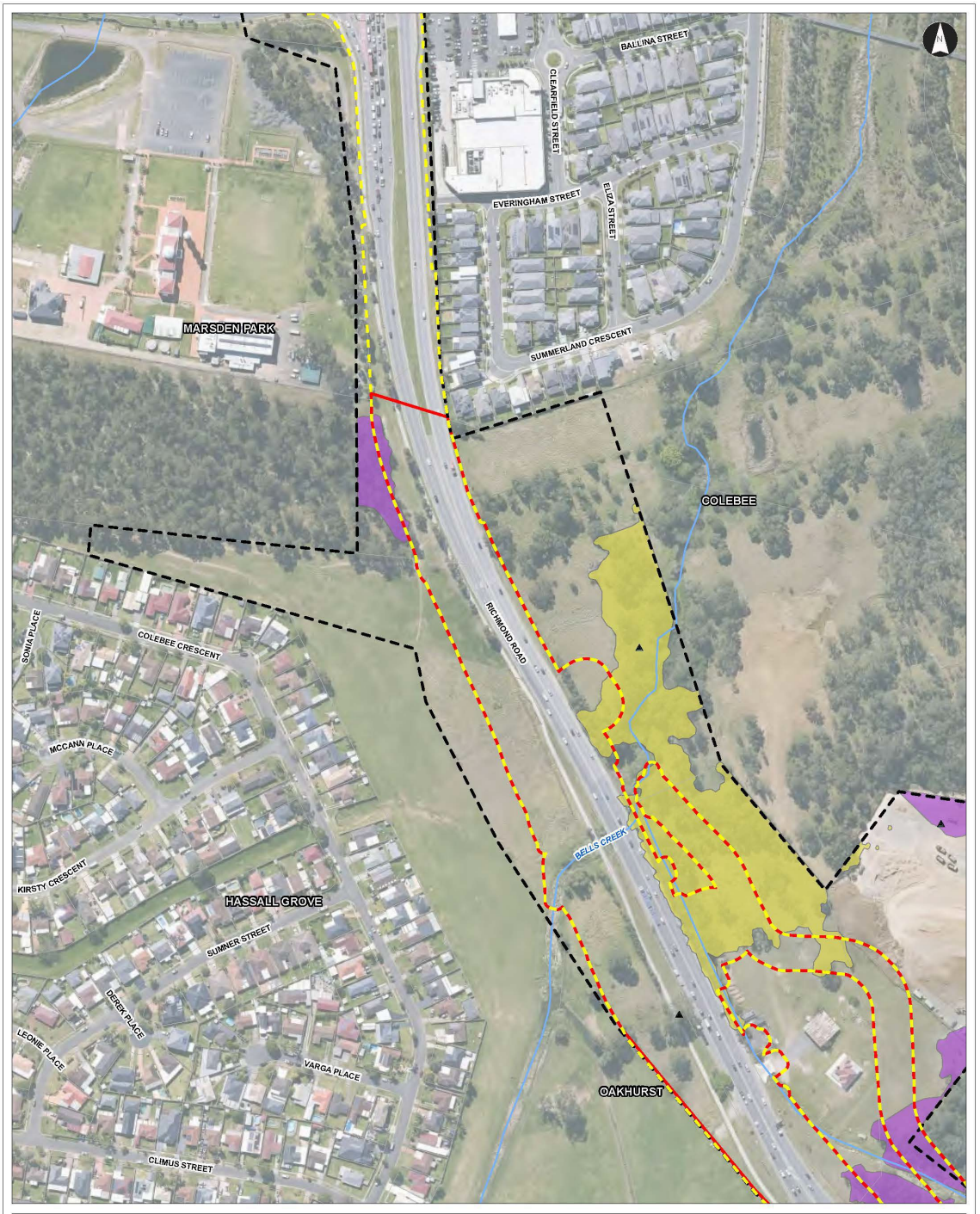


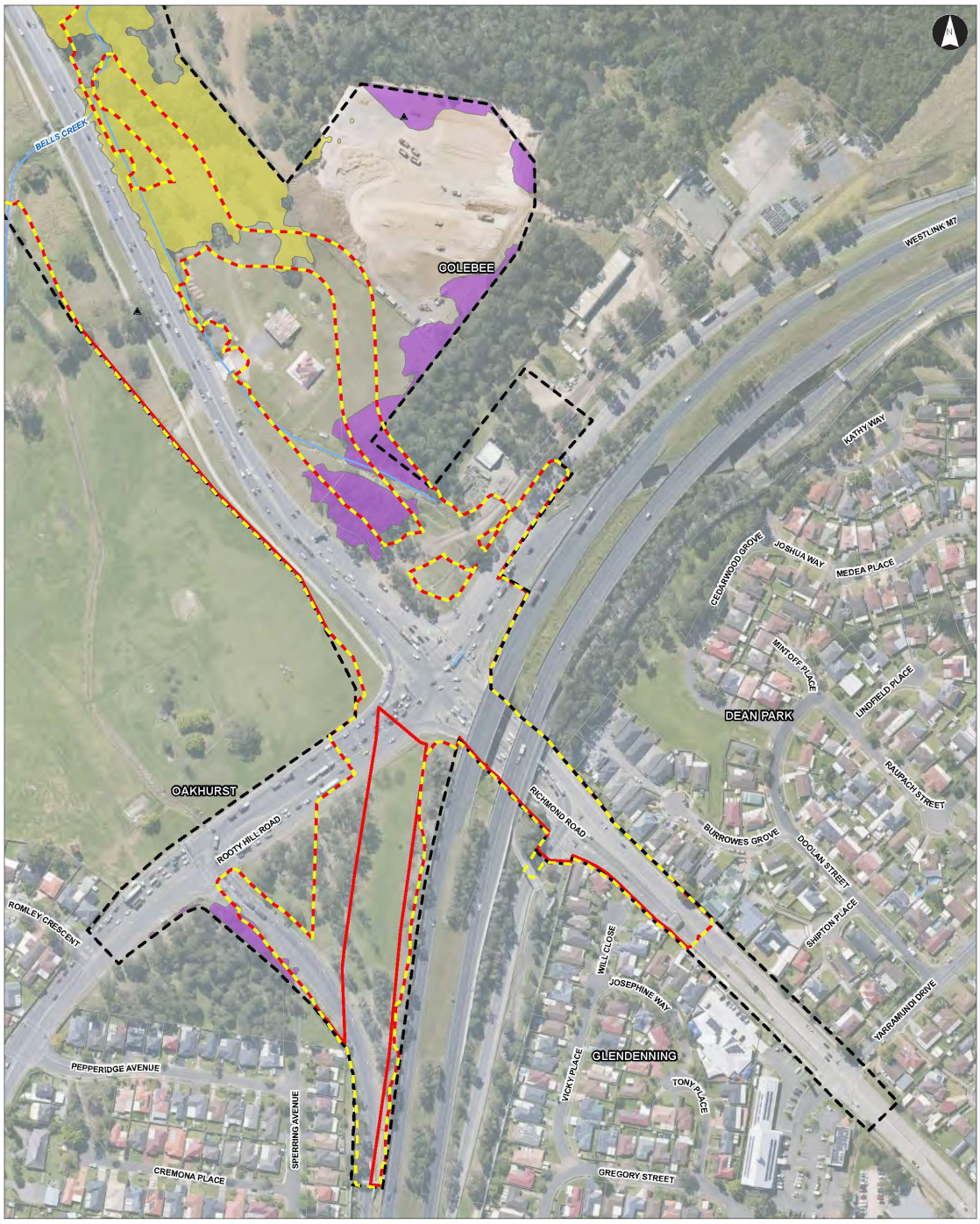
0 25 50 75 100 Metres

Scale at A3: 1:2,500

Project Code: 305001173-BIO-GIS-023
Drawn By: RA, Checked By: MM
Figure: 3-9 | Rev: 02 | Date: 2024-10-08

Stantec | NSW | Transport for NSW





4. Avoidance and minimisation

A key part of Transport's management of biodiversity for this proposal is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

1. Avoid and minimise impacts.
2. Mitigate impacts.
3. Offset impacts in accordance with Transport guidelines.

The proposal has been located to relieve current corridor congestion and provide road capacity to support growth as part of the NWGA Transport Strategy. Due to the nature of the proposal (i.e. widening of existing road corridor) impacts to biodiversity are unavoidable, however the proposal footprint has been limited, as far as practicable, to avoid unnecessary clearing of vegetation.

Efforts have been made to avoid and minimise the impact of the proposal on biodiversity during the design process. The removal of the shared path, along the eastern side of Richmond Road, from the design avoids impacts to approximately 42 trees. Additionally, tree removal has been minimised through the steepening of the batter at the M7 Motorway flyover.

Where possible, compound locations have been chosen to minimise impacts to native vegetation. The placement of ancillary facilities has prioritised the use of existing cleared areas to reduce the requirement for additional, unnecessary clearing of native vegetation. A temporary compound is proposed adjacent to the M7 Motorway and Rooty Hill Road North and would require clearing. This compound is required for the construction of the fly-over bridge and cannot be relocated due to constraints provided by the existing road corridor (M7 Motorway and Rooty Hill Road North).

5. Impact assessment

This section assesses potential impacts to biodiversity in the study area as a result of the construction and operation of the proposal. The main components of the proposal are summarised below:

- Construction
  - widening Richmond Road between the M7 Motorway and Townson Road to six lanes, adding an additional lane in each direction
  - building a new flyover bridge from the M7 Motorway Rooty Hill Road North off-ramp to Richmond Road northbound to allow road users to bypass two sets of traffic lights, reducing congestion and queuing onto the motorway and allowing uninterrupted flow of traffic
  - retaining the existing bridge structure over Bells Creek for southbound traffic on Richmond Road
  - constructing a new concrete bridge structure over Bells Creek for the northbound carriageway that would include a separated pedestrian and bike path and travel lanes
  - new staged pedestrian crossings on Richmond Road at Alderton Drive and Townson Road making it easier for pedestrian and bike riders to move safely in and around the area
  - intersections upgrade along Richmond Road between the M7 Motorway and Townson Road.
  - drainage and water quality structures along the proposal
  - earthwork cutting, embankments and retaining walls to accommodate the widened road alignment, flyover bridge and open flooding channel
  - rehabilitation of disturbed areas and landscaping
  - establishment and use of three temporary ancillary facilities during construction.
- Operation:
  - contaminant-laden runoff from impervious surfaces
  - operational traffic.

Potential impacts of the proposal are as follows (further detail is provided in sections 5.1 and 5.2):

- Construction impacts:
  - removal of native vegetation
  - removal of threatened fauna species habitat and habitat features
  - removal of threatened flora species
  - aquatic impacts
  - injury and mortality of fauna
  - disturbance to groundwater dependent ecosystems.
- Operation/indirect impacts:
  - wildlife connectivity and habitat fragmentation
  - edge effects on adjacent native vegetation and habitat
  - invasion and spread of weeds
  - invasion and spread of pests
  - invasion and spread of pathogens and disease
  - changes to hydrology
  - noise, light, dust and vibration.

5.1 Construction direct impacts

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).

5.1.1 Removal of native vegetation

The proposal would require the removal of 2.11 hectares of native vegetation and 60 planted native trees (as identified in section 3.1.3). This includes 0.35 hectares of native vegetation within certified areas (Table 5-1), which has previously been offset under the North West Growth Centre Biodiversity Certification process and CPCP. As such, no further assessment of these areas is required, provided that the development occurs in accordance with the relevant biocertification order.

Table 5-1 Summary of direct impacts on native vegetation within certified lands

Veg. zone	Plant community type (PCT)	Broad condition class	Area to be impacted (ha)	
			NWGA	Certified- Major Transport Corridor
Zone 1	PCT 3320: Cumberland Shale Plains Woodland	Moderate	0.18	0.10
Zone 2	PCT 3320: Cumberland Shale Plains Woodland	Moderate-Good	0.00	0.00
Zone 3	PCT 4025: Cumberland Red Gum Riverflat Forest	Moderate	0.00	0.07
Zone 4	PCT 4025: Cumberland Red Gum Riverflat Forest	Low	0.00	0.00
		Subtotal	0.18	0.17
		Total	0.35	

The proposal would directly impact 1.76 hectares of native vegetation and 60 planted native trees outside of certified areas. This includes 1.76 hectares of vegetation commensurate with TECs listed under the BC Act, of which 1.07 hectares are commensurate with TECs listed under the EPBC Act.

The removal of native vegetation relates to several key threatening processes listed under the BC Act, including clearing of native vegetation, bushrock removal, invasion of native plant communities, loss of hollow-bearing trees and removal of dead wood and dead trees. Similar key threatening processes are also listed under the EPBC Act, including land clearance.

Table 5-2 Summary of direct impacts on native vegetation within the subject land

Veg. zone	Plant community type (PCT)	Broad condition class	TEC	Area to be impacted (ha)
Zone 1	PCT 3320: Cumberland Shale Plains Woodland	Moderate	Critically Endangered (BC Act)	0.49
Zone 2	PCT 3320: Cumberland Shale Plains Woodland	Moderate-Good	Critically Endangered (BC Act) Critically Endangered (EPBC Act) *	0.31
Zone 3	PCT 4025: Cumberland Red Gum Riverflat Forest	Moderate	Endangered (BC Act) Critically Endangered (EPBC Act)*	0.95
Zone 4	PCT 4025: Cumberland Red Gum Riverflat Forest	Low	Endangered (BC Act)	0.01
			Total	1.76

* Where the patch is greater than 0.5 hectares in size.

5.1.2 Removal of threatened fauna habitat

This assessment relates to impacts within the subject land (i.e. does not include certified land within the proposal footprint). Under Part 8 of the BC Act, an activity proposed to be carried out on biodiversity certified land is taken to be an activity that is not likely to significantly affect any threatened species. The EPBC Act strategic assessment approval for Transport Division 5.1 road activities does not apply to road projects being undertaken within the Western Sydney Growth Centres. In those locations, the requirements of the Western Sydney Growth Centres Strategic Assessment (2011) will continue to apply. As such, no further assessment under the EPBC Act is required in these areas, provided that the development occurs in accordance with the Growth Centre requirements. This does not apply to the subject land, which occurs outside of the NWGA and requires further assessment under the EPBC Act.Two fauna species credit species were recorded in the subject land during field surveys:

- *Meridolum corneovirens* (Cumberland Plain Land Snail)– listed as endangered under the BC Act
- *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act.

Three additional threatened fauna species were also recorded in the subject land, however, the subject land does not contain suitable breeding habitat for these species:

- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)– listed as vulnerable under the BC Act
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat) – listed as vulnerable under the BC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox) – listed as vulnerable under the BC Act and EPBC Act.

Following field surveys, an additional 19 fauna species, consisting of two mammal species and 17 bird species, were considered to have a moderate likelihood of occurring within the subject land based on the presence of potential habitat. Impacts to these species would be limited to foraging habitat and potential breeding habitat.

Other threatened species may also occur within the subject land, however, are highly mobile, not dependent on identified suitable habitat features within the subject land and/or have not recently been recorded within the subject land (Appendix C). As such these species are considered to be transient visitors to the study area and have not been considered further.

Direct impacts on threatened fauna habitat are identified in Table 5-3. For dual credit species, only the credit that is being impacted has been identified and key habitat features absent from the subject land have been noted.

Table 5-3 Summary of direct impacts on threatened fauna and habitat

Species name	BC Act	EPBC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)*
Anthochaera Phrygia (Regent Honeyeater	CE	CE	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No mapped important habitat within the subject land.	1.76
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Callocephalon fimbriatum (Gang-gang Cockatoo)	E	E	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). Breeding activity was not detected during targeted surveys.	1.76

Species name	BC Act	EPBC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)*
Calyptorhynchus lathami lathami (South-eastern Glossy Black-Cockatoo)	V	V	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No suitable hollow bearing trees within the subject land.	1.76
Chthonicola sagittata (Speckled Warbler)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Circus assimilis (Spotted Harrier)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Daphoenositta chrysoptera (Varied Sittella)	V	-	Ecosystem	Moderate	PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Falco subniger (Black Falcon)	V	-	Ecosystem	Moderate	PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Glossopsitta pusilla (Little Lorikeet)	V	-	Ecosystem	Moderate	PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Haliaeetus leucogaster (White-bellied Sea-Eagle)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No stick nests detected within the subject land.	1.76
Hieraaetus morphnoides (Little Eagle)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No stick nests detected within the subject land.	1.76
Lathamus discolor (Swift Parrot)	E	CE	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No mapped important habitat within the subject land.	1.76
Lophoictinia isura (Square-tailed Kite)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No stick nests detected within the subject land.	1.76

Species name	BC Act	EPBC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)*
Neophema pulchella (Turquoise Parrot)	V	-	Ecosystem	Moderate	PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Ninox strenua (Powerful Owl)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No suitable breeding hollows within the subject land.	1.76
Petroica phoenicea (Flame Robin)	V	-	Ecosystem	Moderate	PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Tyto novaehollandiae (Masked Owl)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). No suitable breeding hollows within the subject land.	1.76
Dasyurus maculatus (Spotted-tailed Quoll)	V	E	Ecosystem	Moderate	PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	V	-	Ecosystem	Recorded	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones). Removal of four HBTs containing potential roosting hollows.	1.76
Miniopterus australis (Little Bent-winged Bat)	V	-	Ecosystem	Moderate	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
Miniopterus orianae oceanensis (Large Bent-winged Bat))	V	-	Ecosystem	Recorded	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones).	1.76
*Myotis Macropus (*Southern Myotis	V	-	Species	Recorded	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones) within 200 metres of Bell's Creek.	1.33
Pteropus poliocephalus (Grey-headed Flying-fox)	V	V	Ecosystem	Recorded	Foraging habitat within PCT 3320 (all zones) and PCT 4025 (all zones).	1.76

Species name	BC Act	EPBC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)*
					No breeding camps present within the subject land.	
Meridolum corneovirens (Cumberland Plain Land Snail)	E	-	Species	Recorded	PCT 3320 (all zones) and PCT 4025 (all zones).	1.57
* Refers to areas within the subject land, i.e. areas that are not certified						

5.1.3 Removal of threatened flora

This assessment relates to impacts within the subject land (i.e. does not include certified land within the proposal footprint). Under Part 8 of the BC Act, an activity proposed to be carried out on biodiversity certified land is taken to be an activity that is not likely to significantly affect any threatened species. The EPBC Act strategic assessment approval for Transport Division 5.1 road activities does not apply to road projects being undertaken within the Western Sydney Growth Centres. In those locations, the requirements of the Western Sydney Growth Centres Strategic Assessment (2011) will continue to apply. As such, no further assessment under the EPBC Act is required in these areas, provided that the development occurs in accordance with the Growth Centre requirements. This does not apply to the subject land, which occurs outside of the NWGA and requires further assessment under the EPBC Act.

The proposal would result in the removal of 0.44 hectares of habitat for *Grevillea juniperina* subsp. *juniperina*. Direct impacts have been quantified in accordance with the BAM (i.e. as per the unit of measurement identified in the TBDC).

Potential habitat for an additional eight threatened flora species is present within the subject land. Targeted surveys for these species will be undertaken prior to the determination of the project:

Table 5-4 Threatened flora species to be surveyed prior to determination

Species name	Common name	BC Act	EPBC Act	Associated habitat in subject land	Potential habitat within the subject land (ha)
Deyeuxia appressa	*Deyeuxia appressa*	E	E	PCT 3320 (all zones), PCT 4025 (all zones)	1.76
Dillwynia tenuifolia		V	-	PCT 3320 (all zones)	0.80
Hibbertia sp. Bankstown		CE	CE	PCT 3320 (all zones)	0. 80
Hibbertia puberula		E	-	PCT 4025 (all zones)	0.95
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	E	V	PCT 3320 (all zones), PCT 4025 (all zones)	1.76
Pterostylis saxicola	Sydney Plains Greenhood	E	E	PCT 3320 (all zones)	0.80
Pultenaea parviflora		E	V	PCT 3320 (all zones)	0.80
Pultenaea pedunculata	Matted Bush-pea	E	-	PCT 3320 (all zones)	0.80

5.1.4 Aquatic impacts

This section addresses the potential impacts on aquatic ecology within the study boundary that could occur as a result of the disturbances during the construction phase of the proposal.

Fish passage

The proposal requires the construction of a new bridge along Richmond Road, adjacent to the existing bridge. The new bridge would act as the carriageway for traffic bound for Richmond and include a pedestrian walkway on the eastern edge. Construction of waterway crossings such as bridges can impact fish passage by creating barriers or by altering the natural flow patterns and changing the hydrology of the creek. Under current NSW legislation, consideration for fish passage needs to be incorporated into the design of all structures over waterways classified as KFH. For construction of permanent or temporary barriers in Class 2 waterways adequate fish passage needs to be provided for. In these circumstances waterway crossings are to be designed in accordance with Fairfull and Witheridge 2003 guidelines '*Why do fish need to cross the road? Fish passage requirements for waterway crossings*'.

The foundations of the existing bridge structure have altered the natural flow of the creek. The proposed design is similar to that existing so it is not anticipated that construction of the new bridge foundations would impact fish passage. The new bridge is likely to only have a minor impact on natural flow within the waterway. Other potential impacts to fish passage from the construction of temporary bunds or silt fences as sediment and erosion controls would be temporary during construction and would be removed following the completion of the works.

Following consultation with DPI Fisheries the need for a permit under section 219 of *Fisheries Management Act 1994* (FM Act) would be determined during detailed design.

Disturbance of riverbank and aquatic vegetation

On the western side of Richmond Road bridge, at the upstream end of site BC-2, the waterway was found to have dense in-stream aquatic vegetation. Construction of the new bridge foundations would require excavation causing direct disturbance to the riverbed, bank and associated aquatic vegetation. In stream excavation can impact aquatic habitats and increase turbidity via the mobilisation of sediments. Approximately 0.1 hectares of aquatic vegetation would be impacted by the proposed works. It must be noted, however, that no listed threatened species were identified during the survey. Rehabilitation of aquatic vegetation should be undertaken following the completion of construction to re-instate any aquatic habitat lost during construction.

Following consultation with DPI Fisheries the need for a permit under section 199 of the FM Act would be determined prior to the works commencing.

Erosion and sedimentation

Sediment mobilised by excavation during construction and from runoff or discharges during construction activities, have the potential to increase turbidity in downstream waters. Elevated turbidity can have detrimental effects on aquatic fauna and flora. Sediments can clog the gills and feeding apparatus of aquatic invertebrates and fish and can directly smother in-stream macrophytes. Excess turbidity can also potentially reduce light filtration, reducing photosynthesis in submerged macrophytes. Mobilisation of sediments may impact on habitats further downstream, altering the existing substratum and/or smothering aquatic habitats. The watercourses within the study area are likely to already be exposed to elevated turbidity and sedimentation from urban and semi-rural catchment flows and thus the biota present are likely to be tolerant to these conditions. Erosion and sediment controls in accordance with standard industry practice are recommended.

Water quality

Water quality has the potential to be impacted upon by increased sedimentation during construction of the bridge and open channel particularly where excavation is involved. There is also the potential for contaminants from construction equipment or other sources, to be mobilised and potentially enter the waterway via run-off, accidental releases or if bound to mobilised sediments. The solubility, bioavailability and persistence of contaminants are compound specific. Common compounds that could be mobilised during construction include those that may be present in the sediments (e.g. nutrients, heavy metals and acid sulfate soils (ASS) and/or those associated with the use of construction plant, equipment and vehicles (e.g. petroleum hydrocarbons). A separate Preliminary Site Investigation was undertaken to assess potential contamination within the Project Boundary (Stantec, 2024). Given the existing road and use of the area the biota present are likely to already have been exposed to some of these contaminants. Freshwater biota toxicity varies among species and among life stages within species. Algal blooms also have potential to affect water chemistry and clarity. Further contributions to contaminant concentrations and/ or the introduction of new contaminants via the proposed works have potential to affect freshwater biota through toxicity (from, for example, heavy metals) and/or induce algal blooms (from nutrients). Standard erosion and sedimentation controls implemented during construction should reduce the likelihood of contaminants entering the nearby waterways.

Key threatening processes

Two KTPs listed under the FM Act are relevant to the project including the alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands and degradation of native riparian vegetation.

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

The project involves the permanent construction of an instream structure that has the potential to alter the flow of water within the waterway. To ensure this KTP does not occur the design and installation of the instream structure should be in accordance with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI 2013) and *Why do fish need to cross the road?: fish passage requirements for waterway crossings* (Fairfull & Witheridge, 2003).

Degradation of native riparian vegetation

Removal of native riparian vegetation would be minimal and appropriate mitigation measures would be implemented to minimise any impacts. Potential impacts that may occur via this KTP are not considered significant on the locality scale and it is unlikely to significantly impact native riparian vegetation.

5.1.5 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.

5.1.6 Groundwater dependent ecosystems

Cumberland Shale Plains Woodland is mapped as a high potential GDE at the northern and southern extremities of the study area. An area of Cumberland Shale Plains Woodland within the central portion of the study area is mapped as a moderate potential GDE. Impacts to groundwater quality and quantity may result from:

- Erosion and sedimentation
- Sealing of land surface in recharge zones
- Changes in land drainage
- Excavation and shaping of the upper soil profile
- Removal of overlying vegetation, altering hydrological linkages.

However, the proposal is unlikely to require groundwater extraction or result in a significant impact on GDEs within the locality.

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 1.76 hectares of native vegetation within PCTs and 60 planted trees. This clearing would predominantly be restricted to vegetation located in close proximity to the existing alignment of the road corridor. Although the proposal will expose new areas of vegetation, by 'pushing back' current edge effected areas, these areas are already subject to edge effects and anthropogenic disturbances as a result of their proximity to the existing alignment. The proposal would not result in fragmentation of existing remnant patches or the creation of new edges. It is expected that edge effects, as a result of the proposal, would be minimal.

5.2.2 Wildlife connectivity and habitat fragmentation

Potential impacts to wildlife connectivity may occur where roads affect the movement of plants and animals between habitats. Wildlife connectivity across the study area is currently limited by the existing road corridor and industrial and urban development in the north and south, respectively, however the riparian corridor along Bells Creek would facilitate the movement of wildlife throughout the broader locality (see Section 3.7). The existing road corridor limits connectivity between the open spaces and remnant vegetation to the east and west of Richmond Road, particularly for larger and more mobile animals, such as *Macropus giganteus* (Eastern Grey Kangaroo), in the area. Eastern Grey Kangaroo were observed foraging within the open space to the west of the study area. Eastern Grey Kangaroo are largely nocturnal, so during the day they will rest amongst the shade of dense vegetation or other sheltered areas and become more active in the early evening. The proposal would involve the widening of the existing road corridor and would increase the existing gap between habitat patches within the study area, however the existing riparian corridor along Bells Creek would remain intact. As the existing road corridor presents a barrier to movement, the widening of the road is not considered to result in significant impacts to connectivity as no new barrier is being introduced. As such, it is not expected that the proposal would result in landscape scale impacts to connectivity.

5.2.3 Aquatic impacts

Fish passage

Once installed the bridge structure has the potential to impact fish passage and aquatic fauna by impacting light penetration and increase shading of the water which can be a deterrent for fish species that avoid darker shaded habitats during the day and can reduce vegetation growth which provides habitat for aquatic fauna. Other potential impacts are changes to flow velocities and increased water turbulence which may impact fish passage through the waterway.

The proposed bridge design is similar to the existing bridge and it is likely that aquatic fauna in the area have already migrated or adapted to the changed conditions. Therefore, it is not anticipated that the operation of the new bridge structure would impact fish passage.

Erosion and sedimentation

Road crossings and in stream structures have been linked to increased sedimentation and erosion. As there is an existing road it is unlikely that the operational impact of the proposal would result in increased sedimentation.

The new bridge structure has the potential to impact localised sediments from large scale turbulence at the bridge piers and changes to instream and bank vegetation that would be removed. These impacts are not anticipated to be significantly different from the current environment.

A new open channel is proposed to be constructed to the eastern side of Richmond Road. During flood conditions water would flow from this channel into Bells Creek, increasing flow velocities and risk of sedimentation. The proposed channel would operate similarly to the existing drainage and the impacts on flow velocity (and consequently erosion and sedimentation) of the new structure are considered minimal.

Water quality

Water quality has the potential to be impacted during operation of the road from contaminant-laden runoff particularly during significant rain events where water runoff increases. An increase to impervious surfaces is expected from widening of the road carriageway and construction of the open channel however impacts from run off are not anticipated to be significantly greater than current impacts from the existing road and bridge infrastructure.

5.2.4 Injury and mortality

Injury and mortality can occur during operation through vehicle strike. One case of suspected wildlife vehicle strike (*Dama dama* (Fallow Deer)) was recorded within the study area, in a vegetated patch adjacent to Richmond Road. Four BioNet records of macropod species, likely attributed to wildlife-vehicle collision, occur within the existing road alignment.

The proposed road upgrades may result in increased operational traffic which may increase the likelihood of vehicle strike. Species likely to be at risk of vehicle strike include more common species, such as *Macropus giganteus (*Eastern Grey Kangaroo)*,* which were observed foraging within the open space to the west of the study area.

5.2.5 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 Management Guidelines (Transport 2024).

High threat exotic species identified within the study area are provided in Table 5-5.

Table 5-5 High threat exotic species within the study area

Scientific name	Common name	Extent of infestation
Araujia sericifera	Moth Vine	Scattered infestations throughout the study area.
Asparagus asparagoides	Bridal Creeper	Scattered infestations throughout the study area.
Asparagus aethiopicus	Asparagus Fern	Scattered individuals throughout the study area.
Bidens pilosa	Cobbler's Peg	Scattered individuals throughout the study area.
Bryophyllum delagoense	Mother of Millions	Infestation around Plot 5.
Cestrum parqui	Green Cestrum	Scattered infestations, predominantly around Bells Creek.
Chloris gayana	Rhodes Grass	Dense infestations throughout exotic vegetation and areas of native vegetation with a high groundcover of exotic species.
Cyperus eragrostis	Tall Flatsedge	Few individuals.
Ehrharta erecta	Panic Veldtgrass	Scattered individuals throughout the study area.
Eragrostis curvula	African Lovegrass	Dense infestations throughout exotic vegetation and areas of native vegetation with a high groundcover of exotic species.
Erythrina crista-galli	Cockspur coral tree	Few individuals, predominantly concentrated along Bells Creek.
Hypericum perforatum	St Johns Wort	Few individuals.
Ligustrum sinense	Narrow-leaf Privet	Few individuals, predominantly concentrated along Bells Creek.
Lycium ferocissimum	African Boxthorn	Scattered individuals throughout the study area.
Megathyrsus maximus	Guinea Grass	Few individuals, predominantly around Plot 6.
Paspalum dilatatum	Paspalum	Scattered infestations throughout the study area.
Pinus radiata	-	Few individuals.
Senecio madagascariensis	Fireweed	Scattered individuals throughout the study area.
Vinca major	Periwinkle	Minor infestation around Plot 1.
Xanthium occidentale	Noogoora burr	Minor infestation around Plot 3.

5.2.6 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.

There is the potential for pests to spread beyond the proposal footprint as 'hitchhikers' on earthmoving equipment, machinery or materials being moved to site.

The risk of spread of pests can be avoided and minimised by implementing appropriate mitigation measures (Section 6).

5.2.7 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 cinnamomi* (Phytophthora), *Puccinia psidii* (Myrtle Rust) and *Batrachochytrium dendrobatidis* (Chytrid Fungus), to the surrounding environment. 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).

5.2.8 Changes to hydrology

Construction activities and soil disturbance may result in sedimentation and erosion within the subject land and surrounding areas. Appropriate mitigation measures to reduce the potential for sedimentation and erosion resulting from the proposal are included in Section 6.

5.2.9 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 surrounding 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.

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. Similarly, night works proposed for construction works may impact fauna in the immediate surrounds. These works would be temporary, and it is expected that most fauna in the area would be adapted to a high level of disturbance, given the existing nature of the site.

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.

5.3 Cumulative impacts

The proposal would result in the removal of 1.76 hectares of native vegetation and impacts to 1.76 hectares of known and potential habitat for threatened flora and fauna species outside of biocertified land (see section 5.1). Cumulative impacts can result from the successive, incremental and/or combined effects of a project when considered with other projects to which have a similar scale, location and timing of construction and operation. The proposed works have the potential to have cumulative environmental effects with other existing or likely future activities. Potential impacts on biodiversity would be minimised through the safeguards detailed in Section 6.

The proposal is located within the Blacktown LGA. Projects identified within the broader study locality that could create cumulative impacts with the proposal have been detailed in Table 5-6.

Table 5-6 Present and future project/proposals

Project/proposal	Biodiversity value impacted	Construction impacts	Operational impacts
Westlink M7 Motorway (Mod 6 Widening)	Removal of 7.48 hectares of native vegetation, including 0.84 hectares of River-Flat Eucalypt Forest TEC and 0.08 hectares of Cumberland Plain Woodland TEC. These impact areas relate to the entire length of the proposal, however	Potential impacts related to construction include removal of native vegetation, removal of threatened fauna species habitat and habitat features and injury and mortality of fauna. Potential indirect effects on invasion of weeds, pests and	Likely increase traffic in the locality. Invasion of weeds, pests and pathogens and increased noise and light.

Project/proposal	Biodiversity value impacted	Construction impacts	Operational impacts
	include impacts to areas of River-Flat Eucalypt Forest TEC and Cumberland Plain Woodland TEC within the Blacktown LGA.	pathogens and increased noise, light, dust and vibration.	
Richmond Road upgrade – Elara Boulevard to Heritage Road	Impacts to TECs and threatened species on certified land, including 0.83 hectares of BC Act listed Cumberland Plain Woodland and 500 specimens of Juniper-leaved Grevillea.	Potential impacts related to construction include removal of native vegetation, removal of threatened fauna species habitat and habitat features and injury and mortality of fauna. Potential indirect effects on invasion of weeds, pests and pathogens and increased noise, light, dust and vibration.	Likely increase traffic in the locality. Invasion of weeds, pests and pathogens and increased noise and light.
Townson and Burdekin Road Upgrades	Removal of up to 0.81 hectares of Cumberland Plain Woodland CEEC from within uncertified land, all of which is commensurate with the BC Act community listing and 0.47 hectares which meets the condition thresholds for the EPBC Act-listed form of the community. A total of 0.75 hectares of River-flat Eucalypt Forest EEC (as listed under the BC Act) would be removed from uncertified lands. Removal of 12 *Grevillea juniperina* subsp. *juniperina* within uncertified land and 889 individuals within certified land. Removal of habitat for Cumberland Plain Land Snail and Grey-headed Flying Fox. Removal of Southern Myotis maternity roost (as identified in this assessment).	Potential impacts related to construction include removal of native vegetation, removal of threatened fauna species habitat and habitat features and injury and mortality of fauna. Potential indirect effects on invasion of weeds, pests and pathogens and increased noise, light, dust and vibration.	Likely increase traffic in the locality. Invasion of weeds, pests and pathogens and increased noise and light.
Marsden Park Data Centre	Removal of native vegetation within certified lands.	Potential impacts related to construction 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.

Project/proposal	Biodiversity value impacted	Construction impacts	Operational impacts
		Potential indirect effects on invasion of weeds, pests and pathogens and increased noise, light, dust and vibration.	
Sydney Business Park	Removal of native vegetation within certified lands.	Potential impacts related to construction include removal of native vegetation, removal of threatened fauna species habitat and habitat features and injury and mortality of fauna. Potential indirect effects on invasion of weeds, pests and pathogens and increased noise, light, dust and vibration.	Likely increase traffic in the locality. Invasion of weeds, pests and pathogens and increased noise and light.

Extensive development is present within the locality and includes residential subdivisions, industrial developments and upgrades to transport infrastructure. Table 5-6 has identified a number of projects within the Blacktown LGA that are of similar scale and construction/operation timing to the proposal. The proposal footprint is situated within a legislatively unique geography whereby it is constrained by a number of areas that have been subject to the biocertification process including the NWGA and CPCP.

The CPCP provides strategically assessed growth areas identifying 'certified-urban capable land' and 'certified-major transport corridors', suitable for development, and 'avoided land', which should be retained. Cumulative biodiversity impacts through the identified certified lands are expected to be consistent with the objectives of the strategic assessment of the NWGA and CPCP. A number of projects including the Richmond Road upgrade – Elara Boulevard to Heritage Road, Marsden Park Data Centre and Sydney Business Park and portions of the Townson and Burdekin Road Upgrades occur within certified lands and biodiversity related impacts within these areas have been previously assessed and determined.

There are areas to which biodiversity impacts occur outside of certified areas within the Blacktown LGA including the Westlink M7 widening and areas on the Townson and Burdekin Road Upgrades. Collectively, including the proposal, the following total impacts to sensitive biodiversity in uncertified lands include:

- Loss of 1.74 hectares of TEC Cumberland Plain Woodland.
- Loss of 2.55 hectares of TEC Riverflat Eucalypt Forest.
- Loss of 29 Juniper-leaved Grevillea (*Grevillea juniperina* subsp*. juniperina*).
- Disturbance to Southern Myotis (*Myotis macropus*) maternity roost on Townson Road.

To unlock the potential of the NWGA, upgrades to transport infrastructure must align with current and forecasted needs, while considering forecasted population and economic growth. The proposal has considered these cumulative biodiversity impacts through its design by minimising the project footprint as far as practicable and prioritising areas of prior disturbance for development. Projects identified outside of certified lands have been subject to biodiversity offsetting under the Transport for NSW offset guidelines or in accordance with the NSW Biodiversity Offsets Scheme. The proposals unavoidable impacts would be offset through the Transport for NSW offset guidelines.

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 been assigned a moderate to high likelihood of occurrence and is likely to be impacted by the proposal.

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 (nsw.gov.au)

- Matters of national environmental significance listed under the EPBC Act: Significant Impact Guidelines 1.1 - Matters of National Environmental Significance - DCCEEW
- Referral guidelines for species listed under the EPBC Act: EPBC Act policy statements - DCCEEW.

All completed assessments are provided in Appendix D (BC Act) and Appendix E (EPBC Act). The results of the significance assessments are summarised in Table 5-7 (BC Act 5-part test) and

Table 5-8 (EPBC Act assessment). No species listed under the FM Act were considered to have a moderate or higher likelihood of occurrence.

As a result of a 'strategic assessment' approval granted by the Federal Minister in accordance with the EPBC Act, in September 2015, Transport road proposals assessed via an REF do not require referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for these matters, even if the activity is likely to have a significant impact.

Within the Western Sydney Growth Centres, the requirements of the Western Sydney Growth Centres Strategic Assessment (2011) applies and no further assessment under the EPBC Act is required in these areas, provided that the development occurs in accordance with the Growth Centre requirements.

Potential habitat for an additional eight threatened flora species (see Table 5-4) is present within the subject land. Targeted surveys for these species will be undertaken prior to the determination of the project and assessments of significance for these species will be updated following surveys.

Table 5-7 Summary of BC Act significance assessments findings

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018))*						
Threatened species, or communities	a	b	c	d	e	Likely significant impact?
Communities						
Cumberland Plain Woodland in the Sydney Basin Bioregion	X	N	N	N	N	No
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	X	N	N	N	N	No
Flora						
Grevillea juniperina subsp. *juniperina*	N	X	N	N	N	No
Deyeuxia appressa	?	?	?	?	?	Impacts to be confirmed following completion of targeted surveys for the species
Dillwynia tenuifolia	?	?	?	?	?	Impacts to be confirmed following completion of targeted surveys for the species
Hibbertia sp. Bankstown	?	?	?	?	?	Impacts to be confirmed following completion of targeted surveys for the species
Hibbertia puberula	?	?	?	?	?	Impacts to be confirmed following completion of targeted surveys for the species
Pomaderris brunnea	?	?	?	?	?	Impacts to be confirmed following completion of

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018))*						
Threatened species, or communities	a	b	c	d	e	Likely significant impact?
						targeted surveys for the species
Pterostylis saxicola	?	?	?	?	?	Impacts to be confirmed following completion of targeted surveys for the species
Pultenaea parviflora	?	?	?	?	?	Impacts to be confirmed following completion of targeted surveys for the species
Pultenaea pedunculata	?	?	?	?	?	Impacts to be confirmed following completion of targeted surveys for the species
Fauna						
Anthochaera Phrygia (Regent Honeyeater	N	X	N	N	N	No
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	N	X	N	N	N	No
Callocephalon fimbriatum (Gang-gang Cockatoo)	N	X	N	N	N	No
Calyptorhynchus lathami lathami (South-eastern Glossy Black-Cockatoo)	N	X	N	N	N	No
Chthonicola sagittata (Speckled Warbler)	N	X	N	N	N	No
Circus assimilis (Spotted Harrier)	N	X	N	N	N	No
Daphoenositta chrysoptera (Varied Sittella)	N	X	N	N	N	No
Falco subniger (Black Falcon)	N	X	N	N	N	No
Glossopsitta pusilla (Little Lorikeet)	N	X	N	N	N	No
Haliaeetus leucogaster (White-bellied Sea-Eagle)	N	X	N	N	N	No
Hieraaetus morphnoides (Little Eagle)	N	X	N	N	N	No
Lathamus discolor (Swift Parrot)	N	X	N	N	N	No
Lophoictinia isura (Square-tailed Kite)	N	X	N	N	N	No
Neophema pulchella (Turquoise Parrot)	N	X	N	N	N	No
Ninox strenua (Powerful Owl)	N	X	N	N	N	No
Petroica phoenicea (Flame Robin)	N	X	N	N	N	No
Tyto novaehollandiae (Masked Owl)	N	X	N	N	N	No
Dasyurus maculatus (Spotted-tailed Quoll)	N	X	N	N	N	No

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018))*						
Threatened species, or communities	a	b	c	d	e	Likely significant impact?
Micronomus norfolkensis (Eastern Coastal Free-tailed Bat)	N	X	N	N	N	No
Miniopterus australis (Little Bent-winged Bat)	N	X	N	N	N	No
Miniopterus orianae oceanensis (Large Bent-winged Bat))	N	X	N	N	N	No
*Myotis Macropus (*Southern Myotis)	N	X	N	N	N	No
Pteropus poliocephalus (Grey-headed Flying-fox)	N	X	N	N	N	No
Meridolum corneovirens (Cumberland Plain Land Snail)	N	X	N	N	N	No
***Y** = Yes (negative impact), **N** = No (no or positive impact), **X** = Yes/No answer not applicable, **?** = unknown impact.*						

Table 5-8 Summary of EPBC Act significance assessments findings

Threatened species, or communities	Important population *(per Significant Impact Guidelines 1.1 (DoE 2013))*	Likely significant impact?
Communities		
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	No	No
River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria	No	No
Flora		
Deyeuxia appressa	Impacts to be confirmed following completion of targeted surveys for the species	
Hibbertia sp. *Bankstown*	Impacts to be confirmed following completion of targeted surveys for the species	
Pomaderris brunnea	Impacts to be confirmed following completion of targeted surveys for the species	
Pterostylis saxicola	Impacts to be confirmed following completion of targeted surveys for the species	
Pultenaea parviflora	Impacts to be confirmed following completion of targeted surveys for the species	
Fauna		
Anthochaera Phrygia (Regent Honeyeater	No	No
Callocephalon fimbriatum (Gang-gang Cockatoo)	No	No
Calyptorhynchus lathami lathami (South-eastern Glossy Black-Cockatoo)	No	No

Threatened species, or communities	Important population *(per Significant Impact Guidelines 1.1 (DoE 2013))*	Likely significant impact?
Lathamus discolor (Swift Parrot)	No	No
Dasyurus maculatus (Spotted-tailed Quoll)	No	No
Pteropus poliocephalus (Grey-headed Flying-fox)	No	No
***Y** = Yes (negative impact), **N** = No (no or positive impact)*		

6. Mitigation

Table 6-1 details measures to avoid, minimise or mitigate proposal impacts. Where applicable, these should be included in any Construction Environmental Management Plan (CEMP) or any associated sub-plans prior to construction.

Table 6-1 Mitigation measures

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B01	General	A Flora and Fauna Management Plan (FFMP) would be prepared in accordance with Transport for NSW's Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects (TfNSW, 2024) and implemented as part of the CEMP. The FFMP would include, but not be limited to: • plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas • requirements set out in the Landscape Guideline (RMS, 2008) • pre-clearing survey requirements, including specific pre-clearance measures for Cumberland Plain Land Snail and Southern Myotis (i.e. roost searches of culverts and bridges prior to any impacts) • procedures for the management of resident Kangaroo populations during construction • procedures for unexpected threatened species finds and fauna handling • procedures addressing relevant matters specified in the DPI Policy and guidelines for fish habitat conservation and management (2013) • protocols to manage weeds and pathogens	Detailed design/ Prior to construction	Effective	None	Contractor
B02	Removal of native vegetation	Native vegetation removal would be minimised through detailed design and during construction.	Detailed design	Effective	1.76 hectares of native vegetation and 60 planted native trees, including 1.76 hectares of vegetation commensurate with TECs listed under the BC Act, of which 1.07 hectares of vegetation is commensurate with TECs listed under the EPBC Act. Residual impacts would be offset under the	Transport
B03		Pre-clearing surveys would be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	Prior to construction	Effective		Contractor
B04		Vegetation removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Effective		Contractor
B05		Native vegetation would be re-established in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	Post construction	Effective		Contractor
B06		The unexpected species find procedure is to be followed under *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport*	During construction	Proven		Contractor

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
		for NSW projects (Transport 2024) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.			Biodiversity Offset Strategy and Tree and Hollow Replacement Plan.	
B07		A Biodiversity Offset Strategy would be developed, in accordance with the guidelines, to detail obligations under the *Biodiversity Policy* (Transport 2022).	Prior to construction	Effective		Transport
B08		A Tree and Hollow Replacement Plan would be developed, in accordance with the guidelines, to detail obligations under the *Biodiversity Policy* (Transport 2022).	Prior to construction	Effective		Transport
B09	Removal of threatened fauna habitat	Threatened fauna habitat removal would be minimised through detailed design and during construction.	Detailed design	Effective	Removal of 1.76 hectares of habitat for threatened fauna (Table 5-3), including foraging habitat and removal of habitat features that cannot be avoided (includes 4 HBT). Any habitat features would be relocated or replaced within the study area. Residual impacts would be offset under the Biodiversity Offset Strategy and Tree and Hollow Replacement Plan.	Transport
B10		Fauna would be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024). Specific pre-clearance measures for Cumberland Plain Land Snail have been included in Appendix G. Pre-clearance surveys for Cumberland Plain Land Snail would be undertaken in all areas of PCT 3320 and PCT 4025 (Figure 3-1) prior to any vegetation clearing. Any individuals located during the pre-clearance surveys will be relocated directly into suitable vegetation outside of the proposal footprint.	During construction	Effective		Contractor
B11		Habitat removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Effective		Contractor
B12		Habitat would be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bushrock* and *Guide 8: Artificial hollows* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Proven		Contractor
B13		The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		Contractor

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B14		Pre-clearing surveys would be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW* (Transport 2024).	During construction	Proven		Contractor
B15	Removal of threatened flora	Threatened flora removal would be minimised through detailed design and during construction.	Detailed design	Effective	Removal of 1.76 hectares of (known and potential) threatened flora habitat, including 17 individuals of *Grevillea juniperina* subsp. *juniperina*. Residual impacts to be offset as per BAM-C.	Transport
B16		Prior to the determination of the project, targeted flora surveys are to be completed for all identified candidate species that have not yet been surveyed. Assessments of significance and calculations of offsetting obligations would be completed for any additional threatened species detected on site.	Detailed design	Effective		Ecologist
B17		Pre-clearing surveys would be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Proven		Contractor
B18		The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven		Contractor
B19	Aquatic impacts	Impacts to aquatic habitat would be minimised through detailed design and during construction. Any instream/flow structures (e.g. the proposed bridge structure) would be designed and installed in accordance with the *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI 2013), *Why do fish need to cross the road?: fish passage requirements for waterway crossings* (Fairfull & Witheridge, 2003).	Detailed design	Effective	None	Transport
B20		An Erosion and Sediment Control Plan (ESCP) specific to the proposal would be developed and implemented during the works. The ESCP would be developed in accordance with *The Blue Book – Managing Urban Stormwater: Soils and Construction* (Landcom 2004).	During construction	Effective	None	Contractor
B21		Aquatic habitat would be protected in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024) and Section 3.3.2 *Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013* (DPI (Fisheries NSW) 2013).	During construction	Effective	None	Contractor

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B22		A spill management plan would be developed as part of the CEMP and communicated to workers on site. Appropriate aquatic spill kits are to be maintained on site. These spills kits must be specific for working within a freshwater environment.	During construction	Effective	None	Contractor
B23		Following construction affected aquatic habitat would be rehabilitated and removed aquatic habitat re-instated in accordance with *Guide 10: Aquatic habitats and riparian zones* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	Post construction	Effective	None	Contractor
B24	Groundwater dependent ecosystems	Interruptions to water flows associated with groundwater dependent ecosystems would be minimised through detailed design and during construction.	Detailed design	Effective	None	Transport
B25	Changes to hydrology	Changes to existing surface water flows would be minimised through detailed design.	Detailed design	Effective	None	Transport
B26	Edge effects on adjacent native vegetation and habitat	Exclusion zones would be set up at the limit of clearing in accordance *with Guide 2: Exclusion zones* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Effective	None	Contractor
B27	Injury and mortality of fauna	Fauna would be managed in accordance with *Guide 9: Fauna* handling of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Effective	None	Contractor
B28	Invasion and spread of weeds	Weed species would be managed in accordance *with Guide 6: Weed management* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Effective	None	Contractor
B29	Invasion and spread of pests	Pest species would be managed within the proposal site.	During construction	Effective	None	Contractor
B30	Invasion and spread of pathogens and disease	Pathogens would be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Management Guidelines: Protecting and managing biodiversity on Transport for NSW projects* (Transport 2024).	During construction	Effective	None	Contractor

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B31	Noise, light, dust and vibration	Shading and artificial light impacts would be minimised through detailed design.	Detailed design	Effective	None	Contractor

7. Offsets and other measures

The following section considers requirements for the provision of biodiversity offsets, conservation measures and tree and hollow replacement in accordance with:

- *No Net Loss Guidelines* and supporting resources (Transport 2023a).
- *Tree and Hollow Replacement Guidelines* and supporting resources (Transport 2023b).

7.1 Thresholds

Native vegetation clearing and impacts to threatened species within certified areas of the NWGA under the *State Environmental Planning Policy (Precincts—Central River City) 2021* and certified areas under the CPCP have been offset under the relevant Biodiversity Certification processes.

Offsets are required for clearing of vegetation mapped as Existing Native vegetation (ENV) within non-certified lands. According to the Growth Centres Biodiversity Certification Order, clearing of ENV in non-certified areas must be offset by:

- Protecting an equal or greater area of existing native vegetation elsewhere in the Growth Centres and/or
- Revegetating and/or restoring land elsewhere in the Growth Centres, subject to satisfying the relevant biodiversity measures of the Biodiversity Certification. This includes revegetation or restoration of a ratio of at least 3:1.

Patches of ENV occur within the northern section of the subject land, around Townson Road and the Bells Creek Bridge, however the proposal does not involve the removal of vegetation within non-certified lands of the NWGA. As such, additional offsets are not required under the Biodiversity Certification Order.

Table 7-1 outlines the offset thresholds set out by *No Net Loss Guidelines* (Transport 2023a). Residual impacts that do not exceed offset thresholds must then consider the requirements of the *Tree and Hollow Replacement Guidelines* (Transport 2023b).

Table 7-2 identifies the direct impacts of the proposal that require offsetting under the *No Net Loss Guidelines* (Transport 2023a), in addition to residual impacts that are subject to tree and hollow replacement.

Table 7-1 Offset thresholds (*No Net Loss Guidelines*, Transport 2023a)

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 a EEC ≥ 2 hectares in 'moderate to good' condition.
Works involving clearing of VEC.	Where clearing of VEC ≥ 5 hectares in 'moderate to good' condition.
Works involving clearing of threatened fauna habitat that is also a TEC.	Offsetting is covered by the above TEC thresholds.
Works involving clearing of any habitat (that is not a TEC) for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type).	Where clearing ≥ 1 hectare in 'moderate to good' condition.
Works involving removal of known threatened flora species and their habitat.	Where loss of individuals is ≥ 10 (species that have a count of individuals as the unit of measure) or where clearing of habitat (calculated by a species polygon in accordance with the BAM) is ≥ 1 hectare.
Type 1 or Type 2 key fish habitats.	Where there is a net loss of habitat.

Impact	Threshold
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 ≥5 centimetres DBH.

'Moderate to good' condition vegetation is defined in Section 2.3.2.

Table 7-2 Assessment of vegetation impacts against thresholds

Veg. zone	Plant community type (PCT)	Condition	TEC	Impact area (ha)^	Threshold triggered?
Zone 1	PCT 3320: Cumberland Shale Plains Woodland	Moderate	Critically Endangered (BC Act)	0.49	Yes. Clearing of CEEC in 'moderate to good' condition (VI score of 23.3).
Zone 2	PCT 3320: Cumberland Shale Plains Woodland	Moderate-Good	Critically Endangered (BC Act) Critically Endangered (EPBC Act) *	0.31	Yes. Clearing of CEEC in 'moderate to good' condition (VI score of 41.8).
Zone 3	PCT 4025: Cumberland Red Gum Riverflat Forest	Moderate	Endangered (BC Act) Critically Endangered (EPBC Act)*	0.95	Yes. Clearing of CEEC in 'moderate to good' condition (VI score of 61.1).
Zone 4	PCT 4025: Cumberland Red Gum Riverflat Forest	Low	Endangered (BC Act)	0.01	No. Clearing of EEC in 'moderate to good' condition <2 hectares (VI score of 44).

^ Refers to the subject land.

* Where the patch is greater than 0.5 hectares in size.

7.2 Preliminary offset and tree/hollow replacement calculations

7.2.1 Preliminary offset calculations

This section provides a preliminary calculation of offsets for each impact triggering a threshold identified in Section 7.1. Offsets for terrestrial impacts (i.e. threatened species and ecological communities listed under the BC Act and EPBC Act) have been preliminarily calculated as credits using the BAM-C. A copy of the relevant BAM-C credit reports has been included in Appendix F. For threatened species that have not yet been surveyed, surveys will be completed prior to the determination of the project, including confirmation of any additional offset obligations for the project.

Preliminary tree and hollow replacement estimates for areas that do not require offsetting have been included in section 7.2.2.

Table 7-3 Preliminary ecosystem credit calculations for impacts to threatened ecological communities

Plant community type	EPBC Act	BC Act	VI score	BRW	HBT	Impact (ha)	Ecosystem credits
PCT 3320: Cumberland Shale Plains Woodland (Zone 1, Moderate)	-	Cumberland Plain Woodland in the Sydney	23.3	2.5	No	049	7

Plant community type	EPBC Act	BC Act	VI score	BRW	HBT	Impact (ha)	Ecosystem credits
		Basin Bioregion					
PCT 3320: Cumberland Shale Plains Woodland (Zone 2, Moderate – Good)	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Cumberland Plain Woodland in the Sydney Basin Bioregion	41.8	2.5	No	0.31	8
PCT 4025: Cumberland Red Gum Riverflat Forest (Zone 3, Moderate)	River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	61.1	2.5	Yes	0.95	36
Total ecosystem credits							51

Table 7-4 Preliminary credit calculations for impacts to species-credit species

Species name	EPBC Act	BC Act	Impact (ha/ count)	Threshold triggered?
Grevillea juniperina subsp. *juniperina*	-	V	0.44	No. Clearing of habitat <1ha.
Myotis macropus (Southern Myotis)	-	V	0.01*	No. Clearing of habitat <1ha.
Meridolum corneovirens (Cumberland Plain Land Snail)	-	E	0.01*	No. Clearing of habitat <1ha.

Impact area based on species polygons/ species count as per the BAM.
** Habitat that has not been offset by TEC thresholds as per*

Table 7-2 *and* Table 7-3

7.2.2 Preliminary tree and hollow replacement estimates

The requirement to replace trees and hollows removed has been assessed against the requirements of the *Tree and Hollow Replacement Guidelines* (Transport 2023b). This includes all vegetation clearing that does not trigger an offset threshold and is not covered by the exclusions in Section 1.4 of the guidelines.

Tree and hollow replacement requirements have been estimated using the BAM plot data where tree stem sizes were counted in each plot. An average of the plot data has been taken to provide a representative estimate of the number of trees in each stem size class, and the number of hollows, in each vegetation zone that is subject to tree and hollow replacement (Table 7-5). Taking an average of the plot data can provide a representative estimate of the number of trees in each stem size class, and the number of hollows, in each vegetation zone that are subject to tree and hollow replacement (as per Table 7-2). Tree and hollow replacement requirements for native planted vegetation have been calculated from counts of planted native trees within the study area.

Table 7-6 provides an estimate of the preliminary tree and hollow replacement requirements for all tree removal that does not require offsetting.

Table 7-5 Average counts of trees and hollows and estimates per hectare (Note: only required for vegetation zones that do not trigger offset thresholds)

Veg. zone	Impact (ha)	Plots	Average number of trees in stem size classes (cm) and hollows per ha[1]					Average count of tree and hollows in impact area[2]				
			5-19	20-49	50-99	>100	Hollows	5-19	20-49	50-99	>100	Hollows
Zone 4	0.01	Plot 1	40	30	10	0	0	0.4	0.3	0.1	0	0

NOTE 1: Calculated by the average from the plot data (assuming standard 0.1 hectare plot) multiplied by a factor of 10

NOTE 2: Calculated by the average/ha multiplied by the impact

Table 7-6 Preliminary estimates of trees and hollow replacement requirements (Note: only required for vegetation zones that do not trigger offset thresholds)

Category	Estimated No. impacted		Replacement requirement per tree/hollow removed[1]		Estimates number to be replaced[2]		Estimated equivalent payment to Transport conservation fund[2]
	Native trees	Amenity trees	Planting required	Contribution required	Native trees	Amenity trees	
Very large tree (DBH ≥100 cm)	0	0	Plant minimum 16 trees	$2,500	0	0	$0
Large tree (DBH ≥50 cm to <100 cm)	0	0	Plant minimum 8 trees	$1,000	0	0	$0
Medium tree (DBH ≥20 cm to <50 cm)	20	0	Plant minimum 4 trees	$500	84	0	$10,000
Small tree (DBH ≥ 5 cm to <20 cm)	40	0	Plant minimum 2 trees	$125	80	0	$5,000
Hollow	0		Provide 3 artificial hollows for every occupied hollow removed.*	$500	0		$0
Totals					164		$15,000

**As per the Transport Tree and Hollow Replacement Guidelines (Transport 2023b). An equivalent payment to the Transport Conservation Fund can be used where replanting is not feasible or fully achievable within the project boundary or adjacent land.*

7.3 Biodiversity offset strategy/tree and hollow replacement plan

There are three main options available to meet the biodiversity offset obligations of the proposal that have triggered the thresholds of guidelines. 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.

As biodiversity offsetting thresholds have been reached under the No Net Loss Guideline (Transport 2023a), an environmental safeguard has been included to prepare a Biodiversity Offset Strategy. An environmental safeguard has also been included to prepare a Tree and Hollow Replacement Plan.

8. Conclusion

This BAR was undertaken to assess potential biodiversity impacts of the proposal, which would include the removal of up to 1.76 hectares of native vegetation outside of certified lands. Native vegetation within the subject land is consistent with two PCTs, both listed as TECs under the BC Act and/or EPBC Act:

- PCT 3320: Cumberland Shale Plains Woodland (listed as Critically Endangered under the BC Act and EPBC Act)
- PCT 4025: Cumberland Red Gum Riverflat Forest (listed as Endangered under the BC Act and Critically Endangered under the EPBC Act).

Other vegetation present in the study area, which could not be reasonably assigned to a PCT, included planted native trees, landscaped natives, mixed native exotic instream vegetation and exotic vegetation.

Six threatened species were recorded in the study area during field surveys:

- *Grevillea juniperina subsp. juniperina* – listed as vulnerable under the BC Act
- *Meridolum corneovirens* (Cumberland Plain Land Snail)– listed as endangered under the BC Act
- *Micronomus norfolkensis* (Eastern Coastal Free-tailed Bat)– listed as vulnerable under the BC Act
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)– listed as vulnerable under the BC Act
- *Myotis macropus* (Southern Myotis) – listed as vulnerable under the BC Act
- *Pteropus poliocephalus* (Grey-headed Flying-fox) – listed as vulnerable under the BC Act and EPBC Act.

An additional eight threatened flora species identified as candidate species could not be surveyed in accordance with seasonal requirements and will be surveyed prior to determination of the project.

Following field surveys, a total of 26 threatened species were considered to have a moderate or higher likelihood of occurring within the study area. Assessments of significance have been completed for listed entities considered likely to occur within the study area. No threatened species listed under the BC Act and EPBC Act were considered to have the potential to be significantly impacted by the proposal.

The proposal has the potential to impact on fish passage and aquatic habitat from the installation of a new waterway crossing. Alterations within the waterway have already been impacted from the existing bridge structure and further disturbance from the new crossing is unlikely to have a significant impact greater than currently exists as long as the design and implementation are undertaken in accordance with Fairfull and Witheridge 2003 guidelines '*Why do fish need to cross the road? Fish passage requirements for waterway crossings*'.

Key impacts to biodiversity, as a result of the proposal, relate to the removal of native vegetation and habitat for threatened fauna and the temporary and/or permanent obstruction of a waterway, as well as indirect impacts such as invasion and spread of weeds. 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.

As the Biodiversity Offset Scheme has not been triggered, 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. Direct impacts to native vegetation in zones 1, 2 and 3, as a result of the proposal, exceed the offset thresholds and preliminary offsetting estimates indicate 51 ecosystem credits would be required to offset the proposal impacts on these vegetation zones. The remaining vegetation zone and planted native vegetation do not trigger the offset thresholds and have been considered against the requirements of the *Tree and Hollow Replacement Guidelines* (Transport 2023b). Preliminary estimates of tree and hollow replacement indicate that approximately 164 trees would be required to meet the obligations of the guidelines. Three species credit species have been recorded within the subject land, however, do not require offsetting as per the *No Net Loss Guidelines* (Transport 2023a) thresholds. A Biodiversity Offset Strategy and Tree and Hollow Replacement Plan have been included as environmental safeguards.

9. Glossary

Term	Definition
Accredited person or assessor	A 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 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).
Biodiversity credit report	The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020a).
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 Offsets and Agreement Management System	The online system used to administer the Biodiversity Offsets Scheme. The BOAMS is used by accredited assessors (to carry out specific BAM-related tasks involving access to the BAM-C to perform assessments, submit data, generate credits and calculate a credit price), by landholders (to apply for a Biodiversity Stewardship Agreement and manage ongoing reporting obligations for their agreement) and by proponents of developments (to view their credit obligation or the payment required to the Biodiversity Conservation Fund).
Biodiversity risk weighting	A factor of the formulas used by the BAM to calculate credits. The biodiversity risk weighting (BRW) is a score given to each vegetation zone and species based on the 'sensitivity to loss' versus the 'sensitivity to gain'. The value is set for threatened species and listed in the TBDC. The BRW for vegetation is calculated for each vegetation zone by the BAM-C using a factor of the 'sensitivity to loss' of the PCT or TEC (located in the BioNet vegetation classification) and the 'sensitivity to gain' of the ecosystem credit species (in the TBDC) that are predicted to occur.
Biodiversity Stewardship site	Refers to land which is the subject to a Biodiversity Stewardship Agreement under the BC Act.
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. Refer About BioNet Vegetation Classification | NSW Environment and Heritage (DPE 2020a).
Construction footprint	The area to be directly impacted by the proposal during construction activities. See also definition for subject land.

Term	Definition
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'.
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).
Landscape assessment area	The area which includes the subject land and a 1500 metre buffer surrounding the outside edge of the boundary of the subject land or 500 metres along each side of the centre line of a linear-shaped proposal.
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: • *The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.* • *The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.* • *The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year (OEH 2018).*
Matter of national environmental significance	A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth).
Mitigation	Action to reduce the severity of an impact.
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary, a) trees (including any sapling or shrub or any scrub) b) understory plants

Term	Definition
	c) groundcover (being any type of herbaceous vegetation) d) plants occurring in a wetland. A plant is native to NSW if it was established in NSW before European settlement (BC Act). Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a).
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Patch size	An area of native vegetation that: • *occurs on the development site or biodiversity stewardship site* • *includes native vegetation that has a gap of less than 100 metres from the next area of native vegetation (or ≤30 metres for non-woody ecosystems).* Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).
PlantNET	An online database of the flora of NSW which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Spatial datasets	Spatial databases required to prepare a BAR • *BioNet NSW (Mitchell) Landscapes – Version 3.1* • *NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7* • *NSW soil profiles* • *hydrogeological landscapes* • *acid sulfate soils risk* • *digital cadastral database* • *Vegetation Information Systems maps* • *Geological sites of NSW.*
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of 'candidate species'.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a).
Species polygon	An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a).
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.
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 (i.e. the area of land in the 1500 metre buffer zone around the subject land or 500 metre buffer zone for linear proposals). In the case of a biodiversity certification proposal, subject

Term	Definition
	land includes the biodiversity certification assessment area (DPIE 2020a). See also definition for construction footprint. For the purposes of this assessment, the subject land excludes certified areas within the proposal footprint.
Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a). Part of the BioNet database, published by the EHG and accessible from the BioNet website at www.bionet.nsw.gov.au.
Vegetation integrity (score)	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a).
Vegetation zone	A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a).

10. Abbreviations

Term	Definition
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method calculator
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offset Scheme
BRW	Biodiversity risk weighting
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CPW	Cumberland Plain Woodland
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DIWA	Directory of Important Wetlands in Australia
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EHG	NSW Environment and Heritage Group within the Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	*Environment Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Fisheries NSW Policy and guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
LGA	Local government area
MNES	Matters of national environmental significance
NWGA	North West Growth Area
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SGTF	Shale Gravel Transition Forest
SSD	State Significant Development
SSI	State Significant Infrastructure

Term	Definition
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)
Transport	Transport for NSW
TSSC	Threatened Species Scientific Committee
VEC	Vulnerable Ecological Community

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Appendix A: Species recorded

Recorded flora

Family	Scientific name	Common name	Form	Endemicity	Status			Cover (%) in each plot*								Incidental observation
					Weed	BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	
Acanthaceae	*Brunoniella australis*	Blue Trumpet	fg	N	-	-	-				0.1		0.1	0.1	5	
Amaranthaceae	*Amaranthus viridis*	Green Amaranth	-	E	-	-	-			0.1						
Apiaceae	*Centella asiatica*	Indian Pennywort	fg	N	-	-	-		0.1	0.1	0.1					
Apiaceae	*Cyclospermum leptophyllum*	Slender Celery	-	E	-	-	-			0.1						
Apocynaceae	*Araujia sericifera*	Moth Vine	-	E	HTW	-	-					0.1	0.2		0.1	
Apocynaceae	*Vinca major*	Periwinkle	-	E	HTW	-	-	1								
Arecaceae	*Syagrus romanzoffiana*	Cocos Palm	-	E	-	-	-			0.2		0.1				
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	-	E	HTW	-	-						0.2			
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper	-	E	PW, HTW, WoNS	-	-	0.1	0.2		0.1	0.1	5		0.5	
Asparagaceae	*Yucca sp.*	Yucca (cultivar)	-	E	-	-	-	0.5								
Asphodelaceae	*Tricoryne elatior*	Yellow Autumn-lily	fg	N	-	-	-						0.1			
Asteraceae	*Aster subulatus*	Wild Aster	-	E	-	-	-						0.1			
Asteraceae	*Bidens pilosa*	Cobbler's Peg	-	E	HTW	-	-							0.1	0.1	
Asteraceae	*Calotis cuneifolia*	Purple Burr-daisy,	fg	N	-	-	-								0.5	

Family	Scientific name	Common name	Form	Endemicity	Status			Cover (%) in each plot*								Incidental observation
					Weed	BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	
Asteraceae	*Conyza bonariensis*	Flax-leaf Fleabane	-	E	-	-	-							0.1		
Asteraceae	*Galinsoga parviflora*	Potato Weed	-	E	-	-	-			0.1						
Asteraceae	*Hypochaeris radicata*	Catsear	-	E	-	-	-				0.1		0.1			
Asteraceae	*Onopordum acanthium* subsp. *acanthium*	Scotch Thistle	-	E	-	-	-		0.1			0.1	0.1	0.5		
Asteraceae	*Senecio madagascariensis*	Fireweed	-	E	PW, HTW, WoNS	-	-	0.5	0.1	0.1	0.1	0.2	0.1		0.1	
Asteraceae	*Tagetes minuta*	Stinking Roger	-	E	-	-	-								0.1	
Asteraceae	*Xanthium occidentale*	Noogoora burr	-	E	HTW	-	-			5						
Brassicaceae	*Brassica sp.*	-	-	E	-	-	-							0.1		
Brassicaceae	*Capsella bursa-pastoris*	Shepherds purse	-	E	-	-	-									X
Brassicaceae	*Cardamine hirsuta*	Common Bittercress	-	E	-	-	-									X
Campanulaceae	*Lobelia purpurascens*	Whiteroot	fg	N	-	-	-	0.2	0.1	0.1	0.1		0.2		0.1	
Casuarinaceae	*Casuarina glauca*	Swamp Oak	tg	N	-	-	-	35			15					
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	fg	N	-	-	-					0.1				
Clusiaceae	*Hypericum perforatum*	St Johns Wort	-	E	HTW	-	-		0.1							
Commelinaceae	*Commelina cyanea*	-	fg	N	-	-	-			0.1	0.1	0.1	0.1	0.2	0.2	
Convolvulaceae	*Dichondra repens*	Kidney Weed	fg	N	-	-	-	1	0.2	0.1		0.1	0.5	0.5	30	
Crassulaceae	*Bryophyllum delagoense*	Mother of Millions	-	E	HTW	-	-					3				

Family	Scientific name	Common name	Form	Endemicity	Status			Cover (%) in each plot*								Incidental observation
					Weed	BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	
Cyperaceae	*Carex inversa*	Knob Sedge	gg	N	-	-	-	0.1	0.1							
Cyperaceae	*Cyperus eragrostis*	Tall Flatsedge	-	E	HTW	-	-				0.1	0.1	0.1			
Euphorbiaceae	*Euphorbia peplus*	Petty Spurge	-	E	-	-	-			3						
Fabaceae (Faboideae)	*Erythrina crista-galli*	Cockspur coral tree	-	E	PW, HTW	-	-									X
Fabaceae (Faboideae)	*Dillwynia sieberi*	-	sg	N	-	-	-								1	
Fabaceae (Faboideae)	*Glycine clandestina*	-	og	N	-	-	-			0.1	0.1			0.1	0.1	
Fabaceae (Faboideae)	*Glycine tabacina*	-	og	N	-	-	-	0.1	0.1			0.1	0.1		0.1	
Fabaceae (Faboideae)	*Medicago polymorpha*	Burclover	-	E	-	-	-			0.1						
Fabaceae (Faboideae)	*Vicia hirsuta*	Hairy Vetch	-	E	-	-	-									X
Fabaceae (Mimosoideae)	*Acacia longifolia*	Sydney Golden Wattle	sg	N	-	-	-									X
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta wattle	tg	N	-	-	-						0.2			
Fabaceae (Mimosoideae)	*Acacia sp. (seedling)*	-	sg	N	-	-	-		0.1						0.1	
Fabaceae/faboideae	*Trifolium repens*	White Clover	-	E	-	-	-			0.1	0.1		0.1			
Juncaceae	*Juncus sp.*	-	gg	N	-	-	-									X
Juncaceae	*Juncus subsecundus*	-	gg	N	-	-	-								0.1	
Juncaceae	*Juncus usitatus*	-	gg	N	-	-	-				0.2		0.1			
Lauraceae	*Cassytha glabella*	-	og	N	-	-	-						0.1			

Family	Scientific name	Common name	Form	Endemicity	Status			Cover (%) in each plot*								Incidental observation
					Weed	BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	
Loranthaceae	*Amyema gaudichaudii*	Melaleuca Mistletoe	og	N	-	-	-						0.1			
Lythraceae	*Lagerstroemia indica*	Crapemyrtle	-	E	-	-	-	5								
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	-	E	-	-	-	0.1			0.1	0.1	0.1	0.1	0.1	
Myrtaceae	*Calistemon sp.*	-	sg	N	-	-	-	1								
Myrtaceae	*Corymbia maculata*	Spotted Gum	tg	N	-	-	-	20								
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	tg	N	-	-	-					20				
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	tg	N	-	-	-				5					
Myrtaceae	*Eucalyptus moluccana*	Grey Box	tg	N	-	-	-				20	25	5	30	20	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	tg	N	-	-	-		60	40	10		35		10	
Myrtaceae	*Melaleuca decora*	-	sg	N	-	-	-				5		40			
Myrtaceae	*Melaleuca linariifolia*	Snow in Summer	sg	N	-	-	-									X
Myrtaceae	*Melaleuca squarrosa*	Scented Paper-bark	sg	N	-	-	-			15						
Oleaceae	*Fraxinus excelsior*	European Ash	-	E	-	-	-			0.5						
Oleaceae	*Ligustrum sinense*	Narrow-leaf Privet	-	E	HTW	-	-	3								
Oxalidaceae	*Oxalis perennans*	-	fg	N	-	-	-	0.1	0.1	0.1	0.1			0.1	0.1	
Papaveraceae	*Fumaria officinalis*	Common Fumitory	-	E	-	-	-			0.1						
Pinaceae	*Pinus radiata*	-	-	E	HTW	-	-					0.1				

Family	Scientific name	Common name	Form	Endemicity	Status			Cover (%) in each plot*								Incidental observation
					Weed	BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	
Pittosporaceae	*Bursaria spinosa*	Blackthorn	sg	N	-	-	-			2	0.5		0.5	0.1	70	
Plantaginaceae	*Plantago lanceolata*	Ribwort	-	E	-	-	-				0.1	0.1	0.1	0.5		
Poaceae	*Bromus sp.*	-	-	E	-	-	-						0.1			
Poaceae	*Cenchrus clandestinus*	Kikuyu	-	E	-	-	-			20						
Poaceae	*Chloris gayana*	Rhodes Grass	-	E	HTW	-	-	30	5	10	2		30		0.1	
Poaceae	*Cynodon dactylon*	Couch	gg	N	-	-	-	20	50		50					
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	gg	N	-	-	-						0.1			
Poaceae	*Ehrharta erecta*	Panic Veldtgrass	-	E	HTW	-	-					5				
Poaceae	*Entolasia stricta*	Wiry Panic	gg	N	-	-	-						1			
Poaceae	*Eragrostis curvula*	African Lovegrass	-	E	HTW	-	-	5				3		40	4	
Poaceae	*Eriochloa procera*	Spring Grass	gg	N	-	-	-			0.1	1					
Poaceae	*Megathyrsus maximus*	Guinea Grass	-	E	HTW	-	-						0.5			
Poaceae	*Microlaena stipoides*	Weeping Grass	gg	N	-	-	-	1	3	5			0.1			
Poaceae	*Paspalidium distans*	-	gg	N	-	-	-								0.1	
Poaceae	*Paspalum dilatatum*	Paspalum	-	E	HTW	-	-							10		
Poaceae	*Phalaris aquatica*	Phalaris	-	E	-	-	-		15							
Poaceae	*Poa annua*	Winter Grass	-	E	-	-	-					0.2				
Poaceae	*Setaria parviflora*	-	-	E	-	-	-									X

Family	Scientific name	Common name	Form	Endemicity	Status			Cover (%) in each plot*								Incidental observation
					Weed	BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	
Poaceae	*Setaria pumila*	Pale Pigeon Grass	-	E	-	-	-	2	0.1	0.1	10	0.1	0.1		0.2	
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	gg	N	-	-	-				0.1	0.1			0.1	
Polygonaceae	*Persicaria decipiens*	Slender Knotweed	fg	N	-	-	-				0.1					
Polygonaceae	*Rumex tenax*	Shiny Dock	fg	N	-	-	-						0.1			
Primulaceae	*Lysimachia arvensis*	Scarlet Pimpernel	-	E	-	-	-				0.1	0.1	0.1			
Proteaceae	*Grevillea juniperina ssp. juniperina*	Juniper-leaved Grevillea	sg	N	-	V	-								2	
Pteridaceae	*Cheilanthes sieberi*	-	eg	N	-	-	-								0.1	
Rubiaceae	*Galium aparine*	Velcro Weed	-	E	-	-	-			0.1						
Scrophulariaceae	*Eremophila debilis*	Winter Apple	sg	N	-	-	-								0.5	
Solanaceae	*Cestrum parqui*	Green Cestrum	-	E	PW, HTW	-	-	0.1		0.1			0.1			
Solanaceae	*Lycium ferocissimum*	African Boxthorn	-	E	PW, HTW, WoNS	-	-			0.1	0.1	2				
Solanaceae	*Solanum nigrum*	Blackberry Nightshade	-	E	-	-	-			0.1						
Solanaceae	*Solanum pseudocapsicum*	Jerusalem Cherry	-	E	-	-	-	0.1	0.1	3						
Solanaceae	*Solanum sisymbriifolium*	-	-	E	-	-	-			0.1			0.1		0.1	
Typhaceae	*Typha australis*	Cumbungi	gg	N	-	-	-									X

Family	Scientific name	Common name	Form	Endemicity	Status			Cover (%) in each plot*								Incidental observation
					Weed	BC Act	EPBC Act	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	
Urticaceae	*Parietaria judaica*	Pellitory-of-the-wall	-	E	-	-	-			0.5						
Verbenaceae	*Verbena bonariensis*	Purpletop	-	E	-	-	-							0.1		

Key:
eg = fern, fg = forb, gg = grass and grasslike, og= other, sg = shrub, tg = tree
E= exotic, N= native, V = vulnerable
BC Act= Biodiversity Conservation Act 2016, EPBC Act= Environment Protection and Biodiversity Conservation Act 1999
PW= priority weed, HTW= high threat weed, WoNS= weed of national significance

*Note: *Cover determined in accordance with the BAM.*

Recorded fauna

Class	Scientific name	Common name	Endemicity	Status		Observation Type
				BC Act	EPBC Act	
Actinopterygii	*Anguilla australis*	Short-finned Eel	N			O
Actinopterygii	*Cyprinus carpio*	European Carp	E			O
Actinopterygii	*Gambusia holbrooki*	Mosquito Fish	E			O
Aves	*Acanthorhynchus tenuirostris*	Eastern Spinebill	N			O
Aves	*Anas superciliosa*	Pacific Black Duck	N			O
Aves	*Anthochaera carunculata*	Red Wattle Bird	N			OW
Aves	*Anthochaera chrysoptera*	Little Wattle Bird	N			O
Aves	*Ardea intermedia*	Intermediate Egret	N			O
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	N			OW
Aves	*Cacatua tenuirostris*	Long-billed Corella	N			OW

Class	Scientific name	Common name	Endemicity	Status		Observation Type
				BC Act	EPBC Act	
Aves	*Columba livia*	Rock Dove	E			OW
Aves	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	N			W
Aves	*Cormobates leucophaea*	White-throated Treecreeper	N			W
Aves	*Corvus coronoides*	Australian Raven	N			OW
Aves	*Cracticus torquatus*	Butcher Bird	N			OW
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	N			OW
Aves	*Dicaeum hirundinaceum*	Mistletoe bird	N			O
Aves	*Egretta novaehollandiae*	White-faced Heron	N			O
Aves	*Eolophus roseicapillus*	Galah	N			W
Aves	*Eudynamys orientalis*	Pacific Koel	N			W
Aves	*Glossopsitta concinna*	Musk Lorikeet	N			OW
Aves	*Grallina cyanoleuca*	Magpie-lark	N			OW
Aves	*Gymnorhina tibicen*	Australian Magpie	N			OW
Aves	*Macropygia phasianella*	Brown Cuckoo-dove	N			O
Aves	*Malurus cyaneus*	Superb Fairy-wren	N			OW
Aves	*Manorina melanocephala*	Noisy Miner	N			OW
Aves	*Neochmia temporalis*	Red-browed Finch	N			W
Aves	*Pardalotus punctatus*	Spotted Pardalote	N			W
Aves	*Phylidonyris novaehollandiae*	New Holland Honeyeater	N			O
Aves	*Rhipidura leucophrys*	Willie Wagtail	N			OW

Class	Scientific name	Common name	Endemicity	Status		Observation Type
				BC Act	EPBC Act	
Aves	*Sturnus tristis*	Common Myna	E			OW
Aves	*Threskiornis molucca*	Australian White Ibis	N			O
Aves	*Trichoglossus haematodus*	Rainbow Lorikeet	N			OW
Mammalia	*Austronomus australis*	White-striped Freetail Bat	N			AR (Definite)
Mammalia	*Capra hircus*	Goat	E			P
Mammalia	*Cervus sp.*	Unidentified Deer	E			O
Mammalia	*Chalinolobus gouldii*	Gould's Wattled Bat	N			AR (Definite)
Mammalia	*Chalinolobus morio*	Chocolate Wattled Bat	N			AR (Either)
Mammalia	*Dama Dama*	Fallow deer	E			O
Mammalia	*Macropus giganteus*	Eastern Grey Kangaroo	N			O
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	N	V		AR (Definite)
Mammalia	*Miniopterus australis*	Little Bentwing-bat	N	V		AR (Possible)
Mammalia	*Miniopterus orianae oceanensis*	Eastern Bentwing-bat	N	V		AR (Definite)
Mammalia	*Myotis macropus*	Southern Myotis	N	V		AR (Definite)
Mammalia	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	N			AR (Either)
Mammalia	*Nyctophilus gouldi*	Gould's Long-eared Bat	N			AR (Either)
Mammalia	*Oryctolagus cuniculus*	Rabbit	E			O
Mammalia	*Ozimops ridei*	Ride's Free-Tailed Bat	N			AR (Possible)
Mammalia	*Pseudocheirus peregrinus*	Ring Tailed Possum	N			P
Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	N	V	V	O

Class	Scientific name	Common name	Endemicity	Status		Observation Type
				BC Act	EPBC Act	
Mammalia	*Rattus rattus*	Black Rat	E			O
Mammalia	*Scotorepens orion*	Eastern Broad-nosed Bat	N			AR (Possible)
Mammalia	*Trichosurus vulpecula*	Common Brushtail Possum	N			P
Mammalia	*Vespadelus darlingtoni*	Large Forest Bat	N			AR (Possible)
Mammalia	*Vespadelus vulturnus*	Little Forest Bat	N			AR (Either)
Mammalia	*Vulpes vulpes*	Fox	E			O
Reptilia	*Eulamprus quoyii*	Eastern Water Skink	N			O
Reptilia	*Intellagama lesueurii*	Water Dragon	N			O

Key:
E= exotic, N= native, V = vulnerable
BC Act= Biodiversity Conservation Act 2016, EPBC Act= Environment Protection and Biodiversity Conservation Act 1999
O= observed, W= heard call, OW = observed and heard, AR = acoustic recording, P = scat

Appendix B: Habitat suitability assessment

Use the below criteria to determine the likelihood that a threatened species could occur in the study area. The criteria are designed for use in a BAR only and is not applicable for use in a BDAR (i.e. where the BAM-C is being used). Only recorded sightings from BioNet are valid for these criteria.

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey or has been recorded within the past five years (known from a reputable source).
High	A species is considered highly likely to occur in the study area if: • *There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present.* **OR** • *The species is highly mobile, is dependent on identified suitable habitat within the study area (i.e. for breeding or important life cycle periods such as winter flowering resources) and has been recorded recently (within five years) on BioNet in the locality. This also includes species known or likely to visit the study area during regular seasonal movements or migration.*
Moderate	A species is considered moderately likely to occur in the study area if: • *Any suitable habitat (e.g. 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 (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area.* **OR** • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g. hollows, rocky outcrops) within the study area and has been recorded in the locality in the last 10 years on BioNet.* **OR** • *For flora species that are associated with PCTs in the study area (see TBDC) or have been recorded in the locality in the last 10 years on BioNet – the associated PCT/habitat present in the study area is not degraded and the species was not targeted by surveys in accordance with the BAM and relevant survey guidelines. In addition, for flora species known to occur in disturbed areas (e.g. orchids), records from any time within the locality may warrant inclusion in this category.*
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 (i.e. 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, is dependent on identified suitable habitat features (e.g. 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.*

Likelihood	Criteria
Unlikely	Suitable habitat for the species is absent from the study area.

Habitat suitability assessment table

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
Plants										
Acacia bynoeana	Bynoe's Wattle	E	V	Species	-	-	-	Small, prostrate shrub found in low heath, open woodland, dry sclerophyll, generally on loamy clays and sand. Occurs from the Lower Hunter south to the Southern Highlands. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	44 (BioNet) (PMST-K)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however no associated PCTs occur within the Study Area.
Acacia gordonii		E	E	Species	Rocky areas: sandstone outcrops, ridgetops, spurs or within 200 metres.	-	-	Restricted to the north-west of Sydney, it has a disjunct distribution occurring in the lower Blue Mountains in the west, and in the Maroota/Glenorie area in the east. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops.	(PMST-M)	Low. Species has not been recorded in the locality on BioNet. The species is not associated with any PCTs in the study area.
Acacia pubescens	Downy Wattle	V	V	Species	-	-	-	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. Occurs on alluviums,	26 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet and associated PCTs occur within the study area, however the species

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.		was not recorded in the study area during targeted surveys.
Allocasuarina glareicola		E	E	Species	-	-	-	Grows in Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis*, *Eucalyptus fibrosa, Angophora bakeri*, *Eucalyptus sclerophylla* and *Melaleuca decora*. Common associated understory species include *Melaleuca nodosa*, *Hakea dactyloides*, *Hakea sericea, Dillwynia tenuifolia*, *Micromyrtus minutiflora, Acacia elongata*, *Acacia brownei*, *Themeda australis* and *Xanthorrhoea minor*.	24 (BioNet)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however no associated PCTs occur within the Study Area.
Asterolasia elegans		E	E	Species	-	-	-	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine	(PMST-M)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however no associated PCTs occur within the Study Area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								(*Syncarpia glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Forest Oak (*Allocasuarina torulosa*) and Christmas Bush (*Ceratopetalum gummiferum*).		
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	E	V	Species	-	-	-	The Thick Lip Spider Orchid is known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. 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-M)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs occur within the study area,
Callistemon linearifolius	Netted Bottle Brush	V	-	Species	-	-	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Was more widespread across its distribution in the past. Some populations are reserved in Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve. Further north it has been recorded from Yengo National Park and Werakata National Park. Grows in dry sclerophyll forest on the coast and adjacent ranges.	1 (BioNet) (PMST-K)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however no associated PCTs occur within the Study Area.

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		BC Act	EPBC Act		General	Foraging	Breeding			
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Species	-	-	-	A very rare leafless, saprophytic orchid, which has a symbiotic relationship with a mycorrhizal fungi which provides the plant with all its nutrient requirements. This orchid remains underground for the majority of its lifecycle, flowering periodically when conditions are optimal to reproduce. This species is extremely cryptic as it does not flower every year. Known to occur within a range of habitats including woodlands to swamp heaths. The larger populations have been typically found in woodland dominated by *E. racemosa* (Scribbly Gum) and it prefers areas with an open grassy understory. The species typically prefers moist sandy soils in sparse to dense heath and sedgeland, or moist to dry clay loams in coastal forests.	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs occur within the study area.
Cynanchum elegans	White-flowered Wax Plant	E	E	Species	-	-	-	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland;	(PMST-L)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs or suitable rainforest habitats occur within the study area,

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								Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.		
Darwinia biflora		V	V	Species	-	-	-	Recorded in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde LGAs. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *Eucalyptus haemastoma, Corymbia gummifera* and/or *E. squamosa.* The vegetation structure is usually woodland, open forest or scrub-heath.	4 (BioNet) (PMST-K)	Low. No associated PCTs or suitable habitats occur within the study area,
Deyeuxia appressa	Deyeuxia appressa	E	E	Species				This species has not been seen in over 60 years, therefore almost nothing is known of the species' habitat and ecology. May now to be extinct in the wild due to the level of habitat loss and development that has occurred within these areas.	BAM-C	Species will be surveyed for prior to determination of the project.
Dillwynia tenuifolia		V	-	Species	-	-	-	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale	764 (BioNet) BAM-C	Species will be surveyed for prior to determination of the project.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.		
Epacris purpurascens var. purpurascens		V	-	Species	-	-	-	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	23 (BioNet)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however no associated PCTs occur within the Study Area.
Eucalyptus benthamii	Camden White Gum	CE	V	Species				Occurs on the alluvial flats of the Nepean River and its tributaries. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. Recorded elevation range is from 30m ASL at Bents Basin to 750m ASL in the Kedumba population. Most individuals are found around 60 to 300 metres ASL.	BAM-C	Low. Associated PCTs occur within the study area however the species was not recorded during targeted surveys.
Eucalyptus glaucina	Slaty Red Gum	V	V	Species				Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils.	BAM-C	Low. Associated PCTs occur within the study area however the species was not

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
										recorded during targeted surveys.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Species	-	-	-	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock. Seedling recruitment is common, even in disturbed soils, if protected from grazing and fire. Tends to grow on lower slopes in the landscape. This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. It is found largely on private property and roadsides, and occasionally in conservation reserves. Often planted as urban trees, windbreaks and corridors.	8 (BioNet)	Low. No associated PCTs occur within the study area.
Eucalyptus sp. Cattai (Gregson s.n., 28 Aug 1954)		CE	CE	Species	-	-	-	Occurs in The Hills LGA, with known populations occurring within the area bounded by Kellyville - Maraylya - Glenorie. Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small, clustered groups. The sites at which it occurs are generally flat and on ridgetops.	1 (BioNet) (PMST-K)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs occur within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
Genoplesium baueri	Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid	E	E	Species	-	-	-	The species generally occurs within coastal areas from Ulladulla on the south coast to Port Stephens on the mid-north coast, although it has been recorded from as far west as Woodford in the Blue Mountains and Penrose State Forest in the southern highlands. Grows in dry sclerophyll forest and moss gardens over sandstone.	(PMST-L)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs or moss gardens over sandstone occur within the study area.
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V	-	Species	-	-	-	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest. Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest include E*ucalyptus tereticornis, E. moluccana, E. crebra, E. fibrosa and E. eugenioides.* Understory species include *Bursaria spinosa, Dillwynia sieberi, Ozothamnus diosmifolius, Daviesia ulicifolia, Acacia falcata, Acacia parramattensis, Themeda australis, Aristida ramosa,*	2418 (BioNet) BAM-C	Recorded. The species was recorded in the study area during field surveys.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								Cymbopogon refractus, Eragrostis brownii, Cheilanthes sieberi, Dianella revoluta and Goodenia hederacea.		
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	Species	-	-	-	Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast, and Cessnock and Kurri Kurri in the Lower Hunter. Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	2 (BioNet) (PMST-M)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however no associated PCTs occur within the Study Area.
Haloragis exalata subsp. exalata	Wingless Raspwort, Square Raspwort	V	V	Species	Waterbodies; edges of coastal lakes after flooding has removed other vegetation, creek banks within flood zone, areas close to these features subject to human disturbance including road verges and	-	-	Occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and Northwestern Slopes botanical subdivisions of NSW. Appears to require protected and shaded damp situations in riparian habitats.	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs occur within the study area.

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					powerline easements or within 100 metres.					
Haloragodendron lucasii	Hal	E	E	Species	Seepage zone or within 100 metres.	-	-	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland.	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs or suitable habitats below cliff lines occur within the study area.
Hibbertia puberula		E	-	Species	-	-	-	It extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. Early records of this species are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains. Occurs on sandy soil often associated with sandstone, or on clay. Habitats are typically dry sclerophyll woodland communities, although heaths are also occupied. One of the recently described subspecies also favours upland swamps.	3 (BioNet) BAM-C	Species will be surveyed for prior to determination of the project.
Hibbertia sp. Bankstown		CE	CE	Species	-	-	-	Is currently known to occur in only one population at Bankstown Airport in Sydney's southern suburbs. The airport	27 (BioNet) BAM-C	Species will be surveyed for prior to determination of the project.

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								site is very heavily modified from the natural state, now largely lacks canopy species, and is currently a low grass/shrub association with many pasture grasses and other introduced herbaceous weeds.		
Isotoma fluviatilis subsp. fluviatilis		-	X	Species	-	-	-	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grass-land/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone.	3 (BioNet)	Low. The species is considered extinct.
Kunzea rupestris		V	V	Species	Rocky areas, Hawkesbury sandstone rock platforms or within 50 metres.	-	-	Restricted, with most locations in the Maroota - Sackville - Glenorie area and one outlier in Ku-ring-gai Chase National Park, all within the Central Coast botanical subdivision of NSW. Currently known to exist in 20 populations, 6 of which are reserved. Grows in shallow depressions on large flat sandstone rock outcrops. Characteristically found in short to tall shrubland or heathland.	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No suitable rocky areas occur within, or adjacent to, the study area.

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Lasiopetalum joyceae		V	V	Species	-	-	-	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. It is currently known from 34 sites between Berrilee and Duffys Forest. Seventeen of these are reserved. Grows in heath on sandstone.	1 (BioNet) (PMST-K)	Low. The species has been recorded once within the locality (in 1955). The study area occurs outside of the species' restricted range and no associated PCTs occur within the study area.
Leucopogon exolasius	Woronora Beard-heath	V	V	Species	-	-	-	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone.	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs occur within the study area,
Leucopogon fletcheri subsp. fletcheri		E	-	Species	Slopes near rocky areas or within 50 metres; Rocky areas: weathered laterite over sandstone on sandstone ridges and outcrops.	-	-	Restricted to north-western Sydney between St Albans in the north and Annangrove in the south, within the LGAs of Hawkesbury, Baulkham Hills and Blue Mountains. Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs.	2 (BioNet)	Low. The most recent record of the species in the locality is from 1995. No associated PCTs or rocky area occur within the study area.
Macadamia integrifolia	Macadamia Nut	-	V	Species	-	-	-	While specimens have been collected from the North Coast of NSW (e.g. Lismore), this species is not known to occur naturally in NSW.	2 (BioNet)	Low. The species is not known to occur naturally in NSW.
Marsdenia viridiflora subsp. viridiflora	Marsdenia viridiflora R. Br. subsp. viridiflora population in	EP	-	Species	-	-	-	Endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool	32 (BioNet) BAM-C	Low. The species has been recorded in the locality and suitable habitat occurs within

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	the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGAs							and Penrith LGAs. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Grows in vine thickets and open shale woodland.		the study area. The species was not recorded in the study area during targeted surveys.
Melaleuca deanei	Deane's Melaleuca	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	(PMST-K)	Low. The species has not been recorded in the locality. It is not associated with any PCTs within the study area.
Micromyrtus blakelyi		V	V	Species	Skeletal soil; rocky areas; Hawkesbury sandstone rock platforms and outcrops or within 50 metres.	-	-	Restricted to areas near the Hawkesbury River, north of Sydney. Distribution extends from north of Maroota in the north, to Cowan in the south. All known populations occur within the Baulkham Hills and Hornsby LGAs. Typically occurs within heathlands in shallow sandy soil in cracks and depressions of sandstone rock platforms.	(PMST-M)	Low. The species has not been recorded in the locality. Suitable habitat in rocky areas is not present within the study area.
Micromyrtus minutiflora		E	V	Species	-	-	-	Restricted to the general area between Richmond and Penrith, growing in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary	79 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Associated PCTs occur within the study area. The species was not

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								alluvium and consolidated river sediments.		recorded in the study area during targeted surveys.
Olearia cordata		V	V	Species	-	-	-	A NSW endemic with a scattered distribution generally restricted to the south-western Hunter Plateau, eastern Colo Plateau, and the far north-west of the Hornsby Plateau near Wisemans Ferry east of Maroota. Most known populations occur within conservation reserves (Wollemi National Park, Yengo National Park and Wisemans Ferry Historic Site). Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges.	(PMST-M)	Low. The species has not been recorded in the locality. Suitable sandstone ridge habitat or associated PCTs are not present within the study area.
Persicaria elatior	Knotweed, Tall Knotweed	V	V	Species	Semi-permanent/ ephemeral wet areas or within 50 metres, swamps or within 50 metres of waterbodies including wetlands, or within 50 metres.	-	-	Tall Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	(PMST-L)	Low. The species has not been recorded in the locality. Suitable habitat or associated PCTs are not present within the study area.

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		BC Act	EPBC Act		General	Foraging	Breeding			
Persoonia hirsuta	Hairy Geebung	E	E	Species	-	-	-	The species is distributed from Singleton in the north, along the east coast to Hilltop in the southwest, Dombarton in the southeast and the Blue Mountains to the west. 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.	4 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Associated PCTs occur within the study area. The species was not recorded in the study area during targeted surveys.
Persoonia nutans	Nodding Geebung	E	E	Species	-	-	-	Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium but extend onto shale sandstone transition communities and into Cooks River / Castlereagh Ironbark Forest.	566 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Associated PCTs occur within the study area. The species was not recorded in the study area during targeted surveys.
Pilularia novae-hollandiae	Austral Pillwort	E	-	Species	-	-	-	Recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana, Oolambeyan NP and Lake Cowal. The only known extant populations in NSW are in Oolambeyan and Lake	1 (BioNet)	Low. No associated PCTs occur within the study area.

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								Cowal. It grows in shallow swamps and waterways, often among grasses and sedges. It is likely to be ephemeral as it most frequently appears in drying muds when soils are moistened by rain.		
Pimelea curviflora var. curviflora		V	V	Species	-	-	-	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain.	21 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Associated PCTs occur within the study area. The species was not recorded in the study area during targeted surveys.
Pimelea spicata	Spiked Rice-flower	E	E	Species	-	-	-	The Illawarra populations usually occur in one of two communities - a woodland or a coastal grassland. Woodland sites are dominated by forest red gum (*E. tereticornis*) and stringybark (*E. eugenioides*), with a groundcover dominated by kangaroo grass (*Themeda australis*) and matrush (*Lomandra longifolia*). The grassland sites are dominated by kangaroo grass (*Themeda australis*) and matrush (*Lomandra longifolia*), with blady grass (*Imperata cylindrica*). A shrubby layer, where present, is dominated by coastal wattle (*Acacia sophorae*) and coast rosemary (*Westringia*	212 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Associated PCTs occur within the study area. The species was not recorded in the study area during targeted surveys.

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		BC Act	EPBC Act		General	Foraging	Breeding			
								fruticosa) with coast banksia (*Banksia integrifolia*).		
Pomaderris brunnea	Rufous Pomaderris, Brown Pomaderris	E	V	Species	-	-	-	Brown Pomaderris is found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. The species has been found in association with *Eucalyptus amplifolia, Angophora floribunda, Acacia parramattensis, Bursaria spinosa and Kunzea ambigua*.	(PMST-L) BAM-C	Species will be surveyed for prior to determination of the project.
Pomaderris prunifolia-endangered population	*Pomaderris prunifolia* in the Parramatta, Auburn, Strathfield and Bankstown LGAs.	E		Species				Known from only three sites, at Rydalmere, Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere it occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River/Castlereagh Ironbark Forest on shale soils.	BAM-C	Low. The study area is not consistent with the geographic limitations of the species. The Blacktown LGA is not listed within the LGAs specified in the determination.
Pterostylis gibbosa	Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood	E	E	Species	-	-	-	In the Illawarra region, the species grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Woollybutt *E. longifolia* and White Feather Honey-myrtle *Melaleuca decora*. Near Nowra, the species grows in an open forest of	(PMST-M) BAM-C	Low. No associated PCTs occur within the study area. The species has not been recorded in the locality.

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		BC Act	EPBC Act		General	Foraging	Breeding			
								Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*.		
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Species	-	-	-	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	1 (BioNet) (PMST-L)	Species will be surveyed for prior to determination of the project.
Pultenaea parviflora		E	V	Species	-	-	-	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. Eucalyptus fibrosa is usually the dominant canopy species. *Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla and E. sideroxylon* may also be present or co-dominant, with *Melaleuca decora* frequently forming a secondary canopy layer.	897 (BioNet) (PMST-K) BAM-C	Species will be surveyed for prior to determination of the project.

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		BC Act	EPBC Act		General	Foraging	Breeding			
Pultenaea pedunculata	Matted Bush-pea	E		Species				This species occurs in a range of habitats. NSW populations are generally among woodland vegetation, but plants have also been found on road batters and coastal cliffs. In the Cumberland the species favours sites in clay or sandy-clay soils (Blacktown Soil Landscape) on Wianamatta Shale-derived soils, usually close to patches of Tertiary Alluvium (Liverpool area) or at or near the Shale-Sandstone interface. The species is recorded from Cumberland Plain Woodlands, the shale-soil form of Shale Sandstone Transition Forests and Cooks River/Castlereagh Ironbark Forest. Associated species in the Sydney area include *Eucalyptus moluccana, E. fibrosa, E. crebra, E. longifolia and Melaleuca decora. Understory species include Bursaria spinosa, Ozothamnus diosmifolius, Acacia parramattensis, A. falcata, Indigofera australis, Dillwynia sieberi, Olearia viscidula, Kunzea ambigua, Opercularia diphylla, Astroloma humifusum, Glycine tabacina, Hardenbergia violacea, Wahlenbergia gracilis, Aristida vagans, Gahnia aspera, Lomandra*	BAM-C	Species will be surveyed for prior to determination of the project.

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		BC Act	EPBC Act		General	Foraging	Breeding			
								filiformis, Cheilanthes sieberi and *Themeda australis.*		
Rhizanthella slateri	Eastern Underground Orchid	V	E	Species	-	-	-	Habitat requirements are poorly understood, and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	(PMST-M)	Low. No associated PCTs occur within the study area. The species has not been recorded in the locality.
Rhodamnia rubescens	Scrub Turpentine, Brown Malletwood	CE	CE	Species	-	-	-	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	(PMST-L)	Low. The species has not been recorded in the locality on BioNet. No suitable rainforest habitat occurs within the study area.
Rhodomyrtus psidioides	Native Guava	CE	CE	Species	-	-	-	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines.	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No suitable rainforest habitat occurs within the study area.
Senna acclinis	Rainforest Cassia	E		Species	-	-	-	Occurs in coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland. Grows on the margins of subtropical, littoral and dry rainforests.	1 (BioNet)	Low. No suitable rainforest habitat occurs within the study area.
Syzygium paniculatum	Magenta Lilly Pilly	E	V	Species	-	-	-	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the	6 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Associated PCTs occur

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								Central Coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.		within the study area. The species was not recorded in the study area during targeted surveys.
Thesium australe	Austral Toadflax, Toadflax	V	V	Species	-	-	-	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*).	(PMST-L)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs occur within the study area.
Wahlenbergia multicaulis- endangered population	Tadgell's Bluebell in the LGAs of Auburn, Bansktown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield.	EP						There are 13 known sites around Sydney. In Western Sydney most sites are closely aligned with the Villawood Soil Series, which is a poorly drained, yellow podsolic extensively permeated with fine, concretionary ironstone (laterite). Found in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites, typically amongst other herbs rather than in the open.	BAM-C	Low. The study area is not consistent with the geographic limitations of the species. The Blacktown LGA is not listed within the LGAs specified in the determination.
Zieria involucrata		E	V	Species	-	-	-	Has a disjunct distribution north and west of Sydney, in the Baulkham Hills, Hawkesbury, Hornsby and Blue Mountains LGAs. Recent records for the species come from 22 populations in the catchments of the Macdonald,	(PMST-L)	Low. The species has not been recorded in the locality on BioNet. No suitable sheltered forest habitat occurs within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								Colo and Hawkesbury Rivers between Melon Creek and Mogo Creek in the north to Little Cattai Creek (Hillside) and Wheeny Creek (Colo) in the south and from a single population in the upper Blue Mountains north of Katoomba. Found primarily in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation.		
Birds										
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/ Ecosystem	-	-	As per mapped areas	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.	23 (BioNet) (PMST-K) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area, however the species is unlikely to be dependent on this habitat. No important mapped habitat is present within the study area.
Aphelocephala leucopsis	Southern Whiteface	-	V					Southern whiteface occurs across most of mainland Australia south of the tropics, from the north- eastern edge of the Western Australian wheatbelt, east to the Great	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No associated PCTs occur within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								Dividing Range. Southern whitefaces live in a wide range of open woodlands and shrublands where there is an understory of grasses or shrubs, or both. These areas are usually in habitats dominated by acacias or eucalypts on ranges, foothills and lowlands, and plains.		
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Ecosystem	-	-	-	The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understory is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath.	67 (BioNet) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area, however the species is unlikely to be dependent on this habitat.
Botaurus poiciloptilus	Australasian Bittern	E	E	Ecosystem	Waterbodies: brackish or freshwater wetlands	-	-	In NSW they may be found over most of the state except for the far north-west. They favour permanent freshwater wetlands with tall, dense vegetation, particularly Bullrushes (*Typha* spp.) and Spikerushes (*Eleocharis* spp.).	2 (BioNet) (PMST-K) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.
Burhinus grallarius	Bush Stone-curlew	E		Species				Inhabits open forests and woodlands with a sparse	3 (BioNet)	Low. The species has not been recorded in

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		BC Act	EPBC Act		General	Foraging	Breeding			
								grassy ground layer and fallen timber. Feed on insects and small vertebrates such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	BAM-C	the locality on BioNet, however associated PCT's occur within the Study Area.
Calidris ferruginea	Curlew Sandpiper	E	CE,C, J,K	Species/ Ecosystem	-	As per mapped areas	-	This species has a widespread distribution around most of the Australian coastline. It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. Inland records are probably mainly of birds pausing for a few days during migration. The Curlew Sandpiper inhabits intertidal mudflats in estuaries and bays, lakes and lagoons.	4 (BioNet) (PMST-L)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however the species is unlikely to be dependent on habitat within the study area.
Callocephalon fimbriatum	Gang-gang Cockatoo	E	E	Species/ Ecosystem	-	-	Hollow bearing trees: Eucalypt tree species with hollows greater than 9 centimetres in diameter.	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.	3 (BioNet) (PMST-K) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area, however the species is unlikely to be dependent on this habitat. Suitable breeding habitat for the species was restricted to one hollow bearing tree within the study area, however no breeding activity was recorded

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
										during targeted surveys.
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	Species/ Ecosystem	-	Presence of *Allocasuarina* and *casuarina* species	Hollow bearing trees: living or dead tree with hollows greater than 15 centimetres diameter and greater than 8 metres above ground.	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of she-oak occur. Black She-oak (*Allocasuarina littoralis*) and Forest She-oak (*A. torulosa*) are important foods.	10 (BioNet) (PMST-K) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area, however the species is unlikely to be dependent on this habitat. No suitable breeding habitat is present within the study area.
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover	V	V	Species/ Ecosystem	-	As per mapped areas	-	Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks. Roosts during high tide on sandy beaches and rocky shores; begin foraging activity on wet ground at low tide, usually away from the edge of the water; individuals may forage and roost with other waders.	(PMST-M)	Low. The species has not been recorded in the locality. No suitable coastal habitat occurs in the study area.
Chthonicola sagittata	Speckled Warbler	V	-	Ecosystem	-	-	-	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understory, often on rocky ridges or in gullies. Typical habitat would include scattered native	16 (BioNet) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area, however

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								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.		the species is unlikely to be dependent on this habitat.
Circus assimilis	Spotted Harrier	V	-	Ecosystem	-	-	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	3 (BioNet) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area, however the species is unlikely to be dependent on this habitat.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	Ecosystem	-	-	-	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understory, sometimes with one or more shrub species; also found in mallee and River	2 (BioNet) (PMST-L) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.

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		BC Act	EPBC Act		General	Foraging	Breeding			
								Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understory 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.		
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem	-	-	-	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	79 (BioNet) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area, however the species is unlikely to be dependent on this habitat.
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Ecosystem	Swamps: shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300 metres of these swamps. Waterbodies: shallow lakes, lake margins and estuaries within 300 metres of these waterbodies.	-	-	In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Since 1995, breeding has been recorded as far south as Bulahdelah. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	1 (BioNet) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.

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Erythrotriorchis radiatus	Red Goshawk	CE	E	Species	-	-	-	Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers.	(PMST-M)	Low. The species has not been recorded in the locality.
Falco hypoleucos	Grey Falcon	V	V	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-L)	Low. The species has not been recorded in the locality.
Falco subniger	Black Falcon	V	-	Ecosystem	-	-	-	The Black Falcon is widely, but sparsely, distributed in NSW, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of NSW are likely to be referrable to the Brown Falcon. In NSW there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile,	3 (BioNet) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however the species is unlikely to be dependent on this habitat.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								commonly travelling hundreds of kilometres		
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.	27 (BioNet) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat.
Grantiella picta	Painted Honeyeater	V	V	Ecosystem	Mistletoes present at a density of greater than five mistletoes per hectare.	-	-	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests.	1 (BioNet) (PMST-L)	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet. It is not associated with any PCTs in the study area.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Species/ Ecosystem		Waterbodies: within 1 kilometre of rivers, lakes, large dams or creeks, wetlands and coastlines.	Living or dead mature trees within suitable vegetation within 1 kilometre of rivers, lakes, large dams or creeks, wetlands and coastlines.	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 seashore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes,	6 (BioNet) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however the species is unlikely to be dependent on this habitat. No large

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								reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest).		stick nests were detected within tree canopy during habitat surveys in the study area.
Hieraaetus morphnoides	Little Eagle	V	-	Species/ Ecosystem	-	-	Nest trees - live (occasionally dead) large old trees within vegetation.	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.	30 (BioNet) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however the species is unlikely to be dependent on this habitat. No stick nests are present within the study area.
Hirundapus caudacutus	White-throated Needletail		V,C,J, K	Ecosystem	-	-	-	Non-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.	7 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the last 10 years on BioNet, however is highly mobile and predominantly aerial and therefore is unlikely to utilise any habitat within the study area.
Irediparra gallinacea	Comb-crested Jacana	V		Ecosystem				Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation,	BAM-C	Low. The species has not been recorded in the locality in the last 10 years on BioNet, however associated

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								especially water-lillies, or fringing aquatic vegetation.		PCT's occur within the study area.
Ixobrychus flavicollis	Black Bittern	V		Ecosystem	Waterbodies: land within 40 metres of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation.	-	-	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	2 (BioNet)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however suitable habitat is limited within the study area.
Lathamus discolor	Swift Parrot	E	CE	Species/ Ecosystem	-	-	As per mapped areas	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*.	88 (BioNet) (PMST-K) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however the species is unlikely to be dependent on this habitat. No important mapped habitat is present within the study area.
Limosa lapponica baueri	Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit	-	V	Species/ Ecosystem	-	As per mapped areas	-	It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and	(PMST-M)	Low. No suitable coastal habitat is present within the study area.

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		BC Act	EPBC Act		General	Foraging	Breeding			
								bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms. It often occurs around beds of seagrass, and sometimes in nearby saltmarsh or the outer margins of mangrove areas.		
Limosa limosa	Black-tailed Godwit	V	E	Species/ Ecosystem				Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 centimetres deep, around muddy lakes and swamps. Forages for insects, crustaceans, molluscs, worms, larvae, spiders, fish eggs, frog eggs and tadpoles in soft mud or shallow water.	BAM-C	Low. No suitable coastal habitat is present within the study area. No important mapped habitat occurs within the study area.
Lophoictinia isura	Square-tailed Kite	V	-	Species/ Ecosystem	-	-	Nest trees	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.	13 (BioNet) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however the species is unlikely to be dependent on this habitat. No stick nests are present within the study area.

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		BC Act	EPBC Act		General	Foraging	Breeding			
Melanodryas cucullata cucullata	South-eastern Hooded Robin, Hooded Robin (south-eastern)	V	V	Ecosystem	-	-	-	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. 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.	(PMST-L)	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	Ecosystem	-	-	-	In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. The species mostly occupies upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark	7 (BioNet) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.

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								(*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Is also known to inhabit open forests of smooth-barked gums, stringybarks, ironbarks, river she-oaks (nesting habitat) and tea-trees.		
Neophema chrysostoma	Blue-winged Parrot	V	V	-	-	-	-	During the non-breeding period, from autumn to early spring, birds are recorded from northern Victoria, eastern South Australia, south-western Queensland and western NSW, with some birds reaching south-eastern NSW and eastern Victoria, particularly on the southern migration. Blue-winged parrots inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zones.	(PMST-M)	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.
Neophema pulchella	Turquoise Parrot	V	-	Ecosystem	-	-	-	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the	3 (BioNet) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the

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								ground searching for the seeds or grasses and herbaceous plants or browsing on vegetable matter.		study area; however the species is unlikely to be dependent on this habitat.
Ninox connivens	Barking Owl	V	-	Species/ Ecosystem	-	-	Hollow bearing trees: living or dead trees with hollows greater than 20 centimetres diameter and greater than 4 metres above the ground.	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.	1 (BioNet) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet. No suitable nesting hollows are present within the study area.
Ninox strenua	Powerful Owl	V	-	Species/ Ecosystem	-	-	Hollow bearing trees: living or dead trees with hollows greater than 20 centimetres diameter.	The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked	35 (BioNet) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however the species is unlikely to be dependent on this habitat. No suitable nesting hollows are present within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								Apple Angophora floribunda, Cherry Ballart *Exocarpus cupressiformis* and a number of eucalypt species.		
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew		CE,C, J,K	Species/ Ecosystem	-	As per mapped areas	-	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-M)	Low. No suitable coastal habitat is present within the study area.
Oxyura australis	Blue-billed Duck	V	-	Ecosystem	-	-	-	The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is	2 (BioNet)	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed but prefers to dive if approached.		
Petroica boodang	Scarlet Robin	V	-	Ecosystem	-	-	-	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understory 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.	8 (BioNet) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.
Petroica phoenicea	Flame Robin	V	-	Ecosystem	-	-	-	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open under-stories. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, herb fields, heathlands, shrublands	5 (BioNet) BAM-C	Moderate (foraging). The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however the species is unlikely to be dependent on this habitat. No suitable nesting

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								and sedgelands at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains).		hollows are present within the study area.
Pycnoptilus floccosus	Pilotbird	-	V	-	-	-	-	Pilotbirds are strictly terrestrial, living on the ground in dense forests with heavy undergrowth.	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. No suitable dense forest occurs in the study area.
Rostratula australis	Australian Painted Snipe	E	E	Ecosystem	-	-	-	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	5 (BioNet) (PMST-K) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.
Stagonopleura guttata	Diamond Firetail	V	V	Ecosystem	-	-	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	(PMST-K) BAM-C	Low. The species is highly mobile and may be an occasional visitor, however, has not been recorded in the locality in the past 10 years on BioNet.
Tyto novaehollandiae	Masked Owl	V	-	Species/ Ecosystem	-	-	Hollow bearing trees: living or dead trees with hollows	Found in a range of habitats, locally within sclerophyll forests and woodlands where	9 (BioNet) BAM-C	Moderate (foraging). The species has been recorded in the

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
							greater than 20 centimetres diameter.	appropriate/preferred prey species occur (being predominantly terrestrial mammals). Requires large Eucalypt hollows for nesting and prefers to roost in these hollows as well.		locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat. No suitable nesting hollows are present within the study area.
Tyto tenebricosa	Sooty Owl	V	-	Species/ Ecosystem	-	-	Caves: caves or cliff lines/ledges; Hollow bearing trees: living or dead trees with hollows greater than 20 centimetres diameter.	Occurs in wet Eucalypt Forest and rainforest with tall emergent trees, often in easterly facing gullies. Within these areas this species hunts for a range of mainly mammalian prey at all levels of the forest strata, even recorded feeding on ground. Roosts in tree hollow or dense canopy vegetation. Also nests in large Eucalypt tree hollows.	1 (BioNet)	Low. No suitable wet forest habitat is present within the study area. Caves or large hollows for breeding were not detected within the study area.
Mammals										
Cercartetus nanus	Eastern Pygmy-possum	V		Species				Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-easter NSW where they are most frequently encountered in rainforest. They may occupy small patches of vegetation in fragmented landscapes and	BAM-C	Low. The species has not been recorded in the locality in the last 10 years on BioNet, however associated PCT's occur within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								although the species prefers habitat with a rich shrub understory, they are known to occur in grassy woodlands and the presence of Eucalypts alone is sufficient to support populations in low densities. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus)* dreys of thickets of vegetation.		
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	Cliffs: within 2 kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within 2 kilometres of old mines or tunnels.	-	-	This species forages in tall open forests and the edges of rainforest. It roosts in mine shafts and similar structures. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of Fairy Martin (*H. ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years. Found in well-timbered areas containing gullies. The relatively short, broad wing combined with the low weight per unit area of wing indicates	7 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat. No rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or old mines or tunnels within two kilometres of the study area, based on review of aerial imagery and available databases (e.g. MinView). The species was not detected by ANABAT recorders

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy.		deployed 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.	8 (BioNet) (PMST-K) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat.
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.	40 (BioNet) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat. The species was not detected by ANABAT recorders deployed within the study area.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	Ecosystem	-	-	-	This species is distributed south of Sydney extending north into south-eastern Queensland. There are no records west of the Great Dividing Range. Most records of this species have been reported from dry Eucalypt Forest and woodland. It is	103 (BioNet) BAM-C	Recorded. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								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.		this habitat. The species was detected by ANABAT recorders deployed within the study area (definite recording).
Miniopterus australis	Little Bent-winged Bat	V	-	Species/ Ecosystem	-	-	Caves: cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.	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.	27 (BioNet) BAM-C	Moderate. No suitable roosting habitat was detected within the study area. No records of roosting or breeding habitat (e.g. caves, tunnels, mines, culverts) occur within the 10 kilometre locality (from BioNet), however the species was "possibly" detected by ANABAT recorders deployed within the study area and may forage within the study area.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/ Ecosystem	-	-	Caves: cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;"	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.	146 (BioNet) BAM-C	Recorded. No suitable roosting habitat was detected within the study area. No records of roosting or breeding habitat (e.g. caves, tunnels, mines, culverts) occur within the 10 kilometre locality (from BioNet), however the species was detected by

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
							with numbers of individuals >500.			ANABAT recorders deployed within the study area (definite detection) and may forage within the study area.
Myotis macropus	Southern Myotis	V	-	Species	Hollow bearing trees: within 200 metres of riparian zone. Other: bridges, caves or artificial structures within 200 metres of riparian zone. Waterbodies: this includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 metres of the site.	-	-	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.	87 (BioNet) BAM-C	Recorded. The species was recorded roosting within Bells Creek bridge on Townson Road and was also detected by ANABAT recorders deployed within the study area (definite detection). Associated PCTs occur within 200m of Bells Creek, which contains some suitable (i.e. >3m) pools/stretches.
Notamacropus parma	Parma Wallaby	V	V	Species	-	-	-	Once occurred from north-eastern NSW to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to the Queensland border. Preferred habitat is moist eucalypt forest with thick, shrubby understory, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs	(PMST-M)	Low. The species has not been recorded in the locality on BioNet. Preferred habitat, with a thick, shrubby understory, is not present within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								in more open eucalypt forest and the edges of nearby grassy areas.		
Petauroides volans	Greater Glider (southern and central)	E	E	Species	Hollow bearing trees	-	-	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.	(PMST-M)	Low. Species has not been recorded in the locality on BioNet.
Petaurus australis	Yellow-bellied Glider	V	V	Ecosystem	Hollow bearing trees: hollows > 25 centimetres in diameter.	-	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	8 (BioNet) (PMST-K) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat. The species was not detected by targeted surveys.
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	1 (BioNet) BAM-C	Moderate. The species has been recorded in the locality. Associated PCTs are present

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								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.		within the study area. The species has no listed habitat constraints. The species was not detected by targeted surveys.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species	Land within 1 kilometre of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines.	-	-	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.	(PMST-M)	Low. The species has not been recorded in the locality in the last 10 years on BioNet. The study area does not contain suitable rocky habitat.
Phascolarctos cinereus	Koala	E	E	Species/ Ecosystem	-	-	Areas identified via survey as important habitat	Occurs in forests and woodlands where it requires suitable feed trees (particularly *Eucalyptus* spp.) and habitat linkages. Will occasionally cross open areas, although it becomes more vulnerable to predator attack	831 (BioNet) (PMST-K) BAM-C	Moderate. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								and road mortality during these excursions.		this habitat. The study area occurs within the Central Coast Koala Management Area. Food tree species such as *E. tereticornis* (primary) and *E. moluccana* (secondary) are present within the study area. The species was not detected by targeted surveys.
Pseudomys novaehollandiae	New Holland Mouse, Pookila	-	V	Ecosystem	-	-	-	This species has a patchy distribution within open woodlands, heathlands and in hind dune vegetation throughout Eastern Australia.	(PMST-L)	Low. The species has not been recorded in the locality in the last 10 years on BioNet. The study area does not contain suitable habitat for the species.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/ Ecosystem	-	-	Breeding camps	This species forages over a large area for nectar/fruits. Seasonally roosts in communal base camps situated within wet sclerophyll forests or rainforests. Frequently observed to forage in flowering Eucalypts.	913 (BioNet) (PMST-K) BAM-C	Recorded (foraging). The species was recorded within the study area during field surveys. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat. No active breeding camps occur within the study area. The nearest camp to the study area occurs approximately 6.4 kilometres to the

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
										southwest of the study area at Ropes Creek.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem	-	-	-	Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	24 (BioNet) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat. The species was not detected by ANABAT recorders deployed within the study area.
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Ecosystem	-	-	-	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	62 (BioNet) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, the species is unlikely to be dependent on this habitat. The species was not detected by ANABAT recorders deployed within the study area.
Vespadelus troughtoni	Eastern Cave Bat	V	-	Species	Caves: within 2 kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or	-	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW.	2 (BioNet)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however suitable cave or rocky habitat is not present within 2

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
					within 2 kilometres of old mines, tunnels, old buildings or sheds.			A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.		kilometres of the study area. The species was not detected by ANABAT recorders deployed within the study area.
Amphibians										
Heleioporus australiacus	Giant Burrowing Frog	V	V	Species	-	-	-	The northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 metres from breeding sites.	1 (BioNet) (PMST-L)	Low. The species has not been recorded in the locality in the last 10 years on BioNet. Aquatic habitat within the study area is highly degraded with poor water quality. The species is unlikely to be dependent on any habitat within the study area.
Litoria aurea	Green and Golden Bell Frog	E	V	Species	Semi-permanent/ ephemeral wet areas: within 1 kilometre of wet areas. Swamps: within 1 kilometre of swamp. Waterbodies: within 1 kilometre of waterbody.	-	-	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes waterbodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	24 (BioNet) (PMST-K) BAM-C	Low. The species has been recorded in the locality in the past 10 years on BioNet. Suitable habitat is present within the study area; however, this habitat is suboptimal and the species is unlikely to be dependent on this habitat. The species was not detected during targeted surveys.

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		BC Act	EPBC Act		General	Foraging	Breeding			
Pseudophryne australis	Red-crowned Toadlet	V	-	Species	-	-	-	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter.	1 (BioNet)	Low. The species has been recorded in the locality in the past 10 years on BioNet, however suitable habitat is not present within the study area.
Reptiles										
Delma impar	Striped Legless Lizard, Striped Snake-lizard	V	V	Species	-	-	-	Found mainly in Natural Temperate Grassland but has also been captured in grasslands that have a high exotic component. Also found in secondary grassland near Natural Temperate Grassland and occasionally in open Box-Gum Woodland. Habitat is where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass *Themeda australis*, spear-grasses *Austrostipa* spp. and poa tussocks *Poa* spp., and occasionally wallaby grasses *Austrodanthonia* spp.	(PMST-M)	Low. No suitable grassland habitat is present within the study area. The species has not been recorded in the locality.
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Species/ Ecosystem		-	Rocky areas including escarpments, outcrops and pagodas within the Sydney Sandstone geologies.	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 kilometres of Sydney.	(PMST-M)	Low. No suitable rocky areas are present within the study area. The species has not been recorded in the locality.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								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.		
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. 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 may use other species' burrows, such as rabbit warrens.	BAM-C	Low. The species has not been recorded in the locality in the last 10 years on BioNet, however associated PCT's occur 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	621 (BioNet) BAM-C	Recorded. The species was recorded in the study area during field surveys.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.		
Pommerhelix duralensis	Dural Land Snail	E	E	Species	-	-	-	The Dural land snail is endemic to NSW. The species is a shale-influenced habitat specialist, which occurs in low densities along the northwest fringe of the Cumberland Plain on shale-sandstone transitional landscapes. The species has been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris.	20 (BioNet) (PMST-K)	Low. The species is not associated with any PCTs present within the study area.
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-M)	Low. The species distribution is not mapped within aquatic habitats within the study area.
Prototroctes maraena	Australian Grayling	E	V	-	-	-	-	The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval	(PMST-M)	Low. The species distribution is not mapped within

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								and/or juvenile stages in coastal seas. Adults (including pre spawning and spawning adults) inhabit cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones (such as the Tambo River, which is also known to have granite outcrops. The species has also been associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers (Victoria) and in a muddy-bottomed, heavily silted habitat in the Tarwin River (Victoria). The species has been found over 100 kilometres upstream from the sea.		aquatic habitats within the study area.
Migratory Species										
Actitis hypoleucos	Common Sandpiper	-	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	(PMST-L)	Low. No suitable wetland habitat is present within the study area. The species has not been recorded in the locality on BioNet.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								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.		
Apus pacificus	Fork-tailed Swift	-	C,J,K	-	-	-	-	In NSW, the Fork-tailed Swift is recorded in all regions. It is almost exclusively aerial, flying from less than 1 m to at least 300 metres above ground and probably much higher.	8 (BioNet) (PMST-L)	Low. The species has been recorded in the locality in the last 10 years on BioNet, however is highly mobile and predominantly aerial and therefore is unlikely to utilise any habitat within the study area.
Calidris acuminata	Sharp-tailed Sandpiper	-	C,J,K	-	-	-	-	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland.	48 (BioNet) (PMST-L)	Low. The species has been recorded in the locality in the last 10 years on BioNet, however, the species is not highly mobile and suitable habitat features do not occur within the study area.
Calidris melanotos	Pectoral Sandpiper	-	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	10 (BioNet) (PMST-L)	Low. The species has been recorded in the locality in the last 10 years on BioNet, however, the species is not highly mobile and suitable habitat

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								pools, creeks, floodplains and artificial wetlands.		features do not occur within the study area.
Calidris ruficollis	Red-necked Stint	-	C,J,K	-	-	-	-	The Red-necked Stint breeds in Siberia and sporadically in north and west Alaska. During the non-breeding season, the Red-necked Stint is distributed along the Australian coast, with large densities on the Victorian and Tasmanian coasts. In Australasia, the Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals.	11 (BioNet)	Low. No suitable coastal habitat is present within the study area.
Cuculus optatus	Oriental Cuckoo, Horsfield's Cuckoo	-	C,J,K	-	-	-	-	Non-breeding habitat only: monsoonal rainforest, vine thickets, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands. Frequently at edges or ecotones between habitat types. Riparian forest is favoured habitat in the Kimberley region.	(PMST-K)	Low. No suitable wet forest habitat is present within the study area.
Gallinago hardwickii	Latham's Snipe	-	J,K	-	-	-	-	Occurs in permanent and ephemeral wetlands up to 2000 metres ASL. They usually	20 (BioNet) (PMST-K)	Low. The species has been recorded in the locality in the last

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								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.		10 years on BioNet, however, the species is not highly mobile and suitable habitat features do not occur 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 understory of ferns and/or shrubs.	(PMST-K)	Low. No suitable wet forest habitat is present within 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-K)	Low. No suitable grassland habitat fringing wetlands is present within the study area.
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	(PMST-K)	Low. No suitable wet forest habitat is present within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps.		
Pandion cristatus	Eastern Osprey	V	Bonn	Species/ Ecosystem	-	-	-	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	1 (BioNet) (PMST-L) BAM-C	Low. No suitable coastal habitat within the study area. The species has not been recorded in the locality on BioNet. No large stick nests were detected within the tree canopy during habitat surveys in the study area.
Pluvialis fulva	Pacific Golden Plover	-	C,J,K	-	-	-	-	Pacific Golden Plovers occur in Australia in the non-breeding season, migrating from breeding areas in Asia and Alaska. Within Australia, the Pacific Golden Plover is widespread in coastal regions. Pacific Golden Plovers occur along the east coast and are especially widespread along the Queensland and NSW coastlines.	8 (BioNet)	Low. No suitable coastal habitat is present within the study area.
Pluvialis squatarola	Grey Plover	-	C,J,K	-	-	-	-	In Australia, the Grey Plover has been recorded in all states, where it is found along the coasts, and it especially abundant on the western and southern coastlines, mainly between The Coorong and western beaches of the Eyre	4 (BioNet)	Low. No suitable coastal habitat is present within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								Peninsula in South Australia, and the coast of Western Australia between Albany and the northern Kimberley coast. The species is only occasionally recorded along the coast of NSW.		
Rhipidura rufifrons	Rufous Fantail	-	Bonn	-	-	-	-	Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understory. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands.	(PMST-K)	Low. No suitable wet forest habitat is present within 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-M)	Low. No suitable wet forest habitat is present within the study area.
Tringa glareola	Wood Sandpiper	-	C,J,K	-	-	-	-	Wood Sandpipers are more numerous in the north than the south of Australia and are also found in New Guinea, Africa, the Indian subcontinent and South-east Asia. They breed widely across the north of Europe and Asia, mostly in Scandinavia, Baltic countries and Russia. They are the most abundant migratory wader in non-coastal areas of Asia. Wood Sandpipers are seen in small flocks or singly	6 (BioNet)	Low. No suitable wetland habitat is present within the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations			Distribution and habitat	Number of records (source)	Likelihood of occurrence
		BC Act	EPBC Act		General	Foraging	Breeding			
								on inland shallow freshwater wetlands, often with other waders. They prefer ponds and pools with emergent reeds and grass, surrounded by tall plants or dead trees and fallen timber.		
Tringa nebularia	Common Greenshank	-	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.	1 (BioNet) (PMST-L)	Low. No suitable coastal habitat is present within the study area.
Tringa stagnatilis	Marsh Sandpiper	-	C,J,K	-	-	-	-	The Marsh Sandpiper is found on coastal and inland wetlands throughout Australia. It is recorded in all regions of NSW but especially the central and south coasts. The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, salt marshes, estuaries, pools on inundated floodplains, and intertidal mudflats and regularly at sewage farms and saltworks.	3 (BioNet)	Low. No suitable wetland habitat is present within the study area.

Appendix C: Bat Call Analysis Results

Appendix D: 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. For the purposes of this assessment, species sharing a similar life history and habitat requirements have been grouped, where applicable.

Threatened Species

Grevillea juniperina subsp. *juniperina*

One hundred and fourteen individuals of G*revillea juniperina* subsp. *juniperina* were recorded within the study area during targeted surveys. Seventeen individuals would be directly impacted by the proposal. The species is associated with PCT 3320 and PCT 4025.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 would result in the removal of up to 17 individuals and 0.44 hectares of habitat for the species. 1.76 hectares of potential habitat for the species is present within the subject land. One hundred and fourteen individuals were identified within the study area and there is an abundance of records within the remnant bushland adjacent to the study area. The proposal would result in the removal of a small proportion of individuals within the local population and the loss of 1.76 hectares of potential habitat. Although the proposal would increase fragmentation between some retained individuals, those individuals to be directly impacted by the proposal already exist on disturbed edges of remnant vegetation. It is not expected that the proposal would further limit the ability for pollination by fauna. It is not expected that the proposal would impact the lifecycle of the species such that the local population would be at risk of extinction.
b	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 to threatened species.
c	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	The proposal would result in the removal of up to 17 individuals and 1.76 hectares of habitat for the species. The habitat to be removed consists of disturbed habitat along the existing road corridor. The majority of individuals recorded in the study area would be retained. Over 100 hectares of contiguous habitat occurs in the locality

Significance assessment question		Assessment of the proposal
	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.	inclusive of land protected under biocertification and reserved land.. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal. However, the proposal would contribute to the overall fragmentation of the landscape and increase the degree of fragmentation between individuals in the locality. It is considered unlikely that this would result in isolation of individuals as pollinators would still be able to move between retained individuals.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to the species. Although up to 17 individuals would be removed as a result of the proposal, a large population would be retained in the broader locality. The proposal would increase fragmentation between individuals, however it is unlikely that this would impact the lifecycle of the species to the point of extinction.

Deyeuxia appressa

Deyeuxia appressa has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has not been recorded in the locality, however is associated with PCT 3320 and PCT 4025.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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.	This species has not been recorded in the study area or locality, however potential habitat for the species is present within the subject land. *Deyeuxia appressa* is a highly restricted NSW endemic, only known from two pre-1942 records in the Sydney area. It has not been collected since and may now be extinct in the wild. Should the species occur within the subject land, the proposal would result in its removal and an adverse effect on the species' lifecycle

Significance assessment question		Assessment of the proposal
		given its limited occurrence. Targeted surveys for this species have not been carried out within the subject land, however, would be conducted prior to determination of the project. Potential significant impacts on the species may be avoided through detailed design and mitigation measures such as stop work procedures.
b	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 to threatened species.
c	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 would result in the removal of 1.76 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality. If the species were to occur within the subject land, this would likely be considered important habitat important to the long-term survival of the species, given its limited occurrence. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

Deyeuxia appressa has not been recorded in the study area or locality, however potential habitat for the species is present within the subject land. The species is a highly restricted NSW endemic and may be extinct in the wild. Targeted surveys for this species have not been carried out within the subject land, however, will be conducted prior to the determination of the project. Should the species be recorded within the subject land during targeted surveys, the proposal (based on the 80% concept design footprint) may be considered likely to result in a significant impact on the species. In the case of an activity

under Part 5 of the EP&A Act the proponent is required to prepare a species impact statement unless they elect to prepare a BDAR.

Dillwynia tenuifolia

Dillwynia tenuifolia has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded frequently in the locality (732 records), including in close proximity to the study area. The species is associated with PCT 3320.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 species is known from across the Cumberland Plain, from Windsor and Penrith to Dean Park. It is locally abundant in Western Sydney and 732 records occur within the locality. Given the local abundance of the species, should it occur within the subject land, it is considered unlikely that the removal of some individuals within 0.80 hectares of potential habitat would impact the local population to the extent of extinction.
b	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 to threatened species.
c	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 would result in the removal of up to 0.80 hectares of potential habitat for the species. The habitat to be removed consists of disturbed habitat along the existing road corridor. The majority of individuals recorded in the study area would be retained. Over 100 hectares of contiguous habitat occurs in the locality which provides higher quality potential and known habitat for the species. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal. However, the proposal would contribute to the overall fragmentation of the landscape and increase the degree of fragmentation between individuals in the locality. It is considered unlikely that this would result in isolation of individuals as pollinators would still be able to move between retained individuals.
d	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).	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 40 kilometres east of the study area.

Significance assessment question		Assessment of the proposal
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to the species. Although up to 0.80 hectares of potential habitat would be removed as a result of the proposal and targeted surveys for the species have not yet been undertaken to confirm the presence of the species within the subject land, a large population would be retained in the broader locality. The proposal would increase fragmentation between individuals, however it is unlikely that this would impact the lifecycle of the species to the point of extinction.

Hibbertia sp. Bankstown

Hibbertia sp. Bankstown has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded in the locality (25 records) and is associated with PCT 3320.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 species is listed as critically endangered due to low numbers of individuals and restricted geographic distribution. It is known from one population of less than 50 mature individuals at Bankstown Airport. 25 records have been recorded in the locality and potential habitat is present within the study area. Should the species occur within the subject land, the proposal may result in an adverse effect on the local population through direct removal of breeding individuals and genetic diversity within a restricted population.
b	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 to threatened species.
c	In relation to the habitat of a threatened species or ecological community:	The proposal would result in the removal of up to 0.80 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of

Significance assessment question		Assessment of the proposal
	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.	disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality. If the species were to occur within the subject land, this would likely be considered important habitat important to the long-term survival of the species, given its limited occurrence. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The species has been recorded in the locality, however no records occur within the study area. The species is known from one population of less than 50 individuals and is susceptible to local extinction as a result of its restricted distribution. Should the species occur within the subject land, the proposal may result in a significant impact to the species. Targeted surveys for this species have not been carried out within the subject land, however, will be conducted prior to determination of the project. Should the species be recorded within the subject land during targeted surveys, the proposal (based on the 80% concept design footprint) may be likely to result in a significant impact on the species. In the case of an activity under Part 5 of the EP&A Act the proponent is required to prepare a species impact statement unless they elect to prepare a BDAR.

Hibbertia puberula

Hibbertia puberula has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded in the locality (3 records) and is associated with PCT 4025.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 species is widespread. It has been recorded three times in the locality and up to 0.80 hectares of potential habitat would be removed as part of the proposal. It is expected that, should the species occur within the study area, direct impacts would be limited to a small number of individuals (relative to the locality) within highly disturbed habitat. As the proposal is unlikely to result in direct impacts to a large

Significance assessment question		Assessment of the proposal
		number of individuals, it is unlikely that it would result in an adverse effect on the lifecycle of the species (such as through the removal of a large number of breeding individuals).
b	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 to threatened species.
c	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 would result in the removal of 0.80 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality, which provides higher quality potential (and known) habitat for the species. As such, the removal of this potential habitat would be unlikely to result in a decline in the species. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to the species. Although up to 0.80 hectares of potential habitat would be removed as a result of the proposal and targeted surveys for the species have not yet been undertaken to confirm the presence of the species within the subject land, a large population would be retained in the broader locality. The proposal would increase fragmentation between individuals, however it is unlikely that this would impact the lifecycle of the species to the point of extinction.

Pomaderris brunnea

Pomaderris brunnea has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has not been recorded in the locality, however is associated with PCT 3320 and PCT 4025.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 species has been recorded from 33 subpopulations in NSW. Known subpopulations contain at least 1200 plants. Although a population within the study area may not constitute an important population, the species has not been recorded in the locality and it is expected that, should the species occur within the study area, direct impacts would be limited to a small number of individuals within highly disturbed habitat. Targeted surveys for the species would be undertaken prior to determination of the project. to confirm any impacts on the species. Clearance protocols, such as an unexpected finds protocol and pre-clearance surveys, would be implemented to avoid direct impacts where possible. It is considered unlikely that the proposal would result in the removal of individuals to the extent that the lifecycle of the species would be impacted and the species would be placed at the risk of extinction.
b	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 to threatened species.
c	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 species has a widespread distribution in south-western Sydney, with a concentration of known populations around the Wollondilly and Camden LGAs. It is considered unlikely that the removal of 1.76 hectares of potential habitat would reduce the area of occupancy of the species. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
d	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).	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 40 kilometres east of the study area.

Significance assessment question		Assessment of the proposal
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to the species. Although up to 1.76 hectares of potential habitat would be removed as a result of the proposal and targeted surveys for the species have not yet been undertaken to confirm the presence of the species within the subject land, a large population would be retained in the broader locality. The proposal would increase fragmentation between individuals, however it is unlikely that this would impact the lifecycle of the species to the point of extinction.

Pterostylis saxicola

Pterostylis saxicola has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded once in the locality and is associated with PCT 3320.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 species is known from only five locations in Western Sydney and is susceptible to local extinction as a result of its limited occurrence and distribution. Should the species occur within the subject land, the proposal has the potential to adversely affect the lifecycle of the species, through direct removal of individuals, such that the local population could be placed at risk of extinction.
b	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 to threatened species.
c	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	The proposal would result in the removal of 0.80 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality. If the species were to occur within the subject land, this would

Significance assessment question		Assessment of the proposal
	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.	likely be considered important habitat important to the long-term survival of the species, given its limited occurrence. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The species has not been recorded in the study area or locality, however potential habitat for the species is present within the subject land. The species is known from only five locations in Western Sydney and is susceptible to local extinction as a result. Should the species occur within the subject land, the proposal would likely result in a significant impact to the species. Targeted surveys for this species have not been carried out within the subject land, however, will be conducted prior to the determination of the project. Should the species be recorded within the subject land during targeted surveys, the proposal (based on the 80% concept design footprint) may be considered likely to result in a significant impact on the species. In the case of an activity under Part 5 of the EP&A Act the proponent is required to prepare a species impact statement unless they elect to prepare a BDAR.

Pultenaea parviflora

Pultenaea parviflora has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded frequently in the locality (880 records) and is associated with PCT 3320.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 species is known from Penrith, Windsor and Blacktown where it may be locally abundant. The species has been recorded frequently in the locality and up to 0.80 hectares of potential habitat would be removed as part of the proposal. It is expected that, should the species occur within the study area, direct impacts would be limited to a small number of individuals (relative to the locality) within highly disturbed habitat. As the proposal is unlikely to result

Significance assessment question		Assessment of the proposal
		in direct impacts to a large number of individuals, it is unlikely that it would result in an adverse effect on the lifecycle of the species (such as through the removal of a large number of breeding individuals).
b	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 to threatened species.
c	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 would result in the removal of 0.80 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality, which provides higher quality potential (and known) habitat for the species. As such, the removal of this potential habitat would be unlikely to result in a decline in the species. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to the species. Although up to 0.80 hectares of potential habitat would be removed as a result of the proposal and targeted surveys for the species have not yet been undertaken to confirm the presence of the species within the subject land, a large population would be retained in the broader locality. The proposal would increase fragmentation between individuals, however it is unlikely that this would impact the lifecycle of the species to the point of extinction.

Pultenaea pedunculata

Pultenaea pedunculata has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has not been recorded in the locality, however is associated with PCT 3320.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 species has not been recorded in the locality, however potential habitat is present within the subject land. The proposal would result in the removal of 0.80 hectares of potential habitat for the species, consisting of disturbed roadside vegetation. As the study area provides only low-quality potential habitat for the species, and no known records occur within the locality, it is not expected that there would be a direct impact to any individuals of the species. If direct impacts were to occur, these would be limited to a small number of individuals within highly disturbed habitat. Targeted surveys for the species would be conducted prior to determination of the project. Clearance protocols, such as an unexpected finds protocol and pre-clearance surveys, would be implemented to avoid direct impacts where possible. As the proposal is unlikely to result in direct impacts to a large number of individuals, it is unlikely that it would result in an adverse effect on the lifecycle of the species (such as through the removal of a large number of breeding individuals)
b	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 to threatened species.
c	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 would result in the removal of 0.80 hectares of potential habitat. It is considered unlikely that the removal of 0.80 hectares of potential habitat would reduce the area of occupancy of the species. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
d	Whether the proposed development or activity is likely to have an adverse effect on any declared area	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 40 kilometres east of the study area.

Significance assessment question		Assessment of the proposal
	of outstanding biodiversity value (either directly or indirectly).	
e	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: • Clearing of native vegetation • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to the species. Although up to 0.80 hectares of potential habitat would be removed as a result of the proposal and targeted surveys for the species have not yet been undertaken to confirm the presence of the species within the subject land, a large population would be retained in the broader locality. The proposal would increase fragmentation between individuals, however it is unlikely that this would impact the lifecycle of the species to the point of extinction.

Woodland Birds

Based on the habitat suitability assessment, ten threatened woodland bird species were considered to have a moderate likelihood of occurrence within the study area:

- *Anthochaera phrygia* – listed as critically endangered under the BC Act
- *Artamus cyanopterus cyanopterus*– listed as vulnerable under the BC Act
- *Callocephalon fimbriatum* – listed as vulnerable under the BC Act
- *Calyptorhynchus lathami lathami*– listed as vulnerable under the BC Act
- *Chthonicola sagittata* – listed as vulnerable under the BC Act
- *Daphoenositta chrysoptera* – listed as vulnerable under the BC Act
- *Glossopsitta pusilla* – listed as vulnerable under the BC Act
- *Lathamus discolor* – listed as endangered under the BC Act
- *Neophema pulchella* – listed as vulnerable under the BC Act
- *Petroica phoenicea* – listed as vulnerable under the BC Act

These species were not detected within the study area during targeted surveys, however, have been recorded in the locality and suitable habitat is present within the study area. The occurrence of these species within the study area would be likely be intermittent in nature, due to the presence of potential foraging habitat, and they would not reside for long periods of time within the study area. This potential foraging habitat is not considered a key resource for any of these species due to the abundance of high-quality habitat that occurs in the locality. No active nests or breeding hollows for these species were detected during field surveys. Potential breeding habitat for parrot species within the subject land is limited to four HBT with small (<5 centimetres) to medium (10 centimetres) hollows, however these were inactive during field surveys.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 would result in the removal of up to 1.76 hectares of foraging habitat for these species. Four small to medium HBT, suitable for Little Lorikeet were detected within the subject land, however, were not active at the time of surveys. No nests for these species were detected within the subject land. As such, the proposal would not result in the removal of any existing breeding habitat. Mitigation measures implemented as part of the proposal would include unexpected finds and pre-clearance surveys. As such, the proposal is unlikely to result in direct mortality of these species. Therefore, it is unlikely that the proposal would result in an adverse effect on the lifecycle of these species (i.e. through direct mortality or impacts to breeding activity) such that a local population would be placed at risk of extinction.
b	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 to threatened species.
c	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 would result in the removal of 1.76 hectares of PCTs and 60 planted native trees. This vegetation may provide potential nesting, roosting and foraging habitat for the species, however, does not contain any existing nests. These species are highly mobile and there is an abundance of similar and/or higher quality habitat that occurs in the locality inclusive of land protected under biocertification and reserved land... As such, habitat for the species within the study area is not considered a key resource and its removal is unlikely to result in the fragmentation of available habitat in the locality for the species, given their mobile nature. Therefore, the habitat is not considered to be important and/or fragmented to an extent that its removal would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Removal of dead wood and dead trees. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to any threatened woodland birds. Habitat to be impacted by the proposal consists of potential foraging, roosting and nesting habitat which is not considered to be a of high importance to the long-term survival of the species. There are no existing nests or active breeding hollows within the study area and no impacts to breeding habitat are anticipated to occur as a result of the proposal. Appropriate mitigation measures, including pre-clearance surveys and unexpected finds procedures, would be implemented to minimise impacts to the species.

Raptors

Based on the habitat suitability assessment, five threatened raptor species were considered to have a moderate likelihood of occurrence within the study area:

- *Circus assimilis*– listed as vulnerable under the BC Act
- *Falco subniger*– listed as vulnerable under the BC Act
- *Haliaeetus leucogaster* – listed as vulnerable under the BC Act
- *Hieraaetus morphnoides*– listed as vulnerable under the BC Act
- *Lophoictinia isura* – listed as vulnerable under the BC Act

No existing breeding habitat (i.e. stick nests) for these species was detected in the study area during field surveys. The occurrence of these species within the study area would be likely be intermittent in nature, due to the presence of potential foraging habitat, and they would not reside for long periods of time within the study area. This potential foraging habitat is not considered a key resource for any of these species due to the abundance of high-quality habitat that occurs in the locality.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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.	No suitable breeding features (i.e. stick nests) for these species occur within the study area. As such, the proposal would not result in the removal of any existing breeding habitat. Mitigation measures implemented as part of the proposal would include unexpected finds and pre-clearance surveys. The proposal will remove potential foraging habitat for these species, however there is an abundance of similar and/or higher quality habitat that occurs in the locality including areas protected in perpetuity through biocertification and reservation. As such, the proposal is unlikely to result in direct mortality of these species. Therefore, it is unlikely that the proposal would result in an adverse effect on the lifecycle of these species (i.e. through direct mortality, removal of foraging habitat or impacts to breeding activity) such that a local population would be placed at risk of extinction.
b	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 to threatened species.

Significance assessment question		Assessment of the proposal
c	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 would result in the removal of 1.76 hectares of PCTs and 60 planted native trees. This vegetation may provide potential nesting, roosting and foraging habitat for the species, however, does not contain any existing stick nests. These species are highly mobile and there is an abundance of similar and/or higher quality habitat that occurs in the locality. Inclusive of land protected under biocertification and reserved land. As such, habitat for the species within the study area is not considered a key resource and its removal is unlikely to result in the fragmentation of available habitat in the locality for the species, given their mobile nature. Therefore, the habitat is not considered to be important and/or fragmented to an extent that its removal would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Removal of dead wood and dead trees. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to any threatened raptors. Habitat to be impacted by the proposal consists of potential foraging, roosting and nesting habitat which is not considered to be a of high importance to the long-term survival of the species. There are no existing nests, within the study area and no impacts to breeding habitat are anticipated to occur as a result of the proposal. Appropriate mitigation measures, including pre-clearance surveys and unexpected finds procedures, would be implemented to minimise impacts to the species.

Owls

Based on the habitat suitability assessment, two threatened owl species were considered to have a moderate likelihood of occurrence within the study area:

- *Ninox strenua* – listed as vulnerable under the BC Act
- *Tyto novaehollandiae*– listed as vulnerable under the BC Act

These species have not been recorded within the study area, however, have been recorded in the locality and suitable habitat is present within the study area. The occurrence of these species within the study area would be likely be intermittent in nature, due to the presence of potential foraging habitat, and they would not reside for long periods of time within the study area. This potential foraging habitat is not considered a key resource for either of these species. No suitably sized breeding hollows occur within the study area.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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.	No suitable breeding features (i.e. large hollows) for these species occur within the study area. As such, the proposal would not result in the removal of any existing breeding habitat. Mitigation measures implemented as part of the proposal would include unexpected finds and pre-clearance surveys. The proposal will remove potential foraging habitat for these species, however there is an abundance of similar and/or higher quality habitat that occurs in the locality including areas protected in perpetuity through biocertification and reservation. As such, the proposal is unlikely to result in direct mortality of these species. Therefore, it is unlikely that the proposal would result in an adverse effect on the lifecycle of these species (i.e. through direct mortality, removal of foraging habitat or impacts to breeding activity) such that a local population would be placed at risk of extinction.
b	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 to threatened species.
c	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 would result in the removal of 1.76 hectares of PCTs and 60 planted native trees. This vegetation may provide roosting and foraging habitat for the species, however, does not contain any suitable breeding hollows. These species are highly mobile and there is an abundance of similar and/or higher quality habitat that occurs in the locality inclusive of areas protected under biocertification and reserved land. As such, habitat for the species within the study area is not considered a key resource and its removal is unlikely to result in the fragmentation of available habitat in the locality for the species, given their mobile nature. Therefore, the habitat is not considered to be important and/or fragmented to an extent that its removal would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Removal of dead wood and dead trees. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality

Significance assessment question		Assessment of the proposal
		scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to any threatened owl species. Habitat to be impacted by the proposal consists of foraging habitat which is not considered to be a of high importance to the long-term survival of the species. There are no suitable breeding hollows within the study area and no impacts to breeding habitat are anticipated to occur as a result of the proposal. Appropriate mitigation measures would be implemented to minimise impacts to the species.

Dasyurus maculatus (Spotted-tail Quoll)

Based on the habitat suitability assessment, *Dasyurus maculatus* was considered to have a moderate likelihood of occurrence within the study area. The occurrence of this species within the study area is considered to be likely be intermittent in nature, due to the presence of potential foraging habitat, and they would not reside for long periods of time within the study area, due to the abundance of similar and/or higher quality habitat in the locality.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 occurrence of this species within the study area is considered to be likely be intermittent in nature, due to the presence of potential foraging habitat, and they would not reside for long periods of time within the study area, due to the abundance of similar and/or higher quality habitat in the locality. No evidence of breeding activity or breeding features (including large hollow-bearing trees) were observed within the study area. Appropriate mitigation and management measures would be implemented to avoid negative potential impacts to local ecology. This would include pre-clearance surveys and unexpected finds procedures. Indirect impacts such as noise would be temporary in nature and would not occur at night. Therefore, it is unlikely the proposal would result in an adverse effect on the life cycle of this species, nor would a local population of these species be placed at risk of extinction.
b	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 to threatened species.
c	In relation to the habitat of a threatened species or ecological community:	Habitat within the study area is limited to potential foraging habitat with a high degree of disturbance as a result of the existing road corridor. There is an abundance of similar and/or higher quality habitat in the locality. Potential

Significance assessment question		Assessment of the proposal
	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.	habitat for the species within the study area is not considered a key resource and the removal of 1.76 hectares is unlikely to result in the fragmentation of available habitat in the locality for the species, given its mobile nature. Existing connectivity corridors between areas of vegetation within the study area are already limited as a result of the existing road corridor and surrounding development and the proposal would not significantly increase this fragmentation or result in any additional isolation of potential habitat. Therefore, the habitat is not considered to be important and/or fragmented to an extent that its removal would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to *Dasyurus maculatus*. Habitat to be impacted by the proposal consists of potential foraging habitat which is not considered to be a of high importance to the long-term survival of the species and there is an abundance of similar and/or higher quality habitat in the locality. Existing connectivity corridors between areas of vegetation within the study area are already limited as a result of the existing road corridor and surrounding development and the proposal would not significantly increase this fragmentation or result in any additional isolation of potential habitat. As such, the proposal would be unlikely to result in a significant impact to the species.

Myotis macropus (Southern Myotis)

Three culverts within the Bells Creek Bridge on Townson Road provide roosting habitat for *Myotis macropus.* This species was observed foraging over the pool in Bells Creek, adjacent to the roost and was also recorded on ANABAT devices located to the west of Richmond Road. Suitable habitat for the species within the subject land includes all areas of PCT 3320 and PCT 4025 within 200 metres of the bank of Bells Creek.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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.	A maternity roost for the species was recorded in culverts within Bells Creek Bridge. The proposal would not directly impact the bridge and impacts would be limited to disturbances (such as noise and light from construction activities). Works during the breeding season would be

Significance assessment question		Assessment of the proposal
		appropriately managed to minimise disturbance impacts to the breeding activity of the species. The proposal would result in the removal of 1.33 hectares of vegetation within 200m of waterways that form part of the species polygon. However, there is an abundance of similar and/or higher quality habitat that occurs in the locality including areas protected in perpetuity through biocertification and reservation. Potential foraging habitat may be disturbed as a part of the proposal. There is the potential that this species could be breeding in other locations within the study area including hollow-bearing trees and road bridges that may be removed as part of the proposal. Adequate mitigation measures, such as pre-clearance surveys, will be implemented to minimise direct impacts to active roosts.
b	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 to threatened species.
c	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.	A maternity roost for the species was recorded in culverts within Bells Creek Bridge. The proposal would not directly impact the bridge and impacts would be limited to disturbances (such as noise and light from construction activities). The proposal would not result in the permanent removal of foraging resources for the species, as the species forages over open pools. The proposal will result in the removal of 1.33 hectares of foraging habitat for the species however there is an abundance of similar and/or higher quality habitat that occurs in the locality including areas protected in perpetuity through biocertification and reservation. Therefore, the proposal is not considered to fragment habitat to an extent that its removal would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to *Myotis macropus*. Habitat to be impacted by the proposal consists of roosting and foraging habitat which would not be directly impacted. Appropriate mitigation measures would be implemented to minimise impacts to the species.

Hollow-dependent microbats

Micronomus norfolkensis was recorded within the study area (from ANABAT recordings). Potential habitat for this species within the study area includes roosting-(hollows) and foraging habitat.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 would result in the removal of 1.76 hectares of suitable foraging habitat for the species and 4 HBT. This represents a small portion of available habitat within the locality. Three HBT to be impacted by the proposal may provide potential breeding and/or roosting habitat for the species. Hollow-dependent bats are likely to rely on multiple roost trees and therefore are unlikely to suffer a complete loss of all available roosting trees as a result of the proposal. It is considered unlikely that the proposal would 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 by the removal of 4 HBT, relative to the likely abundance of suitable breeding and roosting habitat in the locality. Pre-clearance surveys would be undertaken to minimise the risk of direct mortality, during vegetation clearing, to the species. As the proposal is unlikely to remove key resources for the species, it is considered unlikely that the proposal would result in an adverse effect on the lifecycle of these species such that a local population would be placed at risk of extinction.
b	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 to threatened species.
c	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	The proposal would result in the removal of 1.76 hectares of suitable foraging habitat for the species and 4 HBT. The species is highly mobile and there is an abundance of similar and/or higher quality habitat that occurs in the locality. As such, habitat for the species within the study area is not considered a key resource and its removal is unlikely to result in the fragmentation of available habitat in the locality for the species, given its mobile nature. Hollow-dependent bats are likely to rely on multiple roost trees and therefore are unlikely to suffer a complete loss of all available roosting trees as a result of the proposal. Therefore, the habitat is not considered to be important and/or likely to be fragmented to an extent that its removal

Significance assessment question		Assessment of the proposal
	to the long-term survival of the species or ecological community in the locality.	would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to *Micronomus norfolkensis*. Habitat to be impacted by the proposal consists of foraging habitat, which is not considered to be a of high importance to the long-term survival of the species, and potential roosting/breeding habitat. The loss of potential roosting/breeding habitat as the result of the proposal is unlikely to significantly impact the local population, as any individuals roosting within the study area are likely to have various roost sites in the broader locality. Appropriate mitigation measures, including pre-clearance surveys, would be implemented to minimise impacts to the species.

Cave-dwelling microbats

One cave dwelling microbat species, *Miniopterus orianae oceanensis* was detected by ANABAT units deployed in the study area. A "possible" recording for *Miniopterus australis* was detected by ANABAT units deployed within the study area. This species has been afforded a moderate likelihood of occurrence. Habitat constraints for these species, as per the TBDC, include the presence of a "cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding". No records of roosting or breeding habitat (e.g. caves, tunnels, mines, culverts) occur within the 10 kilometre locality (from BioNet). Suitable habitat for the species within the study area is restricted to foraging habitat.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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.	No suitable roosting or breeding habitat for these species occurs within the study area. Suitable habitat for the species within the study area is restricted to foraging habitat. Potential foraging habitat for the species within the study area is not considered a key resource for the species due to the abundance of similar and/or higher quality habitat in the locality. As the proposal is unlikely to remove key resources for the species and would not directly impact roosting or breeding habitat, it is unlikely that the proposal would result in an adverse effect on the lifecycle of these species (i.e. through direct mortality or impacts to breeding activity) such that local populations would be placed at risk of extinction.

Significance assessment question		Assessment of the proposal
b	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 to threatened species.
c	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 would result in the removal of 1.76 hectares of suitable foraging habitat for the species and 4 HBT. The species are highly mobile and there is an abundance of similar and/or higher quality habitat that occurs in the locality. As such, habitat for the species within the study area is not considered a key resource and its removal is unlikely to result in the fragmentation of available habitat in the locality for the species, given their mobile nature. Therefore, the habitat is not considered to be important and/or likely to be fragmented to an extent that its removal would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to any cave-dwelling microbats. Habitat to be impacted by the proposal consists of foraging habitat which is not considered to be a of high importance to the long-term survival of the species. No suitable roosting or breeding habitat occurs in the locality and the proposal would not impact the lifecycle of the species through impacts to breeding.

Pteropus poliocephalus (Grey-headed flying-fox)

Several *Pteropus poliocephalus* were recorded within the study area during field surveys. This included several individuals flying over the study area and one individual foraging within the study area. The occurrence of this species within the study area is considered to be likely be intermittent in nature, due to the presence of potential foraging habitat, and they would not reside for long periods of time within the study area. This potential foraging habitat is not considered a key resource due to the abundance of similar and/or higher quality habitat in the locality.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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.	No active breeding camps are present within the study area and the nearest camp to the study area occurs approximately 6.4 kilometres to the south west of the study area at Ropes Creek. The study area provides foraging habitat for the species, however habitat is not considered a key resource for the species due to the abundance of similar and/or higher quality habitat in the locality. As the proposal is unlikely to remove key resources for the species and would not directly impact a breeding camp, it is unlikely that the proposal would result in an adverse effect on the lifecycle of these species (i.e. through direct mortality or impacts to breeding activity) such that a local population would be placed at risk of extinction.
b	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 to threatened species.
c	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 would result in the removal of 1.76 hectares of PCTs and 60 planted native trees. This vegetation provides foraging habitat for the species, however, no breeding camps occur within the study area. The species is highly mobile and there is an abundance of similar and/or higher quality habitat that occurs in the locality. As such, habitat for the species within the study area is not considered a key resource and its removal is unlikely to result in the fragmentation of available habitat in the locality for the species, given its mobile nature. Therefore, the habitat is not considered to be important and/or fragmented to an extent that its removal would result in impacts to the long-term survival of the species in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to *Pteropus poliocephalus*. Habitat to be impacted by the proposal consists of foraging habitat which is not considered to be a of high importance to the long-term survival of the species. There are no breeding camps within the study area and the nearest is located over 6 kilometres away. No impacts to breeding

habitat are anticipated to occur as a result of the proposal. Appropriate mitigation measures would be implemented to minimise impacts to the species.

Meridolum corneovirens (Cumberland Plain Land Snail)

Six shells of *Meridolum corneovirens* were recorded within the study area during field surveys. The species was not recorded within the subject land during targeted surveys. Suitable habitat for this species within the study area was identified as all areas of PCT 3320 and PCT 4025.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact threatened species or their habitats.

Significance assessment question		Assessment of the proposal
a	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 would involve groundcover disturbance, resulting in disturbance to refuge habitat for the species, such as leaf litter and logs. Up to 1.57hectares of habitat for the species would be directly impacted by the proposal. Due to the availability of habitat within the immediate locality (including habitat within the study area that would not be impacted), the species would not be dependent on habitat provided by the study area, and thus the removal of a relatively small 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. The construction phase has to potential to directly impact the species through mortality of individuals. A pre-clearance and relocation survey for the species would be undertaken within the construction footprint prior to the commencement of any clearing activities. Appropriate mitigation and management measures, such as the retention of habitat features (i.e. leaf litter, logs) on site, would be implemented to minimise potential negative impacts to the species. As the species is hermaphroditic, the proposal would not interrupt breeding cycles through fragmentation (i.e. dispersal is not required). Potential mortality of the species during construction may impact the breeding cycle through a reduction in population size, however appropriate mitigation measures would be implemented to minimise direct mortality during construction (i.e. pre-clearance and stop work procedures). 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.
b	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 to threatened species.

Significance assessment question		Assessment of the proposal
c	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 would result in the removal of up to 1.76 hectares of habitat for the species. This habitat occurs adjacent to the existing road corridor and occurs at the edge of a broader area of suitable habitat in the locality, which consists of over 100 hectares of contiguous habitat for the species inclusive of areas protected under biocertification and reserved land. Existing patches are already isolated by the existing road corridor and other development within the locality. As such, the proposal would not result in further fragmentation of habitat and would not result in the isolation of any existing habitat. Areas to be retained would be subject to increased edge effects, however the proposal would include mitigation to minimise impacts to these areas, including exclusion zones and weed management.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Removal of dead wood and dead trees • Invasion of native plant communities by exotic perennial grasses. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal is unlikely to result in a significant impact to the *Meridolum corneovirens*. The species was recorded within the study area and suitable habitat is present throughout the study area, however this habitat occurs adjacent to existing disturbances and the proposal would not result in further fragmentation of habitat or the isolation of any existing habitat. Mitigation measures, including pre-clearance surveys and exclusion fencing, would be implemented to minimise direct and indirect impacts to the species.

Communities

Cumberland Plain Woodland in the Sydney Basin Bioregion

Cumberland Plain Woodland in the Sydney Basin Bioregion is listed as critically endangered under the BC Act. 3.49 hectares of this community is present within the study area and the proposal would result in the removal of up to 0.80 hectares of the community outside of certified lands.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact an endangered ecological community listed under the BC Act.

Significance assessment question		Assessment of the proposal
a	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 a threatened community.
b	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 would result in the removal of 0.80 hectares of the community. Vegetation to be removed consists predominately of disturbed vegetation adjacent to the existing road corridor. As such, this vegetation has a degraded understory and is subject to edge effects, particularly weed infestations. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. In general, these areas are subject to existing disturbances. Areas of the community within the study area would also be retained. The proposal would include mitigation measures relating to the spread of weeds and pathogens. Higher quality patches of the community, including within reserved areas, are present in the locality. Clearing within certified areas has been offset for under the North West Growth Centre Biodiversity Certification process. As such, the proposal is unlikely to result in extinction of the local occurrence through direct and indirect impacts.
c	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 would result in the removal of 0.80 hectares of the TEC. This represents 18% of the community within the study area and <0.006% of the total extent within NSW. Additional areas would be subject to indirect and edge effects as a result of the proposal. These areas are subject to existing disturbance and mitigation measures relating to the spread of weeds and pathogens would be implemented. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated. However, the proposal would contribute to the overall fragmentation of the landscape. As the vegetation is already disturbed and subject to existing edge effects, it is considered to be lower quality vegetation relative to the larger patches of intact and reserved vegetation in the locality. As such, these areas are not considered to be important to the long-term survival of the community in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Loss of hollow-bearing trees • Invasion of native plant communities by exotic perennial grasses

Significance assessment question		Assessment of the proposal
		• Introduction and establishment of disease. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal would directly impact 0.80 hectares of Cumberland Plain Woodland in the Sydney Basin Bioregion. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated. It is not considered that the proposal would result in a significant impact on the community, given the degree of existing disturbance and the abundance of higher quality remnant patches in the locality which would be retained.

River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

River-Flat Eucalyptus Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions is listed as endangered under the BC Act. 3.36 hectares of this community is present within the study area and the proposal would result in the removal of up to 0.95 hectares of the community.

As per the Threatened Species Test of Significance Guidelines (OEH 2018), the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly impact an endangered ecological community listed under the BC Act.

Significance assessment question		Assessment of the proposal
a	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 a threatened community.
b	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 would result in the removal of 0.95 hectares of the community. Vegetation to be removed consists predominately of disturbed vegetation adjacent to the existing road corridor. As such, this vegetation has a degraded understory and is subject to edge effects, particularly weed infestations. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. In general, these areas are subject to existing disturbances. Areas of the community within the study area would also be retained. The proposal would include mitigation measures relating to the spread of weeds and pathogens. Higher quality patches of the community, including within certified lands and reserved areas, are present in the locality. As such, the proposal is unlikely to result in extinction of the local occurrence through direct and indirect impacts.

Significance assessment question		Assessment of the proposal
c	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 would result in the removal of up to 0.95 hectares of the TEC. This represents approximately 0.1% of the total extent of the community within NSW. Additional areas would be subject to indirect and edge effects as a result of the proposal. These areas are subject to existing disturbance and mitigation measures relating to the spread of weeds and pathogens would be implemented. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated. However, the proposal would contribute to the overall fragmentation of the landscape. As the vegetation is already disturbed and subject to existing edge effects, it is considered to be lower quality vegetation relative to the larger patches of intact and reserved vegetation in the locality. As such, these areas are not considered to be important to the long-term survival of the community in the locality.
d	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).	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 40 kilometres east of the study area.
e	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: • Clearing of native vegetation • Loss of hollow-bearing trees • Invasion of native plant communities by exotic perennial grasses • Introduction and establishment of disease. The project would implement appropriate mitigation measures to reduce these impacts. These KTPs arising from the project are not considered significant on the locality scale and are unlikely to significantly impact potential habitat for the species.

Conclusion

The proposal would directly impact 0.95 hectares of River-Flat Eucalyptus Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated. It is not considered that the proposal would result in a significant impact on the community, given the degree of existing disturbance and the abundance of higher quality remnant patches in the locality which would be retained.

Appendix E: Assessments of significance (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.

In September 2015, a 'strategic assessment' approval was granted by the Federal Minister in accordance with the EPBC Act. The approval applies to Transport road activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species.

As a result, Transport road proposals assessed via an REF do not require referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for these matters, even if the activity is likely to have a significant impact.

AoS under the EPBC Act are guided by the Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013).

Threatened Species

Deyeuxia appressa

This species is listed as endangered under the EPBC Act.

Deyeuxia appressa has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has not been recorded in the locality, however is associated with PCT 3320 and PCT 4025.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of a population	This species has not been recorded in the study area or locality, however potential habitat for the species is present within the subject land. *Deyeuxia appressa* is a highly restricted NSW endemic, only known from two pre-1942 records in the Sydney area. It has not been collected since and may now be extinct in the wild. Should the species occur within the subject land, the proposal would result in a long-term decrease in the population size, through direct removal of individuals, given its limited occurrence. The Conservation Advice notes that if the species still exists in the wild, it is likely to be threatened by local extinction due to environmental and demographic uncertainty because of its extremely small population size.
2	Reduce the area of occupancy of the species	Given the limited occurrence and extent of the known population, should the species occur within the subject land, the proposal would reduce the occupancy of the species.
3	Fragment an existing population into two or more populations	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
4	Adversely affect habitat critical to the survival of a species	The proposal would result in the removal of 1.76 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality. If the species were to occur within the subject land, this would likely be

Significance assessment question The action would:		Assessment of the proposal
		considered important critical habitat for the survival of the species, given its limited occurrence.
5	Disrupt the breeding cycle of a population	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
6	Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Conservation Advice notes, that if still extant, the main identified threats to the species are habitat loss and degradation; weed invasion; and changes to hydrology. Should the species occur within the study area of subject land, there is potential that impacts of the proposal would result in a decline due to the small population size.
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 would 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 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 with the recovery of the species.	At the time of preparation, there is currently no recovery plan for the species. Given its small population size and limited occurrence, the proposal would likely interfere with the recovery of the species through direct impacts and/or introduction of additional threats.

Conclusion

Deyeuxia appressa has not been recorded in the study area or locality, however potential habitat for the species is present within the subject land. The species is a highly restricted NSW endemic and may be extinct in the wild. Should the species occur within the subject land, the proposal could result in a significant impact to the species. Targeted surveys for this species have not been carried out within the subject land, however, would be conducted prior to determination of the project.. Should the species be recorded within the subject land during targeted surveys, the proposal (based on the 80% concept design footprint) may be considered likely to result in a significant impact on the species and further assessment through a referral to the federal Minister of the Environment and Energy would be required.

Hibbertia sp. Bankstown

This species is listed as critically endangered under the EPBC Act.

Hibbertia sp. Bankstown has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded in the locality (25 records) and is associated with PCT 3320.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of a population	The species is listed as critically endangered due to low numbers of individuals and restricted geographic distribution. It is known from one population of less than 50 mature individuals at Bankstown Airport. 25 records have

Significance assessment question The action would:		Assessment of the proposal
		been recorded in the locality and potential habitat is present within the study area. Should the species occur within the subject land, the proposal would result in a long-term decrease in the population size, through direct removal of individuals, given its limited occurrence.
2	Reduce the area of occupancy of the species	Given the limited occurrence and extent of the known population, should the species occur within the subject land, the proposal would reduce the occupancy of the species.
3	Fragment an existing population into two or more populations	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
4	Adversely affect habitat critical to the survival of a species	No habitat critical for the survival of the species is identified in the Conservation Advice. The study area does not contain any known populations of the species and potential habitat consists of disturbed habitat along the existing road corridor. It is unlikely that the 0.80 hectares of disturbed habitat to be impacted by the proposal would be considered critical habitat.
5	Disrupt the breeding cycle of a population	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
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 would result in the removal of 0.80 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality, which provides higher quality potential (and known) habitat for the species. As such, the removal of this potential habitat would be unlikely to result in a decline in the species.
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 would 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 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 with the recovery of the species.	Recovery actions for the species include the protection of existing subpopulations from direct and indirect impacts. Although the study area does not contain a known subpopulation, there is potential that the proposal may result in the removal of some individuals of the species. Targeted surveys would be carried out prior to determination of the project to inform the design where

Significance assessment question The action would:		Assessment of the proposal
		there is potential to result in significant impacts to the species. The proposal would implement appropriate mitigation measures to reduce the potential for indirect impacts to any individuals and potential habitat in the locality that would be retained.

Conclusion

The species has been recorded in the locality, however no records occur within the study area. The species is known from one population of less than 50 individuals and is susceptible to local extinction as a result of its restricted distribution. Should the species occur within the subject land, the proposal could result in a significant impact to the species. Targeted surveys for this species have not been carried out within the subject land, however, would be conducted prior to determination of the project. Should the species be recorded within the subject land during targeted surveys, the proposal (based on the 80% concept design footprint) may be considered likely to result in a significant impact on the species and further assessment through a referral to the federal Minister of the Environment and Energy would be required.

Pomaderris brunnea

This species is listed as vulnerable under the EPBC Act.

Pomaderris brunnea has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has not been recorded in the locality, however is associated with PCT 3320 and PCT 4025. As such, it assumed that any individuals within the study area would not constitute an important population.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of an important population	The species has been recorded from 33 subpopulations in NSW. Known subpopulations contain at least 1200 plants. Although a population within the study area may not constitute an important population, the species has not been recorded in the locality and it is expected that, should the species occur within the study area, direct impacts would be limited to a small number of individuals within highly disturbed habitat. Targeted surveys for the species would be undertaken prior to determination of the project to confirm any impacts on the species. Clearance protocols, such as an unexpected finds protocol and pre-clearance surveys, would be implemented to avoid direct impacts where possible. It is considered unlikely that the proposed action would lead to a long-term decrease in the size of an important population.
2	Reduce the area of occupancy of an important population	The species has a widespread distribution in south-western Sydney, with a concentration of known populations around the Wollondilly and Camden LGAs. It is considered unlikely that the removal of 1.76 hectares of potential habitat would reduce the area of occupancy of the species.
3	Fragment an existing important population into two or more populations	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
4	Adversely affect habitat critical to the survival of a species	As per the Conservation Advice for the species, all habitat for the species should be considered for its long-term survival. No Critical Habitat as defined under section 207A

Significance assessment question The action would:		Assessment of the proposal
		of the EPBC Act has been identified or included in the Register of Critical Habitat.
5	Disrupt the breeding cycle of an important population	The species produced seeds asexually. As such the potential removal of few individuals from a population would not impact the reproductive ability of individuals in a 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 would result in the removal of 1.76 hectares of potential habitat. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality. As such, the removal of this potential habitat would be unlikely to result in a decline in the species.
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 would 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 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 with the recovery of the species.	Recovery actions for the species include the protection of existing subpopulations from direct and indirect impacts. Although the study area does not contain a known subpopulation, there is potential that the proposal may result in the removal of some individuals of the species. Targeted surveys would be carried out prior to determination of the project to inform the design where there is potential to result in significant impacts to the species. The proposal would implement appropriate mitigation measures to reduce the potential for indirect impacts to any individuals and potential habitat in the locality that would be retained.

Conclusion

The species has not been recorded in the study area or locality, however potential habitat for the species is present within the subject land. The proposal is unlikely to result in the removal of potential habitat or direct impacts to individuals to the extent that the species is likely to decline. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Pterostylis saxicola

This species is listed as endangered under the EPBC Act.

Pterostylis saxicola has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded once in the locality and is associated with PCT 3320.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of a population	The species is known from only five locations in Western Sydney and is susceptible to local extinction as a result of its limited occurrence and distribution. Should the species occur within the subject land, the proposal would result in a long-term decrease in the population size, through direct removal of individuals, given its limited occurrence.
2	Reduce the area of occupancy of the species	Given the limited occurrence and extent of the known population, should the species occur within the subject land, the proposal would reduce the occupancy of the species.
3	Fragment an existing population into two or more populations	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
4	Adversely affect habitat critical to the survival of a species	No habitat critical for the survival of the species is identified in the Conservation Advice. The study area does not contain any known populations of the species and potential habitat consists of disturbed habitat along the existing road corridor. It is unlikely that the 0.80 hectares of disturbed habitat to be impacted by the proposal would be considered critical habitat.
5	Disrupt the breeding cycle of a population	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
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 would result in the removal of 0.80 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality, which provides higher quality potential (and known) habitat for the species. As such, the removal of this potential habitat would be unlikely to result in a decline in the species.
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 would 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 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 with the recovery of the species.	Recovery actions for the species relate primarily to the management of identified priority populations and monitoring of recovery. Road widening activities should not adversely impact on known populations. There is the potential the proposal may conflict this action should the species occur within the study area, however the proposal

Significance assessment question The action would:		Assessment of the proposal
		would include mitigation measures, including detailed design and stop work procedures to minimise direct impacts to the species.

Conclusion

The species has frequently been recorded in the locality, however no records occur within the study area. The species is known from only five locations in Western Sydney and is susceptible to local extinction as a result of its limited occurrence and distribution. Should the species occur within the subject land, the proposal could result in a significant impact to the species. Targeted surveys for this species have not been carried out within the subject land, however, would be conducted prior to the determination of the project. Should the species be recorded within the subject land during targeted surveys, the proposal (based on the 80% concept design footprint) may be considered likely to result in a significant impact on the species and further assessment through a referral to the federal Minister of the Environment and Energy would be required.

Pultenaea parviflora

This species is listed as vulnerable under the EPBC Act.

Pultenaea parviflora has been assumed present within the study area as targeted surveys have not been undertaken in accordance with the guidelines. The species has been recorded frequently in the locality (880 records) and is associated with PCT 3320.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of an important population	The species is known from Penrith, Windsor and Blacktown where it may be locally abundant. The species has been recorded frequently in the locality and up to 0.80 hectares of potential habitat would be removed as part of the proposal. It is expected that, should the species occur within the study area, direct impacts would be limited to a small number of individuals (relative to the locality) within highly disturbed habitat. Targeted surveys for the species would be undertaken prior to determination of the project to confirm any impacts on the species. Clearance protocols, such as an unexpected finds protocol and pre-clearance surveys, would be implemented to avoid direct impacts where possible. It is considered unlikely that the proposed action would lead to a long-term decrease in the size of an important
2	Reduce the area of occupancy of an important population	The species has a widespread distribution in south-western Sydney. It is considered unlikely that the removal of 0.80 hectares of potential habitat would reduce the area of occupancy of the species. Over 100 hectares of contiguous habitat occurs adjacent to the study area and provides known and potential habitat for the species.
3	Fragment an existing important population into two or more populations	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal.
4	Adversely affect habitat critical to the survival of a species	No habitat critical for the survival of the species is identified in the Conservation Advice. The study area does not contain any known populations of the species and potential habitat consists of disturbed habitat along the existing road

Significance assessment question The action would:		Assessment of the proposal
		corridor. Given the prevalence of records elsewhere in the locality and existing intact remnants located adjacent to the study area, it is unlikely that the 0.80 hectares of disturbed habitat to be impacted by the proposal would be considered critical habitat.
5	Disrupt the breeding cycle of an important population	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, no additional areas of habitat would become isolated as a result of the proposal and the breeding cycle would be expected to occur relatively similar to conditions prior to construction and operation.
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 would result in the removal of 0.80 hectares of potential habitat for the species. This habitat is not known important habitat for the species and consists of disturbed habitat along the existing road corridor. Over 100 hectares of contiguous habitat occurs in the locality, which provides higher quality potential (and known) habitat for the species. As such, the removal of this potential habitat would be unlikely to result in a decline in the species.
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 would 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 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 with the recovery of the species.	Recovery actions for the species relate primarily to the management of identified priority populations and monitoring of recovery. Road widening activities should not adversely impact on known populations. There is the potential the proposal may conflict this action should the species occur within the study area, however the proposal would include mitigation measures, including detailed design and stop work procedures to minimise direct impacts to the species.

Conclusion

The species has frequently been recorded in the locality; however, no records occur within the study area. Targeted surveys have not been undertaken, however would be completed prior to determination of the project. The proposal is unlikely to result in the removal of potential habitat or direct impacts to individuals to the extent that the species is likely to decline. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Anthochaera phrygia (Regent Honeyeater)

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.

This species was not detected within the study area during surveys and known breeding habitat for the species does not occur in the study area. The study area does not coincide with any important habitat maps for the species. Potential habitat within the study area has not been identified as essential to support the critical life stages of the species.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of a population	The species is highly mobile and only occurs irregularly in most sites. As such, the species may occur within the study area but is unlikely to be dependent on habitat provided by the study area. The study area does not occur within a known breeding area and no important mapped habitat occurs within the study area. Impacts to the species would be through the removal of potential foraging habitat. Given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, the removal of foraging 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.
2	Reduce the area of occupancy of the species	The species has a patchy distribution throughout eastern Australia. It is highly mobile and only occurs irregularly in most sites. As such, the species may occur within the study area but is unlikely to be dependent on habitat provided by the study area. The proposal would result in the removal of a relatively small area of potential foraging habitat within the species' range. This area is not identified as important habitat under the BAM. As the species is unlikely to be dependent on this habitat and there is an abundance of similar or higher quality foraging habitat within the locality, the proposal is unlikely to result in a major reduction in the area of occupancy by the species.
3	Fragment an existing population into two or more populations	The removal of vegetation would be limited to a relatively narrow area of vegetation subject to existing edge effects. Given the mobile nature and the large home range of the species, the proposed works are unlikely to cause fragmentation of populations. Removal of potential foraging habitat would be limited to the edge of existing habitat and would not fragment any intact patches of vegetation. The proposal would not introduce a new barrier in the landscape (as there is an existing road corridor). It is considered unlikely that the species would be dependent on habitat within the study area. As the species is highly mobile, dispersal of individuals would not be limited 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. Habitat critical to the survival of the species includes: • Any breeding or foraging areas where the species is likely to occur • Any newly discovered breeding or foraging locations. The study area does not occur within mapped important habitat under the BC Act, therefore the proposal would not impact any areas that are considered essential to support critical life stages of the species, e.g. breeding areas or locations important for foraging/over-wintering for migratory species.

Significance assessment question The action would:		Assessment of the proposal
		Known breeding habitat would not be impacted by the proposal and it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. The proposal is not considered likely to adversely affect habitat critical to the survival of this species.
5	Disrupt the breeding cycle of a population	The study area does not occur within a known breeding area for the species. Mitigation measures, such as unexpected finds procedures would be implemented to minimise any impacts to breeding habitat should it occur on site. As such, the proposal is considered unlikely to disrupt the breeding cycle 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 would result in the removal of up to 1.76 hectares of foraging habitat for the species. Known breeding and/or important habitat would not be impacted. Given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. As such, the proposal is unlikely to decrease available foraging habitat to the extent that the species is likely to decline.
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 would 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 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 with the recovery of the species.	The National Recovery Plan for the Regent Honeyeater identifies actions to be taken to ensure the long-term viability of the species. These predominately relate to government actions. The proposal is not likely to cause population decline and does not interfere with the objectives of the recovery plan. The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal would result in the removal of potential foraging habitat for *Anthochaera phrygia* , however given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. The proposal would not impact any known breeding habitat for the species. As such, the proposal is not expected to impact any critical habitat for the species or lead to long term decrease in the population size. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

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.

This species was not detected within the study area during surveys and the study area. One suitable hollow bearing tree for breeding occurs within the study area but not breeding activity was noted during targeted surveys.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of a population	It is estimated that 25,300 individuals of the species occupy up to 30000 km^2. The proposal would not remove any breeding habitat from this distribution. Potential foraging habitat would be removed by the proposal. The species is highly mobile and unlikely to be dependent on habitat provided by the study area. An abundance of similar or higher quality foraging habitat occurs within the locality. As such, the removal of foraging 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.
2	Reduce the area of occupancy of the species	The species is endemic south-eastern Australia. It is estimated that 25,300 individuals of the species occupy up to 30000 km^2. The species may occur within the study area but is unlikely to be dependent on habitat provided by the study area. The proposal would result in the removal of a relatively small area of potential foraging habitat (1.76 ha) within the species' range. As the species is unlikely to be dependent on this habitat and there is an abundance of similar or higher quality foraging habitat within the locality, the proposal is unlikely to result in a major reduction in the area of occupancy by the species.
3	Fragment an existing population into two or more populations	The Conservation Advice for this species refers to an overall population of the species. The removal of vegetation would be limited to a relatively narrow area of vegetation subject to existing edge effects. Given the mobile nature and the large home range of the species, the proposed works are unlikely to cause fragmentation this population. Removal of potential foraging habitat would be limited to the edge of existing habitat and would not fragment any intact patches of vegetation. The proposal would not introduce a new barrier in the landscape (as there is an existing road corridor). As the species is highly mobile, dispersal of individuals would not be limited 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 proposal would remove a relatively minor area of potential foraging habitat for the species. Suitable breeding habitat would not be directly impacted. The proposal is not considered likely to adversely affect habitat critical to the survival of this species.
5	Disrupt the breeding cycle of a population	Known breeding habitat for the species would not be impacted by the proposal. No breeding activity was detected during targeted surveys. Mitigation measures, such as unexpected finds procedures would be implemented to minimise any impacts to breeding habitat

Significance assessment question The action would:		Assessment of the proposal
		should it occur on site. Potential breeding hollows directly impacted by the proposal would be offset as per the Transport Guidelines. As such, the proposal is considered unlikely to disrupt the breeding cycle 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 would result in the removal of up to 1.76 hectares of foraging habitat for the species. The proposal would not result in the removal of any known breeding habitat. Given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. As such, the proposal is unlikely to decrease available foraging habitat to the extent that the species is likely to decline.
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 would 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	*Callocephalon fimbriatum*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 would be implemented as part of the proposed works.
9	Interfere with the recovery of the species.	At the time of writing, there are currently no adopted or made recovery plans for the species. As per the Conservation Advice for the species, conservation and recovery actions relate to preventing further declines and supporting 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. Relevant actions include the retention of hollow-bearing trees and habitat for the species. Potential foraging habitat located within the study area, however no suitable hollow-bearing trees for the species would be removed by the proposal. Other recovery actions for the species require government and stakeholder implementation. The proposal does not conflict with any of these actions. The proposed works within the study area are not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal would result in the removal of potential foraging habitat for *Callocephalon fimbriatum*, however given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. The proposal would not impact any known breeding habitat for the species. As such, the proposal is not expected to impact any critical habitat for the species or lead to long term decrease in the population size. 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.

This species was not detected within the study area during surveys and the study area does not provide suitable breeding habitat for the species.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size 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 cause a substantial impact on any local population due to the nature and extent of the proposal. The proposal would remove potential foraging habitat for the species; however, it is considered unlikely that the species would be dependent on habitat provided by the study area due to the abundance of available habitat within the locality. No breeding habitat would be impacted by the proposal. Therefore, it is unlikely the proposal would result in a long-term decrease in the population size of the species.
2	Reduce the area of occupancy of an important population	The species may occur within the study area but is unlikely to be dependent on habitat provided by the study area. The proposal would result in the removal of a relatively small area of potential foraging habitat (1.76 ha) within the species' range. As the species is unlikely to be dependent on this habitat and there is an abundance of similar or higher quality foraging habitat within the locality, the proposal is unlikely to result in a major reduction in the area of occupancy by the species.
3	Fragment an existing important population into two or more populations	The removal of vegetation would be limited to a relatively narrow area of vegetation subject to existing edge effects. Given the mobile nature and the large home range of the species, the proposed works are unlikely to cause fragmentation this population. Removal of potential foraging habitat would be limited to the edge of existing habitat and would not fragment any intact patches of vegetation. The proposal would not introduce a new barrier in the landscape (as there is an existing road corridor). As the species is highly mobile, dispersal of individuals would not be limited 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

Significance assessment question The action would:		Assessment of the proposal
		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. The proposal would remove potential foraging habitat for the species; however, it is not considered the species would be dependent on this habitat. No suitable breeding habitat was detected within the study area or subject land during surveys. The proposal would not adversely affect habitat critical to the survival of this species.
5	Disrupt the breeding cycle of an important population	No suitable breeding hollows occur within the study area. As the proposal would not result in the removal of breeding habitat, the breeding cycle of the population is not considered likely to be disrupted as a result of the proposal.
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 would result in the removal of up to 1.76 hectares of foraging habitat for the species. The proposal would not result in the removal of any known breeding habitat. Given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. As such, the proposal is unlikely to decrease available foraging habitat to the extent that the species is likely to 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 would 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 with the recovery of the species.	There are currently no adopted or made recovery plans for this species. As per the Conservation Advice for the species, conservation and recovery actions relate to the protection of important habitats and populations. Relevant actions include the retention of hollow-bearing trees and habitat for the species. No suitable breeding habitat for the species would be impacted by the proposal. Other recovery actions for the species require government and stakeholder implementation. The proposal does not conflict with any of these actions. The proposed works within the study area

Significance assessment question The action would:		Assessment of the proposal
		are not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal would result in the removal of potential foraging habitat for *Calyptorhynchus lathami lathami*, however given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. The proposal would not impact any breeding habitat for the species. As such, the proposal is not expected to impact any critical habitat for the species or lead to long term decrease in the population size. 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

This species was not detected within the study area during surveys and known breeding habitat for the species does not occur in the study area. The study area does not coincide with any important habitat maps for the species. Potential habitat within the study area has not been identified as essential to support the critical life stages of the species.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of a population	The species may occur within the study area but is unlikely to be dependent on habitat provided by the study area. The study area does not occur within a known breeding area and no important mapped habitat occurs within the study area. Impacts to the species would be through the removal of potential foraging habitat. Given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, the removal of foraging 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.
2	Reduce the area of occupancy of the species	The proposal would result in the removal of a relatively small area of potential foraging habitat within the species' range. This area is not identified as important habitat under the BAM. As the species is unlikely to be dependent on this habitat and there is an abundance of similar or higher quality foraging habitat within the locality, the proposal is unlikely to result in a major reduction in the area of occupancy by the species.
3	Fragment an existing population into two or more populations	The removal of vegetation would be limited to a relatively narrow area of vegetation subject to existing edge effects. Given the mobile nature and the large home range of the species, the proposed works are unlikely to cause fragmentation of populations. Removal of potential foraging habitat would be limited to the edge of existing habitat and

Significance assessment question The action would:		Assessment of the proposal
		would not fragment any intact patches of vegetation. The proposal would not introduce a new barrier in the landscape (as there is an existing road corridor). It is considered unlikely that the species would be dependent on habitat within the study area. As the species is highly mobile, dispersal of individuals would not be limited 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 is limited to potential foraging habitat, however the species is not considered likely to be dependent on this habitat. Suitable breeding habitat would not be impacted. Under the BAM, important habitat for the species is mapped. No important habitat maps for the species coincide with the study area and therefore the proposal would not impact any areas that are considered essential to support critical life stages of the species, e.g. breeding areas or locations important for foraging/over-wintering for migratory species. It is considered unlikely that the species would be dependent on habitat within the study area. The proposal is not considered likely to 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. As such, the proposal is considered unlikely to disrupt the breeding cycle 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 would result in the removal of up to 1.76 hectares of foraging habitat for the species. Known breeding and/ or important habitat would not be impacted. Given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. As such, the proposal is unlikely to decrease available foraging habitat to the extent that the species is likely to decline.
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 would 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 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 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. These relate to government actions. The proposal is not likely to cause population decline and does not interfere with the objectives of the recovery plan. The proposal is not considered likely to interfere substantially with the recovery of this species.

Conclusion

The proposal would result in the removal of potential foraging habitat for *Lathamus discolor*, however given the large home range of the species and the abundance of similar or higher quality foraging habitat within the locality, it is considered unlikely that the species would be dependent on any foraging habitat provided by the study area. No mapped important habitat for the species occurs within the study area. The proposal would not impact any known breeding habitat for the species. As such, the proposal is not expected to impact any critical habitat for the species or lead to long term decrease in the population size. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Dasyurus maculatus (Spotted-tail 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.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size of a population	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. Mitigation measures, such as pre-clearance surveys and unexpected finds procedures, would be implemented to minimise injury or mortality to individuals of the species.
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 (<500 km^2) and large home range of the species. The proposal would not introduce a new barrier in the landscape (as there is an existing road corridor). It is considered unlikely that the species would be dependent on habitat within the study area. Therefore, it is unlikely the proposal would 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 fragmentation of populations. Removal of potential foraging habitat would be limited to the edge of existing habitat and would not fragment any intact patches of vegetation. The proposal would not introduce a new barrier in the landscape (as there is an existing road corridor). It is considered unlikely that the species would be dependent on habitat within the study area.
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 would have negligible impacts on potential habitat due to the nature and extent of the proposed works and the availability of potential habitat beyond the study area. The proposal would not adversely affect habitat critical to the survival of this species.

Significance assessment question The action would:		Assessment of the proposal
5	Disrupt the breeding cycle of a population	The proposal would have negligible impacts on potential habitat due to the nature and extent of the proposed works and the availability of potential habitat beyond the study area. Habitat within the study area consists of foraging habitat for the species. As there is an existing road corridor, the proposal would not result in the introduction of new dispersal barriers.
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 would result in the removal of up to 1.76 hectares of foraging habitat for 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.
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 would 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 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 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

Impacts to *Dasyurus maculatus* would be limited to the removal of potential foraging habitat. The proposal would 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 as a result of the proposal. 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.

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.

No active breeding camps are present within the study area and the nearest camp to the study area occurs approximately 6.4 kilometres to the south west of the study area at Ropes Creek.

The national recovery plan for this species does not identify important populations. The local population does not occur near the limit of the species range. The nearest roosting camp to the Ropes Creek camp, the Wetherill Park camp, is located within

20 kilometres. This is considered to be within the dispersal range of the species. Assessed against the above criteria, the local population of this species is not considered to represent an important population.

Significance assessment question The action would:		Assessment of the proposal
1	Lead to a long-term decrease in the size 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 cause a substantial impact on any local population due to the nature and extent of the proposal. The proposal would not impact any breeding habitat and impacts to the species would be associated with the removal of foraging habitat. Foraging habitat within the study area is not considered a key resource for the species due to the abundance of similar and/or higher quality habitat in the locality. As the proposal is unlikely to remove key resources for the species and would not directly impact a breeding camp, it is unlikely that the proposal would result in a long-term decrease in the size of the population.
2	Reduce the area of occupancy of an important population	Given the abundance of higher quality foraging habitat within the feeding range of the Ropes Creek Camp, it is unlikely that the species would be dependent on habitat within the study area. Additionally, as no roosts occur within the study area, habitat within the study area is unlikely to be important to the long-term survival of the species. It is considered unlikely that the species would be dependent on habitat within the study area. The study area does not occur at the edge of the species range. Therefore, it is unlikely the proposal would result in a 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 proposal is unlikely to result in the fragmentation of foraging habitat. Removal of potential foraging habitat would be limited to the edge of existing habitat and would not fragment any intact patches of vegetation. The proposal would not introduce a new barrier in the landscape (as there is an existing road corridor). It is considered unlikely that the species would be dependent on habitat within the study area.
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 recovery plan for the species lists critical habitat as areas which: • Contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May) • Contain native species used for foraging and occur within 20 kilometres of a nationally important camp as identified on the Department's interactive flying-fox web viewer • Contain native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp as identified on the Department's interactive flying-fox web viewer. As such, habitat within the study area may be considered as critical due to the proximity of the Ropes Creek Camp, although an abundance of similar and/or higher quality habitat is present in the locality.

Significance assessment question The action would:		Assessment of the proposal
		No camps are present within the study area.
5	Disrupt the breeding cycle of an important population	No breeding camps occur within the study area. The closest known camp is located 6.4 kilometres to the south west of the study area at Ropes Creek. Therefore, the proposal is unlikely to disrupt the breeding cycle 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 would result in the removal of up to 1.76 hectares of foraging habitat for the species. This vegetation provides foraging habitat for the species; however, no breeding camps occur within the study area. The species is highly mobile and there is an abundance of similar and/or higher quality habitat that occurs in the locality. As such, habitat for the species within the study area is not considered a key resource and its removal is unlikely to result in the fragmentation of available habitat in the locality for the species, given its mobile nature. As such, the proposal is considered unlikely to decrease habitat availability to the extent that the species is likely to 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 would 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 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 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 proposal would not interfere with the recovery plan of the species. Appropriate mitigation and management measures would be implemented to avoid negative potential impacts to local ecology.

Conclusion

Impacts to *Pteropus poliocephalus* would be limited to the removal of potential foraging habitat. The proposal would 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 as a result of the proposal. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Communities

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is listed as critically endangered under the EPBC Act. Approximately 1.1 hectares of this community is present within the study area.

As per the Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013), the following is to be taken into account when determining whether an action is likely to have a significant impact on an endangered ecological community.

Significance assessment question There is a real chance or possibility that an action would:		Assessment of the proposal
1	Reduce the extent of an ecological community	The proposal would result in the removal of 0.31 hectares of the TEC. This represents <0.003 % of the total extent. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. The proposal would result in a small reduction of the extent of the community, consisting predominantly of lower condition vegetation adjacent to the existing road corridor.
2	Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. The proposal would result in the removal of disturbed habitat along the edges of the existing rod corridor. As such, no additional areas of habitat would become isolated. However, the proposal would contribute to the overall fragmentation of the landscape.
3	Adversely affect habitat critical to the survival of an ecological community	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. As such, it is considered unlikely to be critical habitat for the survival of the community. The Conservation Advice notes that small remnants may be important to provide habitat and connectivity. Vegetation to be removed does not contain important habitat features, such as large HBT, and does not contribute to existing connectivity and habitat corridors in the locality, due to existing disturbance and fragmentation. As such, habitat within the study area is unlikely to be considered to be critical habitat for the survival of the community.
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	Direct impacts of the proposal would result in the complete modification of abiotic factors within 0.31 hectares of the community. The proposal may also result in indirect impacts to abiotic factors within adjacent areas of the community, such as through sedimentation and erosion. The implementation of mitigation measures, such as exclusion zones and minimisation of impacts to vegetation and groundwater levels through detailed design, would minimise potential impacts to abiotic factors and ensure the persistence of the community outside of the subject land. The proposal is considered unlikely to destroy abiotic factors necessary for the persistence of the community in the locality.
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 would result in complete removal of 0.31 hectares of the community within the subject land, resulting in a complete loss of species within these areas. Indirect impacts to retained vegetation within the study area may include edge effects, such as through weed incursion, however this would be minimised through implementation of appropriate mitigation measures. As only a small portion of the community within the locality would be impacted by the proposal, it is not expected that the proposal would result in the loss of functionally important species in the locality or result in a substantial change in the occurrence of the community in the locality.

Significance assessment question There is a real chance or possibility that an action would:		Assessment of the proposal
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 may result in edge effects through the removal of existing disturbed vegetation and exposure or more intact remnants, however the proposal would include mitigation measures relating to the spread of weeds and pathogens. As such, it is unlikely that the proposal would result in a substantial reduction in the quality or integrity of the community in the locality.
7	Interfere with the recovery of an ecological community.	The Cumberland Plain Recovery Plan (DECCW, 2011) aims to provide for the long-term survival and protection of threatened biota within the Cumberland Plain. Priority actions for the community relate to conserving existing remnants and maintaining and improving connectivity of remnants. The proposal would result in the removal of 0.31 hectares of the TEC, which is not consistent with the recovery actions, however this is considered to be negligible in relation to the total extent and abundance of higher quality contiguous habitat in the locality. The proposal would not result in further fragmentation of remnants, given existing disturbances in the locality. Mitigation measures to minimise impacts would be implemented as part of the proposal.

Conclusion

The proposal would result in the removal of up to 0.31 hectares of the TEC. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. The proposal would not impact critical areas of habitat. As only a small portion of the community within the locality would be impacted by the proposal, it is not expected that the proposal would result in the loss of functionally important species in the locality or result in a substantial change in the occurrence of the community in the locality. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria

River-flat eucalypt forest on coastal floodplains of southern NSW and eastern Victoria is listed as critically endangered under the EPBC Act. Approximately 2 hectares of this community is present within the study area.

As per the Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013), the following is to be taken into account when determining whether an action is likely to have a significant impact on an endangered ecological community.

Significance assessment question There is a real chance or possibility that an action would:		Assessment of the proposal
1	Reduce the extent of an ecological community	The proposal would result in the removal of up to 0.76 hectares of the TEC. This represents <50 % of the community within the study area and <0.004% of the total extent. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. The proposal would result in a small reduction of the extent of the community,

Significance assessment question There is a real chance or possibility that an action would:		Assessment of the proposal
		consisting predominantly of lower condition vegetation adjacent to the existing road corridor.
2	Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Vegetation within the study area is already subject to existing fragmentation and isolation as a result of the existing road corridor and surrounding development. The proposal would result in the removal of disturbed habitat along the edges of the existing rod corridor. As such, no additional areas of habitat would become isolated. However, the proposal would contribute to the overall fragmentation of the landscape.
3	Adversely affect habitat critical to the survival of an ecological community	The Conservation Advice for the community identifies areas most critical to the survival of the community as those in the best condition (Classes A and B) as these represent patches of high diversity and intact structure and function with the greatest chance of persistence in the long-term. Habitat within the study area is consistent with Class D of the community (section 3.9.1.3) and is therefore not considered "critical to the survival" as per the Conservation Advice.
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	Direct impacts of the proposal would result in the complete modification of abiotic factors within 0.76 hectares of the community. The proposal may also result in indirect impacts to abiotic factors within adjacent areas of the community, such as through sedimentation and erosion. The implementation of mitigation measures, such as exclusion zones and minimisation of impacts to vegetation and groundwater levels through detailed design, would minimise potential impacts to abiotic factors and ensure the persistence of the community outside of the subject land. The proposal is considered unlikely to destroy abiotic factors necessary for the persistence of the community in the locality.
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 would result in complete removal of 0.76 hectares of the community within the subject land, resulting in a complete loss of species within these areas. Indirect impacts to retained vegetation within the study area may include edge effects, such as through weed incursion, however this would be minimised through implementation of appropriate mitigation measures. As only a small portion of the community within the locality would be impacted by the proposal, it is not expected that the proposal would result in the loss of functionally important species in the locality or result in a substantial change in the occurrence of the community in the locality.
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	The proposal may result in edge effects through the removal of existing disturbed vegetation and exposure or more intact remnants, however the proposal would include mitigation measures relating to the spread of weeds and pathogens. As such, it is unlikely that the proposal would result in a substantial reduction in the quality or integrity of the community in the locality.

Significance assessment question There is a real chance or possibility that an action would:		Assessment of the proposal
	inhibit the growth of species in the ecological community.	
7	Interfere with the recovery of an ecological community.	The proposal would result in the removal of small patches of the community, already subject to existing disturbances and would not remove any priority areas of good condition vegetation. Recovery of the community focusses on patches with the potential to be restored and reconnected. Vegetation within the study area is subject to existing fragmentation as a result of the existing road corridor and surrounding land uses. Isolated patches in modified landscapes, with a higher incidence of introduced plants are more susceptible to further degradation and are less amenable to successful recovery actions.

Conclusion

The proposal would result in the removal of up to 0.76 hectares of the TEC. The vegetation to be removed represents a small proportion of larger patches of existing vegetation in the locality that exist within mapped regional corridors under the Cumberland Plain Recovery Plan. The proposal would not impact critical areas of habitat or interrupt the recovery of the community. As only a small portion of the community within the locality would be impacted by the proposal, it is not expected that the proposal would result in the loss of functionally important species in the locality or result in a substantial change in the occurrence of the community in the locality. Consequently, further assessment through a referral to the federal Minister of the Environment is not considered necessary.

Appendix F: Biodiversity credit reports

Provide copies of the following BAM-C credit reports:

- Credits summary report
- Biodiversity credit report (Like-for-like)
- Candidate threatened species report
- Predicted species report.

Appendix G: Cumberland Plain Land Snail Pre-clearance survey advice

Specific Pre-Clearing Surveys will be required for the Cumberland Plains Land Snail prior to the commencement of any vegetation clearing, as it's unlikely that the species will be detected as a result of incidental observations whilst undertaking general survey work. This is due to the species cryptic nature and nocturnal behaviour that requires dedicated targeted survey effort to determine their presence/absence beyond reasonable doubt.

Advice has previously been sought for a separate project in Western Sydney on the Pre-Clearance Surveys required for the Cumberland Plains Land Snail due to required vegetation clearing. Advice was provided by from the DPIE on the 10/09/2023 and is detailed below.

Pre-clearance survey advice

Survey Conditions

Nocturnal surveys are to be undertaken between dusk and dawn the night after rainfall at the survey location where climactic conditions are reasonably consistent with the following:

- Moist ground layer (top soil and leaf litter)
- High humidity (>75% humidity)
- Warm night-time conditions (>12°C)

High levels of insect activity are also indicative of optimal survey conditions.

Survey effort

A minimum of two nights (on different rainfall events) in suitable conditions for nocturnal surveys covering all suitable habitat. If individuals are still being found on the second night, surveys should continue until no further individuals are found.

Nocturnal survey method

Surveys should be conducted at a slow walking pace spotlighting the ground and other low objects for active snails and should not be combined with spotlighting surveys for arboreal mammals.

Surveys should involve turning logs, raking leaf litter and searching within grass clumps for individuals.

Recipient Sites

In regard to recipient site for relocation, additional context is required to provide any advice on this matter.

In general terms, a recipient site should be as close as possible to the location site and share similar or better biophysical attributes and habitat features specific to the species. The recipient should also be of secure tenure where possible.

The consent authority should be consulted regarding the suitability of recipient sites for individuals of the Cumberland Plain Land Snail species and approval should be sought before any relocation commences.

NSW GOVERNMENT