

Sydney International Speedway

Environmental Impact Statement

Technical Paper 3

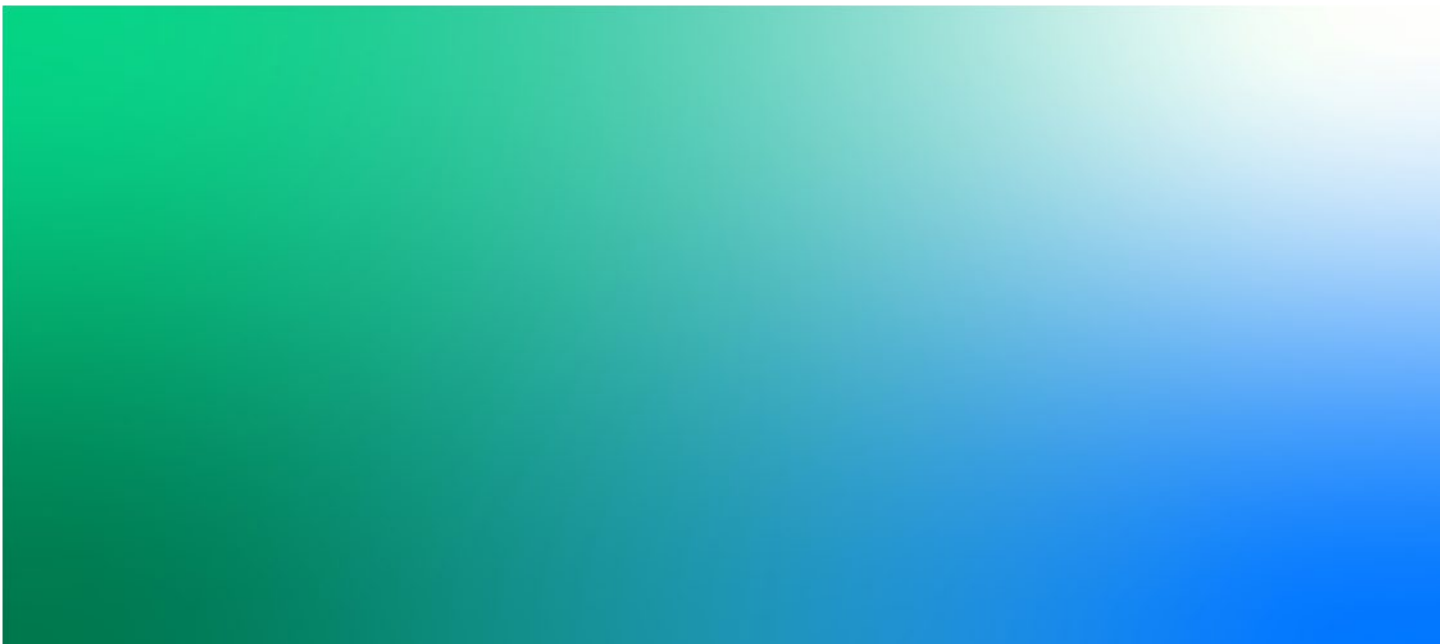
Biodiversity Development Assessment Report



Sydney International Speedway
Technical Paper 3: Biodiversity Development Assessment Report

Final
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Sydney Metro



Sydney International Speedway

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Glossary of terms

Definitions	
Biodiversity Assessment Method	<p>The Biodiversity Assessment Method (BAM) is the assessment manual that outlines how an accredited person assesses impacts on biodiversity at development sites and stewardship sites. It is a scientific document that provides:</p> <ul style="list-style-type: none"> • a consistent method for the assessment of biodiversity on a proposed development or major development, or clearing site, • guidance on how a proponent can avoid and minimise potential biodiversity impacts, and • the number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity.
Biodiversity credits	Ecosystem credits or species credits.
Biodiversity credit report	The report produced by the BAM Calculator (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.
Biodiversity offsets	Management actions that are carried out to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.
Biodiversity Investment Opportunities Map (BIO Map)	A deliverable of the NSW Government's Green Corridors program. The BIO Map development aims to achieve better biodiversity outcomes by directing biodiversity investment funding to the strategic locations of greatest benefit.
Bioregion	Bioregions are relatively large land areas characterised by broad, landscape scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale.
BAM Credit Calculator (BAM-C)	The computer program that provides decision support to assessors and proponents by applying the Biodiversity Assessment Method, which calculates the number and class of biodiversity credits required to offset the impacts of a development or created at a biodiversity stewardship site.
Core area	Land identified by the BIO Map. Core Areas are large remnants where management would be of greatest benefit to the conservation of key state and regional biodiversity values within a region.
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 the development Secretary's Environmental Assessment Requirements for cumulative impact assessment requirements.
Development site	The area of land that is directly impacted on by a proposed development, including access roads, and areas used to store construction materials
Direct impact	An impact on biodiversity values that is a direct result of vegetation clearance and loss of habitat. It is predictable, usually occurs at or near to the development site and can be readily identified during the planning, design, construction, and operational phases of a development.

Definitions	
Ecological community	An ecological community is a naturally occurring group of native plants, animals and other organisms living in a unique location. Ecological communities can be listed as threatened under the EPBC Act and/or BC Act.
Ecosystem credit	A measurement of the value of endangered ecological communities (EECs), critically endangered ecological communities (CEECs) and threatened species habitat for species that can be reliably predicted to occur with a plant community type (PCT). Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
Ecosystem credit species	Threatened species that can be reliably predicted to occur with a PCT, for which species specific biodiversity credits are not required.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component.
Indirect impact	An impact on biodiversity values that occurs when development related activities affect threatened species, threatened species habitat, or ecological communities in a manner other than direct impact. Compared to direct impacts, indirect impacts often: <ul style="list-style-type: none"> • occur over a wider area than just the development site • have a lower intensity of impact in the extent to which they occur compared to direct impacts • occur off-site • have a lower predictability of when the impact occurs • have unclear boundaries of responsibility.
Locality	This is defined as the area within a 10 kilometre radius surrounding the development site
Local population	The population that occurs in the development site. In cases where multiple populations occur in the development site and/or a population occupies part of the development site, impacts on the entirety of each population must be assessed separately.
MNES	A matter of national environmental significance (MNES) protected by a provision of Part 3 of the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1: 250,000.
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Patch	A patch is defined in the BAM as an area of intact native vegetation that occurs on the subject land. The patch may extend onto adjoining land beyond the development site of the subject land, and for woody ecosystems, includes native vegetation separated by ≤ 100 metres from the next area of intact native vegetation. For non woody vegetation, this gap is reduced to ≤ 30 metres.
Plant community type	A NSW plant community type identified using the plant community type (PCT) classification system. The PCT classification was created in 2011 by consolidating two existing community level classifications: the NSW Vegetation Classification and Assessment database; and the BioMetric Vegetation Types database used in NSW regulatory programs. The PCT classification is now maintained in the BioNet Vegetation Classification application. It is a way to classify vegetation types.

Definitions	
Population	A group of organisms, all of the same species, occupying a particular area.
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.
Species credit species	Threatened species that are assessed according to section 6.4 of the BAM which may generate species specific biodiversity credit requirements.
Study area	The development site and any other areas surveyed and assessed for biodiversity values which may be subject to indirect impacts.
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.
Threatened Biodiversity Data Collection	Part of the BioNet database, accessible from the BioNet website at www.bionet.nsw.gov.au .
Threatened species	A species listed under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), <i>Fisheries Management Act 1994</i> (FM Act) or EPBC Act.
Threatened ecological community	A community of different species associated with one another and sharing the same habitat, that is listed under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), <i>Fisheries Management Act 1994</i> (FM Act) and Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act). Threatened ecological communities are listed as endangered or critically endangered under the NSW <i>Biodiversity Conservation Act 2016</i> (BC Act), or may be listed as vulnerable, endangered or critically endangered under the Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).
1,500 metre landscape buffer	The assessment area surrounding the development site includes the area of land in the 1,500 metre landscape buffer around the development site. The study area is situated within the 1,500 metre landscape buffer. The landscape buffer is an assessment area used to identify landscape features surrounding the development site to provide development site context and to inform the likely habitat suitability of the development site.

Abbreviations	
BAM	Biodiversity Assessment Method
BAM-C	BAM Calculator
BC Act	<i>Biodiversity Conservation Act 2016 (NSW)</i>
BDAR	Biodiversity Development Assessment Report
BIO Map	Biodiversity Investment Opportunities Map
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DPI	Department of Primary Industries
EEC	Endangered ecological community
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999 (Federal)</i>
FM Act	<i>Fisheries Management Act 1994 (NSW)</i>
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of National Environmental Significance
PCT	plant community type
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSI	State Significant Infrastructure
TECs	Threatened Ecological Communities
VIS	Vegetation information system (BioNet Vegetation Classification)

Executive Summary

Sydney Metro (as 'the proponent') is seeking approval for the construction and operation of Sydney International Speedway on land owned and managed by Western Sydney Parklands Trust.

The development is State significant infrastructure under Part 5, Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and is subject to approval by the Minister for Planning and Public Spaces.

This Biodiversity Development Assessment Report (BDAR) has been prepared for the Sydney International Speedway development in accordance with the requirements of the *Biodiversity Conservation Act 2016* (BC Act) and the Biodiversity Assessment Method (BAM). This BDAR documents the results of the biodiversity assessment carried out for the development in line with the relevant State and Commonwealth environmental and threatened species legislation and policy. It also considers relevant matters under the *Fisheries Management Act 1994*.

Existing environment

The development site (being the development footprint and the area of land that would be directly impacted) is located within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports which sits within the Blacktown Local government area (LGA) in the Central River City sub region of Greater Sydney, about six kilometres southwest of the Blacktown City Centre, and 32 kilometres west of the Sydney Central Business District.

The Western Motorway (M4 Motorway) is about 1.4 kilometres north, and the Westlink M7 is about 1.2 kilometres west of the development. Industrial and commercial developments are located to the north and west of these major roads. The Prospect Nature Reserve, which contains the Prospect Reservoir, is about 150 metres east of the development. The development is bounded by Ferrers Road to the northwest, Ferrers Road and vegetation as part of Western Sydney Parklands in the west, the Warragamba Pipeline to the south and the Austral Bricks Horsley Park Brickworks located further south. Other motorsport operators within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports include Sydney Dragway immediately to the north and east and Sydney Motorsports Park (operated by the Australian Racing Drivers' Club) to the north.

The landscape is highly modified for existing infrastructure and vegetation is mostly limited to poor condition young regrowth, isolated and likely planted trees and revegetation. Two moderate quality patches of woodland are present. Two plant community types (PCTs) were identified in the development site:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- The Grey Box – Forest Red Gum grassy woodland on shale of the Cumberland Plain, Sydney Basin Bioregion (PCT 850).

Areas of PCT 849 and PCT 850 align with one Threatened Ecological Community (TEC) listed under the BC Act: Cumberland Plain Woodland in the Sydney Basin Bioregion (listed as Critically Endangered). One moderate condition patch of these PCTs met the condition threshold for the EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered Community), however it is outside of the development site between Carpark C and Carpark D. Two additional PCTs were identified within proximity of the development site.

Eighteen candidate threatened plant species were identified as having potential habitat on the development site by the Biodiversity Assessment Calculator and a review of databases and were targeted during surveys. None of the target threatened plant species were found within or adjacent to the development site.

The following threatened fauna species were identified by the BAM Calculator as potential candidate species and their potential presence at the development site is addressed via targeted survey and habitat assessment:

- Cumberland Plain Land Snail (*Meridolum corneovirens*)
- Green and Golden Bell Frog (*Litoria aurea*)
- Birds:
 - Owls: Barking Owl (*Ninox connivens*), Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*)
 - Nectarivores: Little Lorikeet (*Glossopsitta pusilla*), Regent Honeyeater (*Anthochaera virens*), Swift Parrot (*Lathamus discolor*), Gang-gang Cockatoo (*Callocephalon fimbriatum*)
 - Woodland birds: Dusky Woodswallow (*Artamus cyanopterus cyanopterus*), Varied Sittella (*Daphoenositta chrysoptera*)
 - Raptors: Little Eagle (*Hieraaetus morphnoides*), Square-tailed Kite (*Lophoictinia isura*)
- Mammals:
 - Insectivorous bats: Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Greater Broad-nosed Bat (*Scoteanax rueppellii*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Little Bent-winged Bat (*Miniopterus australis*), Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*), Southern Myotis (*Myotis macropus*)
 - Grey-headed Flying Fox (*Pteropus poliocephalus*).

Of these, only the Cumberland Plain land Snail, Southern Myotis and the Green and Golden Bell Frog are considered likely to have potential breeding habitat and potential candidate threatened species for which a biodiversity credit requirement may be generated. In the absence of breeding habitat, the remaining species are only ecosystem credit species for the purposes of this assessment.

Targeted surveys were completed for Southern Myotis and the Green and Golden Bell Frog in February 2020. The Cumberland Plain Land Snail was assumed to be present based on the presence of suitable habitat in moderate condition woodland between Carpark C and Carpark D, which is outside of the development site.

The Green and Golden Bell Frog was not identified from the targeted surveys. Areas of potential habitat are present at locations outside of the development site, including along the artificial drainage line between Carpark C and Carpark D, with some lower quality habitat opportunities along Eastern Creek. Based on the results of the targeted surveys, distribution of recent recorded sightings, the distance of the Parramatta key population and the relatively disconnected nature of the drainage line near the development site to surrounding potential habitats, it is considered that the potential for the Green and Golden Bell Frog to occur within the development site is low. No species polygons have been developed for the Green and Golden Bell Frog and no offsets are required.

The Southern Myotis was not caught during trapping efforts, however analysis of calls recorded made a probable identification of this species along Eastern Creek and the artificial drainage line between Carpark C and Carpark D. Only Eastern Creek was considered to contain suitable habitat based on the habitat requirements for this species as it does not contain areas of open water greater than three metres wide. Species polygons were created to include all associated habitat within 200 metres of Eastern Creek.

Impacts to biodiversity

The potential for direct impacts to biodiversity is limited to clearing of native vegetation and habitat. The development would not impact any areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act.

Plant community types

Despite avoidance and minimisation measures, the development site would result in the direct removal of some native vegetation. The estimated clearing is about 0.63 hectares (6,312 square metres) consisting of the following PCTs:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – 0.17 hectares (1,696 square metres)
- Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850) – 0.46 (4,616 square metres).

Threatened Ecological Communities

One Threatened Ecological Community (TEC) listed under the BC Act would be impacted by the development:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered) – 0.63 hectares comprising the combined extent of the two PCTs described above.

The areas of the TEC are mostly in poor condition represented by regrowth native species amongst plantings and weed growth. The woodland between Carpark C and Carpark D (outside of the development site) is also a patch of BC Act listed Cumberland Plain Woodland in the Sydney Basin Bioregion. Some areas of this vegetation in moderate conditions are also part of the Commonwealth EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community (listed as Critically Endangered). The development would not include clearing of any native vegetation identified as a TEC under the EBPC Act.

Threatened species

Direct impacts on species credit threatened species habitat associated with the clearing of native vegetation is limited to 0.03 hectares (305 m²) of habitat for Southern Myotis. No Cumberland Plain Land Snail habitat would be impacted by the development. Other impacts to threatened species habitat including impacts to connectivity and species movement, impacts to non native vegetation and disturbed areas, and impacts to water quality and hydrology are considered to be minimal and manageable through the implementation of suitable mitigation measures.

Prescribed biodiversity impacts

The development may include the removal of some human made structures that may provide suitable roosting habitat for a range of insectivorous bat species. However, there are likely to be minimal, if any, roosting opportunities for these species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

Up to 1.2 hectares of revegetation and weeds would be impacted by the development. This includes some areas of planted native non indigenous trees. Twelve threatened species may utilise the non native vegetation, including both native and exotic planted trees and shrubs, that are found within the development sites, including the Grey-headed Flying Fox and Swift Parrot. Due to the marginal, unnatural, structure of the vegetation present, it is unlikely to be used as breeding habitat by any threatened species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

Considering the highly disturbed nature of the landscape within which the development site is located, there are not expected to be any indirect impacts that would adversely affect areas of vegetation that would be retained. There is potential for indirect impacts to surrounding aquatic habitats (e.g. Eastern Creek) from erosion and contaminated runoff from construction and operation. The implementation of standard mitigation measures (i.e. sediment control, spill control) would control sediment and pollutants from any significant runoff events.

Management and mitigation

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, management and mitigation measures would be implemented to further lessen the potential ecological impacts of the development. Mitigation measures, identified in **Section 10** of this BDAR, would be implemented during construction and would also be outlined in a Flora and Fauna Management Plan (refer to Appendix C (Construction Environmental Management Framework) of the Environmental Impact Statement).

Offsetting biodiversity impacts

An offset is required for the impacts to PCTs and threatened (species credit) species and the biodiversity credit obligation has been calculated using the Biodiversity Assessment Calculator and presented in this BDAR. Areas of the development site that do not possess PCTs have not been assessed and offset credits are not required. Offsets were identified as being required for the Southern Myotis, however the impact area is so small that no credits were generated by the calculator. A summary of the biodiversity credit requirements for the development include:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) – Moderate: 1 credit
- Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) – Poor: 3 credits
- Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) – Revegetation: 2 credits
- *Myotis macropus* (Southern Myotis) – 0 credits.

1. Introduction

1.1 Sydney International Speedway

The NSW Government has committed to relocating speedway racing to Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports, creating a true motorplex for the NSW motorsport racing community. The new Sydney International Speedway (the development) would provide the community and racing supporters a unique sporting facility that would cater for local, regional, national, and international racing events while continuing to support the growth of speedway racing in NSW.

The new speedway would be located alongside the existing Sydney Dragway to the north and east and the Sydney Motorsports Park (operated by the Australian Racing Drivers' Club) to the north.

Western Sydney Parklands Trust in conjunction with the NSW Office of Sport, is leading a masterplanning process for Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports, with opportunities to share infrastructure and coordinate events across the three venues. This masterplan sets the context for the planning of the new Sydney International Speedway, which is the subject of this Environmental Impact Statement.

As part of delivering Sydney Metro West - the city's next big underground railway, the existing government land currently used for speedway racing is required for a future stabling and maintenance facility. The development is planned to be constructed and operational prior to the closure of the current speedway.

The development site is located on land owned and managed by Western Sydney Parklands Trust. Sydney Metro is applying for State significant infrastructure approval and is proposing to build the development on behalf of and pursuant to arrangements with Western Sydney Parklands Trust.

Section 5.12(4) of the EP&A Act provides for the declaration of specified development on specified land as State significant infrastructure. A declaration is being sought for the Sydney International Speedway as State significant infrastructure under Sections 5.12(4) of the EP&A Act. Schedule 4 of State Environmental Planning Policy (State and Regional Development) 2011 will be amended to include Sydney International Speedway.

1.1.1 Location

The development would be located within Western Sydney Parkland's Precinct 5: Eastern Creek Motor Sports, which sits within the Blacktown Local Government Area (LGA) in the Central River City sub-region of Greater Sydney, about six kilometres south-west of Blacktown City Centre, and 32 kilometres west of the Sydney Central Business District. The location of the development is shown on **Figure 1-1**.

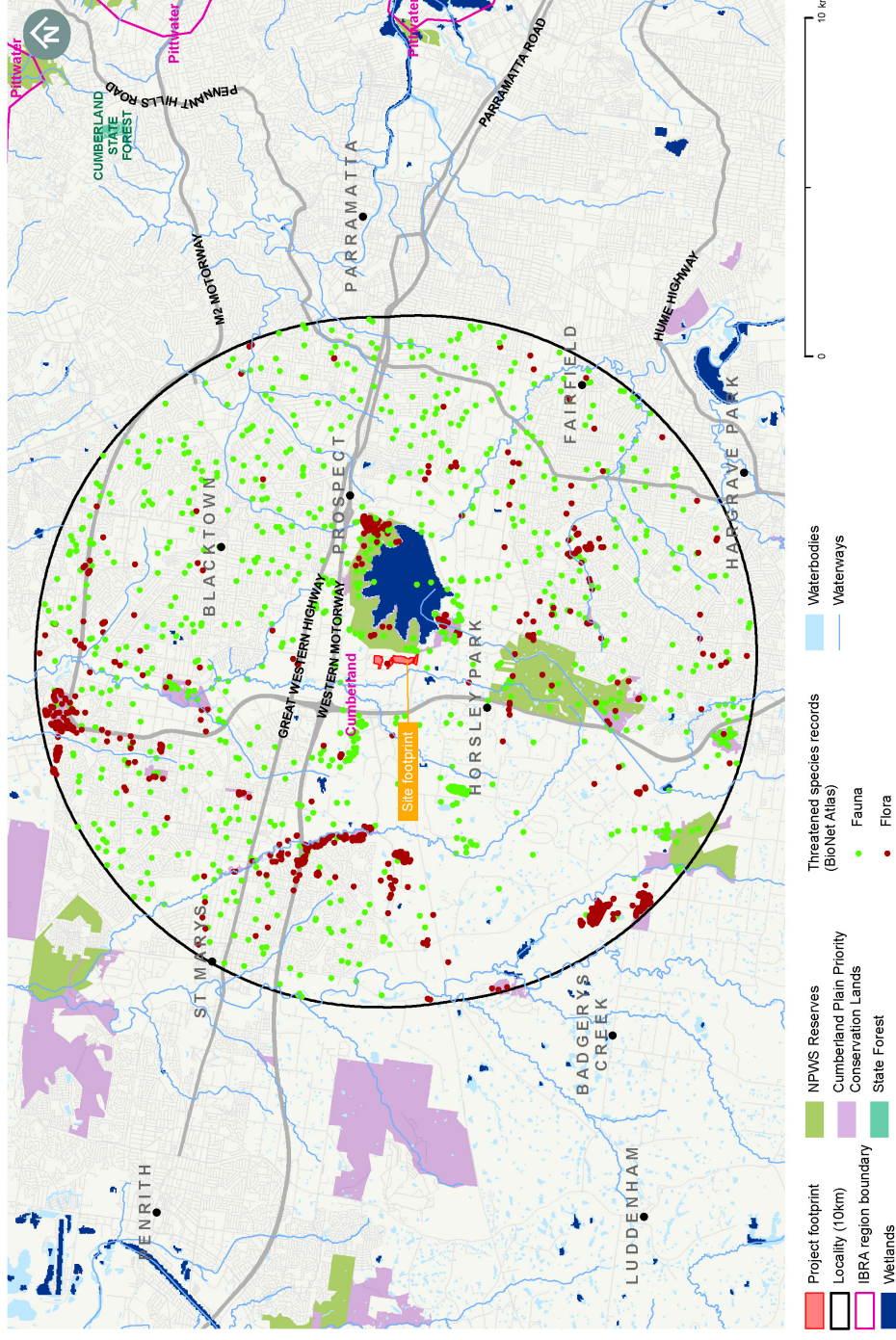


Figure 1-1 Location map

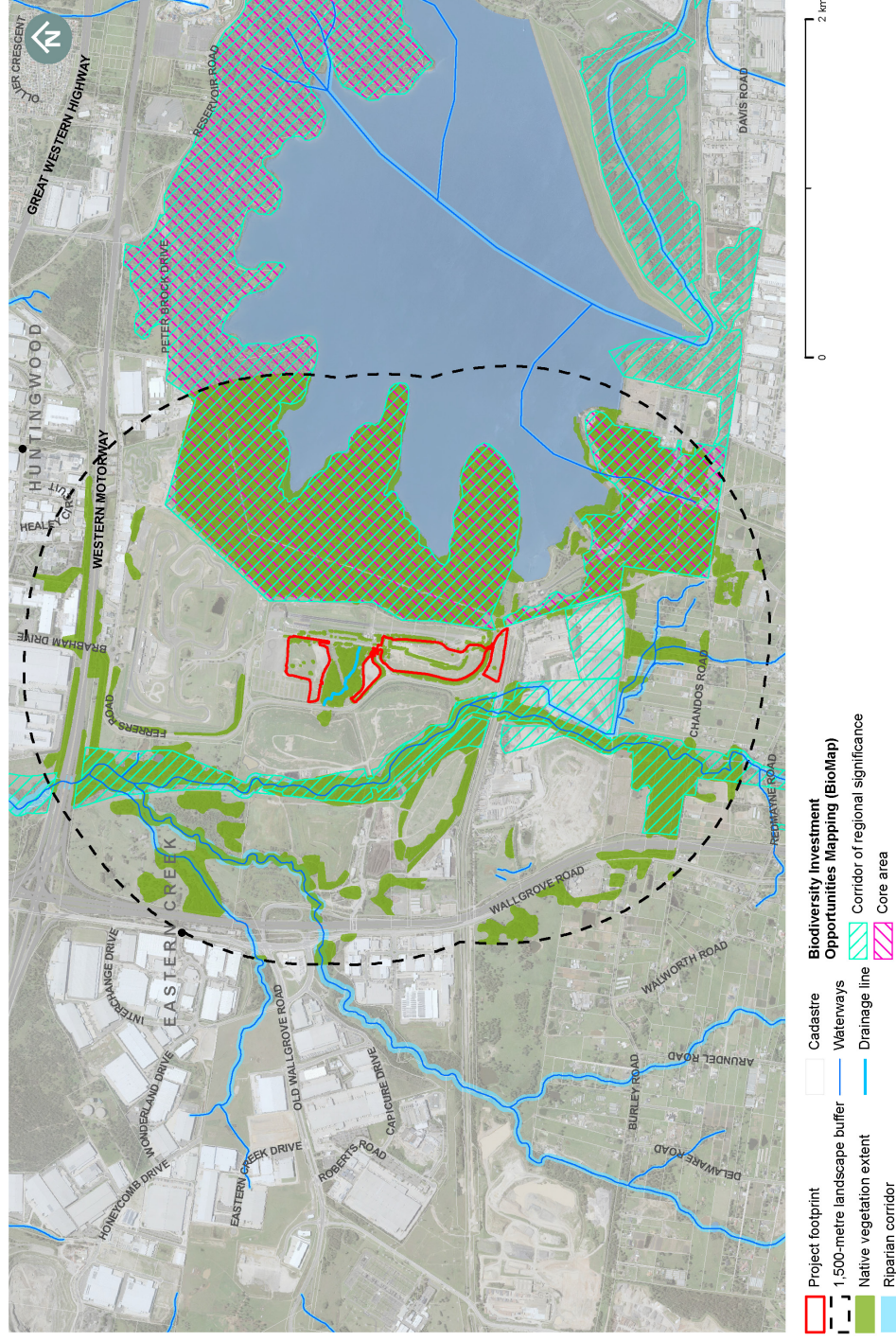


Figure 1-2 Development site

1.1.2 Local context of the development

The development site is about 21 hectares. The Western Motorway (M4 Motorway) is about 1.4 kilometres north, and the Westlink M7 is about 1.2 kilometres west of the development. Industrial and commercial developments are located to the north and west of these major roads. The Prospect Nature Reserve, which contains the Prospect Reservoir, is about 150 metres east of the development.

Sixteen precincts have been identified within the Western Sydney Parklands, each with its own character and land uses, infrastructure, issues and opportunities. The development would be situated within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports. The development is bounded by Ferrers Road to the north-west, Ferrers Road and vegetation as part of Western Sydney Parklands in the west, the Warragamba Pipeline to the south and the Austral Bricks Horsley Park Brickworks located further south. Other motorsport operators within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports include the Sydney Dragway immediately to the north and east and Sydney Motorsports Park (operated by the Australian Racing Drivers' Club) to the north. A full list of stakeholders is provided in Chapter 4 (Stakeholder and community engagement).

Other businesses in the vicinity include:

- The SUEZ Eastern Creek Resource Recovery Park, about 1.1 kilometres west of the development
- Global Renewables waste processing facility, about 650 metres west of the development.

1.1.3 Overview of Sydney International Speedway Development

Once complete, the development would include world class racing infrastructure in the form of a clay-based racetracks benchmarked to national and international best practice for both speedway vehicles and motorcycles. To facilitate the use of the speedway racetracks, the following ancillary racing infrastructure would be constructed:

- New vehicle access to the raceway area, including a gated access via an intersection off Ferrers Road
- A racing competitor's pit area, comprising around 150 parking bays for race vehicles and their tenders, including 20 bays for heavy vehicles transporting racing vehicles to and from the speedway and viewing platforms for pit crews
- Workshops/garages and track-side operational support areas to be used by pit crews.

High quality event support infrastructure provided to maximise the spectator experience at speedway events would comprise:

- A grandstand with the capacity to seat around 3750 spectators
- Ticketing and entryway structures
- Spectator facilities, including terraced seating for up to a total of around 7000 spectators, public amenities, corporate boxes, provision for food and beverage operators together with merchandise outlets
- Dedicated parking provided for spectators, visitors and users of the Sydney International Speedway, available for use by other motorsport operators by agreement
- Dedicated parking for Sydney Dragway to replace the existing spectator parking areas which would form part of the Sydney International Speedway development site. The new Sydney Dragway parking would be available for use by other motorsport operators by agreement.

Operational support infrastructure would be provided to enable the operation of the Sydney International Speedway. Such infrastructure would include:

- Public safety including fencing and fire safety systems

- Communications including a fibre optic network (to suit internet broadcasting bandwidth and PA/AV provisions), signage and large broadcasting screens
- Services including the provision of stormwater, drainage and flooding, utilities and lighting.

The operational site layout is shown on **Figure 1-3**. Operation would also include maintenance activities required to support the development.

Construction of the development is expected to take around 13 months to complete. The following construction activities would be carried out:

- Clearing, earthworks and levelling
- Landforming works
- Establishment of carparks
- Construction of racing and event support infrastructure
- Utilities connections, landscaping and finishing works.

Further detail on the development is provided in Chapter 5 (Project description) of the Sydney International Speedway Environmental Impact Statement.

1.2 Purpose and scope of this report

This technical paper is one of several technical papers that form part of the Environmental Impact Statement. The purpose of the BDAR is to identify and assess the biodiversity impacts of the development. In doing so it responds directly to the Secretary's Environmental Assessment Requirements outlined in **Section 1.3**.

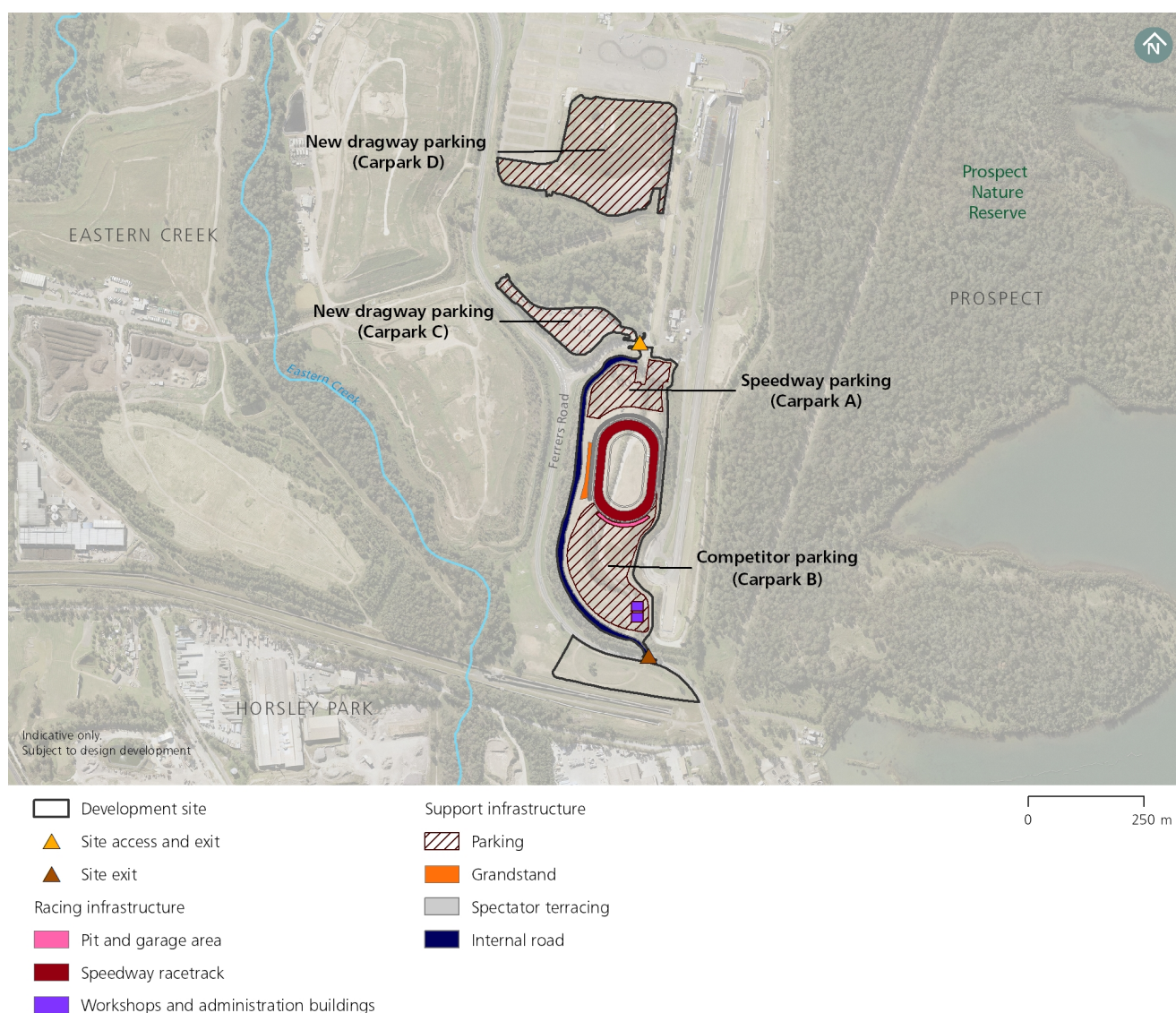


Figure 1-3 Development overview

1.3 Secretary's Environmental Assessment Requirements

The Secretary's Environmental Assessment Requirements were issued for Sydney International Speedway on 19 May 2020. The requirements specific to biodiversity and where these requirements are addressed in this BDAR, are outlined in **Table 1-1**.

Table 1-1 Secretary's Environmental Assessment Requirements – Biodiversity

Reference	Requirement	Where addressed
4. Biodiversity		
2.4.1	The proponent must assess biodiversity impacts in accordance with section 7.9 of the <i>Biodiversity Conservation Act 2016</i> (BC Act), the Biodiversity Assessment Method (BAM), and be documented in a Biodiversity Development Assessment Report (BDAR).	This report is the BDAR as required under section 7.9 of the BC Act. The BDAR was prepared in accordance with the Biodiversity Assessment Method (Office of Environment and Heritage, 2017) and guidance provided in the Biodiversity Assessment Method Operational Manual Stage 1 (State of NSW and Office of Environment and Heritage, 2018) and Biodiversity Assessment Method Operational Manual Stage

Reference	Requirement	Where addressed
4. Biodiversity		
		<p>2 (State of NSW and Department of Planning Industry and Environment, 2019) (see Section 2).</p> <p>The Biodiversity Assessment calculator case associated with this BDAR is 00020140/BAAS19068/20/00020141.</p> <p>The biodiversity surveys completed during preparation of this BDAR were guided by the Threatened Species Survey and Assessment Guidelines (see Section 2).</p>
2.4.2	The BDAR must include information in the form detailed in s6.12 of the BC Act, cl6.8 of the <i>Biodiversity Conservation Regulation 2017</i> and the BAM.	<p>The BDAR has been prepared in accordance with s6.12 of the BC Act. This report has been prepared by an accredited person as described in Section 1.5. The four specific requirements of s6.12 are:</p> <ul style="list-style-type: none"> a) assesses in accordance with the biodiversity assessment method the biodiversity values of the land subject to the proposed development, activity or clearing, and (refer Chapters 2, 3, 4, 5, 6, 7) b) assesses in accordance with that method the impact of proposed development, activity or clearing on the biodiversity values of that land, and (refer Chapter 9) c) sets out the measures that the proponent of the proposed development, activity or clearing proposes to take to avoid or minimise the impact of the proposed development, activity or clearing, and (refer Chapter 8 and 10) d) specifies in accordance with that method the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values of the actions to which the biodiversity offsets scheme applies (refer Chapters 11 and 12). <p>The BDAR has been prepared in accordance with cl6.8 of the <i>Biodiversity Conservation Regulation 2017</i>. A biodiversity development assessment report must include:</p> <ul style="list-style-type: none"> a) the number and classes of biodiversity credits required to be retired in accordance with the like-for-like requirements of the offset rules, and (refer Chapters 11 and 12) b) the number and classes of biodiversity credits that could be retired in accordance with the variation rules (in any case in which the proponent of the development proposes to use the variation rules), and (N/A to this development) c) details of any proposal to fund a biodiversity conservation action in accordance with the offset rules, and (N/A to this development) d) details of any ecological rehabilitation of a site impacted by mining under a mining lease that is proposed as a measure to offset or compensate for those impacts, and (N/A to this development)

Reference	Requirement	Where addressed
4. Biodiversity		
		<p>e) the date of the report and the requisite certification under section 6.15 of the Act, and (refer to the Title page of this report for date)</p> <p>f) details of the accreditation of the person preparing the report and of the qualifications and experience of any other person commissioned to conduct research or investigations that are relied on in preparing the report, and (refer to Section 1.5)</p> <p>g) any other information required by the biodiversity assessment method or ancillary rules to be included in the report (refer Chapters 2, 3, 4, 5, 6, 7).</p> <p>This BDAR has been prepared in accordance with the Biodiversity Assessment Method as described in Chapter 2).</p>
2.4.3	The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 10 of the BAM.	<p>Digital spatial data supplied. Refer to the following figures included in this BDAR:</p> <ul style="list-style-type: none"> • Figure 1-1 • Figure 1-2 • Figure 1-3 • Figure 2-1 • Figure 2-2 • Figure 2-3 • Figure 4-1 • Figure 4-2 • Figure 5-1 • Figure 5-2 • Figure 6-1 • Figure 11-1
2.4.4	The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the BC Act.	Section 1.5
2.4.5	The BDAR must include details of the measures proposed to address offset obligations.	Chapters 11 and 12
2.4.6	The Proponent must assess any impacts on biodiversity values not covered by the BAM.	Section 9.2
2.4.7	The Proponent must identify whether the development, or any component of the development, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the BC Act, FM Act and the Environmental Protection and the Biodiversity Conservation Act 2000 (EPBC Act).	Section 9.3

1.4 Key terms used in this report

The following terms are discussed throughout the technical paper which aligns with terminology of the Biodiversity Assessment Method (BAM), and are defined as:

- **Development site:** this area includes all areas to be directly impacted (see **Figure 1-2**). The development site is also known as the 'subject land' in the BAM. For the purposes of this BDAR, the term *development site* is used.
- **Study area:** the study area is much larger than the development site and includes the development site and surrounding area within a 50 metre buffer (see **Figure 2-1**) that may be subject to surface indirect impacts.
- **Locality:** This is defined as the area within a 10 kilometre radius surrounding the development site (see **Figure 1-2**).
- **Bioregion:** The study area is located in the Sydney Basin bioregion within the Cumberland subregion (Thackway and Cresswell, 1995).
- **1,500 metre landscape buffer:** The assessment area surrounding the development site (or subject land) includes the area of land in the 1,500 metre landscape buffer around the development site. The study area is situated within the 1,500 metre landscape buffer. The landscape buffer is an assessment area used to identify landscape features surrounding the development site to provide development site context and to inform the likely habitat suitability of the development site (see **Figure 1-1**).

1.5 Authors

The work to prepare this BDAR was carried out by appropriately qualified and experienced ecologists as outlined in **Table 1-2**.

Table 1-2 Personnel, role and qualifications

Name	Role	Qualifications
Brenton Hays	Ecologist - Technical lead, targeted surveys, reporting, GIS analysis	Bachelor of Environmental Science and Management (Hons) Accredited under section 6.10 of the Biodiversity Conservation Act 2016 as a Biodiversity Assessment Method Assessor (No. BAAS19068)
Lukas Clews	Associate Ecologist – Vegetation Integrity Surveys and targeted plant searches, reporting, GIS analysis	Master of Scientific Studies Graduate Certificate in Applied Science Bachelor of Science Diploma in Conservation and Land Management Certified Environmental Practitioner (CEnvP) by the Environment Institute of Australia and New Zealand (EIANZ) Accredited under section 6.10 of the <i>Biodiversity Conservation Act 2016</i> as a Biodiversity Assessment Method Assessor (No. BAAS17060)
Chris Thomson	Principal Ecologist – Technical review	Graduate Certificate in Natural Resources Bachelor of Applied Science (Environmental Management) Accredited under section 6.10 of the <i>Biodiversity Conservation Act 2016</i> as a Biodiversity Assessment Method Assessor (No. BAAS18058)

2. Methodology

This section documents the methodology applied in the preparation of the BDAR. The BDAR was prepared in accordance with the *Biodiversity Assessment Method* (Office of Environment and Heritage, 2017) and guidance provided in the *Biodiversity Assessment Method Operational Manual Stage 1* (State of NSW and Office of Environment and Heritage, 2018) and *Biodiversity Assessment Method Operational Manual Stage 2* (State of NSW and Department of Planning Industry and Environment, 2019). Further detail on the methodology for aquatic environments is provided in **Section 6**.

2.1 Study area

As defined in **Section 1.1**, the study area includes the development site and adjacent areas within a 50 metre buffer to capture areas around the development site that may be subject to indirect impacts (see **Figure 2-1**). The study area is located primarily in the suburb of Eastern Creek in the local government area (LGA) of Blacktown. The study area also extends into a small section of the suburb of Horsley Park in the Fairfield LGA.

2.2 Background research and data sources

A background review of existing information was carried out to identify the existing environment within a search area of 10 kilometres surrounding the development site. The review focussed on database searches, relevant ecological reports pertaining to the development site (where publicly available) and relevant GIS layers. The review was used to prepare a list of plant community types (PCTs), threatened species, populations and communities as well as important habitat for migratory species with a likelihood of occurrence in the survey area and locality. The searches were also carried out to identify if any Areas of Outstanding Biodiversity Value were present.

The following databases were searched or viewed:

- BioNet – the website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (searched 5 March 2020)
- NSW Department of Primary Industries (DPI) freshwater threatened species distribution maps (viewed 5 March 2020)
- The federal Department of Agriculture, Water and the Environment Protected Matters Search Tool (PMST) (searched 5 March 2020) (refer to **Appendix F**)
- BioNet NSW Vegetation Classification database (viewed February 2020)
- Atlas of Living Australia (viewed April 2020)
- The federal Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) (viewed April 2020)
- Department of Agriculture, Water and the Environment directory of important wetlands (viewed April 2020).

Regional vegetation mapping, geology and soil mapping developments were reviewed including:

- *The Native Vegetation of the Sydney Metropolitan Area – Version 3.1* (VIS_ID 4489) (State Government of NSW and Office of Environment and Heritage, 2016)
- *Remnant Vegetation of the western Cumberland subregion, 2013 Update* (VIS_ID 4207) (State Government of NSW and Office of Environment and Heritage, 2015).
- *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (State Government of NSW and Office of Environment and Heritage (OEH), 2010)
- *Penrith 1:100 000 Geological Sheet 9030* (Clarke and Jones, 1991)
- *Soil landscapes of the Penrith 1:100,000 Sheet 9030* (Hazelton et al., 1989)
- *Australian Soil Classification (ASC) Soil Type map of NSW* (State Government of NSW and Office of Environment and Heritage (OEH), 2012).

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed from the NSW Threatened Species Scientific Committee web resources. At the time of writing, there are no preliminary or provisional listings of relevance. The annual Final Priority Assessment List (FPAL) is the list of nominated species, ecological communities and key threatening processes that have been approved for assessment by the Minister responsible for the EPBC Act for a particular assessment year. These have a statutory timeframe in which the assessment must be completed.

2.3 Mapping extent of native vegetation cover

The extent of native vegetation in the development site was ground truthed and mapped using up to date aerial imagery. Polygons were digitised in a GIS (ArcGIS 10.6) at a scale of between 1:1,000 and 1:5,000. The vegetation extent within the development site has been mapped as accurately as possible although some boundary errors may still exist.

To assess per cent of current extent of native vegetation, a landscape buffer of 1,500 metres was placed around the boundary of the development site in accordance with section 4.2 of the BAM. Per cent native vegetation cover in the landscape buffer was calculated using a combination of regional vegetation mapping and aerial imagery, in some cases making assumptions of native vegetation where no mapping exists (e.g. along M4 Motorway).

2.3.1 Definition of native vegetation

Under the BAM, native vegetation has the same meaning as in section 1.6 of the BC Act which states that native vegetation and clearing native vegetation have the same meanings as in Part 5A of the *Local Land Services Act 2013*. Part 5A 60B of the *Local Land Services Act 2013* defines the meaning of native vegetation as any of the following types of plants native to New South Wales:

- a) Trees (including any sapling or shrub or any scrub)
- b) Understorey plants
- c) Groundcover (being any type of herbaceous vegetation)
- d) Plants occurring in a wetland.

A plant is native to New South Wales if it was established in New South Wales before European settlement. This includes planted vegetation which is important as the development site and study area contains several native species plantings.

2.4 Plant community type identification

The type and distribution of PCTs within the development site and study area were identified and mapped progressively during the field surveys. The identification of PCTs presented here in this BDAR is according to the NSW PCT classification as described in the BioNet Vegetation Classification database. Each PCT was assigned to the relevant corresponding Threatened Ecological Community (TEC) where applicable. A plot based floristic vegetation survey as described in section 5.2 of the BAM was carried out in areas where the vegetation was of sufficient size and shape to allow for plots to be completed. The plot based floristic vegetation surveys were carried out over three days in December 2019.

2.4.1 Stratification of native vegetation into survey units

Using existing vegetation mapping, survey sites (plots/midlines) were established within each area of mapped vegetation to provide a representative assessment of the vegetation prior to the field survey. Plots were also positioned to provide a wide spatial coverage of the development site and study area. Once the identification of PCTs had been finalised, each PCT was then divided into vegetation zones (an area of native vegetation that is the same PCT and has a similar broad condition state). The PCTs identified within the development site are described in detail in **Section 4** of this BDAR.

The vegetation within the development site has been assigned to a PCT as listed in the BioNet Vegetation Classification database based on the observed plant species composition, vegetation structure, landscape position, and underlying geology and soils.

2.4.2 Plot based floristic vegetation survey and Vegetation Integrity Assessment

A plot based full floristic survey and Vegetation Integrity Assessment was carried out according to the BAM using a series of 20 x 20 metre plots (or equivalent 400 square metre area) nested inside a 20 x 50 metre plot (or equivalent 1,000 square metre area). In some situations, along narrow PCT patches, 10 x 40 metre floristic plots were used. The location of each plot/midline completed during the survey is illustrated in **Figure 2-1**.

Plots/midlines were established to provide a representative assessment of the vegetation integrity of the vegetation zone, accounting for the level of variation in the broad condition state of the vegetation zone.

A summary of the survey effort completed in each vegetation zone is provided in **Table 2-1**.

Table 2-1 Plant community types and vegetation zones identified in the development site

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Minimum number of plots/midlines required	Number of plots/midlines completed
1	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	0.1	1	1
2	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	0.07	1	2
3	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Poor	0.3	1	1
4	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Revegetation	0.16	1	2

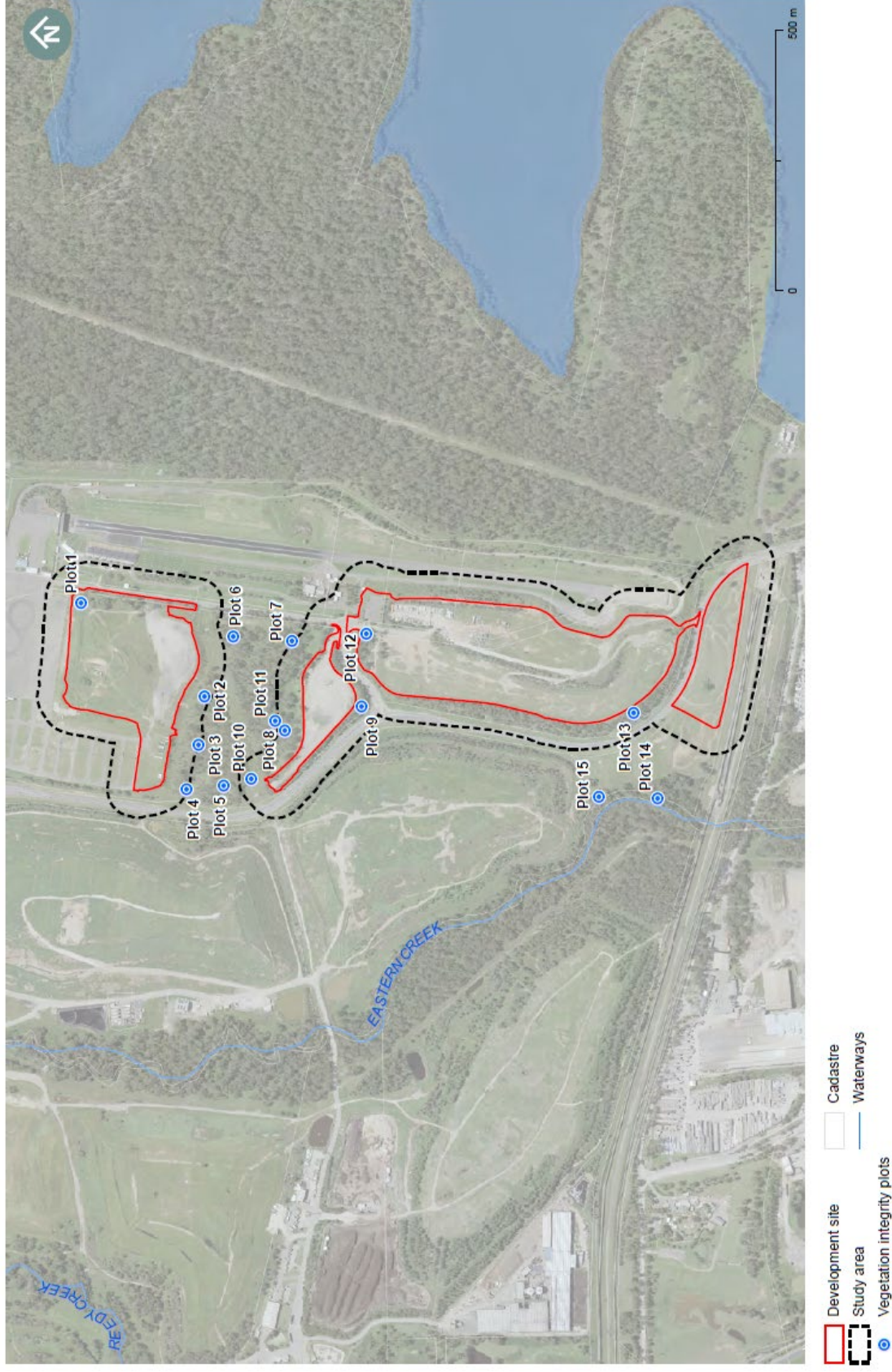


Figure 2-1 Location of plot based floristic vegetation survey and vegetation integrity assessments

2.5 Patch size

A patch is defined in the BAM as an area of intact native vegetation that occurs on the development site. The patch may extend onto adjoining land beyond the development site, and for woody ecosystems, includes native vegetation separated by less than or equal to 100 metres from the next area of intact native vegetation. For non woody vegetation, this gap is reduced to less than or equal to 30 metres. Patch size for each vegetation zone located on the development site was mapped in accordance with section 5.3.2 of the BAM using the following steps:

- Identify vegetation zones to be included in the same patch
- Identify the boundary of any adjoining intact native vegetation which extends beyond the limit of the development site
- Digitise each patch in a GIS using separate polygons where multiple patches exist
- Calculate the area of each patch in hectares in a GIS.

The patch was then allocated to a patch size class (being less than five hectares, five to 24 hectares, 25 to 100 hectares and greater than 100 hectares). Patch size class is used as a filter in the Biodiversity Assessment Calculator to predict threatened species likely to occur or use habitat on the development site. The patch size of all vegetation zones is greater than 100 hectares.

2.6 Threatened species habitat assessment – creating a candidate species list

Once the development site had been assessed for landscape context, and the PCTs present and vegetation integrity known, the list of candidate threatened species for assessment was developed. As outlined in section 6.4.1.3 of the BAM, the following criteria (a – f) were used to predict the threatened species that require assessment:

- a) The distribution of the species includes the IBRA subregion which the development site is, in the opinion of the assessor, mostly located within, and
- b) The development site is within any geographic constraints of the distribution of the species within the IBRA sub region, and
- c) The species is associated with any of the PCTs identified by the assessor under chapter 5 of the BAM as occurring within the development site, and
- d) The native vegetation cover within an assessment area 1,500 metres wide surrounding the boundary of the development site as determined by the assessor in accordance with section 4.3.2 of the BAM is equal to or greater than the minimum class that is required for the species (unless the development is, or is part of, a linear shaped development), and
- e) The patch size which the vegetation zone is part of, as identified in section 5.3.2 of the BAM is equal to or greater than the minimum specified for that species, and
- f) The species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

A threatened species was predicted as requiring assessment if that species meets all the criteria (a to f) that are relevant to the species. The Biodiversity Assessment Calculator was used to derive the list of candidate species based on criteria a to f. If any one of the criteria (a to f) relevant to a species was not met, the development site was considered not to be suitable habitat for the threatened species and no further assessment was carried out for that species.

The results of the BioNet search and the PMST search were also used to inform development of the candidate species list. Some species returned from the database searches (i.e. BioNet and the PMST) were removed from the assessment due to the absence of suitable habitat in the development site. The development site itself is

highly disturbed and lacks high quality natural habitats, and species that are known to no longer occur in the Sydney urban area were removed from the assessment based on the lack of these habitat types from the development site.

The threatened species habitat suitability assessment is provided in **Section 5** and **Appendix A**. The candidate list of threatened species for assessment is provided in **Section 5**.

2.7 Targeted threatened species surveys

After the candidate species list had been developed (see **Section 5.3**), targeted threatened species surveys were carried out where possible. The surveys carried out for candidate threatened species of plants and animals are outlined in **Section 2.7.1** and **Section 2.7.2**, respectively. The habitat assessment identified that there is limited habitat in the development site for most threatened species. Targeted surveys were completed in December 2019 and February 2020.

2.7.1 Threatened plants

After the PCTs and finer scale habitats within the development site had been identified, and the threatened species habitat assessment had been completed, threatened plant surveys were completed across areas of suitable habitat. **Table 2-2** lists the species that were targeted. Most of the species in **Table 2-2** were identified by the BAM-Calculator, however an additional five species were added based on nearby records and suitable habitat on the development site. Two plants species identified by the BAM-Calculator, *Caladenia tessellata* and *Pterostylis saxicola*, were omitted from surveys due to a lack of suitable habitat in the development site.

Surveys for threatened plants were guided by the methodology and effort as outlined in the *NSW Guide to Surveying Threatened Plants* (Office of Environment and Heritage, 2016). Where possible, transects were walked by two ecologists through the habitats within the development site at 10 metre spacing. This was primarily carried out in the woodland between Carpark C and Carpark D in February 2020, which contains the highest quality habitat for threatened plants (refer to **Figure 2-2**). The artificial drainage line in this woodland was also targeted for aquatic and semi aquatic species (e.g. Austral Pilwort). All other areas of vegetation were mostly considered low quality and only likely to contain larger conspicuous species and were therefore surveyed as part of initial vegetation transects of the development site. Habitats directly adjacent to the development site were also surveyed where possible to provide context for consideration of any potential indirect and/or off-site impacts.

Table 2-2 Summary of survey effort for threatened plant species

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	All year	December 2019 and February 2020
<i>Acacia pubescens</i>	Downy Wattle	V	V	All year	December 2019 and February 2020
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	All year	December 2019 and February 2020
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia	-	V	August, September, October	December 2019 and February 2020
<i>Dillwynia tenuifolia</i> – endangered population	Dillwynia tenuifolia, Kemps Creek				

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
<i>Eucalyptus benthamii</i>	Camden White Gum	V	V	All year	December 2019 and February 2020
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	All year	December 2019 and February 2020
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	-	V	All year	December 2019 and February 2020
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - <i>endangered population</i>	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	All year	December 2019 and February 2020
<i>Persoonia bargoensis</i>	Bargo Geebung	V	E	All year	December 2019 and February 2020
<i>Persoonia nutans</i>	Nodding Geebung	E	E	All year	December 2019 and February 2020
<i>Pilularia novae-hollandiae</i>	Austral Pilwort	-	E	October, November, December	December 2019 and February 2020
<i>Pimelea curviflora</i> var. <i>curviflora</i>	Pimelea curviflora var. curviflora	V	V	October, November, December, January, February, March	December 2019 and February 2020
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	All year	December 2019 and February 2020
<i>Pultenaea parviflora</i>	Sydney-bush Pea	V	E	September, October, November	December 2019 and February 2020
<i>Pultenaea pedunculata</i>	Matted Bush-pea	-	V	September, October, November	December 2019 and February 2020
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	E	April, May, June	December 2019 and February 2020
<i>Thesium australe</i>	Austral Toadflax	V	V	November, December, January, February	December 2019 and February 2020
Key: V = Vulnerable species, E = Endangered species, EP = Endangered population, CE = Critically Endangered species					

*Note: = the survey was completed outside of the allocated survey period for *Dillwynia tenuifolia*, *Pomaderris brunnea*, and *Pultenaea pedunculata*. However, no species of *Dillwynia*, *Pomaderris* or *Pultenaea* were found during the surveys.

2.7.2 Threatened animals

Targeted threatened species surveys were completed for animals that had potential habitat within the development site and study area. The habitat assessment identified that there is limited habitat in the development site for most threatened species. However, two species, the Green and Golden Bell Frog (*Litoria aurea*) and Southern Myotis (*Myotis macropus*) were considered moderately likely to occur in the development site and surrounding habitat based on the presence of suitable habitat. To determine presence or absence from within or adjacent to the proposed development site, targeted surveys for these species were carried out in accordance with the following guidelines:

- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (Department of Environment and Climate Change, 2009)
- *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (State of NSW and Office of Environment and Heritage, 2018).

Table 2-3 outlines the threatened animal species that were identified by the BAM Calculator and assessed during surveys of the development site. Locations of targeted surveys are illustrated in **Figure 2-3**.

Table 2-3 Summary of survey effort for threatened animal species

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
<i>Anthochaera phrygia</i>	Regent Honeyeater (breeding habitat)	CE	CE	None allocated	Surveys not done. Species excluded through habitat assessment. No breeding habitat present.
<i>Burhinus grallarius</i>	Bush Stone-curlew	-	E	All year	Surveys not done. Species excluded through habitat assessment.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	October, November, December, January, February, March	Surveys not done. Species excluded through habitat assessment.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	November, December, January	Surveys not done. Species excluded through habitat assessment. Only foraging habitat present in development site.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (breeding habitat)	-	V	October, November, December, January	Surveys not done. Species excluded through habitat assessment.
<i>Hieraaetus morphnoides</i>	Little Eagle (breeding habitat)	-	V	August, September, October	Surveys not done. Species excluded through habitat assessment.
<i>Pommerhelix duralensis</i>	Dural Land Snail	E	E	All year	Surveys not done. Species excluded through habitat assessment.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (breeding habitat)	-	V	July, August, September, October, November, December	Surveys not done. Species excluded through habitat assessment.
<i>Lathamus discolor</i>	Swift Parrot (breeding habitat)	CE	E	None allocated	Surveys not done. No breeding habitat present. Foraging habitat assumed present.

Species name	Common name	EPBC Act	BC Act	Required survey period	Survey completed
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	November December, January, February, March	Targeted survey completed in February 2020.
<i>Lophoictinia isura</i>	Square-tailed Kite (breeding habitat)	-	V	September, October, November, December, January	Surveys not done. Species excluded through habitat assessment.
<i>Meridolum carneovirens</i>	Cumberland Plain Land Snail	-	E	All year	Surveys completed in December 2019. Assumed present in moderate quality woodland between Carpark C and Carpark D. No habitat in the development site.
<i>Miniopterus australis</i>	Little Bent-winged Bat (breeding habitat)	-	V	December, January, February	Surveys not done. Species excluded through habitat assessment. Only foraging habitat present in development site.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (breeding habitat)	-	V	December, January, February	Surveys not done. Species excluded through habitat assessment. Only foraging habitat present in development site.
<i>Myotis macropus</i>	Southern Myotis	-	V	October, November December, January, February, March	Targeted survey completed in February 2020.
<i>Ninox connivens</i>	Barking Owl (breeding habitat)	-	V	May, June, July, August, September, October, November, December	Surveys not done. Species excluded through habitat assessment.
<i>Ninox strenua</i>	Powerful Owl (breeding habitat)	-	V	May, June, July, August	Surveys not done. Species excluded through habitat assessment.
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	All year	Surveys not done. Species excluded through habitat assessment.
<i>Phascolarctos cinereus</i>	Koala (breeding habitat)	V	V	All year	Surveys not done. Species excluded through habitat assessment.
<i>Pommerhelix duralensis</i>	Dural Land Snail	E	E	All year	Surveys not done. Species excluded through habitat assessment.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (breeding habitat)	V	V	October, November December	Surveys completed in December 2019 and February 2020. No breeding habitat present.
<i>Tyto novaehollandiae</i>	Masked Owl (breeding habitat)	-	V	May, June, July, August	Surveys not done. Species excluded through habitat assessment.
Key: V = Vulnerable species, E = Endangered species, EP = Endangered population, CE = Critically Endangered species					

The fauna species which were identified from the background review and habitat assessment that were targeted during the survey are discussed in **Table 2-4**.

Table 2-4 Targeted fauna survey details

Threatened fauna species	Minimum survey requirements	Survey completed
Green and Golden Bell Frog	<p>All surveys should be completed within one week of heavy rainfall (>50 mm in seven days) during spring/summer (October – March).</p> <p>Initial habitat assessment surveys using a combination of call detection, call playback and spotlighting.</p> <p>A minimum of four nights under ideal conditions.</p> <p>Small wetlands (<50 m at greatest length) should be covered in about one hour.</p> <p>Large sites should be sampled systematically.</p>	<p>Sections of Eastern Creek and the drainage line within 100 to 200 m of the development site were assessed for their habitat value using criteria identified in the literature. This also included daytime searches for basking frogs.</p> <p>Potential habitats identified and each searched for one hour by two ecologists using call detection, call playback and spotlighting. Total survey effort was 4 nights. All surveys were completed within a week of heavy rainfall which ranged from 30 to 221 mm. Surveys were completed over a period of 4 nights from 17 February to 20 February 2020</p>
Southern Myotis	<p>All surveys are to be carried out during spring/summer from October – March.</p> <p>Harp trap or mist net is to be placed in areas of potential habitat. Harp traps are to be set beside or over pools of water along creeks or rivers. The minimum number of survey nights using harp traps is 4 nights per trap.</p> <p>Acoustic detection is to occur between October and March during spring/summer, for a duration of 4 nights.</p> <p>The range of Plant Community Types associated with the species, including 849 and 850, within 200 metres of any medium to large permanent creeks, rivers, lakes or other waterways. Potential habitat is within 2.5 km of riparian vegetation.</p>	<p>Two harp traps were assembled beside and in Eastern Creek (where possible) in separate locations, each for three nights. One harp trap remained in the same position for three nights. The other trap was moved after one night. Total survey effort was 6 trap nights covering 3 locations along Eastern Creek.</p> <p>Two Anabat Express bat call detectors were deployed, each for two nights. One positioned on Eastern Creek and one on a deep water section of the drainage line. Total survey effort was 4 trap nights. Recorded bat calls were analysed by Greg Ford (Balance Environmental).</p>

Green and Golden Bell Frog

Potential habitat for the Green and Golden Bell Frog was identified in and adjacent to the study area during initial surveys of the development site in December 2019 (see **Photos 1-3**). This includes parts of Eastern Creek within 100 to 200 metres of the development site and the artificial drainage line that runs through the moderate quality woodland between Carpark C and Carpark D.



Photo 1 – Survey site 1 (drainage line)



Photo 2 – Survey site 2 (drainage line)



Photo 3 – Survey site 3 (Eastern Creek)

Survey locations and transects are shown in **Figure 2-3**. Fauna survey sites 1 and 2 consisted of an artificial drainage line within an open grassy woodland. Both Site 1 and 2 had distinct patches of *Typha orientalis* around the culverts at either end. Site 3 was located on a section of Eastern Creek containing disturbed riparian woodland, dominated by *Eucalyptus tereticornis*, *Melaleuca styphelioides* and *Casuarina glauca*. To the east of Site 3, about 20 metres was cleared exotic grassland.

Table 2-5 Weather and rainfall conditions during nocturnal fauna surveys (Horsley Park Equestrian Centre AWS 067119)

Date	Min temp (°C)	Max temp (°C)	Wind (3pm)	Rainfall (24 hours)	Total rainfall in 7 days before survey	Observations
17/02/2020	21.3	22.8	Slight E 6 km/hr	16.6 mm	221 mm	Survey completed after thunderstorm with hail and flooding.
18/02/2020	20.1	28.3	Calm NNE 7 km/hr	0.6 mm	30 mm	Storm towards end of survey. High abundance of insects during survey.
19/02/2020	20.9	23.0	Slight W 9 km/hr	14.6 mm	30 mm	High abundance of insects during survey.
20/02/2020	19.4	19.7	Slight SE 7km/hr	0 mm	44.6 mm	100% cloud cover during survey period.

Nocturnal surveys were completed at three survey sites over four nights, between the 17 February and 20 February 2020. Weather conditions are shown in **Table 2-5**. Each survey site was searched by two ecologists on all four nights during the survey period. The duration of each sampling event extended between 20 and 40 minutes per site depending on the size of the site. The survey involved a spotlight search of the entire perimeter of the drainage lines / creek focusing on the upper water column and within emergent vegetation. Call playback was used at each survey site which involved playing calls through a 20W loudspeaker for a total of 2 to 5 minutes along multiple locations at each site. Details of the survey effort are described in **Table 2-6** and illustrated in **Figure 2-3**.

Table 2-6 Green and Golden Bell Frog survey timing and sampling effort

Survey site	Survey nights				Total duration (hours)	No. sampling events
	1	2	3	4		
Survey site 1	17/02/2020	18/02/2020	19/02/2020	20/02/2020	1.92	4
Survey site 2	-	18/02/2020	19/02/2020	20/02/2020	0.92	3
Survey site 3	17/02/2020	18/02/2020	19/02/2020	20/02/2020	1.45	4

Southern Myotis

Southern Myotis was considered moderately likely to occur around the development site based on recent records in the locality and the presence of suitable habitat along Eastern Creek.

Two harp traps were installed along and, where possible, over Eastern Creek for three nights from 17 February to 19 February 2020. Harp traps were placed in potential flyways along the creek to capture foraging bats (see **Photos 4-6**). Two Anabat Express (Titley Scientific) bat call detectors were also positioned along suitable habitat, 'Anabat 1' was placed on Eastern Creek and 'Anabat 2' on the artificial drainage line. Both Anabats were deployed for two nights each: 18 February and 19 February 2020. Weather conditions during the survey period are shown in **Table 2-5**. Survey locations for Southern Myotis are shown in **Figure 2-3**.



Photo 4 – Harp 1



Photo 5 – Harp 2



Photo 6 – Harp 3

2.8 Survey limitations

The desktop assessment and field survey carried out for this BDAR provides a limited view into the ecological values of the development site present at the time of the survey. The diversity of flora and fauna species recorded from this study should not be seen to be comprehensive. It is unlikely that every species present within the development site has been recorded. The field survey aimed to sample the development site and a comprehensive inventory of species was not made. A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year (e.g. orchids or migratory birds) and require specific weather conditions for optimum detection (e.g. breeding and flowering periods). The conclusions of this report are therefore based upon available data and are

indicative of the environmental condition of the development site at the time of the survey. The vegetation integrity plot surveys were completed in December 2019 during a period of drought so the results must be considered with regard to the environmental conditions at the time of survey. Survey site conditions, including the presence of threatened species, can change with time. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species.

The vegetation within the development site has been assigned to the most likely PCT as they are described in the BioNet Vegetation Classification database. In many cases there are no sharp boundaries defining the transition between PCTs, so the mapping provided in this BDAR is supported by on ground floristic surveys and observations of potential ecotones. Plant communities are naturally variable and the boundaries between different PCTs on the development site overlap considerably with a gradual transition from one community to another. However, a choice must be made to map and assign a PCT to an area of the development site. As mapping necessitates that a hard boundary is drawn to separate PCTs, boundaries of PCTs and vegetation zones have been mapped as best as possible based on observations made during the field survey and based on patterns observed on aerial photography. It is likely that the boundaries of PCTs and vegetation zones will change with time and in response to long term variation in biophysical conditions at the development site such as rainfall and surface drainage patterns.

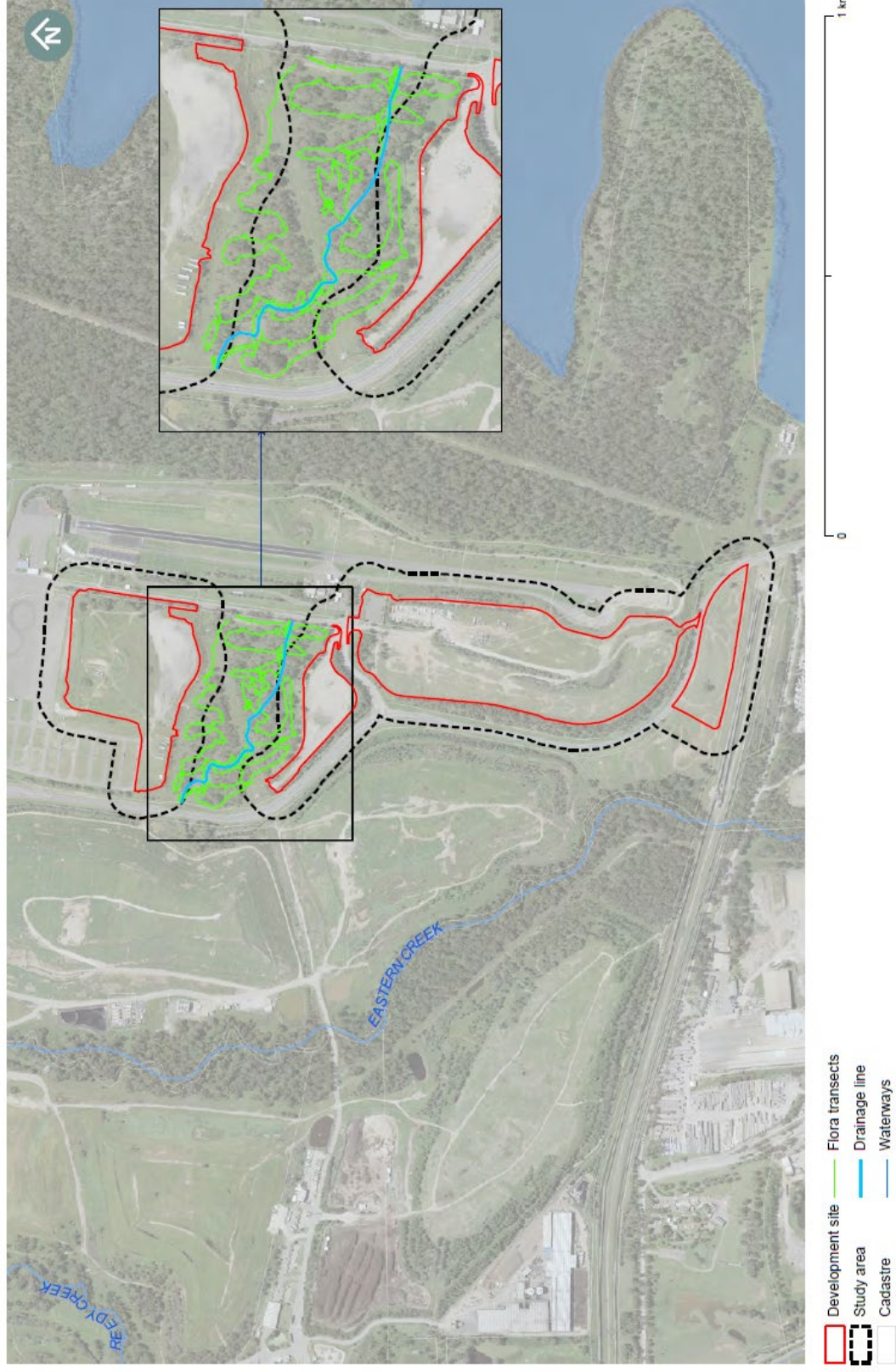


Figure 2-2 Threatened plant surveys

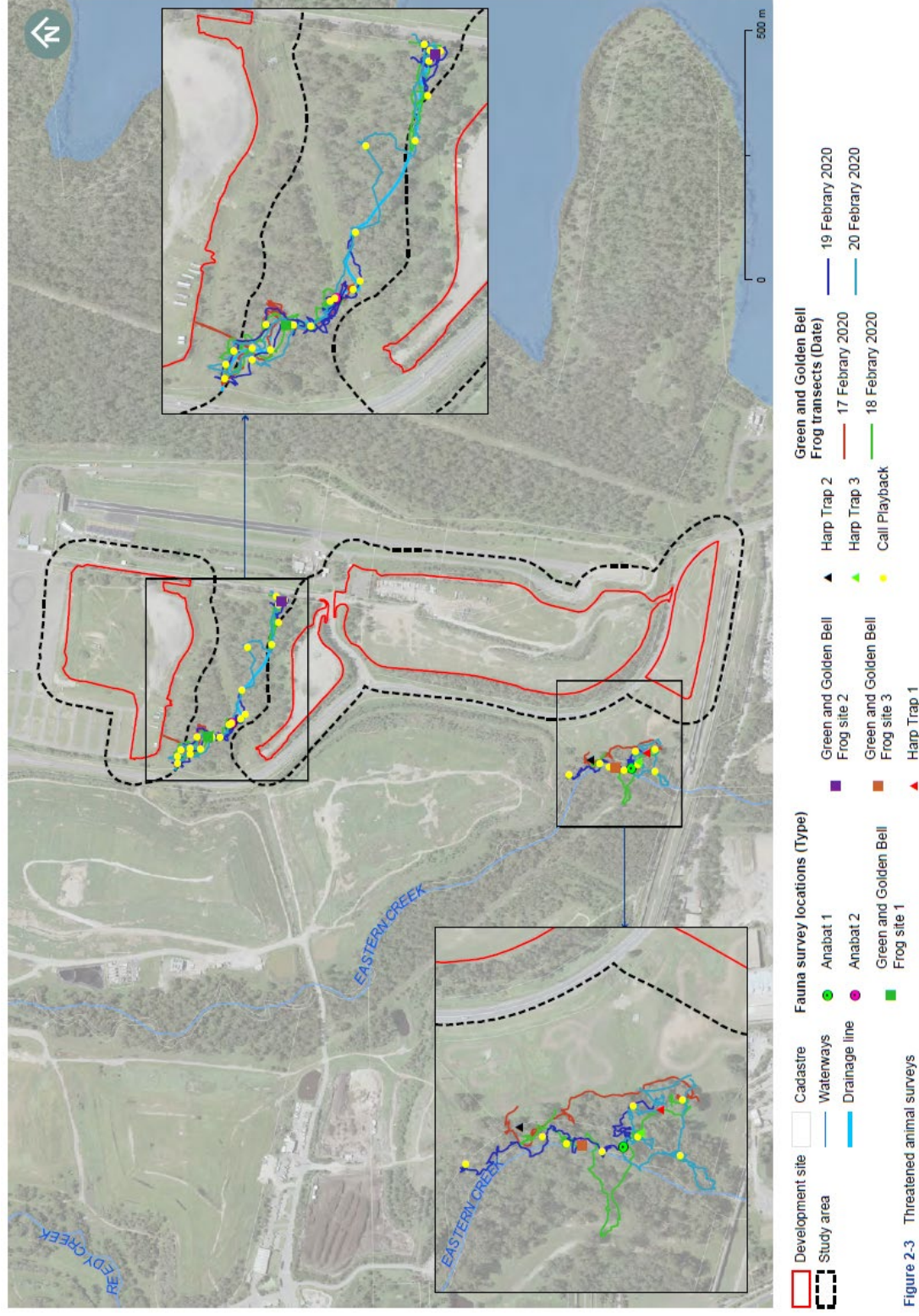


Figure 2-3 Threatened animal surveys

3. Landscape features

3.1 IBRA Bioregions and sub regions

The development site is located in the Sydney Basin bioregion, within the Cumberland subregion (Thackway and Cresswell, 1995) (see **Figure 1-1** and **Figure 1-2**).

3.2 BioNet NSW Landscapes

The development site is located on the Cumberland Plain landscape as mapped by the NSW National Parks and Wildlife Service (NPWS) (2002) and described by the then NSW Department of Environment and Climate Change (2001).

3.3 Rivers, streams and estuaries

The development site is located entirely within the Hawkesbury catchment. There are no rivers, streams or estuaries within the development site. However, a section of Eastern Creek (Strahler class 3) is about 160 metres west of the development site. A small unnamed and unmapped artificial drainage line runs in a northwest direction through woodland in part of the study area, outside of the development site. This appears to drain stormwater from parts of Sydney Dragway northwest through woodland and under Ferrers Road, where it eventually feeds into Eastern Creek.

Other waterways in the 1,500 metre landscape buffer include Reedy Creek (Strahler class 3) and several unnamed tributaries (see **Figure 1-1** and **Figure 1-2**).

3.4 Wetlands

Prospect Reservoir (artificial dam) is located about 600 metres to the east of the development site. There are no other wetlands located within the 1,500 metre landscape buffer apart from farm dams and small areas of impeded drainage.

3.5 Connectivity of habitat

According to the BAM, for development sites, the assessor must identify the connectivity of different areas of habitat that may facilitate the movement of threatened species across their range. While the habitats surrounding the Prospect Reservoir and Eastern Creek are not physically connected to the vegetation in the development site, these habitats are connected as there is woody vegetation separated by less than or equal to 100 metres from the next area of intact native vegetation creating corridors.

3.6 Areas of geological significance and soil hazard features

Areas of geological significance generally include karst, caves, crevices and cliffs. There are no areas of geological significance within or adjacent to the development site.

3.7 Areas of outstanding biodiversity value

The proposed development site does not contain any areas of outstanding biodiversity value listed on the register of declared areas of outstanding biodiversity value.

3.8 Native vegetation extent

The 1,500 metre landscape buffer is about 1,288 hectares in size and contains about 373 hectares of native vegetation (woody and non woody vegetation). This area was calculated with a combination of available regional mapping (i.e. VIS_ID 4489 and VIS_IS4407) and native vegetation mapped within the study area as part of this assessment. This results in a native vegetation cover in the landscape of about 29 per cent. It is apparent from aerial imagery that there is likely to be more native vegetation than has been mapped, so it is expected that this number is higher. Therefore, native vegetation cover in the landscape is in the '>30 – 70 per cent' cover class. These calculations are an estimate only based on existing regional mapping and aerial imagery.

4. Native vegetation and vegetation integrity

This section outlines the native vegetation within and directly adjacent to the development site.

4.1 Plant community type descriptions

This BDAR describes PCTs in terms of their floristic composition, geological substrate and relevant regional vegetation classification. The distribution of PCTs within the development site is outlined in **Figure 4-1**. Descriptions of the vegetation that occurs at the development site are provided below and matched to the most likely PCT as described in the BioNet Vegetation Classification database. In some cases, the vegetation at the development site does not strictly meet the definition of a PCT as per the BioNet Vegetation Classification database so the vegetation has been allocated to the PCT with which it most closely aligns. The mapping provided in this BDAR is supported by on ground observations and quantitative data. Plant communities are naturally variable and the boundaries between different PCTs at the development site overlap considerably. However, a choice must be made to map and assign a PCT to a particular area of the development site.

Table 4-1 provides a summary of the PCTs found within and adjacent to the development site.

Table 4-1 Plant community types and vegetation zones identified in the development site and study area

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area (ha)	
				Development site	Study area
1	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	0.1	0.28
2	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	0.07	0.83
3	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Poor	0.3	0.34
4	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Revegetation	0.16	2.29
5	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Blackberry dominant	0	0.06
6	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Moderate	0	0.85
7	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Regeneration	0	0.08
8	1071	Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	Drainage line	0	0.07

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area (ha)	
				Development site	Study area
9	835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	0	0
TOTAL				0.63	4.8

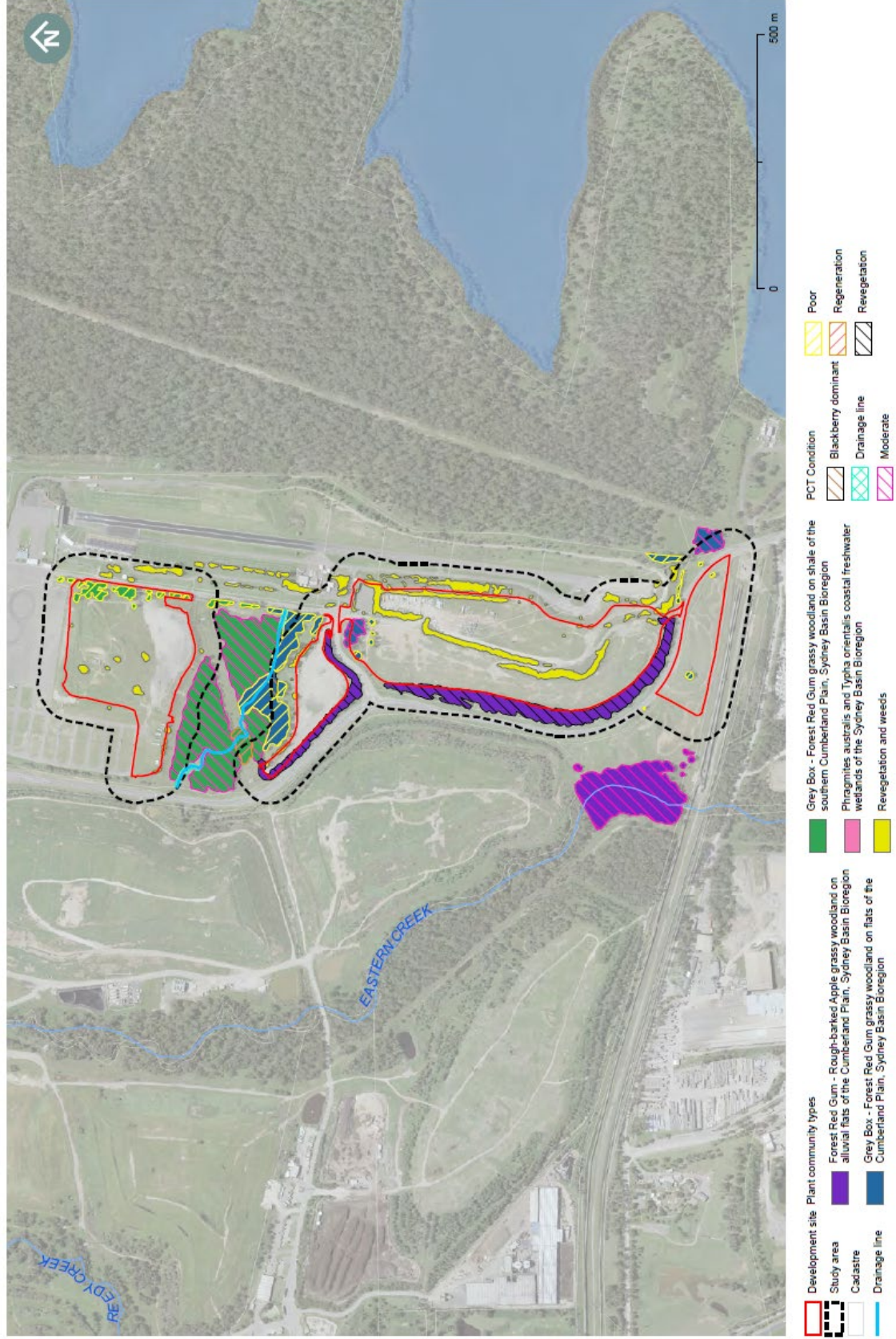


Figure 4-1 Plant community types and vegetation zones

4.1.1 Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – Cumberland Shale Plains Woodland

Vegetation formation: Grassy Woodlands

Vegetation class: Coastal Valley Grassy Woodlands

Classification confidence level from VIS: High

Vegetation zones / survey effort / extent at the development site:

- Zone 2 (Blackberry dominant) / One plot (Plot 11) / 0.07 ha
- Zone 3 (Moderate) / One plot (Plot 12) / 0.15 ha
- Zone 4 (Poor) / Two plots (Plot 7 and 8) / 1.27 ha

The Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849) is described in the BioNet Vegetation Classification database as a grassy woodland located on the gentle topography associated with the shale plains of western Sydney.

The Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849) directly corresponds to the Cumberland Shale Plains Woodland (GW p29) as described in the *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (State Government of NSW and Office of Environment and Heritage (OEH), 2010) and the Cumberland Shale Plains Woodland (S_GW03) as described in *The Native Vegetation of the Sydney Metropolitan Area – Version 3* (State Government of NSW and Office of Environment and Heritage, 2016).



Photo 7: Plot 7 in Vegetation Zone 4 showing the Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849)

The Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT849) has a classification confidence level in the VIS of High. Therefore, classification of this vegetation to the PCT 849 is relatively straightforward and the vegetation is not considered likely to be representative of any other PCT.

This vegetation within the study area is highly disturbed and in poor to moderate condition. The vegetation lacks native species, particularly in the mid storey (shrub layer) and ground layer but is most likely to be PCT 849 for the following reasons:

- The upper stratum contains typical species of PCT 849 including *Eucalyptus tereticornis* and *Eucalyptus moluccana*.
- The ground cover contains typical species of PCT 849 including *Rytidosperma tenuius*.

A summary of the vegetation structure and floristics of PCT 849 as it occurs in the study area is provided in **Table 4-2**. The list of species recorded at each survey site is provided in **Appendix A** and reflects the local variation of species gathered from the survey.

This PCT forms part of the Cumberland Plain Woodland in the Sydney Basin Bioregion which is listed as a threatened ecological community under the BC Act (listed as Critically Endangered). This vegetation is not listed as a threatened ecological community under the EPBC Act. The condition of this PCT is such that it does not meet the condition criteria to be part of the Critically Endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest as listed under the EPBC Act.

Table 4-2 Floristic and structural summary of PCT 849 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	<i>Eucalyptus tereticornis</i> , <i>Eucalyptus moluccana</i>
Midstorey (mid stratum)	Native species absent
Groundcovers (ground stratum)	<i>Einadia hastata</i> , <i>Einadia nutans</i> , <i>Einadia trigonos</i> , <i>Rytidosperma tenuius</i>
Exotic species	<i>Bidens Pilosa</i> , <i>Cirsium vulgare</i> , <i>Lepidium africanum</i> , <i>Plantago lanceolate</i> , <i>Sida rhombifolia</i> , <i>Solanum pseudocapsicum</i> , <i>Sonchus oleraceus</i>
High Threat Weeds	<i>Araujia sericifera</i> , <i>Chloris gayana</i> , <i>Eragrostis curvula</i> , <i>Lantana camara</i> , <i>Lycium ferocissimum</i> , <i>Pennisetum clandestinum</i> , <i>Rubus fruticosus</i> sp. agg.

4.1.2 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850) – Cumberland Shale Hills Woodland

Vegetation formation: Grassy Woodlands

Vegetation class: Coastal Valley Grassy Woodlands

Classification confidence level from VIS: High

Vegetation zones / survey effort / extent at the development site:

- Zone 5 (Moderate) / Four plots (Plot 2, 3, 5 and 6) / 3.91 ha
- Zone 6 (Poor) / One plot (Plot 1) / 0.44 ha
- Zone 7 (Regeneration) / One plot (Plot 10) / 0.18 ha
- Zone 8 (Revegetation) / Two plots (Plot 9 and 13) / 2.29 ha

The Grey Box – Forest Red Gum grassy woodland on shale of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT850) is described in the BioNet Vegetation Classification database as a grassy woodland located on the gentle topography associated with the shale plains of western Sydney occupying the higher elevations associated with the hills and rises south from Prospect.

The Grey Box – Forest Red Gum grassy woodland on Shale of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 850) directly corresponds to the Cumberland Shale Hills Woodland (GW p28) as described in the *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (State Government of NSW and Office of Environment and Heritage (OEH), 2010) and the Cumberland Shale Hills Woodland (S_GW02) as described in *The Native Vegetation of the Sydney Metropolitan Area – Version 3* (State Government of NSW and Office of Environment and Heritage, 2016).



Photo 8: Plot 2 in Vegetation Zone 5 showing the Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850)

The Grey Box – Forest Red Gum grassy woodland on Shale of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 850) has a classification confidence level in the VIS of High. Therefore, classification of this vegetation to the PCT 850 is relatively straightforward and the vegetation is not considered likely to be representative of any other PCT.

This vegetation within the study area ranges from poor to moderate condition and includes some areas of revegetation that have been planted with species representative of the PCT. This vegetation is considered most likely to be PCT 850 for the following reasons:

- The upper stratum contains typical species of PCT 850 including *Eucalyptus tereticornis*.
- The midstorey contains the typical species *Bursaria spinosa*.
- The ground cover contains typical species of PCT 850 including *Dichondra repens*, *Brunoniella australis*, *Aristida* sp., *Microlaena stipoides*, and *Cyperus gracilis*.

A summary of the vegetation structure and floristics of PCT 850 as it occurs in the study area is provided in **Table 4-3**. The list of species recorded at each survey site is provided in **Appendix A** and reflects the local variation of species gathered from the survey.

This PCT forms part of the Cumberland Plain Woodland in the Sydney Basin Bioregion which is listed as a threatened ecological community under the BC Act (listed as Critically Endangered). Parts of this vegetation (moderate condition areas) meet the condition criteria to be part of the Critically Endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest as listed under the EPBC Act. The PCT 850 is identified in the study area, however, these areas that meet the EPBC Act threshold are not within the constraints of the development site.

Table 4-3 Floristic and structural summary of PCT 850 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	<i>Eucalyptus tereticornis</i> , <i>Eucalyptus crebra</i> , <i>Corymbia maculata</i>
Midstorey (mid stratum)	<i>Acacia decurrens</i> , <i>Casuarina glauca</i> , <i>Acacia falcata</i> , <i>Bursaria spinosa</i> , <i>Daviesia ulicifolia</i> , <i>Melaleuca styphelioides</i> , <i>Pittosporum undulatum</i>
Groundcovers (ground stratum)	<i>Brunoniella australis</i> , <i>Centella asiatica</i> , <i>Dianella longifolia</i> , <i>Dichondra repens</i> , <i>Dietes</i> sp., <i>Einadia hastata</i> , <i>Einadia nutans</i> , <i>Einadia trigonos</i> , <i>Eremophila debilis</i> , <i>Hypericum gramineum</i> , <i>Opercularia diphylla</i> , <i>Plantago gaudichaudii</i> , <i>Aristida</i> sp., <i>Cynodon dactylon</i> , <i>Cyperus gracilis</i> , <i>Cyperus</i> sp., <i>Lachnagrostis filiformis</i> , <i>Lomandra confertifolia</i> , <i>Lomandra filiformis</i> , <i>Lomandra longifolia</i> , <i>Microlaena stipoides</i> , <i>Panicum</i> sp., <i>Rytidosperma tenuius</i> , <i>Sporobolus creber</i> , <i>Glycine clandestine</i> , <i>Glycine tabacina</i> , <i>Passiflora herbertiana</i>
Exotic species	<i>Bidens pilosa</i> , <i>Brassica</i> sp., <i>Briza subaristata</i> , <i>Bromus catharticus</i> , <i>Cirsium vulgare</i> , <i>Dovyalis caffra</i> , <i>Foeniculum vulgare</i> , <i>Opuntia stricta</i> , <i>Pavonia hastata</i> , <i>Plantago lanceolata</i> , <i>Senecio pterophorus</i> , <i>Sida rhombifolia</i> , <i>Solanum nigrum</i> , <i>Solanum pseudocapsicum</i> , <i>Verbena bonariensis</i>
High Threat Weeds	<i>Araujia sericifera</i> , <i>Asparagus aethiopicus</i> , <i>Chloris gayana</i> , <i>Ehrharta erecta</i> , <i>Eragrostis curvula</i> , <i>Lantana camara</i> , <i>Ligustrum lucidum</i> , <i>Lycium ferocissimum</i> , <i>Megathyrus maximus</i> , <i>Olea europaea</i> , <i>Paspalum dilatatum</i> , <i>Pennisetum clandestinum</i> , <i>Senecio madagascarensis</i>

4.1.3 Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071)

Vegetation formation: Freshwater Wetlands

Vegetation class: Coastal Freshwater Lagoons

Classification confidence level from VIS: Very Low

Vegetation zones / survey effort / extent at the development site:

- Zone 9 (Drainage line) / One plot (Plot 10) / 0.07 ha

The *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) is described in the BioNet Vegetation Classification database as artificial water bodies, drainage lines and depressions across a wide variety of environments and includes modified former wetlands. It occurs also in original form in a wide variety of situations associated with coastal plains, valleys, lagoons and other areas of poor drainage. The version of PCT 1071 in the study area is a result of altered drainage and is therefore artificial.

The *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) does not directly correlate to any map unit as described in the *Southeast NSW Native Vegetation Classification and Mapping – SCIVI* (State Government of NSW and Office of Environment and Heritage (OEH), 2010) or *The Native Vegetation of the Sydney Metropolitan Area – Version 3* (State Government of NSW and Office of Environment and Heritage, 2016).



Photo 9: Plot 4 in Vegetation Zone 9 showing the *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071)

The *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071) has a classification confidence level in the VIS of Very Low. This PCT may be replaced or retired in future revisions of the BioNet Vegetation Classification database. However, this vegetation is not considered likely to be representative of any other PCT.

This vegetation within the study area is not a natural occurrence of a wetland. The vegetation has established naturally but has resulted from human interference causing impeded drainage within a drainage line. The description of PCT 1071 in the BioNet Vegetation Classification database lacks detail but the vegetation is dominated by native wetland species and is most likely to be PCT 1071 due to the dominance of *Typha orientalis*.

A summary of the vegetation structure and floristics of PCT 1071 as it occurs in the study area is provided in **Table 4-4**. The list of species recorded at each survey site is provided in **Appendix A** and reflects the local variation of species gathered from the survey. The quality of the vegetation is poor and is not comparable to a naturally occurring Freshwater Lagoon system.

The *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion PCT has developed at this location due to human alteration of the drainage line and is not a naturally occurring wetland. As such, this particular occurrence of this PCT is unlikely to be part of the TEC described as 'Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions' TEC and listed under the BC Act. This is because artificial wetlands created on previously dry land specifically for purposes such as sewerage treatment, stormwater management and farm production, are not regarded as part of this community (see NSW Scientific Committee, 2010). This PCT is not part of a threatened ecological community listed under the EPBC Act.

Table 4-4 Floristic and structural summary of PCT 1071 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	<i>Eucalyptus tereticornis</i> at edges
Midstorey (mid stratum)	Absent
Groundcovers (ground stratum)	<i>Typha orientalis</i> , <i>Cynodon dactylon</i> , <i>Persicaria lapathifolia</i> (outside of plot)
Exotic species	<i>Sida rhombifolia</i> , <i>Sonchus oleraceus</i>
High Threat Weeds	<i>Rubus fruticosus</i> sp. agg.

4.1.4 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) – Cumberland Riverflat Forest

Vegetation formation: Forested Wetlands

Vegetation class: Coastal Floodplain Wetlands

Classification confidence level from VIS: High

Vegetation zones / survey effort / extent at the development site:

- Zone 1 (Moderate) / Two plots (Plot 14 and 15) / 2.03 ha

The Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) is an open eucalypt forest situated on broad alluvial flats of the Hawkesbury and Nepean river systems. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain.

This vegetation is considered most likely representative of PCT 835 based on the species composition observed at the development site and the landscape position along Eastern Creek. The Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) directly corresponds to the Cumberland River Flat Forest (FoW p33) as described in the *Southeast NSW Native Vegetation Classification and Mapping – SCVI* (State Government of NSW and Office of Environment and Heritage (OEH), 2010) and the Cumberland Riverflat Forest (S_FoW06) as described in *The Native Vegetation of the Sydney Metropolitan Area – Version 3.1* (State Government of NSW and Office of Environment and Heritage, 2016).



Photo 10: Plot 14 in Vegetation Zone 1 showing the Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)

The Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835) has a classification confidence level in the VIS of High. Therefore, classification of this vegetation to the PCT 835 is relatively straightforward and the vegetation is not considered likely to be representative of any other PCT.

Based on the floristic composition of the vegetation observed at the development site and the landscape position the vegetation is considered most likely to be representative of PCT 835 for the following reasons:

- A canopy layer composed of *Eucalyptus tereticornis* and *Angophora floribunda* (listed as typical canopy species for PCT 835 in the VIS) and *Eucalyptus bosistoana* with a lower tree layer composed of *Casuarina glauca* and *Melaleuca styphelioides*.
- While native species in the middle stratum are lacking, species including *Bursaria spinosa* and *Sigesbeckia orientalis* are present which are species typical of PCT 835.
- The presence of species including *Microlaena stipoides*, *Dichondra repens*, *Solanum prinophyllum*, *Commelina cyanea*, *Entolasia* sp., and *Echinopogon* sp. that are species recognised as typical of PCT 835 in the VIS database.
- The PCT is located on the alluvial soils of the South Creek soil landscape along Eastern Creek.

A summary of the vegetation structure and floristics of PCT 835 as it occurs in the study area along Eastern Creek is provided in **Table 4-5**. The list of species recorded at each survey site is provided in **Appendix A** and reflects the local variation of species gathered from the survey.

This PCT forms part of the River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions which is listed as a threatened ecological community under the BC Act (listed as Endangered). This vegetation is not listed as a threatened ecological community under the EPBC Act.

Table 4-5 Floristic and structural summary of PCT 835 within the development site

Vegetation layer	Dominant species
Tree canopy (upper stratum)	<i>Eucalyptus tereticornis</i> , <i>Angophora floribunda</i> , <i>Eucalyptus bosistoana</i> , <i>Casuarina glauca</i> , <i>Melaleuca styphelioides</i>
Midstorey (mid stratum)	<i>Melaleuca styphelioides</i> , <i>Casuarina glauca</i> , <i>Bursaria spinosa</i> , <i>Sigesbeckia orientalis</i> , <i>Platycerium bifurcatum</i>
Groundcovers (ground stratum)	<i>Commelina cyanea</i> , <i>Dichondra repens</i> , <i>Geranium solanderi</i> , <i>Cynodon dactylon</i> , <i>Echinopogon caespitosus</i> , <i>Eragrostis leptostachya</i> , <i>Glycine clandestine</i> , <i>Entolasia sp.</i> , <i>Einadia hastata</i> , <i>Solanum prinophyllum</i> , <i>Persicaria lapathifolia</i> , <i>Potamogeton sp.</i> , <i>Alisma plantago-aquatica</i> , <i>Spirodela sp.</i> , <i>Juncus sarophorus</i> , <i>Juncus usitatus</i>
Exotic species	<i>Bidens pilosa</i> , <i>Cirsium vulgare</i> , <i>Conyza bonariensis</i> , <i>Gamochaeta Americana</i> , <i>Lactuca serriola</i> , <i>Morus alba</i> , <i>Parietaria judaica</i> , <i>Rumex crispus</i> , <i>Senecio pterophorus</i> , <i>Solanum pseudocapsicum</i> , <i>Verbena bonariensis</i> , <i>Cyclosporum leptophyllum</i> , <i>Dovyalis caffra</i> , <i>Sida rhombifolia</i> , <i>Solanum linnaeanum</i> , <i>Solanum nigrum</i> , <i>Sonchus oleraceus</i>
High Threat Weeds	<i>Ageratina adenophora</i> , <i>Cardiospermum grandiflorum</i> , <i>Cestrum parqui</i> , <i>Cyperus eragrostis</i> , <i>Ehrharta erecta</i> , <i>Lantana camara</i> , <i>Tradescantia fluminensis</i> , <i>Lycium ferocissimum</i> , <i>Paspalum dilatatum</i> , <i>Senecio madagascarensis</i>

4.2 Vegetation zones and vegetation integrity score

A description of the vegetation zones identified within the development site and the corresponding vegetation integrity score developed from the Biodiversity Assessment Calculator is presented in **Table 4-6**. The vegetation integrity survey plot data is provided in **Appendix C**.

Table 4-6 Vegetation zones and vegetation integrity scores for the South East Highlands bioregion

Vegetation zone	Plant community type ID No.	Plant community type name	Broad condition class	Vegetation zone area in development site (ha)	Vegetation integrity score
1	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Moderate	0.1	18.7
2	849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Poor	0.07	11.3
3	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Poor	0.3	15.2
4	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Revegetation	0.16	23.9

4.3 Patch size

The native vegetation within the development site is all part of the same vegetation patch according to the definition of a patch as provided in the BAM. While the habitats surrounding the Prospect Reservoir and Eastern Creek are not physically connected to the vegetation in the development site, these habitats are connected as there is woody vegetation separated by less than or equal to 100 metres from the next area of intact native vegetation creating corridors.

As the vegetation within the development site is connected to the Prospect Nature Reserve and the vegetation along Eastern Creek, the patch size is at least 905 hectares so for the purposes of the assessment the patch size is in the greater than 100 hectare size class.

4.4 Threatened ecological communities

One Threatened Ecological Community (TEC) listed under the BC Act occurs in the development site:

- Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered).

This corresponds to PCT 849 and PCT 850. The areas of the TEC are mostly in poor condition represented by regrowth native species amongst plantings and weed growth. The largest occurrence of this TEC is represented by revegetated areas along Ferrers Road.

The woodland between Carpark C and Carpark D is also a patch of BC Act listed Cumberland Plain Woodland in the Sydney Basin Bioregion. Some areas of this vegetation, found within the study area, and outside of the development site, in moderate conditions are also part of the Commonwealth EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community (listed as Critically Endangered). There are no areas of EPBC Act listed TECs within the development site.

The two patches of PCT 1071 on the drainage line between Caraprk C and Carpark D do not meet the definition of the BC Act listed Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions as this TEC does not include artificial waterways created on previously dry land for purposes such as stormwater management.

One additional TEC listed under the BC Act, River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, is located outside of the development site to the west around Eastern Creek. This TEC corresponds directly with PCT 835.

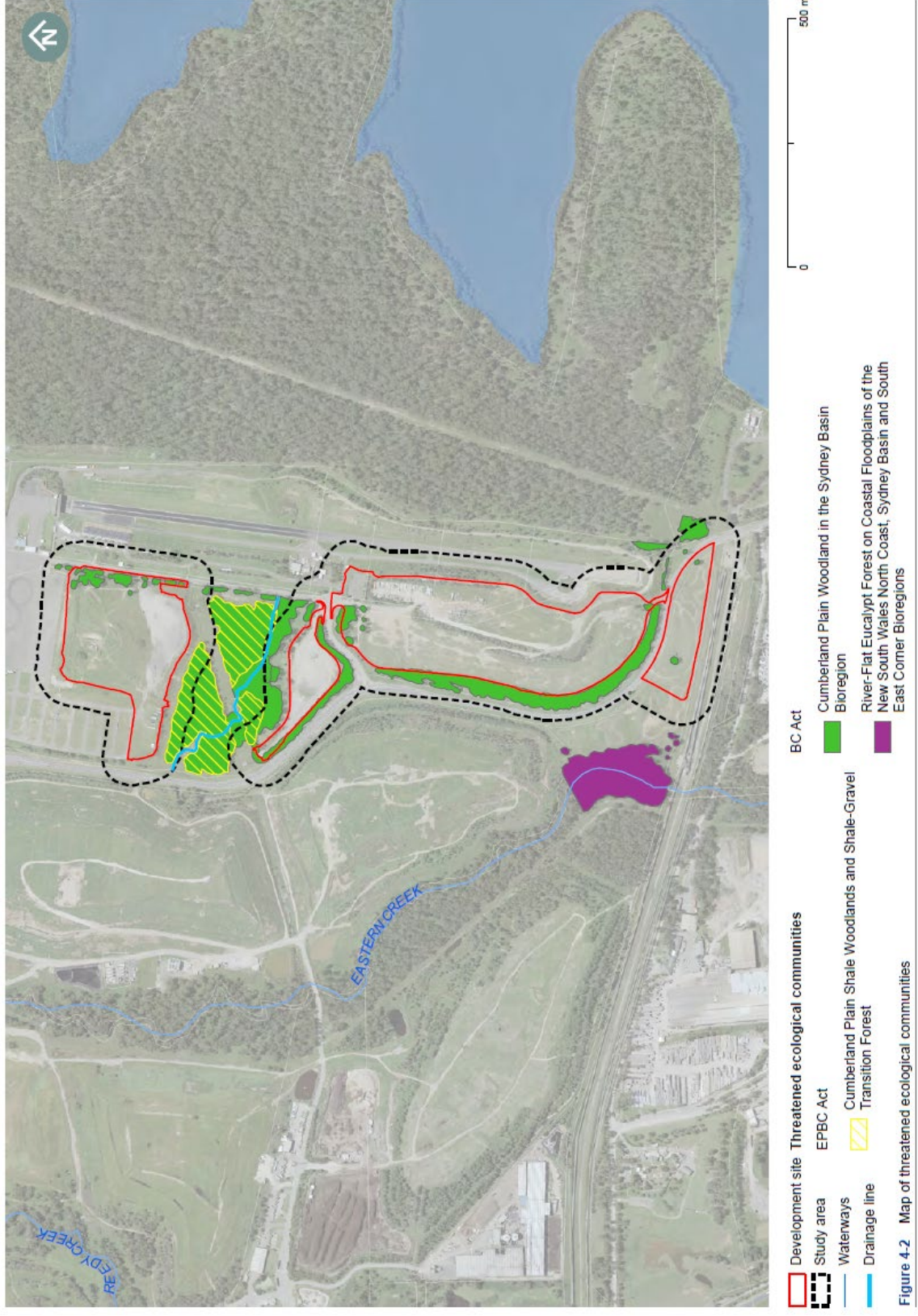


Figure 4-2 Map of threatened ecological communities

Figure 4-2 Threatened ecological communities

4.5 Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the development site has been identified using the *Atlas of Groundwater Dependent Ecosystems* (GDEs) (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the former NSW Department of Primary Industries (Kuginis et al., 2012). The list of high priority GDEs provided in Schedule 4 of the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 was also reviewed. The mapping of GDEs provided by the Atlas of GDEs provides an indication whether a GDE may be present but the mapping is based on a coarse regional vegetation mapping dataset and does not accurately reflect project site conditions.

There are no mapped aquatic GDEs within the development site or the 1,500 metre landscape buffer. However, the *Atlas of Groundwater Dependent Ecosystems* (Bureau of Meteorology, 2017) identifies portions of the locality as containing some areas of high potential groundwater dependent terrestrial vegetation. Based on the results of the field surveys carried out for this BDAR and examination of the *Native Vegetation of the Sydney Metropolitan Area – Version 3* vegetation map (State Government of NSW and Office of Environment and Heritage, 2016), there is potential for groundwater dependent terrestrial vegetation types to be present.

Two terrestrial GDEs were identified on the Atlas of Groundwater Dependent Ecosystems within the development site. Based on these results and data collected during field surveys carried out for this assessment, there is potential for groundwater dependent terrestrial vegetation types to be present. The following plant community types were identified during field surveys and are considered with a moderate to high likelihood to be terrestrial GDEs:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 849)
- Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion PCT (PCT 835)
- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071).

However, these PCTs are not obligate GDEs (i.e. they are not entirely dependent on groundwater). These PCTs are likely to be opportunistic facultative GDEs that may depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others. This capillary water may be accessed by the plants where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. As the plants within these PCTs may at times rely on capillary water in the soil that rises from the water table, any lowering of the water table may result in a reduction in groundwater availability and declining vegetation health during low rainfall periods.

However, if the groundwater table is shallow where the potential GDE occurs, and there is no perched aquifer above the water table (separated from the water table by a layer of impermeable rock or sediment), then impacts on vegetation health may occur.

5. Habitat suitability for threatened species

The Biodiversity Assessment Calculator was used to derive the list of candidate species for this assessment, but the results were also supplemented with database searches, including a review of the Threatened Biodiversity Data Collection, to identify the threatened species that have been recorded by previous surveys or are considered likely to occur in the broader locality and development site. This section provides the results of the habitat suitability assessment for threatened species as outlined in section 6 of the BAM.

5.1 Habitat suitability for species that can be predicted by habitat surrogates (ecosystem credit species)

Ecosystem credit species are those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection. Ecosystem credit threatened species have been assessed in conjunction with information about development site context (section 4.3 and section 5.3.2 of the BAM), PCTs and vegetation integrity attributes (chapter 5 of the BAM), and data from the Threatened Biodiversity Data Collection (section 6.1 of the BAM).

The Biodiversity Assessment Calculator was used to generate a list of the predicted threatened species that met the criteria outlined in section 6.4.1.3 of the BAM. The results of the BioNet search and the federal Department of the Agriculture, Water and the Environment's PMST were also used to inform development of the species list.

The initial list of predicted ecosystem credit species is provided in **Table 5-1**. The full threatened species habitat suitability assessment is provided in **Appendix A**. Once the initial list of predicted ecosystem credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Geographic limitations usually relate to altitude or topographic features. Where the development site is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was completed.

In accordance with paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an on-site assessment was completed to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the development site. Some species do not have any identified habitat constraints, in which case this step was not carried out. The justification for including or excluding ecosystem credit species from the assessment is provided in **Table 5-1**.

The remainder of the ecosystem credit species outlined in **Appendix A** have suitable habitat within and adjacent to the development site, albeit limited in size, and would therefore need to be addressed in future assessment under the BAM. Under the BAM, targeted survey is not required for ecosystem credit species. However, in some circumstances, the Threatened Biodiversity Data Collection may identify that a species requires assessment for ecosystem credits and species credits (a dual credit species). This occurs where part of the habitat is assessed as a species credit (e.g. breeding habitat, or mapped locations identified as an important area that is used by a species). The remaining part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat, unmapped locations used by a species). Therefore, some species are listed in both **Table 5-1** and **Table 5-2** as an ecosystem credit species and a species credit species.

Table 5-1 Summary of predicted ecosystem credit species that were assessed

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
Birds					
<i>Anthochaera phrygia</i>	Regent Honeyeater (foraging)	CE	CE	Included. This species may occasionally forage in vegetation, particularly winter flowering species such as <i>Eucalyptus tereticornis</i> .	High
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the development site.	Moderate
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (foraging)	-	V	Included. May occur in study area on occasion in winter. No breeding habitat in development site.	Moderate
<i>Chthonicola sagittata</i>	Speckled Warbler	-	V	Excluded from the assessment as the development site is low quality. Only one record in the locality suggests this species is quite rare and likely to stick to high quality remnant woodland. The likelihood of this species occurring in the development site is considered low.	High
<i>Circus assimilis</i>	Spotted Harrier	-	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.	Moderate
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	-	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.	High
<i>Daphoenositta chrysoptera</i>	Varied Sittella	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the development site.	Moderate
<i>Glossopsitta pusilla</i>	Little Lorikeet	-	V	Included. This species is commonly seen in the locality and may forage in or over the vegetation in and adjacent to the development site.	High
<i>Grantiella picta</i>	Painted Honeyeater	V	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.	Moderate
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (foraging)	M	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species.	High
<i>Hieraaetus morphnoides</i>	Little Eagle (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	Moderate

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Lathamus discolor</i>	Swift Parrot (foraging)	CE	E	Included. The vegetation in the development site does not represent any significant foraging or nesting opportunities for this species. While this species is unlikely to use the development site on a permanent basis, temporary foraging cannot be discounted. Impacts on this species associated with the loss of vegetation associated with the development are discussed in Section 9.2 .	Moderate
<i>Lophoictinia isura</i>	Square-tailed Kite (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	Moderate
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	-	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.	Moderate
<i>Melithreptus gularis Gularis</i>	Black-chinned Honeyeater (eastern subspecies)	-	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species.	Moderate
<i>Neophema pulchella</i>	Turquoise Parrot	-	V	Excluded from the assessment as there is no habitat in the development site considered suitable for this species.	High
<i>Ninox connivens</i>	Barking Owl (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	High
<i>Ninox strenua</i>	Powerful Owl (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	High
<i>Petroica boodang</i>	Scarlet Robin	-	V	Excluded from assessment. This species may occur in higher quality vegetation around the development site and pass through it on occasion. However, there is no habitat in the development site considered suitable for this species.	Moderate
<i>Petroica phoenicea</i>	Flame Robin	-	V	Excluded from assessment. This species may occur in higher quality vegetation around the development site and pass through it on occasion. However, there is no habitat in the development site considered suitable for this species.	Moderate
<i>Stagonopleura guttata</i>	Diamond Firetail	-	V	Excluded from the assessment. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.	Moderate
<i>Tyto novaehollandiae</i>	Masked Owl (foraging)	-	V	Included. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.	High

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
Mammals					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	E	V	Excluded from the assessment. The development site does not provide optimal habitat for this species. There are eight records of this species from the locality, but it hasn't been recorded since 2013 and is unlikely to use the habitats in the development site.	High
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	-	V	Included. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.	High
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	-	V	Included. Analysis of bat calls recorded along the drainage line as part of this assessment identified this species on one night. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.	High
<i>Miniopterus australis</i>	Little Bent-winged Bat (foraging)	-	V	Included. This species is most likely to forage in the woodland around the drainage line and may occur in the development site as it flies around. However, there is no high quality foraging habitat or breeding habitat in the development site.	High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (foraging)	-	V	Included. This species is most likely to forage in the woodland around the drainage line and may occur in the development site as it flies around. However, there is no high quality foraging habitat or breeding habitat in the development site.	High
<i>Petaurus australis</i>	Yellow-bellied Glider	-	V	Excluded from the assessment. There is no habitat in the development site considered suitable for this species.	High
<i>Phascolarctos cinereus</i>	Koala (foraging)	V	V	Excluded from the assessment. <i>Eucalyptus tereticornis</i> is a primary food tree species. However, the known occurrence of this species within the locality is very rare. This species may pass through the development site on occasion, however the likelihood is considered low.	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (foraging)	V	V	Included. This species is assumed to occur based on the presence of suitable foraging habitat and the proximity of several camps. There are no camps within the development site.	High

Species name	Common name	EPBC Act *	BC Act *	Justification for inclusion / exclusion	Sensitivity to gain class
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	-	V	Included. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.	High
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	-	V	Included. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.	High

*Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory

5.2 Habitat suitability for species that cannot be predicted by habitat surrogates (species credit species)

Habitat suitability is identified as the degree to which the habitat needs of threatened species are present at a particular site. Species credit species have been assessed in conjunction with information collected about the context of the development site (section 4.3 of the BAM), on PCTs and vegetation integrity attributes in (section 5 of the BAM), and data obtained from the Threatened Biodiversity Data Collection (section 6.1 of the BAM).

Species credit species are threatened species or components of species habitat that are identified in the Threatened Biodiversity Data Collection as requiring assessment for species credits. Species credit species are those species for which the likelihood of occurrence, or elements of suitable habitat, cannot be confidently predicted by vegetation surrogates or landscape features. Species credit species can be reliably detected by survey. Based on the assessment of habitat in the development site, and review of databases and published information, the species credit species as outlined in **Table 5-2** are considered 'candidate species' for the assessment. The full threatened species habitat suitability assessment is provided in **Appendix A**.

Table 5-2 Summary of candidate species credit species returned by the BAM-Calculator

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
Plants				
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	High
<i>Acacia pubescens</i>	Downy Wattle	V	V	High
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	V	E	Moderate
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	High
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia	-	V	Moderate
<i>Dillwynia tenuifolia</i> - endangered population	Dillwynia tenuifolia, Kemps Creek	-	EP	High
<i>Eucalyptus benthamii</i>	Camden White Gum	V	V	High
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	-	V	Moderate

Species name	Common name	EPBC Act*	BC Act*	Sensitivity to gain class
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	Moderate
<i>Persoonia bargoensis</i>	Bargo Geebung	V	E	High
<i>Pimelea curviflora</i> var. <i>curviflora</i>	Pimelea curviflora var. curviflora	V	V	High
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	High
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	Moderate
<i>Pultenaea pedunculata</i>	Matted Bush-pea	-	E	High
<i>Thesium australe</i>	Austral Toadflax	V	V	Moderate
Birds				
<i>Anthochaera phrygia</i>	Regent Honeyeater (breeding)	CE	CE	High
<i>Burhinus grallarius</i>	Bush Stone-curlew	-	E	High
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (breeding)	-	V	High
<i>Callocephalon fimbriatum</i> - endangered population	Gang-gang Cockatoo population in the Hornsby and Kuring-gai Local government areas	-	EP	High
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (breeding)	M	V	High
<i>Hieraaetus morphnoides</i>	Little Eagle (breeding)	-	V	Moderate
<i>Lathamus discolor</i>	Swift Parrot (breeding)	CE	E	Moderate
<i>Lophoictinia isura</i>	Square-tailed Kite (breeding)	-	V	Moderate
<i>Ninox connivens</i>	Barking Owl (breeding)	-	V	High
<i>Ninox strenua</i>	Powerful Owl (breeding)	-	V	High
<i>Tyto novaehollandiae</i>	Masked Owl (breeding)	-	V	High
Mammals				
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	-	V	High
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Very High
<i>Miniopterus australis</i>	Little Bent-winged Bat (breeding)	-	V	Very High
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (breeding)	-	V	Very High
<i>Myotis macropus</i>	Southern Myotis	-	V	High
<i>Petaurus norfolcensis</i>	Squirrel Glider	-	V	High
<i>Phascolarctos cinereus</i>	Koala (breeding)	V	V	High
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (breeding)	V	V	High
Frogs				
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	High
Invertebrates				
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	-	E	High
<i>Pommerhelix duralensis</i>	Dural Land Snail	E	E	High

Key: CE = critically endangered, E = endangered, EP = endangered population, V = vulnerable, M = migratory

5.2.1 Identifying geographic and habitat constraints

Once the initial list of predicted candidate species credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Where the development site is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was completed. In accordance with paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an on-site assessment was carried out to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the development site. Some species do not have any identified habitat constraints, in which case this step was not carried out. The species included or excluded based on habitat constraints or geographic limitations are outlined below in **Table 5-3**.

Table 5-3 Summary of candidate species credit species with geographic or habitat constraints

Species name	Common name	EPBC Act	BC Act	Habitat constraint	Geographic limitation	Justification for inclusion / exclusion
Plants						
<i>Dillwynia tenuifolia</i> - endangered population	Dillwynia tenuifolia, Kemps Creek	-	EP	-	Bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool LGA.	Excluded. The development site is not in the area bounded by western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local government area.
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	-	Blacktown, Camden, Campbelltown, Canterbury-Bankstown, Cumberland, Fairfield, Liverpool and Penrith LGAs.	Included. The development site is included in the Blacktown Local government area.
Birds						
<i>Anthochaera phrygia</i>	Regent Honeyeater (breeding)	CE	CE	As per mapped areas.	-	Excluded. The development site does not contain mapped Regent Honeyeater breeding habitat.
<i>Burhinus grallarius</i>	Bush Stone-curlew	-	E	Fallen/standing dead timber including logs.	-	Excluded. The development site does not contain any fallen/standing dead timber.

Species name	Common name	EPBC Act	BC Act	Habitat constraint	Geographic limitation	Justification for inclusion / exclusion
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (breeding)	-	V	Hollow bearing trees. Eucalypt tree species with hollows greater than nine centimetres.	-	Excluded. No trees with hollows greater than nine centimetres were identified on the development site.
<i>Callocephalon fimbriatum</i> - endangered population	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local government areas	-	EP	-	Hornsby and Ku-ring-gai LGAs	Excluded. The development site is not within the Hornsby and Ku-ring-gai LGAs.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (breeding)	M	V	Living or dead mature trees within suitable vegetation within one kilometres of a rivers, lakes, large dams or creeks, wetlands and coastlines.	-	Excluded. The development site is within one kilometre of Prospect Reservoir, however it lacks large emergent trees and the vegetation is generally in poor and disturbed condition.
<i>Hieraaetus morphnoides</i>	Little Eagle (breeding)	-	V	Nest trees - live (occasionally dead) large old trees within vegetation).	-	Excluded. The development site lacks large emergent trees and the vegetation is generally in poor and disturbed condition.
<i>Lathamus discolor</i>	Swift Parrot (breeding)	CE	E	As per mapped areas.		Excluded. There is no breeding habitat in the development site.
<i>Lophoictinia isura</i>	Square-tailed Kite (breeding)	-	V	Nest trees.	-	Excluded. The development site lacks large emergent trees and the vegetation is generally in poor and disturbed condition.
<i>Ninox connivens</i>	Barking Owl (breeding)	-	V	Hollow bearing trees. Living or dead trees with hollows greater than 20 centimetres diameter and greater than four metres above the ground.	-	Excluded. No trees with hollows greater than 20 centimetres were identified on the development site.
<i>Ninox strenua</i>	Powerful Owl (breeding)	-	V	Hollow bearing trees. Living or dead trees with hollow greater than 20 centimetres diameter.	-	Excluded. No trees with hollows greater than 20 centimetres were identified on the development site.

Species name	Common name	EPBC Act	BC Act	Habitat constraint	Geographic limitation	Justification for inclusion / exclusion
<i>Tyto novaehollandiae</i>	Masked Owl (breeding)	-	V	Hollow bearing trees. Living or dead trees with hollows greater than 20 centimetres diameter.	-	Excluded. No trees with hollows greater than 20 centimetres were identified on the development site.
Mammals						
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Cliffs Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	-	Excluded. The development site does not contain any cliffs and is not within two kilometres of rocky areas, old mines or tunnels.
<i>Miniopterus australis</i>	Little Bent-winged Bat (breeding)	-	V	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.	-	Excluded. The development site does not contain any caves, tunnel, mine, culvert or other structure known to be used for breeding. There are no records of observation type 'IC' or 'E' in the locality.
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (breeding)	-	V	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' with numbers of individuals greater than 500.	-	Excluded. The development site does not contain any caves, tunnel, mine, culvert or other structure known to be used for breeding. There are no records of observation type 'IC' or 'E' in the locality.
<i>Myotis macropus</i>	Southern Myotis	-	V	Hollow bearing trees. Within 200 metres of riparian zone. Bridges, caves or artificial structures within 200 metres of riparian zone. Waterbodies:	-	Included as the development site is within 200 metres of Eastern Creek.

Species name	Common name	EPBC Act	BC Act	Habitat constraint	Geographic limitation	Justification for inclusion / exclusion
				This includes rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 metres of the development site.		
<i>Phascolarctos cinereus</i>	Koala (breeding)	V	V	Areas identified via survey as important habitat. ('Important' habitat (however this is not a mapped important habitat area) is defined by the density of koalas and quality of habitat determined by on-site survey).	-	Excluded. The development site does not contain any important habitat.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (breeding)	V	V	Breeding camps.	-	Excluded. There are no breeding camps on the development site.
Frogs						
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	Semi-permanent/ephemeral wet areas. Within one kilometre of wet areas. Within one kilometre of swamp. Within one kilometre of waterbody.	-	Included as the development site is within one kilometre of wet areas.
Invertebrates						
<i>Pommerhelix duralensis</i>	Dural Land Snail	E	E	Other Leaf litter and shed bark or within 50 metres of litter or bark Rocky areas Rocks or within 50 metres of rocks Fallen/standing dead timber including logs Including logs and bark or within 50 metres of logs or bark	-	Included. The development site is within 50 metres of woodland with leaf litter.

Key: CE = critically endangered, E = endangered, EP = endangered population, V = vulnerable

5.2.2 Identifying candidate species for further assessment

In accordance with paragraphs 6.4.1.17 – 6.4.1.19 (Step 3) of the BAM, a field assessment was carried out to determine whether the habitats within the development site were substantially degraded to the point that a candidate species is unlikely to utilise the development site (or specific vegetation zones). There were a number of threatened species returned from the calculator that are species credit species if breeding habitat would be impacted. The development site does not contain breeding habitat for any of these identified species as follows:

- The Regent Honeyeater does not breed in the Sydney urban area. There are only four known key breeding regions remaining for the Regent Honeyeater: northeast Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. Therefore, the Regent Honeyeater was removed from the candidate species list.
- The Swift Parrot breeds in Tasmania. As such, it was removed from the candidate species list.
- The Bush Stone-curlew is no longer known from the Sydney Region. Habitats on the development site are primarily managed (mown) and do not contain any areas of fallen-standing dead timber and logs. As such, the Bush Stone-curlew was removed from the candidate species list.
- The Gang-gang Cockatoo requires hollow bearing Eucalypt trees with hollows greater than nine centimetres in diameter for breeding. No hollows greater than nine centimetres were identified in the development site. The development site also does not fall within the Hornsby or Ku-ring-gai LGAs. As such, the Gang-gang Cockatoo and Endangered Populations were removed from the candidate species list.
- White-bellied Sea-Eagle breeding habitat is specified as live large old trees within one kilometre of rivers, lakes, large dams or creeks, wetlands and coastlines AND the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period. There are no live large old trees within the development site that contain large stick nests. The habitats within the development site contain relatively small to moderate sized *Eucalyptus* spp. trees that are not suitable as nesting sites for the White-bellied Sea-Eagle. Consequently, the White-bellied Sea-Eagle was removed from the candidate species list.
- Little Eagle breeding habitat is specified as live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. There are no live large old trees within the development site that contain large stick nests. The habitats within the development site contain relatively small to moderate sized *Eucalyptus* spp. trees that are not suitable as nesting sites for the Little Eagle. Consequently, the Little Eagle was removed from the candidate species list.
- The Square-tailed Kite also requires nest trees for breeding. It is difficult to identify a Kite nest (there are lots of comparable sized stick nests built by other species), especially given Kites have large territories and other stick nesters also nest where Kites might be recorded. Kites need be in attendance to confirm breeding sites. As discussed, there are no large old trees that contain large stick nests. Consequently, the Square-tailed Kite was removed from the candidate species list.
- The Barking Owl, Powerful Owl and Masked Owl all require living or dead trees with hollow greater than 20cm diameter. There are no trees with hollows greater than 20 centimetres in the development site. As such, these three species were removed from the candidate species list.
- Breeding habitat for the Large-eared Pied Bat requires either cliffs or the development site to be within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels. The development site does not contain cliffs and an assessment of a two-kilometre radius did not identify any of these breeding features. As such, the Large-eared Pied Bat was removed from the candidate species list.
- Breeding habitat for the Large Bent-winged Bat and Little Bent-winged Bat is highly specific and is restricted to cave systems. There are only five Little Bent-winged Bat nursery sites /maternity colonies known in Australia and a single maternity colony in NSW which is in close association with a large maternity colony of Large Bent-winged bats. The breeding colonies of the Little Bent-winged Bat and Large Bent-winged Bat are not in the Sydney area and would not be affected. As such, these species were removed from the candidate species list.

- There are no Koala breeding colonies in or near the development site. Consequently, the Koala was removed from the candidate species list.
- There are no Grey-headed Flying-fox camps in the development site. The nearest camps are at Wetherill Park and Ropes Creek, but these camps would not be affected. Consequently, the Grey-headed Flying-fox was removed from the candidate species list.
- The Dural Land Snail was removed from the candidate species list as the development site is outside of the species' known distribution.

The Green and Golden Bell Frog has been included based on the potential for suitable habitat along Eastern Creek adjacent to the main operational site and sections of the artificial drainage line within woodland located between Carpark C and Carpark D. Although these areas would not be directly impacted by the development, this potential suitable habitat has been identified as at risk of being indirectly impacted by the development considering the proximity. For breeding, the Green and Golden Bell Frog needs water bodies that are still, shallow, ephemeral, unpolluted (but the frog can be found in polluted habitats), unshaded, with aquatic plants and free of mosquito fish and other predatory fish (refer to **Section 5.3.2** for assessment of habitat on the development site). Survey site 1 and 2 (artificial drainage line) meet most of the known habitat requirements (Pyke and White 1996) while Survey site 3 (Eastern Creek) is considered low quality. Additionally, there are both grassland habitats and open woodlands adjacent to the waterway's that would be suitable as terrestrial habitat for the Green and Golden Bell Frog.

The Southern Myotis has been included based on the presence of suitable habitat within the study area and recorded observations within the locality. According to the habitat requirements of this species, Eastern Creek and the unnamed drainage line between Carpark C and Carpark D may offer suitable aquatic fishing/foraging habitat, including most areas of vegetation. No breeding habitat is likely to be present.

The Cumberland Plain Land Snail has been included based on the presence of suitable habitat (though marginal) within the study area, represented by the moderate quality woodland between Carpark C and Carpark D. No snails were identified during surveys, however conditions in December 2019 were very dry. This woodland contains a low abundance of coarse wood debris and leaf litter. The occurrence of this woodland would not be directly impacted by the development.

The development site is largely composed of a highly modified landscape, with areas of native vegetation existing as disturbed remnant, regrowth and revegetation. Much of the vegetation in the development site is currently managed (e.g. mown and slashed). This historical and current disturbance regime has resulted in existing vegetation to be unsuitable habitat for many of the candidate threatened flora species identified by the BAM-Calculator. Due to the disturbance on the development site, the following plant species are considered unlikely to occur and were excluded from the assessment based on habitat degradation:

- *Caladenia tessellata* (Thick Lip Spider Orchid)
- *Pterostylis saxicola* (Sydney Plains Greenhood).

The following species were excluded from the assessment as they do not occur in the development site based on geographic limitations:

- *Dillwynia tenuifolia* – endangered population (Dillwynia tenuifolia, Kemps Creek)
- *Callocephalon fimbriatum* - endangered population (Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local government areas).

The list of species retained for further assessment is shown in **Table 5-4**. This list includes an additional five species that were not identified by the BAM-Calculator, including:

- *Eucalyptus nicholii* (Narrow-leaved Black Peppermint) – commonly planted in the Sydney region.
- *Persoonia nutans* (Nodding Geebung) – records within the locality and suitable habitat present.
- *Pilularia novae-hollandiae* (Austral Pilwort) – suitable habitat in the drainage line.
- *Pultenaea parviflora* (Sydney-bush Pea) – records and suitable habitat present.
- *Syzygium paniculatum* (Magenta Lilly Pilly) - commonly planted in the Sydney region.

Table 5-4 Summary of candidate species credit species for further assessment

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAII*	Relevant habitat in the study area
Plants						
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	E	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Acacia pubescens</i>	Downy Wattle	V	V	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia	-	V	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Eucalyptus benthamii</i>	Camden White Gum	V	V	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	High	No	Anywhere - a commonly planted street tree in the Sydney region.
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	-	V	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> - endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	EP	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Persoonia bargoensis</i>	Bargo Geebung	V	E	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Persoonia nutans</i>	Nodding Geebung	E	E	Moderate	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Pilularia novae-hollandiae</i>	Austral Pilwort	-	E	High	No	Drainage line in woodland between Carpark C and Carpark D, outside of the development site.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	Pimelea curviflora var. curviflora	V	V	High	No	Highest quality habitat represented by the woodland

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAIL*	Relevant habitat in the study area
						between Carpark C and Carpark D, outside of the development site.
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	High	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Pultenaea parviflora</i>	Sydney-bush Pea	V	E	Moderate	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Pultenaea pedunculata</i>	Matted Bush-pea	-	V	NA	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	E	High	No	Anywhere - a commonly planted street tree in the Sydney region.
<i>Thesium australe</i>	Austral Toadflax	V	V	Moderate	No	Highest quality habitat represented by the woodland between Carpark C and Carpark D, outside of the development site.
Mammals						
<i>Myotis macropus</i>	Southern Myotis	-	V	High	No	Potential habitat is associated vegetation within 200 metres of Eastern Creek.
Frogs						
<i>Litoria aurea</i>	Green and Golden Bell Frog	V	E	High	No	Potential habitat along Eastern Creek adjacent to Carpark B and sections of the artificial drainage line within woodland located between Carpark C and Carpark D, outside of the development site.
Invertebrates						
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	-	E	High	No	Suitable habitat within the study area, represented by the moderate quality woodland between Carpark C and Carpark D, outside of the development site.

Note: SAIL* = Serious and Irreversible Impact Entity.

5.3 Threatened species survey results

5.3.1 Threatened plant species

Eighteen threatened plant species were targeted during surveys of the development site (refer **Table 2-2**). No threatened plant species were found in the development site during the surveys. The highest quality habitat for threatened plants was identified in woodland between Carpark C and Carpark D, outside of the development site (refer to **Figure 4-1**). Parallel transects were completed through this habitat on 18 February 2020 after a month of suitable rainfall and within the recommended survey period for most of the species identified in **Table 2-2**.

5.3.2 Threatened animal species

Surveys were carried out for *Litoria aurea* (Green and Golden Bell Frog) and *Myotis macropus* (Southern Myotis bat) in February 2020. The habitat based assessment of these species suggested the existence of suitable habitat and therefore required further assessment.

Green and Golden Bell Frog

Potential habitat for the Green and Golden Bell Frog was identified in and adjacent to the study area during initial surveys of the development site in December 2019 (see **Photos 1-3** in **Section 2.7.2**). This includes parts of Eastern Creek within 100 to 200 metres of the development site and the artificial drainage line that runs through the moderate quality woodland between Carpark C and Carpark D outside of the development site. Habitat quality at the three survey sites is discussed in **Table 5-5** in relation to some of the known Green and Golden Bell Frog habitat requirements as reported by Pyke and White (1996). Survey site 1 and 2 (artificial drainage line in the woodland between Carpark C and Carpark D outside of the development site) meet most of the known habitat requirements, while Survey site 3 (Eastern Creek outside of the development site) is considered low quality (**Figure 2-3**).

Table 5-5 Assessment of Green and Golden Bell Frog habitat quality

Habitat Requirement (from Pyke and White 1996)	Survey site 1	Survey site 2	Survey site 3
Ephemeral or fluctuating water level, with still or slow moving water	Yes, some deep pooled sections connected by slow moving shallow riffles. However, drain was flowing from recent rain and likely to be highly ephemeral.	Yes, some deep pooled sections connected by slow moving shallow riffles. However, drain was flowing from recent rain and likely to be highly ephemeral.	Slow flow, contains pools and riffles and has low ephemerality.
Shallow water depth <50 cm	Likely	Likely	Some shallow areas
No visible signs/sources of water pollution	Very likely to contain contaminated runoff from raceway (e.g. hydrocarbons). Litter and rubbish present.	Very likely to contain contaminated runoff from raceway (e.g. hydrocarbons). Site is on the down side of internal Sydney Dragway road. Litter and rubbish present.	Moderate considering high rainfall. Deposited rubbish along banks. Water opaque/light brown with foamy film.
Absence of shaded cover	Riparian vegetation is young open grassy woodland. <i>Typha orientalis</i> dominated depression near Ferrers Road culvert, which is not shaded.	Riparian vegetation is young open grassy woodland. <i>Typha orientalis</i> dominated culvert headwall depression next to drainage area from the Sydney Dragway road, which is partially shaded.	Moderate to high shade cover.
<i>Crinia signifera</i> or <i>Limnodynastes peronii</i> present	Both present	Both present	Both present
Absence of predatory fish (in particular <i>Gambusia</i> sp.)	None observed.	None observed.	<i>Gambusia holbrooki</i> observed in edge ponds.
Pond substrate is sand or rock	25% sand, 75% mud, with no rocks.	25% sand, 75% mud, rock present at artificial headwall.	40% mud, 40% clay, 20% sand. Scattered rock observed on banks.

Habitat Requirement (from Pyke and White 1996)	Survey site 1	Survey site 2	Survey site 3
Presence of emergent aquatic vegetation or rocks for diurnal shelter	Stand of <i>Typha orientalis</i> (400 m ²) in depression near Ferrers Road culvert. Most of drainage line covered with exotic grass.	Large artificial rocks around culvert headwall. <i>Typha orientalis</i> patch 30 metres long up to 15m wide tapering along drain.	Low, mostly herbaceous plants along creek banks. High abundance of exotic vines and shrubs.
Adjacent to grassy area	Yes, surrounded by grassy woodland.	Yes, surrounded by grassy woodland.	Cleared exotic grasslands about 20 metres east of Eastern Creek. Some patches of open grassy woodland within riparian corridor.
Adjacent vegetation is no higher than woodland	Adjacent vegetation is woodland.	Adjacent vegetation is woodland.	Adjacent vegetation is woodland.

*Note: = green shading indicates that habitat requirements are likely to be met at the relevant survey site; red shading indicates the habitat requirements are unlikely to be met.

Nocturnal surveys were completed at three survey sites over four nights, between the 17 February and 20 February 2020. Amphibian activity was moderate during the surveys and seven common species were recorded across the three survey sites. The Green and Golden Bell Frog was not identified during these surveys. An attempt was made to access a reference site in Sydney Olympic Park on 17 February 2020, however the park was closed and locked before any frogs could be identified. The Green and Golden Bell Frog was confirmed calling at a Port Kembla site on 17 February 2020 (confirmed by Jacobs ecologist). Weather conditions during the survey period were ideal for this species (refer Table 2-5).

Table 5-6 Results of nocturnal frog surveys (species present and general observations)

Date	Survey site 1	Survey site 2	Survey site 3	Calling Y/N	Observations
17/02/2020	<i>Crinia signifera</i>	N/A	<i>C. signifera</i>	Yes, all sites	Wind speed low to still, cloud cover about 20% at all sites.
	<i>Limnodynastes peronii</i>		<i>L. peronii</i>	Yes, all sites	
	<i>Litoria fallax</i>		-	No	
	-		<i>Litoria dentata</i>	Yes	
18/02/2020	<i>C. signifera</i>	<i>C. signifera</i>	<i>C. signifera</i>	Yes, all sites	Wind speed low to still. Raining towards the end of Site 3 survey at 21:45. Large electric storm to the south. 30% to 100% cloud cover.
	<i>L. peronii</i>	<i>L. peronii</i>	<i>L. peronii</i>	Yes, all sites	
	-	-	<i>L. fallax</i>	Yes	
	-	-	<i>Limnodynastes tasmaniensis</i>	Yes	
19/02/2020	<i>C. signifera</i>	<i>C. signifera</i>	<i>C. signifera</i>	Yes, all sites	0% cloud cover and wind speed low to still.
	<i>L. peronii</i>	-	<i>L. peronii</i>	Yes, all sites	
	<i>L. fallax</i>	-	-	No	
	<i>Crinia parinsignifera</i>	-	-	Yes	
	-	<i>Litoria caerulea</i>	-	Yes	
	-	<i>L. tasmaniensis</i>	-	Yes	

Date	Survey site 1	Survey site 2	Survey site 3	Calling Y/N	Observations
20/02/2020	<i>C. signifera</i>	<i>C. signifera</i>	<i>C. signifera</i>	Yes, all sites	Cloud cover was 100% at all sites.
	<i>L. peronii</i>	<i>L. peronii</i>	-	Yes	

The distribution of the Green and Golden Bell Frog has become very disjunct in the Cumberland Plain region. There is one record of this species from within the locality (10 kilometre radius database search zone) since 2000 recorded at the St Marys Leagues Club in 2001), which is almost 10 kilometres north west of the development site. There is another nearby more recent record from 2012 on Ropes Creek (though just outside the 10 kilometre database search zone), which may be evidence that a low density population is active around Ropes Creek in that area. Targeted surveys for the Archbold Road Extension REF (WSP | Parsons Brinckerhoff 2017) about five kilometres west of the development site near Ropes Creek were unsuccessful at identifying the Green and Golden Bell Frog. The key population at Mount Druitt was reported to have gone extinct in the late 1990s (Pyke and White 2001). The closest extant key population of Green and Golden Bell Frog is in Parramatta.

Based on the results of the targeted surveys, distribution of recent recorded sightings, the distance of the Parramatta key population and the relatively disconnected nature of the drainage line near the development site to surrounding potential habitats, it is considered that the potential for the Green and Golden Bell Frog to occur within the development site is low. No species polygons have been developed for the Green and Golden Bell Frog.

Southern Myotis

Surveys targeting the Southern Myotis were completed around the development site from 17 February to 20 February, involving the use of harp traps (total six trap nights at three locations) and Anabat call detectors (total 4 trap nights at two locations). Harp traps were placed in potential flyways along the creek to capture foraging bats (see **Photos 4-6** in **Section 2.7.2**). Two Anabat Express (Titley Scientific) bat call detectors were also positioned along suitable habitat both outside of the development site, 'Anabat 1' was placed on Eastern Creek and 'Anabat 2' on the artificial drainage line. Both Anabats were deployed for two nights each: 18 February and 19 February 2020. Refer to **Figure 2-3** for survey locations.

No bats were captured in the harp traps.

The two Anabat Express detectors recorded a total of 70 discernible calls over the two nights. Analysis of calls by Greg Ford (Balance Environmental) confidently identified four species from 42 of the calls and another possible two species from unresolved calls (refer **Table 5-7**). Six unresolved calls were thought to be very likely from Southern Myotis; however, the call quality and duration was insufficient to be certain of their identities. Additionally, Southern Myotis calls are very similar in frequency to *Nyctophilus* species and often it is not able to be confidently identified from calls alone. One other threatened species, Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) was also positively identified by Anabat 2 (drainage line). The development site and surrounds are only likely to provide foraging habitat for this species.

Table 5-7 Results of bat call analysis (number of calls identified per species per detector night)

Night	Anabat 1		Anabat 2	
	18/04/20	19/04/20	18/04/20	19/04/20
Positively identified calls (n = 42)				
<i>Chalinolobus gouldii</i>	5	7	3	6
<i>Chalinolobus morio</i>	1	1		6
<i>Micronomus norfolkensis</i>				3
<i>Ozimops ridei</i>	6		3	1
Unresolved calls (n = 28)				

Night	Anabat 1		Anabat 2	
	18/04/20	19/04/20	18/04/20	19/04/20
Probable <i>Myotis macropus</i>	1	2	3	
<i>C. gouldii</i> or <i>O. ridei</i>	6	1	2	7
<i>M. norfolkensis</i> or <i>O. ridei</i>				4
<i>Vespadelus</i> sp. or <i>Miniopterus orianae oceanensis</i>	1			1

For the Southern Myotis, the Threatened Biodiversity Data Collection states:

All habitat on the subject land where the subject land is within 200 metres of a waterbody with pools / stretches 3m or wider including rivers, creeks, billabongs, lagoons, dams and other waterbodies on the subject land must be mapped. Use aerial imagery to map waterbodies with pools / stretches 3m or wider on or within 200 metres of the subject land. Species polygon boundaries should align with PCTs on the subject land to which the species is associated that are within 200 metres of waterbodies mapped.

The Threatened Biodiversity Data Collection lists all the PCTs in the development site as being associated habitat, i.e.:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850).

Eastern Creek and the artificial drainage line represent the only waterbodies within 200 metres of the development site. The drainage line contained water along some of the deeper sections during the survey, though this is likely due to the high rainfall experienced in February (461.8 mm recorded at Horsley Park Equestrian Centre station 067119). The drainage line is artificial and designed to quickly drain runoff from areas of Sydney Dragway into Eastern Creek. Naturally, some areas have eroded over time where water now pools, however these are not expected to hold water for long periods of time. The small sections of the drain that are greater than three metres wide are at either end around the road culverts and contain dense *Typha orientalis* with no open water suitable for foraging by the Southern Myotis. These sections of the drain are not considered to be consistent with the habitat requirements listed in the Threatened Biodiversity Data Collection. Therefore, the drainage line is not considered to be a waterway that would provide suitable habitat for the Southern Myotis. The culverts at either end of the drainage line were visually inspected though no potential roosting or breeding habitat was identified.

Eastern Creek is the only waterway that meets the habitat description listed in the Threatened Biodiversity Data Collection, containing some sections greater than three metres wide with open water (see **Photo 3**). All associated PCTs within a 200 metre buffer of the mapped sections of Eastern Creek (PCT 849 and PCT 850) have been included in the Southern Myotis species polygon. Impacts to the habitat for the Southern Myotis are outlined in **Section 9.1**. The species polygon for the Southern Myotis is estimated at 305 m² and is shown in **Figure 5-1**.

Cumberland Plain Land Snail

The Cumberland Plain Land Snail is assumed to be present in the study area in accordance with paragraph 6.4.1.21 of the BAM. The Cumberland Plain Land Snail is considered likely to occur based on the presence of suitable habitat in moderate quality woodland between Carpark C and Carpark D. None of this habitat is within the development site and would not be directly impacted by the development as shown in **Figure 5-2**.

5.3.3 Serious and irreversible impact entities

The concept of serious and irreversible impacts (SAIL) is fundamentally about protecting threatened entities that are most at risk of extinction from potential development. The Biodiversity Offsets Scheme recognises that there are some types of serious and irreversible impacts that the community expects would not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that a development would deliver to the State. There are no SAIL entities that would be affected.

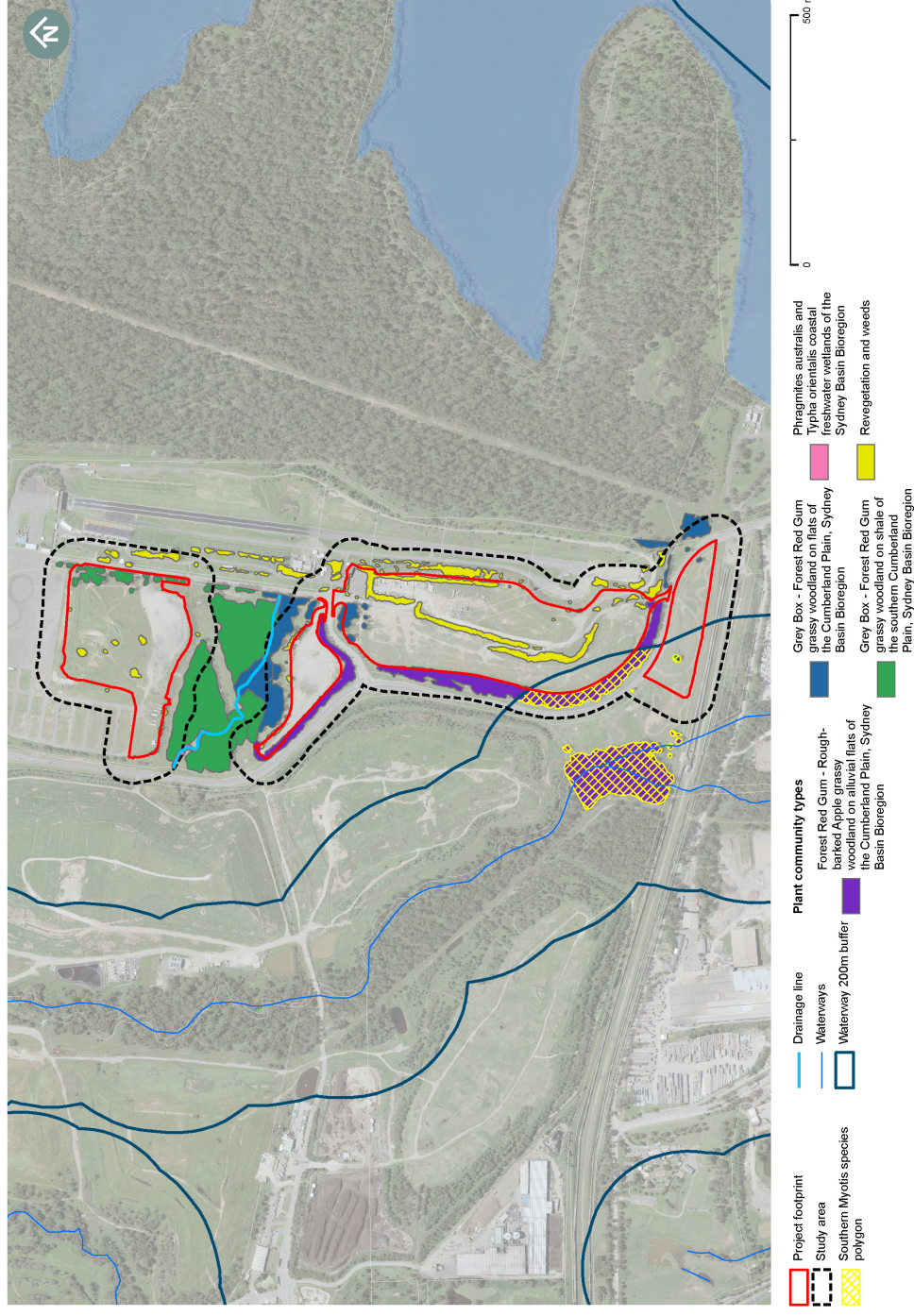


Figure 5-1 Threatened species polygon for Southern Myotis (Myotis macropus)

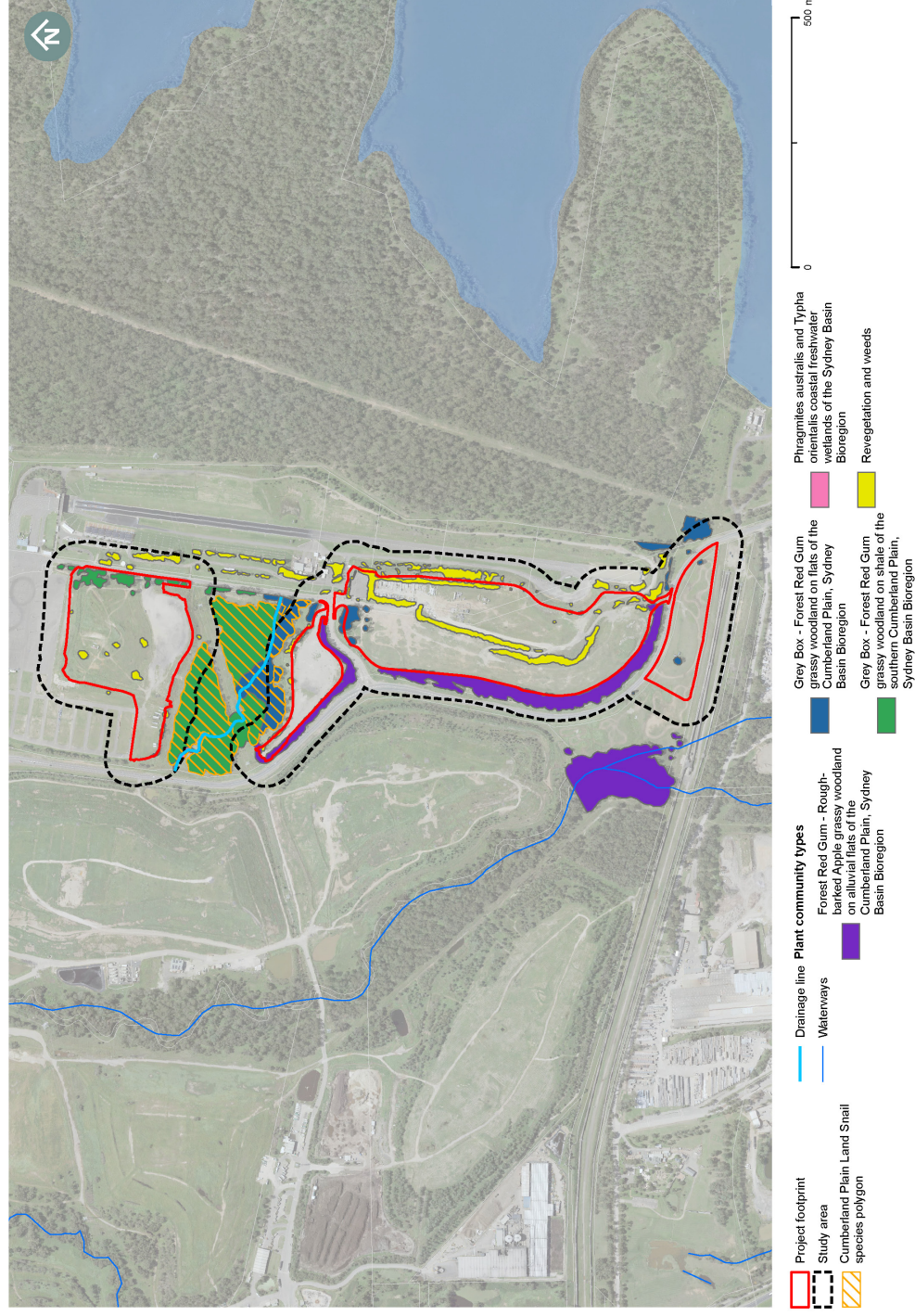


Figure 5-2 Threatened species polygon for the Cumberland Plain Land Snail

6. Aquatic assessment

Aquatic habitats within the development site and broader locality were assessed against the *Policy and guidelines for fish habitat conservation and management – Update 2013* (NSW Department of Primary Industries, 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). The Aquatic Ecology in Environmental Impact Assessment – EIA Guideline (Lincoln Smith, 2003) was used to guide the level of aquatic assessment required. There is enough existing information to describe the existing aquatic environment and to assess the quality and importance of the aquatic environments to be impacted by the development. As such, this assessment was based on a review of existing information and a habitat assessment.

Searches of databases, existing mapping and other literature were used to identify the locations of sensitive receptors. Sources included:

- Fisheries Spatial Data Portal
- Protected Matters Search Tool
- Atlas of GDEs (Bureau of Meteorology, 2017)
- SEED - NSW Wetlands mapping
- SEPP (Coastal Management) 2018 – Interactive map viewer
- Australian Wetlands Database (Department of the Environment and Energy, 2019).

6.1 Existing environment

The development site is located entirely within the Hawkesbury Nepean catchment, which includes Eastern Creek to the west. The catchment area around the development site is highly modified from its original state, being cleared for rural, urban, waste and industrial land uses. The development site is currently used as an entertainment and motorsport area, and the landform and drainage has been substantially modified to accommodate large cleared areas sealed by concrete and asphalt. These land uses influence the water quality and quantity/velocity of flows within the catchment.

Three waterways have been identified surrounding the development site and are discussed below. No threatened species listed under the *Fisheries Management Act 1994* have potential habitat within these watercourses. There are no Coastal wetlands as defined by the Coastal Management SEPP close to the development site.

The 1,500 metre landscape buffer also includes the western edge of Prospect Reservoir, an unnamed second order parallel offshoot from Eastern Creek to the south, and the end of Reedy Creek (third order stream) and an unnamed second order stream that both meet Eastern Creek just south of the M4 motorway (see **Figure 1-1** and **Figure 1-2**).

The proposed development would have no direct impacts to any aquatic environments.

6.1.1 Sydney Dragway Drainage line

A small unnamed and unmapped artificial drainage line runs in a northwest direction through woodland in part of the study area. This appears to drain stormwater runoff from parts (possibly most) of Sydney Dragway northwest through woodland between Carpark C and Carpark D and under Ferrers Road, where it eventually feeds into Eastern Creek through another concrete channel around the perimeter of the SUEZ Eastern Creek Resource Recovery Park.

In the woodland between Sydney Dragway and Ferrers Road, the drain varies in form from an established creek line with established banks, to a wide and shallow grassy overland flow. Sections of the drainage line have formed pools that hold water for periods of time, evidenced by the diversity of aquatic and macrophyte

vegetation present. This is particularly evident around the road culverts at either end of the drain and through the disturbed transmission easement. Some areas toward the end of the drainage line have steep scoured banks and a small abundance of large woody debris

6.1.2 Eastern Creek

Eastern Creek flows generally north, where it is joined by the Reedy, Angus, Bungaribee, Breakfast, Burdekin, Quakers and Bells Creeks before reaching its confluence with South Creek, located in Vineyard. South Creek then enters the Hawkesbury River at Pitt Town, 25 kilometres to the north of the development site. The section of Eastern Creek closest to the development site is a third order stream, surrounded by a disturbed riparian corridor that aligns with Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835).

Eastern Creek is about 180 metres west of the closest section of the development (Carpark A). Eastern Creek is adjoined to Sydney Dragway by a 750 metre long drainage channel starting from Ferrers Road. The channel connects to the artificial drainage line discussed above. The development would not directly impact any part of Eastern Creek or its riparian vegetation, however there is potential for indirect impacts by contaminated runoff flowing into the drainage line, if improperly managed.

6.1.3 Prospect Reservoir

Prospect Reservoir is a storage reservoir that was built in the 1888 as part of the Upper Nepean Scheme to supply Sydney with water collected from the weirs on the Illawarra Plateau south of the city. The reservoir remains an integral part of Sydney's drinking water supply and is used regularly in times of high demand for water and when other parts of the water supply system are taken offline for maintenance.

The reservoir is surrounded by significant high quality remnant of Cumberland Plain woodland and includes publicly accessible picnic areas and a cycleway. The freshwater wetlands occurring on the margins of the reservoir are an artefact of inundation but are significant because there are few large or intact examples in the region (State of NSW and the Office of Environment and Heritage, 2012).

Prospect Nature Reserve directly borders Sydney Dragway and the closest edge of the reservoir is around 600 metres from the edge of Carpark A of the development site. The development would not directly impact any part of Prospect Reservoir or its reserve, however there is low potential for indirect impacts by contaminated runoff.

6.2 Aquatic biota

No fish surveys or site inspections for aquatic ecology were completed as part of this assessment. No publicly available aquatic ecology studies of Eastern Creek could be found as part of this assessment. An assessment of the aquatic habitat around the development site against the basic 'Class' system (Fairfull and Witheridge et al. 2003) is provided in **Table 6-1**. Eastern Creek is mapped as 'Key Fish Habitat' by the NSW Department of Primary Industries, which is outside of the impact area.

Table 6-1 Fish habitat classification

Class	Characteristics	Habitat in the study area
<u>Class 1</u> Major fish habitat	Major permanently or intermittently flowing waterway (e.g. river or major creek); habitat of a threatened fish species.	Not present in the development site or immediate surrounds. The closest Class 1 waterway to the study area would be the Georges River.

Class	Characteristics	Habitat in the study area
<u>Class 2</u> Moderate fish habitat	Named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area.	Not present in the development site. Eastern Creek is mapped as Key Fish Habitat and meets the description of Class 2 minimal fish habitat. Prospect Reservoir also likely meets the definition of Class 2, although there is no discussion about waterbodies.
<u>Class 3</u> Minimal fish habitat	Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats.	Not present in the development site or immediate surrounds.
<u>Class 4</u> Unlikely fish habitat	Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or freestanding water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present).	Present immediately adjacent to the development site in the unmapped unnamed drainage line in between Carpark C and Carpark D.

The drain is an unmapped and artificial waterway, draining runoff that is likely contaminated into Eastern Creek. The sections of semi permanent pools provide some aquatic habitat features for common amphibian species. There is no upstream connectivity within Eastern Creek and only very common fish species are likely to inhabit the drain. No threatened aquatic species have been recorded. One introduced species, the Eastern Gambusia (*Gambusia holbrooki*) was identified around Eastern Creek during surveys for this assessment.

6.3 Threatened fish

The desktop searches returned two threatened fish, Macquarie Perch (*Macquaria australasica*) and Australian Grayling (*Prototroctes maraena*), as having the potential to occur within the locality. An assessment of the likelihood of occurrence of all threatened species and endangered populations was completed to determine the potential for these species to occur within the development site (see **Appendix A**).

These two threatened fish species were identified by the Protected Matters Search Tool based on the presence of modelled suitable habitat and have not actually been recorded in the locality. There is no mapped threatened fish habitat within or adjacent to the development site. The Nepean River (west) and Georges River (south) are the closest waterways that are mapped habitat for a threatened fish species, the Macquarie Perch.

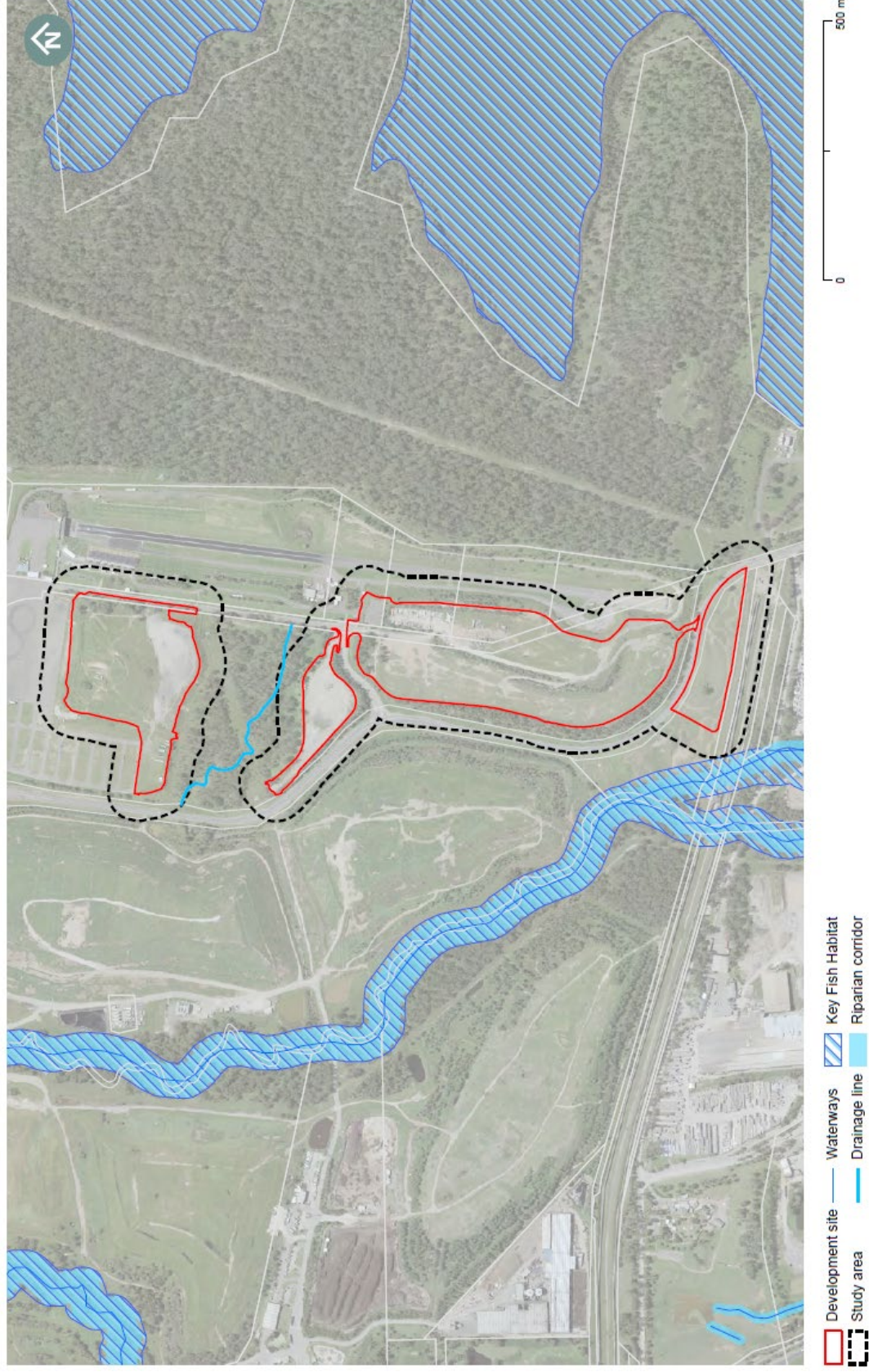


Figure 6-1 Aquatic habitats

7. Matters of National Environmental Significance

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined as matters of national environmental significance. Matters relevant and applicable to this assessment include:

- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species.

For threatened biodiversity and migratory species listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see **Appendix D**). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while completing the assessments.

7.1 Wetlands of international and national importance

The development site and 1,500 metre landscape buffer does not contain any wetlands of international or national importance.

The nearest wetland of international importance is Towra Point Nature Reserve, located on the southern edge of Botany Bay and too great a distance to be affected by the development.

7.2 Nationally listed threatened ecological communities

According to the Protected Matters Search Tool (PMST) six EPBC Act listed TECs are known to occur, likely to occur, or may occur in the development site (see **Table 7-1**).

There would be no direct impacts to EPBC Act listed TECs. None of the PCTs within the development site correspond to EPBC Act listed TECs. All the occurrence of PCT 849 and PCT 850 in the development site are too small and degraded to meet the condition threshold criteria for the EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest TEC. However, the moderate condition woodland outside of the development site between Carpark C and Carpark D does meet the EPBC Act TEC condition criteria.

An assessment of the likely occurrence of these TECs in the 1,500 metre landscape buffer is shown in **Table 7-1** and has been completed using regional vegetation mapping, including:

- *The Native Vegetation of the Sydney Metropolitan Area – Version 3.1* (State Government of NSW and Office of Environment and Heritage, 2016) (see **Table 7-1**), and
- *Remnant Vegetation of the western Cumberland subregion, 2013 Update* (VIS_ID 4207) (State Government of NSW and Office of Environment and Heritage, 2015).

Table 7-1 EPBC Act listed TECs returned from the Protected Matters Search Tool and their predicted occurrence (based on PMST assessment)

Threatened ecological community	Predicted occurrence	Actual occurrence and mapped location
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion (Endangered Community)	May occur	Not mapped in the 1,500 metre landscape buffer.
Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community (Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer.
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion (Critically Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer.
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Critically Endangered Community)	Likely to occur	Confirmed between Carpark C and Carpark D, outside of the development site. Also occurs around Prospect Reservoir. PCT 849 and PCT 850 are mapped commonly in the 1,500 metre landscape buffer.
Shale Sandstone Transition Forest of the Sydney Basin Bioregion (Critically Endangered Community)	May occur	Not mapped in the 1,500 metre landscape buffer.
Western Sydney Dry Rainforest and Moist Woodland on Shale (Critically Endangered Community)	Likely to occur	Not mapped in the 1,500 metre landscape buffer

7.3 Threatened plants

Thirteen EPBC Act listed threatened plant species were considered potentially likely to occur based on the presence of broadly associated habitat and nearby records. Refer to **Table 5-4** for a list of all EPBC Act listed species included in this assessment. These species were not found within or adjacent to the development site during the surveys completed for this BDAR. As such, these species are considered unlikely to be impacted.

7.4 Threatened animals

Targeted surveys for EPBC Act listed threatened animals were completed as part of the surveys for this BDAR. This included targeted surveys for the Green and Golden Bell Frog (*Litoria aurea*). Refer to **Section 2.7.2** for details of survey effort carried out and **Section 5.3.2** for the results of the surveys.

7.4.1 Green and Golden Bell Frog

The Green and Golden Bell Frog was not identified from the targeted surveys completed in February 2020. Areas of potential habitat are present along the artificial drainage line, with some lower quality habitat opportunities along Eastern Creek. Based on the results of the targeted surveys, distribution of recent recorded sightings, the distance of the Parramatta key population and the relatively disconnected nature of the drainage line near the development site to surrounding potential habitats, it is considered that the potential for the Green and Golden Bell Frog to occur within the development site is low. No species polygons have been developed for the Green and Golden Bell Frog.

7.4.2 Other species

The development site also provides some limited foraging habitat for three other EPBC Act listed threatened species. The Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater are considered likely to forage on the flowers and/or fruit of trees within the development site. Impacts to foraging habitat would be of low magnitude, so impacts to these species would be negligible. Significance assessments have been completed for these species in accordance with the EPBC Act *Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see **Appendix D**). The White-throated Needletail and Fork-tailed Swift (migratory species) may fly over the development site on occasion but would not use the habitats and would not be impacted.

The estimated direct impacts to native vegetation that provides habitat for threatened species is outlined in **Table 7-2**. There is unlikely to be a significant impact to any threatened species (see **Appendix D**).

Table 7-2 Summary of direct impact to EPBC Act listed threatened species habitat (native vegetation) within the development site

Species	Associated plant community types	Area (ha) in development site
Large-eared Pied Bat	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) Revegetation and weeds	1.87
Grey-headed Flying-fox Regent Honeyeater Swift Parrot	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850)	0.63

7.5 Migratory species

Based on the results of the Protected Matters Search Tool, 14 listed migratory species may occur in the broader locality (see **Appendix A**). An additional five species were recorded from the BioNet search. Suitable habitat does not exist within the development site for most migratory species identified by the database searches. The following species are considered moderately likely to occur in, or adjacent to, the development site based on the presence of suitable habitats:

- Migratory marine birds – Fork-tailed Swift
- Migratory terrestrial species – White-throated Needletail.

'Important habitat' for a migratory species is defined as (Department of Environment, 2013):

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular lifecycle stages
- Habitat utilised by a migratory species which is at the limit of the species range
- Habitat within an area where the species is declining.

According to the guidance provided in the EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (Department of the Environment, 2015), important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important. A wetland habitat should be considered internationally important if it regularly supports one per cent of the individuals in a population of one species or subspecies of waterbird, or a total abundance of at least 20,000 waterbirds. Nationally important wetland habitat includes

wetlands that regularly support 0.1 per cent of the flyway population of a single species of migratory shorebird, or 2,000 migratory shorebirds, or 15 migratory shorebird species. The habitats in the development site are not important habitats for migratory birds.

An assessment of the likely occurrence of these species and the presence of important habitat is included in **Appendix A**. While some migratory species of bird are likely to use the development site and locality, the development site would not be classed as an 'important habitat'. A nationally significant proportion of a population would not be supported by the habitats in the development site. The development would not substantially modify, destroy or isolate an area of important habitat for the migratory species and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

8. Impact avoidance and minimisation

This section of the BDAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values in accordance with section 8 of the BAM. Combined with management and mitigation measures implemented during construction (as outlined in Appendix C (Construction Environmental Management Framework) of the Environmental Impact Statement), the siting and planning of the development is likely to be sufficient to ensure that the requirements to avoid and minimise impacts on biodiversity values as set out in section 8 of the BAM are met.

Chapter 2 (Strategic need, justification and project alternatives) of the Environmental Impact Statement outlines the options considered for the Sydney International Speedway. As part of delivering Sydney Metro West, Sydney's next underground railway, the existing government land currently used for speedway racing is required for a future stabling and maintenance facility. The NSW Government has committed to relocating speedway racing to Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports. The process included consideration of strategic alternatives (i.e. 'Do nothing' and 'Build the development'), development alternatives and design refinements.

Three options for the development were evaluated within the Western Sydney Parklands at Eastern Creek. Two of these options (the eastern and the southern options) are within Western Sydney Parklands' Precinct 5: Eastern Creek Motor Sports. The three options are:

- A northern option located immediately east of the Light Horse Interchange, to the south of the M4 motorway
- An eastern option within the southwest area of Sydney Motorsport Park (operated by the Australian Racing Drivers' Club)
- A southern option to the west of Sydney Dragway (the preferred option).

Following assessment against the development site suitability criteria and consultation with key stakeholders, the southern option was identified as the preferred option. Part of the justification for the development site selection included the consideration that the development site has the least environmental constraints and is likely to result in the least environmental impact.

8.1 Avoiding and minimising impacts on native vegetation and habitat

The development site is located within a highly developed area that does not possess large expanses of intact native vegetation with high biodiversity value. As most of the development is within previously modified and developed areas, direct impacts to terrestrial biodiversity have been avoided and/or minimised. The development would result in minimal disturbance of native vegetation. Where this disturbance cannot be avoided, the vegetation is of poor to moderate quality and/or provides limited habitat for threatened species.

No areas of land declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act would be affected. Importantly, opportunities to further minimise native vegetation clearance would be refined during detailed design and reviewed as part of the pre clearing process.

As the design process for Sydney International Speedway has progressed, it has been informed by stakeholder feedback and the outcome of early environmental and engineering investigations. As a result, various aspects of the design have been developed and refined. **Table 8-1** shows an excerpt of some of the design refinements and changes considered in Chapter 2 (Strategic need, justification and project alternatives) of the Environmental Impact Statement, that relate to avoiding and minimising impacts to biodiversity.

Table 8-1 Design refinements noted to avoid impacts to native vegetation

Design aspect	Options considered	Rational for design refinement
Racetrack location	<ul style="list-style-type: none"> Northern racetrack location Central racetrack location (preferred option). 	<p>An initial design, with the speedway track located across the current Carpark C and D areas, was discounted due to the requirement for clearance of existing woodland areas that are protected under Commonwealth and State legislation. Locating the speedway track more centrally (the preferred design) avoided this area of vegetation and utilised the total area of land available most efficiently. This configuration also allows the inclusion of a second development site exit (at the southern end of the main operational site) to minimise congestion during post event peak periods.</p>
Parking areas	<ul style="list-style-type: none"> Main Spectator parking to the south of Ferrers Road, with either dedicated shuttlebuses or a pedestrian footbridge providing access to the main operational site Provision of parking bays in an area below the power transmission lines that traverse the lot Spectator parking in the northern part of the development site (preferred option). 	<p>The southern parking area was not pursued further in favour of maximising parking areas to the north that would:</p> <ul style="list-style-type: none"> Be closer to the main operational site, Sydney Dragway and Sydney Motorsports Park Avoid the Potential Archaeological Deposit within the area to the south of Ferrers Road Avoid the need to spectators to cross Ferrers Road and, as a result, remove any associated safety risks or additional infrastructure. <p>Parking bays located beneath the transmission lines would have been adjacent to two areas of woodland protected under the Commonwealth EPBC Act. To avoid potential impacts on these ecological areas, this parking area was not pursued further as part of the design process.</p>
Parking layout	Adjustments have also been made to the development boundaries to minimise vegetation clearance, particularly where vegetation is part of a threatened ecological community as listed under Commonwealth and State legislation.	
Drainage	<ul style="list-style-type: none"> Vegetated swales running north to south, linking Carparks A, C and D Use of existing Ferrers Road embankment and culvert Weir and throttle pipe for use in extreme event On-site detention basins (preferred option). 	<p>Although the use of vegetated swales would apply sustainable drainage principles to the development, their installation was discounted as it would require the clearance of vegetation which has been listed under Commonwealth and State legislation.</p> <p>The preferred option for development site drainage includes the provision of on-site detention basins, which would allow for the reuse of water within the development site, including for water suppression of the racetrack to manage dust generation during race events.</p> <p>The use and upgrade of (where necessary) existing drainage infrastructure near the development has been considered, including:</p> <ul style="list-style-type: none"> The existing embankment and culvert along Ferrers Road Installation of a weir and throttle pipe along the unnamed drainage line between Carpark C and Carpark D <p>The use and upgrade of this drainage infrastructure would enable more efficient use of space within the development site to maximise car parking provision and would result in a reduction in of the amount of on-site detention required. However, this infrastructure would be located in an area identified as a Potential</p>

Design aspect	Options considered	Rational for design refinement
		<p>Archaeological Deposit and adjacent to an area of vegetation protected under the EPBC Act.</p> <p>Further investigations would be carried out as part of design development of the development with regards to the installation of a weir design that would avoid impacts to environmentally sensitive areas; however, this does not form part of the scope of the development nor is it assessed as part of this Environmental Impact Statement.</p>

8.2 Avoiding and minimising prescribed biodiversity impacts

Some types of developments may have impacts on biodiversity values (as defined in the BC Act and Biodiversity Conservation Regulation 2017) in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical. Clause 6.1 of the Biodiversity Conservation Regulation 2017 identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme as follows:

- a) impacts of development on the habitat of threatened species or ecological communities associated with:
 - i. karst, caves, crevices, cliffs and other geological features of significance, or
 - ii. rocks, or
 - iii. human made structures, or
 - iv. non-native vegetation
- b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
- c) impacts of development on movement of threatened species that maintains their life cycle
- d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)
- e) impacts of wind turbine strikes on protected animals
- f) impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

Importantly, the development would have negligible impact on prescribed biodiversity values as:

- There would be no impacts to karst, caves, crevices, cliffs and other geological features of significance
- There would be no impacts to rocks that provide habitat for threatened species
- The development is not a wind farm development so turbine strike is not an issue
- While there would be some additional construction vehicle movements on existing roads and likely increased vehicle movements when Sydney International Speedway is operational due to greater attendance at events, the development site is fenced and would normally have a large amount of vehicle traffic. Therefore, impacts of vehicle strike due to the development is unlikely to be substantially increased from current levels.

There is however potential for impacts on non-native vegetation, connectivity and species movement, and water quality water bodies and hydrological processes (see **Section 9.2**).

9. Assessment of impacts

The potential for direct impacts to biodiversity is limited to clearing of native vegetation and habitat. Indirect and other biodiversity related impacts of the development are identified below in **Section 9.2**. Potential aquatic biodiversity impacts are discussed in **Section 9.3**.

9.1 Impacts on native vegetation and habitat

Despite avoidance and minimisation measures (see **Section 8.1**), the development site would result in the direct removal of some native vegetation. The estimated clearing is about 0.63 hectares (6,312 square metres) consisting of the following PCTs:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – 0.17 hectares (1,696 square metres).
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850) – 0.46 hectares (4,616 square metres).

Table 9-1 provides a summary of the native vegetation clearing that would occur within the development site including the corresponding BC Act TEC where applicable and the vegetation integrity loss. The biodiversity credit requirements for these impacts are outlined in **Section 12**. Vegetation clearing as part of this development would directly impact TECs listed under the BC Act. No direct impacts would occur to TECs listed under the EPBC Act.

The direct impacts on species credit threatened species habitat associated with the clearing of native vegetation are outlined in **Table 9-2**. Other impacts to threatened species habitat, including impacts to connectivity and species movement, impacts to non-native vegetation and disturbed areas, and impacts to water quality and hydrology are discussed in **Section 9.2**.

Indirect impacts to vegetation retained directly adjacent to the areas of direct impact are expected to be negligible. The development site does not contain any large areas of native vegetation that would be broken up by the development. The vegetation that would remain is already adjacent to the existing Sydney Dragway infrastructure and subject to edge effects. No further loss of vegetation integrity is expected in these areas as a result of the development, therefore no indirect impacts have been calculated.

Table 9-1 Summary of native vegetation clearing within the development site

Zone	Plant community type ID No.	Plant community type name	Vegetation formation	PCT per cent cleared (historically across range)	Corresponding Threatened Ecological Community (TEC)	Area (ha) in development site	Vegetation integrity loss
1	849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Moderate	Coastal Valley Grassy Woodlands	93%	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.1 (1005 m ²)	18.7

Zone	Plant community type ID No.	Plant community type name	Vegetation formation	PCT per cent cleared (historically across range)	Corresponding Threatened Ecological Community (TEC)	Area (ha) in development site	Vegetation integrity loss
2	849	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion – Poor				0.07 (691 m ²)	11.3
3	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion - Poor	Coastal Valley Grassy Woodlands	88%	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.3 (2981 m ²)	15.2
4	850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion – Revegetation				0.16 (1635 m ²)	23.9

Table 9-2 Summary of direct impacts on threatened species credit species habitat associated with the loss of native vegetation

Species name	Common name	EPBC Act	BC Act	Sensitivity to gain class	SAIL	Area (ha) in development site
<i>Myotis macropus</i>	Southern Myotis	-	V	High	No	0.03 (305 m ²)

9.2 Prescribed biodiversity impacts

This section identifies the potential prescribed biodiversity impacts on threatened species associated with the development in accordance with section 6.7 of the BAM. These are impacts that are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat.

9.2.1 Impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance

There are no occurrences of karst, caves, crevices and cliffs or other geological features of significance within the development site, or threatened species or ecological communities associated with these features. As such, this prescribed impact has not been considered further.

9.2.2 Impacts on the habitat of threatened species or ecological communities associated with rocks

There are no occurrences of rocks or rocky habitats within the development site or threatened species or ecological communities associated with rocks. As such, this prescribed impact has not been considered further.

9.2.3 Impacts on the habitat of threatened species or ecological communities associated with human made structures

There are seven threatened species that can use human made structures as habitat that may be affected by the development which are:

- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Southern Myotis (*Myotis macropus*).

The Large Bent-winged Bat, Little Bent-winged Bat and Southern Myotis are known to roost in cave-like human made structures including mine shafts, storm water channels, buildings, and under bridges. There is no human made structures in the development site that would be suitable for these bats to use as roosting habitat. There are road drainage culverts at either end of the artificial drainage line in the areas adjacent to Carpark C and Carpark D. Most of the existing buildings in the development site are subject to a high amount of human use. There are scattered derelict demountable buildings across the development site, though would be at best marginal as roost sites. The Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat roost mainly in tree hollows but also under bark or in artificial structures. There are likely to be minimal, if any, roosting opportunities for these species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

9.2.4 Impacts on the habitat of threatened species or ecological communities associated with non-native vegetation

Up to 1.2 hectares of revegetation and weeds would be impacted by the development. This includes some areas of planted native non-indigenous trees.

Twelve threatened species may utilise the non-native vegetation, including both native and exotic planted trees and shrubs, that are found within the development sites.

The Grey-headed Flying-fox, Swift Parrot and Little Lorikeet are considered likely to forage on the flowers and/or fruit of both planted and exotic trees within the development site. The Dusky Woodswallow may forage in the air space above the planted trees and non-native vegetation and may use the vegetation for perching. The Eastern Coastal Free-tail Bat, Large Bent-winged Bat, Little Bent-winged Bat, Eastern False Pipistrelle, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat may forage in the air spaces around areas of non-native vegetation, feeding on the insects attracted to the vegetation. Although no high quality hollow bearing trees were identified on the development site, potential roosting habitat in the form of small tree hollows may also be present in some of the larger trees for the Eastern Coastal Free-tailed Bat, Eastern False Pipistrelle, Yellow-bellied Sheath-tail-bat and Greater Broad-nosed Bat. In the case of the Southern Myotis, only tree hollows within 200 metres of water bodies are likely to be utilised, which are unlikely to be present. Large predatory birds such as the Powerful Owl and Masked Owl may also perch on larger non-native and planted trees while travelling through the development site.

Due to the marginal, unnatural, structure of the vegetation present in the development site, it is unlikely to be used as breeding habitat by any threatened species. It is unlikely that the development would detrimentally affect the bioregional persistence of these species.

9.2.5 Impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

Habitat connectivity is identified as the degree to which a particular site connects different areas of habitat of threatened species to facilitate the movement of those species across their range. Threatened species movement is identified as the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle.

In terms of habitat connectivity, the development site is located within a highly disturbed landscape where the majority of habitats have been cleared. The habitats that do remain are fragmented and highly isolated.

The development site is located directly between two areas that have been mapped as a biodiversity corridor of regional significance (see **Figure 1-1**) as identified by the Biodiversity Investment Opportunities Map (BIO Map). These areas are the vegetated riparian zone of Eastern Creek and the significant area of Cumberland Plain Woodland surrounding Prospect Reservoir. These corridors are only likely used by flying species or local common mammals, reptiles and amphibians. Neither of these areas would be directly impacted by the development.

The vegetation on the development site may facilitate movement between the corridors for highly mobile species. Flying animals such as birds and bats use the airspace to move between natural habitats and the patchy vegetation within the development site is likely to be used as a foraging or perching resource as part of daily movements. For example, a portion of the Grey-headed Flying-fox population leaves the nationally important Parramatta camp of an evening and likely passes over the development site as the animal's head to foraging grounds. The threatened Swift Parrot is likely to pass through the development site during seasonal movements. Threatened species known from the locality including the Grey-headed Flying-fox, Swift Parrot and Southern Myotis (and other threatened bats) are powerful flyers capable of covering large distances between habitat patches. The landscape of the locality in its current form is permeable to these species and habitat connectivity for these species would not be detrimentally affected, and the bioregional persistence of these species would not be detrimentally affected by the development.

9.2.6 Impacts on movement of threatened species that maintains their life cycle

The life cycle of threatened species known from the locality including the Grey-headed Flying-fox, Swift Parrot and Southern Myotis is unlikely to be dependent on the habitats to be affected by the development site. The habitats to be affected are marginal foraging habitat and no breeding habitat is likely to be impacted. The development site is not part of a recognised movement corridor between breeding grounds, foraging grounds, or other habitats important for the lifecycle of these species such as staging points for migration. The movement of these species between foraging and breeding grounds would not be affected, and the bioregional persistence of these species would not be detrimentally affected by the development.

9.2.7 Impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

The development does not include any direct impacts to waterways or waterbodies. The development is unlikely to directly impact on any areas that affect the water quality and hydrological processes that sustain threatened species and threatened ecological communities.

There is potential for indirect impacts to surrounding habitats from erosion and contaminated runoff from the development. The main risk would be to Eastern Creek via the artificial drainage line designed to drain stormwater from the existing development site. Construction activities adjacent to drainage areas across the

proposed main operational site, and in Carpark C and Carpark D that are directly adjacent to the woodland and drainage line, are most likely to have an impact on water quality (if not mitigated). This may affect downstream environments due to potential changes in water quality and geomorphology associated with the construction of the development. The implementation of standard mitigation measures (i.e. sediment control, spill control) would control sediment and pollutants from any significant runoff events.

A groundwater assessment has been completed as part of the environmental assessment of the development and is included as Chapter 15 (Groundwater and geology) of the Environmental Impact Statement. Excavation works as part of construction of the development would involve a maximum cut depth of around six metres with a lowest finished level of 68 metres Australian Height Datum. The lowest finished level is consistent with the highest groundwater table previously recorded at the development site. Therefore, earthworks are not expected to intercept substantial groundwater. Any perched groundwater table in the clayey residual soils, if present, is intermittent and/or localised. Groundwater level drawdown and groundwater take is therefore unlikely as a result of construction. Any actual drawdown that may occur in the process of excavating to the highest groundwater level, would be very minor.

The terrestrial GDEs identified in and around the study area, that are EPBC Act listed or BC Act listed TECs, are likely to be opportunistic facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. Importantly, these GDEs are not obligate GDEs (meaning they are not entirely dependent on groundwater), therefore any minor drawdown associated with excavation works is unlikely to result in any impacts. The TECs/GDEs identified in the study area are outlined in **Table 9-3**.

Table 9-3 Threatened ecological communities that may be impacted by groundwater drawdown

Threatened Ecological Community	Location
Cumberland Plain Woodland in the Sydney Basin Bioregion (BC Act) Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act)	This TEC is mostly represented by poor and revegetated woodland in the study area. There is a patch of moderate condition woodland between Carpark C and Carpark D that aligns with the EPBC Act listed TEC.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (BC Act)	This TEC is located outside of the development site and study area, though is around 100 metres from the western edge of Carpark A.

9.2.8 Impacts of wind turbine strikes on protected animals

This prescribed impact is not applicable to the development.

9.2.9 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

Vehicle collision is a direct impact that reduces local population numbers and is a common occurrence in Australia. Mammals, reptiles, amphibians and birds are all at risk of vehicle strike, particularly those common species (e.g. birds) that are tolerant of disturbance and remain in the development site. The risk of an increase in the frequency of vehicle strike due to the development is low and would generally be limited to vehicle movements to and from construction areas along Ferrers Road, which already experiences moderate traffic levels. After the completion of the development, there would be an increase in traffic as a result of Sydney International Speedway events. Traffic movements within the development site are not expected to have a significant impact as the development site is fenced. Additional traffic movements along Ferrers Road are also not expected to have a significant impact because of the existing moderate levels of traffic. Vehicle strike associated with the development is unlikely to affect any threatened species of animals or animals that are part of a TEC.

9.3 Contribution to Key Threatening Processes

A Key Threatening Process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or an ecological community. KTPs are listed under the BC Act and EPBC Act. At present, there are currently 39 listed KTPs under the BC Act. There are eight KTPs listed under the *Fisheries Management Act 1994*. There are 21 KTPs listed under the EPBC Act. Of the listed KTPs, the development may directly or indirectly contribute to the following KTPs as outlined in **Table 9-4**. Aside from direct impacts to native vegetation, the potential for contribution to these KTPs can be minimised and avoided through the implementation of management and mitigation measures during construction of the development. These measures would be outlined in a Flora and Fauna Management Plan (refer to Appendix C (Construction Environmental Management Framework) of the Environmental Impact Statement).

Table 9-4 Summary of Key Threatening Processes that the development would directly or indirectly contribute to

Key Threatening Process	BC Act, FM Act or EPBC Act	Likelihood of the development directly or indirectly contributing to the KTP
Clearing of native vegetation	BC Act	High – clearing of native vegetation would occur. However, the magnitude of clearing is small (0.63 hectares).
Land clearance	EPBC Act	High – clearing of native vegetation would occur. However, the magnitude of clearing is small (0.63 hectares).
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus.
Infection of amphibians with chytrid fungus resulting in chytridiomycosis	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of amphibian chytrid fungus.
Infection of native plants by <i>Phytophthora cinnamomi</i>	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of <i>Phytophthora cinnamomi</i> .
Dieback caused by the root rot fungus (<i>Phytophthora cinnamomi</i>)	EPBC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of <i>Phytophthora cinnamomi</i> .
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	BC Act	Low – mitigation measures would be implemented to prevent the spread or introduction of Exotic Rust Fungi.
Invasion and establishment of exotic vines and scrambler	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by African Olive <i>Olea europaea</i> subsp. <i>cuspidata</i> (Wall. ex G. Don) Cif.	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by <i>Chrysanthemoides monilifera</i>	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion of native plant communities by exotic perennial grasses	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Invasion, establishment and spread of Lantana (<i>Lantana camara</i> L. sens. Lat)	BC Act	Low – mitigation measures would be implemented to prevent the spread of weeds.
Degradation of native riparian vegetation along New South Wales water courses	FM Act	Low – mitigation measures would be implemented to avoid inadvertent impacts to vegetation outside of the development site associated with Eastern Creek.

9.4 Aquatic impacts

The development does not include any direct impacts to aquatic habitats. Unmitigated impacts to aquatic habitats may arise from construction activities. There is potential for indirect impacts to surrounding aquatic habitats from erosion and contaminated runoff from the development. The main risk would be to Eastern Creek via the artificial drainage line designed to drain stormwater from Sydney Dragway. Construction activities adjacent to drainage areas across the proposed main operational site, and in Carpark C and Carpark D that are directly adjacent to the woodland and drainage line, are most likely to have an impact on water quality (if not mitigated). This may affect downstream environments due to potential changes in water quality and geomorphology associated with the construction of the development. The implementation of standard mitigation measures (i.e. sediment control, spill control) would control sediment and pollutants from any significant runoff events.

9.5 Cumulative biodiversity impacts

Potential cumulative impacts were considered for assessment based on the likely interactions of the development with other developments and plans that met the adopted screening criteria. The approach to assessment and the other developments considered are described further in Chapter 23 (Cumulative impacts) of the Environmental Impact Statement.

The cumulative impacts of historic vegetation clearing for agriculture, urban development, and development and maintenance of infrastructure is likely to include continued loss of biodiversity on the Cumberland Plain. The Cumberland Plain is an over cleared landscape and due to the expansion of western Sydney and creation of housing and associated infrastructure, further impacts to biodiversity are likely to result in this region.

While data from all recent developments in the locality is not freely available, some information on recent developments with biodiversity impacts are listed in **Table 9-5**.

Table 9-5 Past, present and future developments within the Cumberland Plain region

Development	Impacts
Sydney Metro West – Stage 1	The estimated clearing is about 0.18 hectares; consisting of two PCTs, 0.03 hectares of Cumberland Plain Woodland in the Sydney Basin Bioregion (listed under the BC Act) and 0.15 hectares of habitat for the Southern Myotis.
Archbold Road Upgrade, Old Wallgrove Road to the Great Western Highway	The development, located in the Cumberland Plain region, would require the removal of about 9.81 ha of vegetation, of which 7.60 ha is native vegetation and is consistent with a threatened ecological community and habitat for threatened species (WSP Parsons Brinckerhoff 2017).
Parramatta Light Rail	Direct impact to 0.62 hectares of native vegetation within the Cumberland Plain region. Removal of about 300 individual trees that are mostly horticultural plantings (WSP 2017).
Clyde Terminal Conversion Development	Located within the Cumberland Plain region, there were no impacts to native vegetation, but potential impacts to tank farm habitat for the Green and Golden Bell Frog (AECOM 2013).

Development	Impacts
Viva Energy Clyde Western Area Remediation Development	No direct impacts to native vegetation all within the Cumberland Plain region. Removal of foraging habitat for the Green and Golden Bell Frog, however this was not considered to have a significant impact on the species. Potential direct and indirect impacts were identified (e.g. fragmentation of movement corridors and water quality impacts) but were considered manageable with mitigation measures (Biosis 2018).
WestConnex program of works	This includes M4 Widening (direct impact on up to 8.86 hectares of planted and remnant vegetation), M4 East (around 15.7 hectares of vegetation, of which 12.9 hectares comprises of planted trees and landscaped areas) and M4-M5 Link (with no direct impacts to native vegetation), located in the Cumberland Plain region. Other impacts (direct and indirect) were concluded to not have a significant impact or unlikely (including GDEs), and/or considered to be minimal and manageable.

When the impacts of the development are considered together with the impacts of the above developments, the contribution of Sydney International Speedway to cumulative biodiversity impacts in the Cumberland Plain region is relatively low.

10. Managing and mitigating impacts on biodiversity values

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, management and mitigation measures would be implemented to further lessen the potential ecological impacts of the development.

Biodiversity impacts during construction would be managed in accordance with the Construction Environmental Management Framework, which is included as Appendix C of the Environmental Impact Statement. The Construction Environmental Management Framework includes biodiversity management objectives to maximise workers' awareness of biodiversity values and avoid or minimise potential impacts to biodiversity.

The Construction Environmental Management Framework also requires the preparation and implementation of a Flora and Fauna Management Plan, including (but not limited to):

- Procedures for the demarcation and protection of retained vegetation, including all vegetation outside and adjacent to the construction areas.
- Measures to reduce disturbance to sensitive fauna.
- Procedures for the clearing of vegetation and the relocation of flora and fauna, including pre clearing surveys and hollow bearing tree identification.
- Procedures for dealing with unexpected Endangered Ecological Communities or threatened species identified during construction.
- Weed management measures in accordance with the *Biosecurity Act 2015*.
- Pathogen management measures to prevent introduction and spread of amphibian chytrid fungus, *Phytophthora cinnamomi* and Exotic Rust Fungi.
- Inspection and monitoring requirements.

Additional biodiversity mitigation measures are outlined in **Table 10-1**. These would be in addition to mitigation measures as detailed elsewhere in the Environmental Impact Statement relating to:

- Groundwater (refer to Chapter 15 (Groundwater and geology))
- Soils and surface water quality (refer to Chapter 13 (Soils and surface water quality))

Table 10-1 Mitigation measures

Refence	Mitigation measure
Design	
B1	Opportunities to minimise the amount of vegetation clearance within the development site would be considered as part of further design development where reasonable and feasible

11. Thresholds for the assessment and offsetting of impacts of development

This section of the BDAR identifies the impact thresholds that the assessor must apply including:

- a) impacts on a potential entity that are serious and irreversible impacts
- b) impacts for which the assessor is required to determine an offset requirement
- c) impacts that do not require further assessment by the assessor.

11.1 Impacts on a potential entity that are serious and irreversible impacts

There would be no impacts to any SAIL entities. As such, the additional impact assessment provision outlined in section 10.2.3 of the BAM has not been completed.

11.2 Impacts for which the assessor is required to determine an offset requirement

The determination of impacts at the development site which require an offset was completed in accordance with section 10.3 of the BAM.

11.2.1 Impacts on native vegetation (ecosystem credits)

An offset is required for the impacts to most of the native vegetation in the development site as outlined in **Table 11-1**. Complete removal of the vegetation within the development site would occur. The location of the vegetation zones that would be impacted is shown in **Figure 11-1**.

Table 11-1 Impacts to PCTs which require an offset

Veg zone	PCT	TEC	Area (ha)	VI score
1	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) - Moderate	Yes	0.1 (1005 m ²)	18.7
3	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) - Poor	Yes	0.3 (2981 m ²)	15.2
4	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) – Revegetation	Yes	0.16 (1635 m ²)	23.9

11.2.2 Impacts on threatened species

An offset is required for impacts to threatened species as outlined in **Table 11-2**. The location of this habitat is shown in **Figure 11-1**.

Table 11-2 Impacts to threatened species which require an offset

Veg zone	PCT	TEC	Area (ha)	VI score
Southern Myotis (<i>Myotis macropus</i>)				
4	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) – Revegetation	Yes	0.01 (130 m ²)	23.9

11.3 Impacts for which the assessor is not required to determine an offset requirement

An offset is not required for impacts where the vegetation integrity score is below those set out in paragraph 10.3.1.1 of the BAM for impacts on native vegetation and paragraph 10.3.2.1 of the BAM for impacts on threatened species. Impacts not requiring offset are described in **Table 11-3**. The vegetation integrity score for the Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion PCT – Poor (PCT 849) is 11.3. As the vegetation integrity score for this vegetation zone is below 15 an offset is not required for this impact to native vegetation. Similarly, as the vegetation integrity score for this vegetation zone is below 17 an offset is not required for this impact to habitat for the Southern Myotis. The location of this vegetation zone is shown in **Figure 11-1**.

Table 11-3 Impacts which do not require an offset

Veg zone	PCT	Area (ha)	VI score	VI score threshold*	Offset required
Native vegetation					
2	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) – Poor	0.07 (691 m ²)	11.3	≥15	No
Southern Myotis (<i>Myotis macropus</i>)					
2	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) – Poor	0.02 (175 m ²)	11.3	≥17	No

*Note: Vegetation integrity score thresholds as set out by section 10.3 of the BAM

11.4 Impacts that do not require further assessment by the assessor

Areas of land on the development site without native vegetation do not need to be assessed for credits under chapter 4 or chapter 5 of the BAM. As such, areas of the development site that do not possess PCTs have not been assessed and credits have not been generated.

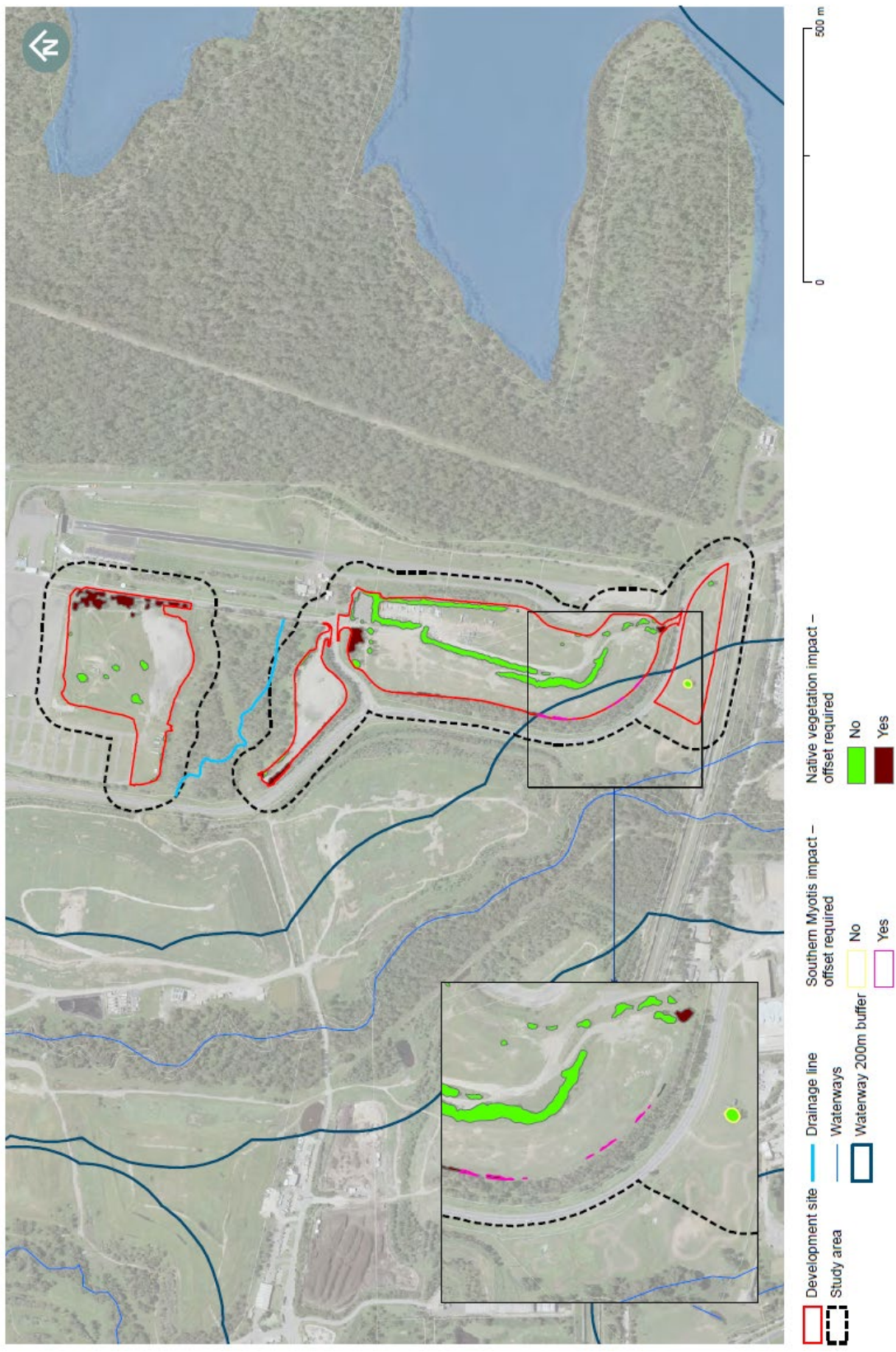


Figure 11-1 Impacts requiring offsets and impacts not requiring offsets

12. Biodiversity credit requirements

A summary of the biodiversity credit requirements for the development are provided below in **Table 12-1** and **Table 12-2**. The credit report is provided in **Appendix E**.

Table 12-1 Ecosystem credits required

Veg zone	PCT	TEC	Credits
1	Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) - Moderate	Yes	1
3	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) - Poor	Yes	3
4	Grey Box – Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850) – Revegetation	Yes	2
Total			6

Due to the very minor impact for Southern Myotis, no credits were generated by the BAM-Calculator.

Table 12-2 Species credits required

Species	Credits
<i>Myotis macropus</i> (Southern Myotis)	0

13. Conclusions

The Sydney International Speedway development is located within a highly disturbed landscape that does not possess large expanses of intact native vegetation with high biodiversity value. As most of the development site is in existing developed areas, direct impacts to terrestrial biodiversity has been avoided and/or minimised. The limited amount of native vegetation that would be disturbed is of poor to moderate quality and threatened species habitats are limited. No areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act would be affected. Importantly, the areas proposed for clearing would be refined during detailed design and reviewed as part of the pre clearing process.

The direct impacts to biodiversity values that would occur as a result of the development construction includes 0.63 hectares of native vegetation, which includes the following PCTs:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849) – 0.17 hectares.
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850) – 0.46 hectares.

One Threatened Ecological Community (TEC) listed under the BC Act would be impacted by the development:

- Cumberland Plain Woodland in the Sydney Basin Bioregion – 0.63 hectares comprising the combined extent of the two PCTs noted above.

The Development would not result in any direct impacts to TECs listed under the EPBC Act.

One species credit species is assumed to be directly impacted: the Southern Myotis. The extent of impact to this species is limited to a very small area of habitat (305 m²) that is within 200 metres of Eastern Creek. The artificial drainage line between Carpark C and Carpark D, and outside of the development site is not considered to meet the habitat requirements described for this species.

Targeted surveys for the Green and Golden Bell Frog did not identify this species around the artificial drainage line or along Eastern Creek. While these two areas meet many of the known habitat requirements for this species the development would not actually impact the potential habitat for this species. Further it was concluded that, due to the absence of the species from the survey, and the fact there are no known populations close to the development site, and all local records are very old, that the Green and Golden Bell Frog is unlikely to be impacted and species offsets are not required. No significant impacts to threatened species listed under the EPBC Act are likely to occur.

Considering the highly disturbed nature of the landscape within which the development sits, there are not expected to be any indirect impacts that would adversely affect areas of vegetation that would be retained. There is potential for indirect impacts to surrounding aquatic habitats (e.g. Eastern Creek) from erosion and contaminated runoff from construction and operation. The implementation of standard mitigation measures (i.e. sediment control, spill control) would control sediment and pollutants from any significant runoff events.

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, management and mitigation measures would be implemented to further lessen the potential ecological impacts of the development. Management and mitigation measures that would be implemented during the development would be outlined in a Flora and Fauna Management Plan (refer to Appendix C (Construction Environmental Management Framework) of the Environmental Impact Statement).

An offset would be required for the impacts to native vegetation for which the credit requirement has been calculated using the Biodiversity Assessment Calculator. Offsets were identified as being required for the Southern Myotis, however the impact area is so small that no credits were generated by the calculator.

14. References

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Appendix A. Habitat assessment

State and nationally listed threatened species identified from the literature review, database searches (BioNet and PMST) and Biodiversity Assessment Method Calculator (BAM-C), were considered in terms of their likelihood to occur in the habitats present within the survey area based on identified habitat requirements. The habitat suitability assessment for threatened species is provided in **Table A-1** and **Table A-2**.

Table A-1 Habitat suitability assessment for threatened plant species

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Acacia bynoeana</i> (Bynoe's Wattles)	E	V	Found in central eastern NSW, from the Hunter District south to the Southern Highlands and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood (<i>Corymbia gummifera</i>), Scribbly Gum (<i>Eucalyptus haemastoma</i>), Drooping Red Gum (<i>E. parramattensis</i>), Old Man Banksia (<i>Banksia serrata</i>) and Small-leaved Apple (<i>Angophora bakeri</i>).	PMST BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. Surveys did not identify this species.
<i>Acacia pubescens</i> (Downy Wattle)	V	V	Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. 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. Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone.	236 – BioNet PMST BAM-C	Low in development site. Recorded close to the development site around Prospect Reservoir. Only small amount of suitable habitat around the development site. Surveys did not identify this species.
<i>Allocasuarina glauca</i>	E	E	This species grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. These soils are low in fertility and are strongly to very strongly acidic. Rainfall in the area is lower than surrounding regions. The median annual rainfall is 803 mm (measured at the University of Western Sydney), with a summer peak. It is found in the Castlereagh open woodland community, with <i>Eucalyptus parramattensis</i> , <i>E. fibrosa</i> , <i>E. sclerophylla</i> , <i>Angophora bakeri</i> and <i>Melaleuca decora</i> . Common associated understorey species include <i>Melaleuca nodosa</i> , <i>Hakea dactyloides</i> , <i>H. sericea</i> , <i>Dillwynia tenuifolia</i> , <i>Micromyrtus minutiflora</i> , <i>Acacia elongata</i> , <i>A. brownnei</i> , <i>Themeda australis</i> and <i>Xanthorrhoea minor</i> .	1 – BioNet PMST	Low in development site. There is no habitat considered suitable for this species in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Caladenia tessellata</i> (Thick-lipped Spider-orchid)	E	V	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. It was also recorded in the Huskisson area in the 1930s. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border. 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 BAM-C	Low in development site. Habitat in the development site is too degraded for this species.
<i>Callistemon linearifolius</i>	V	-	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 open dry sclerophyll forest on a substrate of sandy to clayey soils on sandstone on the coast and ranges e.g. with <i>Corymbia eximia</i> , <i>Eucalyptus punctata</i> , <i>E. umbra</i> , <i>Allocasuarina littoralis</i> , and <i>Angophora costata</i> .	2 - BioNet	Low in development site. Surveys did not identify this species. Generally low-quality habitat in the development site.
<i>Cynanchum elegans</i> (White-flowered Wax Plant)	E	E	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar. Typically occurs in rainforest gullies, scrub and scree slopes and at the ecotone between dry rainforest vegetation and dry subtropical forest/woodland communities. Other associated vegetation types include littoral rainforest, Coastal Tea-tree (<i>Leptospermum laevigatum</i>) – Coastal Banksia (<i>Banksia integrifolia</i> subsp. <i>integrifolia</i>) coastal scrub; Forest Red Gum (<i>Eucalyptus tereticornis</i>) aligned open forest and woodland; Spotted Gum (<i>Corymbia maculata</i>) aligned open forest and woodland; and Bracelet Honeymyrtle (<i>Melaleuca armillaris</i>) scrub to open scrub.	2 - BioNet PMST BAM-C	Low in development site. Surveys did not identify this species. Generally low-quality habitat in the development site.
<i>Darwinia biflora</i>	V	V	Occurs at 129 sites in the northern and north-western suburbs of Sydney, in the Ryde, Baulkham Hills, Hornsby and Ku-Ring-Gai Local government areas (LGAs). Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include <i>Eucalyptus haemastoma</i> , <i>Corymbia gummifera</i> and/or <i>E. squamosa</i> . The vegetation structure is usually woodland, open forest or scrub-heath.	PMST	Unlikely in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
<i>Dillwynia tenuifolia</i>	V	-	Core distribution is the Cumberland Plain from Windsor to Penrith east to Deans Park. Other populations in Western Sydney are recorded at Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. Disjunct localities include the Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains. In western Sydney, it 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. At Yengo, is reported to occur in disturbed escarpment woodland on Narrabeen sandstone.	727 - BioNet BAM-C	Low in development site. Surveys did not identify this species. Generally low-quality habitat in the development site.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Dillwynia tenuifolia</i> , Kemps Creek	EP	-	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local government area.	42 – BioNet BAM-C	Unlikely in development site. This population does not include the development site.
<i>Eucalyptus benthamii</i>	V	V	Occurs on the alluvial flats of the Nepean River and its tributaries. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. A further 18 trees are scattered along the Nepean River, south to The Oaks. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Occurs in open forest. Associated species at the Bents Basin site include <i>Eucalyptus elata</i> , <i>E. baueriana</i> , <i>E. amplifolia</i> , <i>E. deanei</i> and <i>Angophora subvelutina</i> . Understorey species include <i>Bursaria spinosa</i> , <i>Pteridium esculentum</i> and a wide variety of agricultural weeds. The Kedumba Valley site lists <i>E. crebra</i> , <i>E. deanei</i> , <i>E. punctata</i> , <i>Leptospermum flavescens</i> , <i>Acacia filicifolia</i> and <i>Pteridium esculentum</i> among its associated species.	BAM-C	Unlikely in development site. Surveys did not identify this species. This species has not been recorded in the locality.
<i>Eucalyptus nicholii</i> (Narrow-leaved Black Peppermint)	V	V	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. Found largely on private property and roadsides, and occasionally conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	2 – BioNet	Known to occur in the broader locality. Commonly planted as a street tree in Sydney but not present in the development site.
<i>Genoplesium baueri</i> (Bauer's Midge Orchid)	E	E	Recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. The species has been recorded at locations now likely to be within the several conservation reserves including Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Found in sparse sclerophyll forest and moss gardens over sandstone	10 – BioNet PMST	Low in development site. There is no habitat considered suitable for this species in the development site.
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V	-	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.	449 – BioNet BAM-C	Low in development site. There is no alluvial habitat considered suitable for this species in the development site. Surveys did not identify this species.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V	V	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.	13 – BioNet PMST	Low in development site. Surveys did not identify this species.
<i>Haloragis exalata</i> subsp. <i>exalata</i>	V	V	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunct distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Square Raspwort appears to require protected and shaded damp situations in riparian habitats. Flowering specimens in NSW are recorded from November to January.	1 – BioNet PMST	Low in development site. There is no habitat considered suitable for this species in the development site.
<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EP	-	Endangered population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas. Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Grows in vine thickets and open shale woodland.	67 – BioNet BAM-C	Low in development site. Targeted surveys for this species were carried out in the development site and adjacent higher quality habitat.
<i>Micromyrtus minutiflora</i>	E	V	Restricted between Richmond and Penrith of western Sydney. Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest and open forest on sandy clay or gravelly soils tertiary alluvium.	PMST	Low in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Persicaria elatior</i> (Tall Knotweed)	V	V	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 Giberagee State Forests). This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	PMST	Low in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
<i>Persoonia bargoensis</i> (Bargo Geebung)	E	V	The Bargo Geebung is restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. The historical limits are Picton and Douglas Park (northern), Yanderra (southern), Cataract River (eastern) and Thirlmere (western). The Bargo Geebung occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone. It favours interface soil landscapes such as between the Blacktown Soil Landscape and the complex Mittagong Formation soils (Lucas Heights Soil Landscape) with the underlying sandstone (Hawkesbury Soil Landscape and Gynea Soil Landscape).	BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
<i>Persoonia hirsuta</i> (Hairy Geebung)	E	E	<i>Persoonia hirsuta</i> is patchily distributed on the Central Coast and Tablelands of NSW, in an area bounded by Putty, Glen Davis and Gosford in the north, and Royal National Park (NP) and Hill Top in the south. It occurs in the Sydney coastal area (Gosford, Berowra, Manly and Royal NP), the Blue Mountains area (Springwood, Lithgow and Putty) and the Southern Highlands (Balmoral, Buxton, Yanderra and Hill Top). It is frequently found on ridge tops and the mid slopes of hills and rises in dry sclerophyll forest and woodland with a shrubby understorey, heath, shrubby thickets and sandstone scrubs from near sea level to 600 m altitude. Associated canopy species include <i>Eucalyptus sclerophylla</i> , <i>Corymbia gummifera</i> , <i>Leptospermum trinervium</i> , <i>Eucalyptus sieberi</i> , <i>Eucalyptus punctata</i> , <i>Eucalyptus sparsifolia</i> , <i>Corymbia eximia</i> and <i>Banksia ericifolia</i> . It grows on sandy to stony soils derived from sandstone or very rarely on shale and is often found in disturbed areas, like along track edges.	PMST	Low in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
<i>Persoonia nutans</i> (Nodding Geebung)	E	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Core distribution occurs within the Penrith, and to a lesser extent, Hawkesbury LGAs, with isolated and relatively small populations also occurring in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs. Confined to aeolian and alluvial sediments and occurs 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.	23 – BioNet PMST	Low in development site. There is no aeolian or alluvial habitat considered suitable for this species in the development site. Surveys did not identify this species.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Ptilularia novae-hollandiae</i> (Austral Pilwort)	E	-	In NSW, Austral Pilwort has been recorded from suburban Sydney, Khancoban, the Riverina between Albury and Urana (including Henty, Walbundrie, Balldale and Howlong) and at Lake Cowal near West Wyalong. The population at Lake Cowal is the only known extant population in NSW. The species has also been recorded in the Australian Capital Territory, Victoria, Tasmania, South Australia and Western Australia. Austral Pilwort grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous. Most of the records in the Albury-Urana area were from table drains on the sides of roads.	1 – BioNet	Low in development site. Targeted surveys for this species were carried out along the drainage line between Carpark C and Carpark D. Habitat quality for this species is low.
<i>Pimelea curviflora</i> var. <i>curviflora</i> (Slender Curved Rice Flowers)	V	V	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots.	3 – BioNet PMST BAM-C	Low in development site. Targeted surveys for this species were carried out in the development site and adjacent higher quality habitat.
<i>Pimelea spicata</i> (Spiked-rice Flower)	E	E	Broad distribution in western Sydney, occurring on the Cumberland Plain (Narellan, Marayong, Prospect Reservoir areas). Another smaller population is recorded in districts (Landsdowne to Shellharbour to northern Kiama) Illawarra. It grows on well-structured clay soils. On the inland Cumberland Plain sites, it is associated with Grey Box and Ironbark. In the coastal Illawarra it occurs commonly in Coastal Banksia open woodland with a more well-developed shrub and grass understorey.	250 – BioNet PMST BAM-C	Low in development site. Targeted surveys for this species were carried out in the development site and adjacent higher quality habitat.
<i>Pomaderris brunnea</i> (Brown Pomaderris)	E	V	Found in a very limited area around the Nepean and Hawkesbury Rivers, including the Bargo area. It also occurs at Walcha on the New England tablelands and in far eastern Gippsland in Victoria. Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	PMST	Low in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pomaderris prunifolia</i> (a shrub) population, Parramatta, Auburn, Strathfield and Bankstown local government areas	EP	-	Endangered population in the Parramatta, Auburn, Strathfield and Bankstown Local government areas. Known from only three sites within the listed local government areas, at Rydalmere, within 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.	2 – BioNet	Low in development site. There is no habitat considered suitable for this species in the development site.
<i>Pterostylis gibbosa</i> (Illawarra Greenhood)	E	E	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in western Sydney which is the area where it was first collected (1803).	PMST	Low in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
<i>Pterostylis saxicola</i> (Sydney Plains Greenhood)	E	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated. Only one population occurs within a conservation reserve at Georges River National Park. 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 it occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	61 – BioNet PMST BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site.
<i>Pultenaea parviflora</i> (Sydney-bush Pea)	E	V	Endemic to the Cumberland Plain the core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce. May be locally abundant, particularly within scrubby/dry heath areas of 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. <i>Eucalyptus fibrosa</i> is usually the dominant canopy species. <i>Eucalyptus globoides</i> , <i>E. longifolia</i> , <i>E. parramattensis</i> , <i>E. sclerophylla</i> and <i>E. sideroxylon</i> may also be present or co-dominant, with <i>Melaleuca decora</i> frequently forming a secondary canopy layer. Associated species may include <i>Allocasuarina littoralis</i> , <i>Angophora bakeri</i> , <i>Aristida</i> spp., <i>Banksia spinulosa</i> , <i>Cryptandra</i> spp., <i>Daviesia ulicifolia</i> , <i>Entolasia stricta</i> , <i>Hakea sericea</i> , <i>Lissanthe strigosa</i> , <i>Melaleuca nodosa</i> , <i>Ozothamnus diosmifolius</i> and <i>Themeda australis</i> .	184 – BioNet PMST	Low in development site. Targeted surveys for this species were carried out in the development site and adjacent higher quality habitat.

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pultenaea pedunculata</i>	V	-	Widespread in Victoria, Tasmania, and south-eastern South Australia, however in NSW it is represented by just three disjunct populations on the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn. NSW populations are generally among woodland vegetation, but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	2 – BioNet BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site.
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	E	V	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast it occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	3 – BioNet PMST	Known to occur in the broader locality. Commonly planted as a street tree in Sydney but not present in development site.
<i>Thesium australe</i> (Austral Toadflax)	V	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>).	PMST BAM-C	Low in development site. There is no habitat considered suitable for this species in the development site. This species has not been recorded in the locality.
<p>* Distribution and habitat requirement information adapted from: Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html, NSW Office of Environment and Heritage http://www.environment.nsw.gov.au/threatenedspecies/</p> <p><u>Key:</u> CE = critically endangered E = endangered EP = endangered population Ex = extinct V = vulnerable</p>					

Table A-2 Habitat suitability assessment for threatened animal species

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Birds					
<i>Anthochaera Phrygia</i> (Regent Honeyeater)	CE	CE	The Regent Honeyeater that has a patchy distribution between south-east Queensland and central Victoria. It mostly inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak (<i>Casuarina</i> spp) where it feeds on needle-leaved mistletoe and sometimes breeds. It sometimes utilises lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought. It also uses a range of disturbed habitats within these landscapes including remnant patches in farmland and urban areas and roadside vegetation. It feeds primarily on the nectar of eucalypts and mistletoes and, to a lesser extent, lerps and honeydew; it prefers taller and larger diameter trees for foraging. It is nomadic and partly migratory with its movement through the landscape being governed by the flowering of select eucalypt species. There are four known key breeding areas: three in NSW and one in Victoria. Breeding varies between regions and corresponds with flowering of key eucalypt and mistletoe species. It usually nests in horizontal branches or forks in tall mature eucalypts and Sheoaks.	9 – BioNet PMST BAM-C	Moderate in development site. No breeding habitat present. This species may occasionally forage in vegetation, particularly winter flowering species such as <i>Eucalyptus tereticornis</i> .
<i>Artamus cyanopterus</i> (Dusky Woodswallow)	V	-	The Dusky Woodswallow has two separate populations. The eastern population is found from Atherton Tableland, Queensland south to Tasmania and west to Eyre Peninsula, South Australia. The other population is found in south-west Western Australia. The Dusky Woodswallow is found in open forests and woodlands and may be seen along roadsides and on golf courses.	25 – BioNet BAM-C	Moderate. May forage over the development site and perch on trees.
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	E	E	Occurs from south-east Queensland to south-east South Australia, Tasmania and the south-west of Western Australia. The Australasian Bittern's preferred habitat is comprised of wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and reeds (e.g. Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus) or cutting grass (Gahnia) growing over a muddy or peaty substrate.	1 – BioNet PMST BAM-C	Low in development site. This species may occur in the drain habitat in the development site on occasion, however the likelihood is considered low.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Burhinus grallarius</i> (Bush Stone-curlew)	E	-	Open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch.	1 – BioNet BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species.
<i>Calidris ferruginea</i> (Curlew Sandpiper)	E	CE, M	In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one-year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh and in mangroves.	PMST	Unlikely in development site. There is no habitat in the development site considered suitable for this species.
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests with an acacia understorey. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box ironbark assemblages, or in dry forest in coastal areas, occasionally feeding on exotic plant species on urban fringe areas. Favours old growth forest and woodland attributes for nesting and roosting. Nesting occurs in Spring and Summer with nests located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	2 – BioNet BAM-C	Moderate. May occur in study area on occasion in winter. No breeding habitat in development site.
Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local government areas	EP	-	This endangered population is found in the Ku-ring-gai and Hornsby local government areas. The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area.	BAM-C	Moderate. May occur in study area on occasion in winter. No breeding habitat in development site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Calyptrorhynchus lathamii</i> (Glossy-black Cockatoo)	V	-	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Inland populations feed on a wide range of Sheoaks, including Drooping Sheoak, <i>Allocasuarina diminuta</i> , and <i>A. gymnanthera</i> . Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (<i>Casuarina cristata</i>).	1 – BioNet	Low in development site. There is no habitat in the development site considered suitable for this species. There are no <i>Allocasuarina</i> spp in the development site.
<i>Chthonicola sagittata</i> (Speckled Warbler)	V	-	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt re-growth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant, often among fallen branches and other litter. A side entrance allows the bird to walk directly inside.	1 – BioNet BAM-C	Low in development site. The habitat in the development site is considered to be low quality. Only one record in the locality suggests this species is quite rare and likely to stick to high quality remnant woodland. The likelihood of this species occurring in the development site is considered low.
<i>Circus assimilis</i> (Spotted Harrier)	V	-	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.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper (eastern subspecies))	V	-	Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (<i>Eucalyptus camaldulensis</i>) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	V	-	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticated bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Nests in an upright tree fork high in the living tree canopy.	19 – BioNet BAM-C	Moderate. This species may forage and fly through the development site.
<i>Dasyornis brachypterus</i> (Eastern Bristlebird)	E	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NP, Budderoo NP, Woronora Plateau, Jervis Bay NP, Boodee NP and Beecroft Peninsula and Southern - Nadgee NP and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Falco subniger</i> (Black Falcon)	V	-	Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres. The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.	1 - BioNet	Low in development site. There is no habitat in the development site considered suitable for this species.
<i>Glossopsitta pusilla</i> (Little Lorikeet)	V	-	In NSW it is found from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. The species forages primarily in the canopy of dry open eucalypt forest and woodland but also utilises paperbark (<i>Melaleuca</i> sp.) dominated forests. 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. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of smooth-barked eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited; riparian trees are often chosen, including non-eucalypt species such as she-oaks.	7 – BioNet BAM-C	Moderate. This species may forage in trees in the development site on occasion.
<i>Grantiella picta</i> (Painted Honeyeater)	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of birds, and almost all breeding, occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amymema</i> .	PMST BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Haliaeetus leucogaster</i> (White-bellied Sea- Eagle)	V	M	Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea). It feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion. It generally forages over large expanses of open water; this is particularly true of birds that occur in coastal environments close to the sea-shore. However, it also forages over open terrestrial habitats (such as grasslands). Nests may be built in a variety of sites including tall trees (especially <i>Eucalyptus</i> species), bushes, mangroves, cliffs, rocky outcrops, crevices, on the ground or even on artificial structures.	3 – BioNet BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species.
<i>Hieraetus morphnoides</i> (Little Eagle)	V	-	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. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used.	21 – BioNet BAM-C	Moderate. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.
<i>Hirundapus caudacutus</i> (White-throated Needletail)	-	V, M	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps.	PMST	Low. Likely to use airspace above the development site. Unlikely to utilise the affected vegetation or be impacted.
<i>Irediparra gallinacea</i> (Comb-crested Jacana)	V	-	Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in south-eastern NSW (possibly in response to unfavourable conditions further north). Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Ixobrychus flavicollis</i> (Black Bittern)	V	-	The Black Bittern is found along the coastal plains within NSW, although individuals have rarely been recorded south of Sydney or inland. It inhabits terrestrial and estuarine wetlands such as flooded grasslands, forests, woodlands, rainforests and mangroves with permanent water and dense waterside vegetation. The Black Bittern typically roosts on the ground or in trees during the day and forages at night on frogs, reptiles, fish and invertebrates. The breeding season extends from December to March. Nests are constructed of reeds and sticks in branches overhanging the water.	1 – BioNet BAM-C	Low in development site. This species may occur in the drain habitat in the development site on occasion, however the likelihood is considered low.
<i>Lathamus discolor</i> (Swift Parrot)	E	CE	The swift parrot breeds in Tasmania during the summer and the entire population migrates north to mainland Australia for the winter. Whilst on the mainland the swift parrot disperses widely to forage on flowers and psyllid lerps in eucalypt species, with the majority being found in Victoria and NSW. In NSW they forage in forests and woodlands throughout the coastal and western slopes regions each year. Coastal regions tend to support larger numbers of birds when inland habitats are subjected to drought. Non-breeding birds preferentially feed in inland box-ironbark and grassy woodlands, and coastal swamp mahogany (<i>E. robusta</i>) and spotted gum (<i>Corymbia maculata</i>) woodland when in flower; otherwise often in coastal forests. 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 <i>Eucalyptus robusta</i> , <i>Corymbia maculata</i> , <i>C. gummifera</i> , <i>E. sideroxylon</i> , and <i>E. albens</i> . Commonly used lerp infested trees include <i>E. microcarpa</i> , <i>E. moluccana</i> and <i>E. pilularis</i> .	51 – BioNet PMST BAM-C	Moderate. This species is known to occasionally visit street trees and disturbed vegetation around Sydney during migration. However, the vegetation in the site is not important habitat and the likelihood of birds using the trees within the development site as a continual source of habitat is low.
<i>Limicola falcinellus</i> (Broad-billed Sandpiper)	V	-	The eastern form of this species breeds in northern Siberia before migrating southwards in winter to Australia. In Australia, Broad-billed Sandpipers overwinter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW. Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sand flats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Limosa limosa</i> (Black-tailed Godwit)	V	M	A migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently found at Kooragang Island (Hunter River estuary). Occurs in sheltered bays, estuaries and lagoons with large intertidal mudflats and sand flats. Also found at inland mudflats, swamps.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
<i>Lophoictinia isura</i> (Square-tailed Kite)	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> , or <i>E. smithii</i> . Individuals appear to occupy large hunting ranges of more than 100 km ² . They require large living trees for breeding, particularly near water with surrounding woodland /forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	2 – BioNet BAM-C	Moderate. This species may fly over and perch in the development site on occasion. There is unlikely to be any suitable breeding habitat present.
<i>Melanodryas cucullata cucullata</i> (Hooded Robin (south-eastern form))	V	-	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. However, it is common in few places, and rarely found on the coast. 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. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground.	BAM-C	Low in development site. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion. There are no records of this species in the locality.
<i>Melithreptus gularis</i> (Black-chinned Honeyeater (eastern subsp.))	V	-	Extends south from central Queensland, through NSW, Victoria into south-eastern South Australia, though it is very rare in the last state. 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. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (<i>Eucalyptus sideroxylon</i>), White Box (<i>E. albens</i>), Inland Grey Box (<i>E. microcarpa</i>), Yellow Box (<i>E. melliodora</i>), Blakely's Red Gum (<i>E. blakelyi</i>) and Forest Red Gum (<i>E. tereticornis</i>). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	1 – BioNet BAM-C	Low in development site. There is no habitat considered suitable for this species. Vagrant birds may appear on occasion.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Neophema pulchella</i> (Turquoise Parrot)	V	-	Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	1 – BioNet BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species.
<i>Ninox connivens</i> (Barking Owl)	V	-	Found throughout continental Australia except for the central arid regions. 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.	3 – BioNet BAM-C	Moderate. This species may fly over, perch and forage in the development site on occasion. There is no suitable breeding habitat present.
<i>Ninox strenua</i> (Powerful Owl)	V	-	In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. 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.	14 – BioNet BAM-C	Moderate. This species may fly over, perch and forage in the development site on occasion. There is no suitable breeding habitat present.
<i>Numenius madagascariensis</i> (Eastern Curlew)	-	CE, M	Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
<i>Petroica boodang</i> (Scarlet Robin)	V	-	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and re-growth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. This species' nest is built in the fork of tree usually more than 2 metres above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub.	2 – BioNet BAM-C	Low in development site. This species may occur in higher quality vegetation around the development site and pass through it on occasion. However, there is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Petroica phoenicea</i> (Flame Robin)	V	-	The Flame Robin ranges from near the Queensland border to south-east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgeland at high altitudes.	1 – BioNet BAM-C	Low in development site. This species may occur in higher quality vegetation around the development site and pass through it on occasion. However, there is no habitat in the development site considered suitable for this species.
<i>Rostratula australis</i> (Australian Painted Snipe)	E	E, M	Most records are from south-east Australia, particularly the Murray Darling Basin, with scattered records across northern Australia. They generally inhabit shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass. Breeding habitat requirements may be quite specific; shallow wetlands with areas of bare wet mud and both low cover and canopy cover nearby; nest records nearly all from or near small islands in freshwater wetlands. Has also been recorded nesting in and near swamps, canegrass swamps, flooded areas including samphire, grazing land, among cumbungi, sedges and grasses; one nest has been found in the centre of a cow-pat in a clump of long grass.	1 – BioNet PMST BAM-C	Low in development site. This species may occur in the drain habitat in the development site on occasion, however the likelihood is considered low.
<i>Stagonopleura guttata</i> (Diamond Firetail)	V	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (<i>Eucalyptus pauciflora</i>) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Tyto novaehollandiae</i> (Masked Owl)	V	-	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within about 90% of NSW, excluding the most arid northwest corner. There is no seasonal variation in its distribution. Dry eucalypt forests and woodland typically prefers open forest with low shrub density. Requires old trees for roosting and nesting.	6 – BioNet BAM-C	Moderate. This species may fly over, perch and forage in the development site on occasion. There is no suitable breeding habitat present.
Frogs					
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	V	V	The Giant Burrowing Frog is distributed in south-eastern NSW and Victoria and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are about 0.04 ha in size.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
<i>Litoria aurea</i> (Green and Golden Bell Frog)	E	V	Since 1990 there have been about 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range; however, they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Ephemeral and permanent freshwater wetlands, ponds, dams with an open aspect and fringed by Typha and other aquatics, free from predatory fish.	26 – BioNet PMST	Low in development site. Surveys for this species were carried out in suitable habitat around the development site. No frogs were detected. The closest known population is at Parramatta Park. All records of this species within the locality are greater than 20 years old, with most being from the 1960s and 1970s. While there is still moderate potential that dispersing individuals may occur in habitats around the study area on occasion, there is no habitat inside the development site that would be impacted.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Litoria raniformis</i> (Southern Bell Frog)	E	V	The species is currently widespread throughout the Murray River valley and has been recorded from six Catchment Management Areas in NSW: Lower Murray Darling, Murrumbidgee, Murray, Lachlan, Central West and South East. Found mostly amongst emergent vegetation, including Typha sp. (bullrush), Phragmites sp. (reeds) and Eleocharis sp. (sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. This species is not known from the Sydney area.
Invertebrates					
<i>Meridolum comeovirens</i> (Cumberland Plain Land Snail)	E	-	Primarily inhabits Cumberland Plain Woodland (an endangered ecological community). This community is grassy, open woodland with occasional dense patches of shrubs. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	359 - BioNet	Low in development site. There is moderate to high likelihood that this species is present in the moderate condition woodland between Carpark C and Carpark D. This species was not located during surveys however conditions were very dry in December 2019. The vegetation within the development site is considered poor quality for this species.
<i>Pommerhelix duralensis</i> (Dural Land Snail)	E	E	The Dural land snail is endemic to New South Wales. 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 also shelters beneath logs, rocks and light woody debris.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. The development site is not within this species natural range.
<i>Synemon plana</i> (Golden Sun Moth)	E	CE	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. The species' historical distribution extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia. Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by wallaby grasses <i>Austrodanthonia</i> spp. Grasslands dominated by wallaby grasses are typically low and open - the bare ground between the tussocks is thought to be an important microhabitat feature for the Golden Sun Moth, as it is typically these areas on which the females are observed displaying to attract males. Habitat may contain several wallaby grass species, which are typically associated with other grasses particularly spear-grasses <i>Austrostipa</i> spp. or Kangaroo Grass <i>Themeda australis</i> .	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Mammals					
<i>Cercartetus nanus</i> (Eastern Pygmy-possum)	V	-	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Important habitat requirements include trees with hollows >2cm, loose bark of eucalypts or accumulations of shredded bark in tree forks for nesting; and associated vegetation types and with an understorey containing heath, banksias or myrtaceous shrubs and soft-fruited plants in rainforests.	BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	V	V	Forages over a broad range of open forest and woodland habitats; this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	1 – BioNet PMST BAM-C	Moderate. This species is most likely to forage in the woodland around the drainage line and may occur in the development site as it flies around. However, there is no high quality foraging habitat or breeding habitat in the development site.
<i>Dasyurus maculatus</i> (Spotted-tailed Quoll)	V	E	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	8 – BioNet PMST BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle)	V	-	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	18 – BioNet BAM-C	Moderate. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.
<i>Micronomus norfolkensis</i> (Eastern Coastal Free-tailed Bat)	V	-	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roosts mainly in tree hollows but also roosts under bark or in huartifical structures.	48 – BioNet BAM-C	High. Analysis of bat calls recorded along the drainage line as part of this assessment identified this species on one night. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.
<i>Miniopterus australis</i> (Little Bent-winged Bat)	V	-	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	6 – BioNet BAM-C	Moderate. This species is most likely to forage in the woodland around the drainage line and may occur in the development site as it flies around. However, there is no high quality foraging habitat or breeding habitat in the development site.
<i>Miniopterus orianae oceanensis</i> (Large Bent-winged Bat)	V	-	Occurs on east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other manmade structures.	72 – BioNet BAM-C	High. This species is most likely to forage in the woodland around the drainage line and may occur in the development site as it flies around. However, there is no high quality foraging habitat or breeding habitat in the development site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Myotis macropus</i> (Southern Myotis)	V	-	Roost in groups close to water in caves, mine shafts, hollow bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish.	37 – BioNet	Moderate. Targeted surveys for this species were carried out as part of this assessment. No bats were trapped in harp traps. Bat call analysis concluded some recorded calls were probably this species, though it is not possible to determine from calls alone. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. There are no associated PCTs within 200 metres of a waterway in the development site.
<i>Petauroides volans</i> (Greater Glider)	-	V	The Greater Glider occurs in eucalypt forests and woodlands along the east coast of Australia from north-east Queensland to the Central Highlands of Victoria from sea level to 1200 m altitude. It feeds exclusively on eucalypt buds, flowers and mistletoe and favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. It roosts in tree hollows, with a particular selection for large hollows in large, old trees. Individuals use multiple hollows and a relatively high abundance of tree hollows (at least 4-8 suitable hollows per hectare) seems to be needed for the species to persist. Individuals occupy relatively small home ranges with an average size of 1 to 3 ha, but the species has relatively low persistence in small forest fragments and disperses poorly across vegetation that is not native forest. Forest patches of at least 160 km ² may be required to maintain viable populations.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
<i>Petaurus australis</i> (Yellow-bellied Glider)	V	-	Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar.	1 – BioNet BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Petaurus norfolcensis</i> (Squirrel Glider)	V	-	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey.	1 – BioNet BAM-C	Low in development site. There is no habitat in the development site considered suitable for this species.
<i>Petrogale penicillata</i> (Brush-tailed Rock-wallaby)	E	V	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. It also utilises tree limbs. While it appears that most Brush-tailed Rock-wallaby colonies are on north-facing slopes and cliff lines, colonies have been found on south-facing cliffs in Kangaroo Valley, in the Macleay River Gorge, in the Warrumbungles and at Mt Kaputar, although usually in lower densities. Rocky outcrops appear crucial to current habitat selection by rock-wallabies; however, vegetation structure and composition is also considered to be an important factor. In many parts of their range, including at the Warrumbungles, rock-wallabies are closely associated with dense arboreal cover, especially fig trees. The vegetation on and below the cliff appear to be important to this species as a source of food and shelter and in some cases may provide some protection from predation. A range of vegetation types are associated with Brush-tailed Rock-wallaby habitat, including dense rainforest, wet sclerophyll forest, vine thicket, dry sclerophyll forest, and open forest.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.
<i>Phascogale cinerea</i> (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory	V	V	In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabits eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area selects preferred browse species.	7 – BioNet PMST BAM-C	Low in development site. <i>Eucalyptus tereticornis</i> is a primary food tree species. However, the known occurrence of this species within the locality is very rare. This species may pass through the development site on occasion, however the likelihood is considered low.
<i>Pseudomys novaehollandiae</i> (New Holland mouse)	V	-	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	PMST	Low in development site. There is no habitat in the development site considered suitable for this species. There are no records of this species in the locality.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Pteropus poliocephalus</i> (Grey-headed Flying- fox)	V	V	Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young.	900 – BioNet PMST BAM-C	High. This species is assumed to occur based on the presence of suitable foraging habitat and the proximity of several camps. There are no camps within the development site.
<i>Saccolaimus flaviventris</i> (Yellow- bellied Sheathtail- bat)	V	-	Wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	4 – BioNet BAM-C	Moderate. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	V	-	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.	20 – BioNet BAM-C	Moderate. The highest quality foraging habitat is around the drainage line, though this species may also forage around trees within the development site. No hollow bearing trees were identified within the development site; however, some roosting habitat may be present. There is unlikely to be any breeding habitat in the development site.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Fish					
<i>Macquaria australasica</i> (Macquarie Perch)	E	E	Macquarie Perch have declined considerably from their historical distribution within NSW and they are now considered isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW. It is also found in low numbers in the Mongarlowe River, where the population is considered likely to be the result of a translocation from the Murray-Darling Basin. Other populations exist in Cataract Dam in the Nepean River catchment, as well as a 2008 record from Georges River near Campbelltown, the first record from the river since 1894. It persists in the Burrinjuck, Cotter (Murrumbidgee) and Wyangala impoundments. A breeding population in the Queanbeyan River upstream of the Googong Reservoir exists solely due to a translocation of individuals from the reservoir past a natural barrier. The Googong reservoir population is believed to be effectively extinct. Macquarie perch may occasionally become displaced downstream from the Queanbeyan River into Googong, but they do not form a population in the reservoir. The New South Wales Rivers Survey (1994–1996) demonstrated that the Macquarie Perch was present only in low numbers at three sites in streams above Lake Wyangala and Burrinjuck Dam. Hawkesbury and Shoalhaven River populations, including in large impoundments, seem abundant and generally occur upstream of Australian Bass (<i>Macquaria novemaculata</i>) populations. 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	Low in development site. There is no habitat considered suitable for this species.
<i>Prototroctes maraena</i> (Australian Grayling)	E	V	The Australian Grayling is diadromous, spending part of its lifecycle in freshwater and at least part of the larval 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 km upstream from the sea	PMST	Low in development site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
Migratory species					
<i>Actitis hypoleucos</i> (Common Sandpiper)	-	M	Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. 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.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Apus pacificus</i> (Fork-tailed Swift)	-	M	Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.	PMST	Low in development site. May fly over the site on occasion but would not use the habitats and would not be impacted.
<i>Calidris acuminata</i> (Sharp-tailed Sandpiper)	-	M	The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation; this includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. They use flooded paddocks, sedgeland and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves. They tend to occupy coastal mudflats mainly after ephemeral terrestrial wetlands have dried out, moving back during the wet season. Sometimes they occur on rocky shores and rarely on exposed reefs.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Calidris melanotos</i> (Pectoral Sandpiper)	-	M	In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Cuculus optatus</i> (Oriental Cuckoo)	-	M	The Oriental cuckoo is a non-breeding visitor to Australia. Inhabits rainforest margins, monsoon forest, vine scrub and mangroves, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands. It frequently occurs at edges or ecotones between habitat types.	PMST	Low in development site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Gallinago hardwickii</i> (Latham's Snipe)	-	M	Recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. Occurs in permanent and ephemeral wetlands up to 2000 m above sea-level.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Hirundapus</i> <i>caudatus</i> (White-throated Needle-tail)	-	M	Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps.	PMST	Low in development site. May fly over the site on occasion but would not use the habitats and would not be impacted.
<i>Monarcha melanopsis</i> (Black-faced Monarch)	-	M	Widespread in eastern Australia. Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Monarcha trivirgatus</i> (Spectacled Monarch)	-	M	Occurs along the entire east coast of Australia. Breeds in dense scrub in gullies of coastal ranges.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Motacilla flava</i> (Yellow Wagtail)	-	M	Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground; occasionally on drier inland plains.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Myiagra cyanoleuca</i> (Satin Flycatcher)	-	M	Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Pandion haliaetus</i> (Osprey)	-	M	The Osprey has a global distribution with four subspecies previously recognised throughout its range. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	PMST	Low in development site. There is no habitat considered suitable for this species.
<i>Rhipidura rufifrons</i> (Rufous Fantail)	-	M	Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (<i>Eucalyptus microcorys</i>), Mountain Grey Gum (<i>E. cypellocarpa</i>), Narrow-leaved Peppermint (<i>E. radiata</i>), Mountain Ash (<i>E. regnans</i>), Alpine Ash (<i>E. delegatensis</i>), Blackbutt (<i>E. pilularis</i>) or Red Mahogany (<i>E. resinifera</i>); usually with a dense shrubby understorey often including ferns.	PMST	Low in development site. There is no habitat considered suitable for this species.

Scientific Name (Common Name)	BC Act / FM Act	EPBC Act	Habitat Requirements	No. records in locality	Likelihood of occurrence
<i>Tringa nebularia</i> (Common Greenshank)	-	M	The Common Greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia.	PMST	Low in development site. There is no habitat considered suitable for this species.
Distribution and habitat requirement information adapted from: Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html NSW Office of Environment and Heritage http://www.environment.nsw.gov.au/threatenedspecies/ and IUCN red list https://www.iucnredlist.org/ . Key: CE = critically endangered E = endangered V = vulnerable M = migratory					

Appendix B. Floristic survey composition and structure data

Table B-1 Species and estimated cover recorded in each of the Vegetation Integrity survey plots

Species	GF code	Cover (%)														
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15
<i>Acacia decurrens</i>	TG					10										
<i>Acacia falcata</i>	SG	0.1														
<i>Ageratina adenophora</i>	HT															0.5
<i>Alisma plantago-aquatica</i>	FG															0.1
<i>Angophora floribunda</i>	TG															10
<i>Araujia sericifera</i>	HT						0.1	0.1						0.1		
<i>Aristida spp.</i>	GG		0.1	0.1												
<i>Asparagus aethiopicus</i>	HT								0.1							
<i>Bidens pilosa</i>	EX		0.2	0.2			0.1	0.2	0.1		0.1			0.1		
<i>Brassica spp.</i>	EX													0.1		
<i>Briza subaristata</i>	EX									50						
<i>Bromus catharticus</i>	EX			0.1										0.1		
<i>Brunoniella australis</i>	FG						0.1									
<i>Bursaria spinosa</i>	SG												0.3	0.5		
<i>Cardiospermum grandiflorum</i>	HT													5	20	
<i>Casuarina glauca</i>	TG								30					10	2	
<i>Centella asiatica</i>	FG		0.1				0.1			0.3						
<i>Cestrum parqui</i>	HT															0.1
<i>Chloris gayana</i>	HT	0.2														
<i>Chloris gayana</i>	HT											1	0.5			
<i>Cirsium vulgare</i>	EX			0.1		0.1				0.1		0.1		0.1		
<i>Commelina cyanea</i>	FG													0.1	0.1	
<i>Corymbia maculata</i>	TG												10			
<i>Cyclospermum leptophyllum</i>	EX													0.1		

Species	GF code	Cover (%)														
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15
<i>Cynodon dactylon</i>	GG	5	10	10	5	1	10			20						5
<i>Cyperus eragrostis</i>	HT														0.2	0.1
<i>Cyperus gracilis</i>	GG	0.1														
<i>Cyperus spp.</i>	GG		0.1						0.1							
<i>Daviesia ulicifolia</i>	SG			0.3												
<i>Dianella longifolia</i>	FG									0.1						
<i>Dichondra repens</i>	FG	0.1	0.1	0.3			0.1									0.5
<i>Dietes spp.</i>	FG													0.3		
<i>Dovyalis caffra</i>	EX	0.5													0.5	
<i>Echinopogon caespitosus</i>	GG															0.1
<i>Ehrharta erecta</i>	HT					0.1				5				20	0.1	10
<i>Einadia hastata</i>	FG			0.3					0.1	0.2					0.5	
<i>Einadia nutans</i>	FG	0.1					0.1			5			0.1	0.3		
<i>Einadia trigonos</i>	FG					0.1			0.1			0.2				
<i>Entolasia stricta</i>	GG														0.2	
<i>Eragrostis curvula</i>	HT	80				5				10	0.1	10				
<i>Eragrostis leptostachya</i>	GG															0.1
<i>Eremophila debilis</i>	SG					0.1										
<i>Eucalyptus bosistoana</i>	TG														30	
<i>Eucalyptus crebra</i>	TG									5			20			
<i>Eucalyptus moluccana</i>	TG							5				40				
<i>Eucalyptus tereticornis</i>	TG	15	30	25	0.5	25	20	30	20	20	20		2			20
<i>Foeniculum vulgare</i>	EX	0.1														
<i>Geranium solanderi</i>	FG															0.1
<i>Glycine clandestina</i>	OG	0.1	0.1	0.1			0.1								0.1	
<i>Glycine tabacina</i>	OG					0.1										
<i>Hypericum gramineum</i>	FG									0.1						

Species	GF code	Cover (%)														
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15
<i>Juncus sarophorus</i>	GG															0.1
<i>Juncus usitatus</i>	GG															0.3
<i>Lachnagrostis filiformis</i>	GG						0.1									
<i>Lantana camara</i>	HT	0.2				1	0.5	0.5						0.3		25
<i>Lepidium africanum</i>	EX											0.1				
<i>Ligustrum lucidum</i>	HT													0.5		
<i>Lomandra confertifolia</i>	GG						0.1									
<i>Lomandra filiformis</i>	GG						0.1									
<i>Lomandra longifolia</i>	GG			0.2			0.1							1		
<i>Lycium ferocissimum</i>	HT	0.2		0.3		1	0.2	0.2	0.5	0.5		0.1	0.2	1	5	
<i>Megathyrsus maximus</i>	HT									5						
<i>Melaleuca styphelioides</i>	SG													0.5	25	30
<i>Microlaena stipoides</i>	GG		90	80		60	80				20					10
<i>Olea europaea</i>	HT	0.2	0.3				0.2			5				0.3		
<i>Opercularia diphylla</i>	FG			0.1												
<i>Opuntia stricta</i>	EX	0.1							0.1							
<i>Panicum spp.</i>	GG						0.5									
<i>Paspalum dilatatum</i>	HT		0.2												5	
<i>Passiflora herbertiana</i>	OG	0.1														
<i>Pavonia hastata</i>	EX	0.1														
<i>Pennisetum clandestinum</i>	HT	1		10				80	90			1	20			
<i>Persicaria lapathifolia</i>	FG															0.5
<i>Pittosporum undulatum</i>	SG		0.3													
<i>Plantago gaudichaudii</i>	FG		0.1													
<i>Plantago lanceolata</i>	EX	0.1	0.1	0.1						0.1	0.1		0.1	0.1		0.1
<i>Rubus fruticosus agg.</i>	HT				0.3							95				
<i>Rytidosperma tenuius</i>	GG	0.1									0.5		40			

Species	GF code	Cover (%)														
		Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Plot 9	Plot 10	Plot 11	Plot 12	Plot 13	Plot 14	Plot 15
<i>Senecio madagascarensis</i>	HT	0.1									0.1				0.1	
<i>Senecio pterophorus</i>	EX						0.1									
<i>Sida rhombifolia</i>	EX	0.3	0.2		0.2	0.2	0.3		0.3	0.1		0.1	0.1	0.2		
<i>Sigesbeckia orientalis</i>	FG															0.1
<i>Solanum linnaeanum</i>	EX													0.1		
<i>Solanum nigrum</i>	EX													0.1	0.1	
<i>Solanum prinophyllum</i>	FG														0.5	
<i>Solanum pseudocapsicum</i>	EX					0.1	0.3	0.2	0.2			0.1				
<i>Sonchus oleraceus</i>	EX				0.1			0.1						0.1		
<i>Spirodela spp.</i>	FG															0.1
<i>Sporobolus creber</i>	GG		0.1													
<i>Tradescantia fluminensis</i>	HT													0.5		5
<i>Typha orientalis</i>	GG				90											
<i>Verbena bonariensis</i>	EX	0.1									0.1					0.1

*GF code: TG = Tree, SG = Shrub, GG = Grass and grass-like, FG = Forb, EG = Fern, OG = Other, HT = High Threat weed, EX = Exotic

*GF code: TG = Tree, SG = Shrub, GG = Grass and grass-like, FG = Forb, EG = Fern, OG = Other, HT = High Threat weed, EX = Exotic

Appendix C. Vegetation integrity assessment plot data

Table C-1 Vegetation integrity assessment plot data for vegetation zones in the Sydney Basin bioregion

plot	PCT	Area	Patch size	Condition class	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTrees	funHollowtree	funLitterCover	funLenFallenL	funTreeStem5	funTreeStem1	funTreeStem2	funTreeStem3	funTreeStem5	funTreeRegen	funHighThreat
1	850	0.44	101	Poor	56	3024 92	625566 6.7	161	1	1	3	2	0	2	15.0	0.1	5.2	0.2	0.0	0.2	0	0	66.0	0.0	1	1	1	1	0	1	81.9
2	850	3.91	101	Moderate	56	3024 89	625555 2.4	269	1	1	5	3	0	1	30.0	0.3	100.3	0.3	0.0	0.1	0	0	77.0	10.0	1	1	1	1	0	1	0.5
3	850	3.91	101	Moderate	56	3026 53	625559 9.8	185	1	1	4	3	0	1	25.0	0.3	90.3	0.7	0.0	0.1	1	1	82.0	22.0	1	1	1	1	0	1	10.3
4	1071	0.07	101	Drain	56	3028 05	625611 3.1	137	1	0	2	0	0	0	0.5	0.0	95.0	0.0	0.0	0.0	0	0	0.0	0.0	0	0	0	0	0	1	0.3
5	850	3.91	101	Moderate	56	3026 38	625628 7.2	130	2	1	2	1	0	1	35.0	0.1	61.0	0.1	0.0	0.1	0	0	76.0	24.0	1	1	1	1	0	1	7.1
6	850	3.91	101	Moderate	56	3025 26	625633 4.1	194	1	0	7	4	0	1	20.0	0.0	90.9	0.4	0.0	0.1	0	0	87.0	2.0	1	1	1	1	0	1	0.5
7	849	1.27	101	Poor	56	3026 65	625612 2.2	181	2	0	0	0	0	0	35.0	0.0	0.0	0.0	0.0	0.0	0	0	24.0	0.0	0	1	1	1	0	0	80.8
8	849	1.27	101	Poor	56	3026 19	625626 8.8	290	1	0	0	2	0	0	20.0	0.0	0.0	0.2	0.0	0.0	0	0	25.0	5.0	0	0	1	1	0	0	90.5
9	850	2.29	101	Revegetation	56	3027 91	625625 5.4	66	3	0	1	2	0	0	65.0	0.0	0.1	5.2	0.0	0.0	0	0	71.0	0.0	1	1	1	1	0	1	26.1
10	850	0.18	101	Regeneration	56	3027 99	625636 8.4	63	1	0	3	3	0	0	20.0	0.0	40.5	0.5	0.0	0.0	0	0	36.0	1.0	1	0	0	0	0	1	0.2
11	849	0.07	101	Blackberry	56	3025 13	625638 6.6	71	1	0	0	0	0	0	20.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	0.0	0	0	1	1	0	0	96.1

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Appendix D. EPBC Act significance assessments

Assessment of significance have been completed for threatened species, populations and communities that were recorded in the development site during field surveys or were identified as having a moderate or higher potential to occur in the development site based on the presence of habitat. For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not a remote chance or possibility (Department of Environment, 2013). This advice has been considered while completing the assessments.

The EPBC Act listed species subject to this assessment include:

- Grey-headed Flying-fox
- Regent Honeyeater
- Swift Parrot

The Green and golden Bell Frog was not assessed as the species has not been confirmed on-site and a population is not expected to occur

When assessing Vulnerable species, the assessment centres around whether the population that would be impacted is an 'important population' or not. An 'important population' is a population that is necessary for a species' long-term survival and recovery (Department of Environment, 2013). This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

This definition of what constitutes an 'important population' has guided the assessments for Vulnerable species.

The direct impact of the development is summarised below in **Table D-1**. The vegetation that would be impacted only provides potential foraging habitat these species.

Table D-1 Summary of direct impact to EPBC Act listed threatened species habitat (native vegetation) within the development site

Species	Plant community type name	Area (ha) in development site
Grey-headed Flying-fox Regent Honeyeater Swift Parrot	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (849) Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (850)	0.63

Planted revegetation and weeds would also be impacted. No profusely fruiting (e.g. *Ficus* sp.) or flowering trees were identified, and these areas are unlikely to provide substantial foraging opportunities for the Grey-headed Flying-fox, Swift Parrot and Regent Honeyeater.

Grey-headed Flying-fox

The Grey-headed Flying-fox (*Pteropus poliocephalus*) is known to forage widely throughout the Sydney urban area and a nationally important camp is located along the Parramatta River in Parramatta Park around 12 kilometres east of the development site. This species is considered likely to occur throughout the development site when trees are flowering based on the presence of suitable foraging habitat. The Grey-headed Flying-fox exists as a single interconnected population in Australia. As such, it is considered an important population.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it would:

1) lead to a long-term decrease in the size of an important population of a species

There would be no direct impact to the Parramatta Park roost camp so no direct impacts to a known permanent roosting, breeding / maternity site would occur. Therefore, it is likely that the impacts of the development would be confined to loss of feeding habitat caused by direct clearing or damage to PCTs during the construction. However, this loss of foraging habitat would be negligible and unlikely to affect breeding success given the extent of similar habitat in the Sydney area and the wide-ranging nature of Grey-headed Flying-fox foraging movements. The development is considered unlikely to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-fox.

2) reduce the area of occupancy of an important population

The area of occupancy of the Grey-headed Flying-fox is not known but the species exists as one interconnected population along the eastern Australian coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. The area occupied by this species would remain the same after construction. No impact to area of occupancy is expected.

3) fragment an existing important population into two or more populations

The Grey-headed Flying-fox is particularly well adapted to accessing widely spaced habitat resources given its mobility and preference for seasonal fruits and blossom in differing parts of the landscape. The development would not fragment an important population of the Grey-headed Flying-fox. Individuals would still be able to disperse between roosts along the east Australian coast.

4) adversely affect habitat critical to the survival of a species

The draft recovery plan for the Grey-headed Flying-fox identifies critical habitat for this species as:

- Productive during winter and spring, when food bottlenecks have been identified
- Known to support populations of greater than 30,000 individuals, within an area of 50-kilometre radius of a camp site
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (Sept-May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes
- Known to be continuously occupied as a camp site.

Critical roosting habitat is present in the Parramatta Park camp. Two other intermittently used camps are close by; Wetherill Hill and Ropes Creek. However, there would be no direct impacts to these camps as the development is located at a sufficient distance and would not even result in disturbance to these camps. The foraging habitat to be impacted is a small area of poor and moderate condition woodland vegetation and does not constitute critical foraging habitat given the relative widespread nature of similar, and higher quality, vegetation in the locality and abundance of higher quality foraging habitat within the feeding range of regional

populations. As such, the development is not expected to adversely affect foraging habitat critical to the survival of this species.

5) disrupt the breeding cycle of an important population

Critical roosting and breeding habitat is present in the Parramatta Park camp. However, there would be no direct impacts to the camp. There would be a negligible impact on foraging habitat that may be used during the breeding cycle of the species but a disruption to the breeding cycle of the Grey-headed Flying-fox is not likely.

6) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Grey-headed Flying-fox can cover large areas of its range seeking suitable flowering eucalypts and fruits for foraging. The species is likely to utilise vegetation at the development site for foraging when the trees are in flower. The impact to foraging habitat from the development would be negligible and the development is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of 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 development is unlikely to result in an invasive species harmful to the Grey-headed Flying-fox becoming established in the habitat. Weeds are already well established in the habitat. Invasive species would be managed under the Construction Environmental Management Plan using best practice methods.

8) introduce disease that may cause the species to decline, or

There are no known disease issues affecting this species in relation to the development. The development would be unlikely to increase the potential for significant disease vectors to affect local populations.

9) interfere substantially with the recovery of the species.

The Draft National Recovery Plan for the Grey-headed Flying-fox (*Pteropus poliocephalus*) outlines the following actions:

- Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes across their range
- Enhance winter and spring foraging habitat for Grey-headed Flying-foxes
- Identify, protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes
- Significantly reduce levels of deliberate Grey-headed Flying-fox destruction associated with commercial horticulture
- Provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps
- Produce and circulate educational resources to improve public attitudes toward Grey-headed Flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions
- Monitor population trends for the Grey-headed Flying-fox
- Assess the impacts on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts
- Oversee a program of research to improve knowledge of the demographics and population structure of the Grey-headed Flying-fox
- Maintain a National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.

The recovery actions listed above are largely not applicable to the development. The development is not expected to interfere substantially with the recovery of the species.

Conclusion

The Grey-headed Flying-fox would suffer a negligible reduction in extent of suitable foraging habitat from the development site. No breeding camps or other important habitat would be directly impacted. This impact is unlikely to reduce the population size of the Grey-headed Flying-fox or decrease the reproductive success of this species. The development would not interfere with the recovery of the Grey-headed Flying-fox.

After consideration of the factors above, an overall conclusion has been made that the development is unlikely to result in a significant impact to the Grey-headed Flying-fox and a referral for biodiversity matters is not necessary.

Swift Parrot and Regent Honeyeater

The Swift Parrot (*Lathamus discolor*) and Regent Honeyeater (*Anthochaera phrygia*) are considered moderately likely to occur based on the presence of suitable foraging habitat, particularly winter flowering species *Eucalyptus tereticornis*. These species are known to sporadically occur within and move through the Sydney region, particularly the Swift Parrot while on mainland Australia during winter. Both species are considered likely to only occur intermittently and the likelihood of birds using the trees within the development site as a continual source of habitat is low.

The Swift Parrot occurs as a single, migratory population. It is thought that the Regent Honeyeater also comprises a single Australian population.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it would:

1) lead to a long-term decrease in the size of a population

The development site contains potential foraging habitat for the Swift Parrot and Regent Honeyeater in the form of scattered poor condition woodland and one moderate condition woodland patch. While the habitat at the development site is not optimal, the loss of potential feed trees would directly affect the opportunity for these species to feed in the area. However, the development site is not considered a critical area for the Swift Parrot or Regent Honeyeater.

These species may utilise trees at the development site for foraging intermittently when no other suitable inland (i.e. box ironbark woodlands) or coastal resources (i.e. Spotted Gum and Swamp Mahogany forests) are available or opportunistically while moving through the Sydney region. The development would remove a small amount of potential foraging habitat for these species, but the impact would be negligible considering that no high quality natural foraging habitat would be impacted and the extent of resources in the adjacent environment that would remain (i.e. Eastern Creek riparian corridor and Prospect Reservoir woodland).

The Swift Parrot does not breed at the development site. The Regent Honeyeater does not breed in the Sydney urban area. There are only four known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. The extent of habitat remaining at the development site would provide sufficient foraging resources to sustain future visitation, such that the development is unlikely to lead to a long-term decrease in the size of the Swift Parrot population or the Regent Honeyeater population.

2) reduce the area of occupancy of the species

As specialist nectarivores dependent on flowering eucalypts, Swift Parrot and Regent Honeyeaters are vulnerable to the loss of quantity and quality of key forage tree species. As a large-scale migrant, the Swift Parrot has the ability to cover vast areas of its winter range, seeking suitable flowering eucalypt habitat. Similarly, the Regent

Honeyeater is known to travel large distances around south-eastern Australia in search of large flowering events. These species are an occasional visitor to the Sydney region and may utilise trees at the development site for foraging intermittently when no other suitable resources are available.

The development would contribute to the loss of a small amount of marginal potential foraging habitat which would result in a negligible reduction in foraging habitat available. However, it would not reduce the area of occupancy of the Swift Parrot which is estimated at 4,000 square kilometres or the Regent Honeyeater, which is estimated at 300 square kilometres.

3) fragment an existing population into two or more populations

Importantly, the development would not result in fragmentation of habitat for the Swift Parrot. These species are highly mobile and as a regular behaviour fly long distances over open areas to move between suitable foraging habitats. The development would not affect the movement of the Swift Parrot or Regent Honeyeater between habitat patches or fragment the populations.

4) adversely affect habitat critical to the survival of a species

Habitat critical to the survival of the Swift Parrot includes; those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot. Key habitats for the Swift Parrot on the coast and coastal plains of New South Wales include large stands of Spotted Gum (*Corymbia maculata*), Swamp Mahogany (*Eucalyptus robusta*), Red Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*) forests.

Habitat critical to the survival of the Regent Honeyeater includes:

- Any breeding or foraging habitat in areas where the species is likely to occur (as defined by the distribution map provided in Figure 2 of the National Recovery Plan – this includes the Sydney Region); and
- Any newly discovered breeding or foraging locations.

The development site is dominated by *Eucalyptus tereticornis* (Forest Red Gum) constituting suitable foraging habitat for these species. The development site is within an area where the Regent Honeyeater is likely to occur, therefore the foraging habitat that would be impacted is considered to be critical to survival. The habitat at the development site is not primary habitat and unlikely to be of critical importance to the survival of these species as it consists of a small area of young trees in between two larger contiguous patches of woodland. The habitats are likely to only be visited on rare occasion by birds passing through on route to larger higher quality habitats on the coast and inland. The development is unlikely to adversely affect habitat critical to the survival of the Swift Parrot and Regent Honeyeater.

5) disrupt the breeding cycle of a population

The Swift Parrot is endemic to south-eastern Australia and breeds only in Tasmania. This species migrates to mainland Australia in autumn. As such, the development would not impact on breeding habitat for this species. Important winter foraging grounds would not be impacted so there would be negligible impact on the life cycle of the Swift Parrot.

There are only four known key breeding regions remaining for the Regent Honeyeater: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley, Hunter Valley and the Bundarra-Barraba region. It is likely that this species also breeds in other locations, breeding mostly corresponds with the flowering of key eucalypt and mistletoe species. Nests are usually placed in the canopy of mature trees with rough bark, e.g. ironbarks, sheoaks (*Casuarina*) and rough-barked Apple (*Angophora*). As such it is unlikely that the development site would constitute breeding habitat for this species. Additionally, the trees that would be impacted are mostly young and unlikely to experience a large flowering event that is going to support nearby breeding birds. As such, the development would not impact on breeding habitat for the Regent Honeyeater.

6) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

As a large-scale migrant (Swift Parrot) and a 'rich-patch nomad' (Regent Honeyeater), these species can cover vast areas of their winter range, seeking suitable flowering eucalypt habitat. These species are an occasional visitor to the region and may utilise trees at the development site for foraging intermittently when no other suitable resources are available. The impact to foraging habitat from the development would be negligible and the development is unlikely to modify, destroy, remove, isolate or decrease the availability or quality of 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 main invasive species harmful to the habitat for the Swift Parrot and Regent Honeyeater in NSW is weeds. Additionally, Noisy Miners and Bell Miners may make the habitat less suitable for these species due to competitive exclusion. The development may result in weed invasion and the removal of habitat may increase competition for food resources, but this impact is considered to be negligible given the context of the habitat in the immediate vicinity of the development site (i.e. Eastern Creek riparian corridor and Prospect Reservoir woodland) and the locality. Consequently, it is unlikely to result in any further invasive species becoming established in the habitat.

8) introduce disease that may cause the species to decline, or

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. It is the intention to use current best practice hygiene protocols as part of a Construction Environmental Management Plan to prevent the introduction or spread of pathogens. Management and mitigation measures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

9) interfere with the recovery of the species.

The *National Recovery Plan for the Swift Parrot* (Commonwealth of Australia 2011) identifies the following actions for recovery of this species:

- Identify the extent and quality of habitat
- Manage and protect Swift Parrot habitat at the landscape scale
- Monitor and manage the impact of collisions, competition and disease
- Monitor population and habitat.

The *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)* (Commonwealth of Australia 2011) identifies four strategies for recovery of this species:

- Improve the extent and quality of regent honeyeater habitat.
- Bolster the wild population with captive-bred birds until the wild population becomes self-sustaining.
- Increase understanding of the size, structure, trajectory and viability of the wild population.
- Maintain and increase community awareness, understanding and involvement in the recovery program.

The recovery actions listed above to help recover the Swift Parrot and Regent Honeyeater are largely not applicable to the development. The removal of suitable foraging habitat conflicts with the first strategy of the Regent Honeyeater Recovery Plan, though this impact is not considered likely to interfere with the recovery of this species. The development would not interfere with the recovery of the Swift Parrot.

Conclusion

There would be a small reduction in extent of foraging habitat for the Swift Parrot and Regent Honeyeater at the development site. The development would not separate large blocks of habitat or restrict movement patterns of these species. There would be no impact to breeding habitat for either of these species. It is unlikely to reduce the size of the Swift Parrot population or the Regent Honeyeater population or decrease the reproductive success of these species. The development is unlikely to interfere with the recovery of the Swift Parrot or Regent Honeyeater. After consideration of the factors above, an overall conclusion has been made that the development is unlikely to result in a significant impact to the Swift Parrot or Regent Honeyeater and a referral is not required.

Appendix E. Biodiversity credit report



BAM Credit Summary Report

Proposal Details

Assessment Id	00020140/BAAS19068/20/00020141	Proposal Name	Sydney International Speedway	BAM data last updated *	18/06/2020
Assessor Name		Report Created	23/07/2020	BAM Data version *	29
Assessor Number		BAM Case Status	Open	Date Finalised	To be finalised
Assessment Revision	0	Assessment Type	Major Projects		

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
Cumberland shale hills woodland								
3	850_Poor	15.2	0.3	0.25	High Sensitivity to Potential Gain	2.50	TRUE	3
4	850_Revegetation	23.9	0.2	0.25	High Sensitivity to Potential Gain	2.50	TRUE	2
							Subtotal	5

BAM Credit Summary Report

Cumberland shale plains woodland					
1	849_Moderate	18.7	0.1	0.25 High Sensitivity to Potential Gain	2.50 TRUE
2	849_Poor	11.3	0.1	0.25 High Sensitivity to Potential Gain	2.50 TRUE
Subtotal					1
Total					6

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAI	Species credits
<i>Myotis macropus / Southern Myotis (Fauna)</i>						
850_Revegetation	23.9	0.01	0.25	2	False	0
849_Poor	11.3	0.07	0.25	2	False	0
					Subtotal	0

Appendix F. Protected Matters Search Tool Report



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 05/03/20 10:10:58

[Summary](#)

[Details](#)

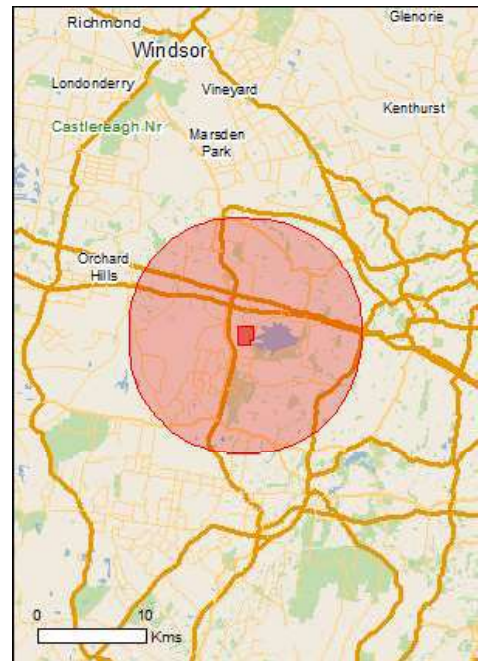
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

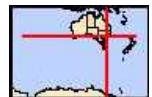
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	44
Listed Migratory Species:	16

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	14
Commonwealth Heritage Places:	None
Listed Marine Species:	22
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	50
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [\[Resource Information \]](#)

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community likely to occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Fish		
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria raniformis Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat may occur within area
Insects		
Synemon plana Golden Sun Moth [25234]	Critically Endangered	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Acacia pubescens Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat known to occur within area
Allocasuarina glareicola [21932]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Asterolasia elegans [56780]	Endangered	Species or species habitat may occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area
Darwinia biflora [14619]	Vulnerable	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat may occur within area
Micromyrtus minutiflora [11485]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat known to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat known to occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat known to occur within area
Pomaderris brunnea Rufous Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat likely to occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat known to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species

Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
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Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
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Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
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Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
--	--	--

Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
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Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
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Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
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Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
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Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
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Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
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Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
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Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
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Name	Threatened	Type of Presence
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Commonwealth Scientific & Industrial Research Organisation
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Deputy Director of War Service Homes
Commonwealth Land - Director of Defence Service Homes
Commonwealth Land - Director of War Service Homes
Commonwealth Land - Telstra Corporation Limited
Defence - BLACKTOWN TRAINING DEPOT
Defence - HMAS NIRIMBA

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Kemps Creek	NSW
Prospect	NSW

Invasive Species	[Resource Information]
<p>Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.</p>	

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species

Name	Status	Type of Presence
Streptopelia chinensis Spotted Turtle-Dove [780]		habitat likely to occur within area Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171] Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.812283 150.859574,-33.812212 150.859488,-33.812711 150.872706,-33.821981 150.872363,-33.821981 150.870303,-33.825119 150.870217,-33.825119 150.859746,-33.812283 150.859574

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- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
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- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
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- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.