ARTC

CABRAMATTA LOOP PROJECT

TECHNICAL REPORT

TECHNICAL REPORT 4 —
BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

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Australian Rail Track Corporation

Cabramatta Loop Project
Environmental Impact Statement
Technical Report 4 – Biodiversity Development Assessment Report

August 2019

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Glossary and abbreviations

Term	Definition
AOBV	Areas of Outstanding Biodiversity Value
BC Act	*Biodiversity Conservation Act 2016*
BCT	Biodiversity Conservation Trust
BCTF	A fund established under the BC Act that receives monies from the purchase of biodiversity credits and that provides for payments to landowners to carry out the management actions required each year on a stewardship site.
BDAR	Biodiversity Development Assessment Report
Biodiversity Assessment Method (BAM)	The rules for biodiversity assessment established under the BC Act that determine credits created, credits required and the circumstances that improve or maintain biodiversity values.
Biodiversity credit	A unit of biodiversity value to measure specific development impacts or conservation gains in accordance with the BAM. Includes ecosystem credits and species credits.
Biodiversity credit report	Specifies the number and type of biodiversity credits: required to offset the impacts of a development to obtain a Biodiversity Certification Agreement; or that would be generated through conservation and management of a Stewardship site under a Biodiversity Stewardship site agreement.
Biodiversity offsets	Specific measures that are put in place to compensate for impacts on biodiversity values.
Biodiversity values	The composition, structure and function of ecosystems, including threatened species, populations and ecological communities, and their habitats.
BOS	Biodiversity Offset Scheme
Candidate threatened species	A species credit entity that could potentially be present at a site, based on the PCTs and habitat resources present at that site, and that requires targeted survey in order to confirm or discount its presence at the site in accordance with the BAM
CEEC	Critically endangered ecological community
CEMP	Construction Environmental Management Plan
DEE	Department of the Environment and Energy
DPI	Department of Primary Industries
Ecosystem credit	A credit that relates to a vegetation type and the threatened species that are reliably predicted by that vegetation type (as a habitat surrogate).
EEC	Endangered ecological community
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
Exotic species	A species of plant or animal that does not naturally occur in Australia
FFMP	Flora and Fauna Management Plan
High threat exotic species	A species of plant that does not naturally occur in Australia and that has been identified by OEH as being a particular threat to biodiversity values
IBRA	Interim Biogeographic Regionalisation for Australia
Indigenous native species	A species of plant or animal that naturally occurs in the study area (see also 'native species')
LEP	Local Environment Plan
LGA	Local Government Area
Locality	The area within a 10 km radius of the project site.

Term	Definition
Migratory species	Species listed under international agreements (i.e Ramsar, JAMBA and CAMBA conventions) to which Australia is a party
MNES	Matters of National Environmental Significance
Native species	A species of plant or animal that naturally occurs in Australia (see also 'indigenous native species')
OEH	Office of Environment and Heritage
PCT	Plant community type
PMST	'Protected Matters Search Tool', an online tool used to identity matters protected under the EPBC Act that are known or predicted to occur in a given search area.
Predicted threatened species	A threatened species that is associated with the ecosystem credits at a site, based on the PCTs and habitat resources present at that site
Prescribed impacts	Impacts on biodiversity values that are not directly related to the removal of native vegetation but which require consideration in accordance with section 9.2 of the BAM. Examples include 'Impacts on habitat of threatened species or ecological communities associated with human made structures' and 'Impacts on habitat associated with areas of non-native vegetation'
Project	The construction and operation of the Cabramatta Loop.
Project site	Refers to the area that would be directly disturbed by construction of the project (for example, as a result of ground disturbance and the construction of foundations for structures). It includes the location of construction activities, compounds and work sites, and the location of permanent operational infrastructure.
SAII	Serious and irreversible impacts
SAII entity	Species and ecological communities that are likely to be the subject of serious and irreversible impacts (SAIIs)
SEPP	State Environment Planning Policy
Species credit	A credit that relates to an individual threatened species that cannot be reliably predicted based on habitat surrogates. Threatened species that require species credits are identified in the Threatened Biodiversity Data Collection
Species credit entitiy	A threatened species or component of threatened species habitat that is identified in the Threatened Biodiversity Data Collection as requiring calculation of species credits
Study area	The area that was subject to a detailed site survey and assessed for direct or indirect impacts arising from construction and operation of the project.
Project site	The area that would be directly impacted by construction and operation of the project.
TEC	Threatened ecological community
Threatened biota	Threatened species, populations or ecological communities listed under the BC Act, FM Act and/or the EPBC Act.

Executive Summary

Australian Rail Track Corporation (ARTC) proposes to construct and operate a passing loop for trains on the Southern Sydney Freight Line (SSFL) between Sydney Trains' Cabramatta and Warwick Farm stations. The Cabramatta Loop Project ("the project") would allow freight trains to pass and provide additional rail freight capacity along the SSFL.

The project is State significant infrastructure in accordance with Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As State significant infrastructure, the project needs approval from the NSW Minister for Planning.

This Biodiversity Development Assessment Report (BDAR) has been prepared to accompany the environmental impact statement (EIS) to support the application for approval of the project, and address the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs), issued on 17 May 2018. The BDAR has been prepared in accordance with the Biodiversity Assessment Method (BAM) to describe the biodiversity values present at the project site and surrounding study area, outline the approach to avoiding or minimising impacts, assess residual impacts of the project and determine the need or otherwise for biodiversity offsets.

This assessment considers the biodiversity values of the study area with a particular focus on threatened biota listed under the *Biodiversity Conservation Act 2016* and protected matters listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). This BDAR was prepared by an accredited BAM assessor in accordance with the BAM, based on desktop assessments and field surveys completed by GHD ecologists. The objectives of this BDAR are to:

- outline the methods used in the biodiversity assessment
- describe the landscape features that relate to the assessment, including the physical environment and regional context of the project site
- describe the biophysical environment of the project site, including extent of native vegetation, type and condition of Plant Community Types (PCTs), flora and fauna species and terrestrial and aquatic habitats
- describe the conservation significance of the project site in terms of threatened biota and their habitats that are known or predicted to occur
- provide a description of the project, including potential impacts on biodiversity values
- identify measures undertaken to avoid and minimise impacts on biodiversity values
- present the data used to perform the BAM assessment and credit calculations for the project
- identify the need or otherwise to provide biodiversity offsets for residual impacts of the project
- briefly discuss options to deliver the required quantum of biodiversity offset for the project.

The majority of the project site is located within the existing rail corridor, which has been cleared and substantially modified through earthworks and construction. The project's impacts are therefore substantially less than would be associated with an undisturbed 'green field' site.

The Cabramatta Creek Grey-headed Flying-fox (*Pteropus poliocephalus*) roost camp is located around 350 metres to the east of the project site and was identified as requiring specific consideration in the project SEARs with a particular focus on potential effects of noise and

lighting. The Grey-headed Flying-fox is listed as a vulnerable species under the EPBC Act and the BC Act.

Cumberland River-flat Forest in the riparian corridor of Cabramatta Creek comprises a local occurrence of 'River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' (River-Flat Eucalypt Forest) which is listed as an endangered ecological community under the BC Act and the subject of a preliminary listing as a critically endangered ecological community under the EPBC. There is no River-Flat Eucalypt Forest within the project site. The project design, construction compounds, work sites and construction access routes have been purposefully selected and designed to avoid impacts to this threatened ecological community.

A population of the threatened plant Downy Wattle (*Acacia pubescens*) was recorded in the study area. *Acacia pubescens* is listed as a vulnerable species under the BC and EPBC Acts. The population in the study area comprises a single stem in slashed open space in the rail corridor just north of Warwick Farm station; and a patch of six individuals in an area of exotic grassland on the outside edge of the rail corridor, south of Warwick Farm station.

The project has been purposefully designed to avoid or reduce impacts on biodiversity values as far as is practicable. Specific mitigation measures are recommended to minimise impacts on the natural environment and threatened biota, including:

- exclusion of native vegetation and a population of the threatened plant *Acacia pubescens* from the project site
- erosion and sediment control measures to avoid indirect impacts on native vegetation and aquatic habitats
- restriction of access into adjacent remnant vegetation during construction and machinery hygiene protocols, washing of vehicles and erection of appropriate barriers to reduce the risk of transmission of weeds, contaminants or pathogens
- management of environmental weeds
- clearing surveys and fauna management during vegetation clearing activities.

Despite measures taken to avoid and mitigate impacts, the project would result in some unavoidable residual adverse impacts imposed upon some elements of the natural environment, including removal of a single hollow-bearing tree, other native plants and habitat resources, and imposition of edge effects on adjoining areas of native vegetation. These residual impacts are small in extent and magnitude and would comprise a minor reduction in biodiversity values in the study area.

The project would remove a very small proportion of available habitat resources for local populations of native fauna. Impacts would include the removal of 0.5 hectares of foraging habitat for mobile threatened fauna species, including the Grey-headed Flying-fox, birds and microbats. The site is unlikely to contain any important breeding, roosting or nesting habitat for native fauna. No, wetlands, permanent aquatic habitat, rock outcrops, woody debris or any other important habitat resources would be removed.

The impact and offset assessment has been completed in accordance with the BAM and concluded that the project would only result in 'impacts not requiring offset', comprising clearing of non-native vegetation and construction within previously cleared land. Impacts on biodiversity values have been avoided or minimised to the extent that no biodiversity offsets are required. A specific assessment of potential direct or indirect impacts on the Cabramatta Creek Grey-headed Flying-fox roost camp has concluded that the project would have a minor effect on this roost camp.

The desktop assessment, field surveys and habitat assessments undertaken for this biodiversity assessment report have been used to identify MNES listed under the EPBC Act that may be affected by the project, through either direct or indirect impacts. The project would result in the removal of a small area of foraging habitat (0.5 hectares of planted native species) for the Grey-headed Flying-fox and construction within around 500 metres of a roost camp. An assessment of significance of impacts on the Grey-headed Flying-fox has been prepared based on the consideration of the criteria contained in the EPBC Act *assessment of significance guidelines 1.1* (DoE, 2013).

The outcome of this assessment is that the project is unlikely to have a significant impact on the Grey-headed Flying-fox or on any other MNES. Given the minor magnitude of impacts, further assessment or approval under the EPBC Act is highly unlikely to be required and a referral is not recommended. The project would not result in any significant impacts on any threatened biota or migratory species listed under the EPBC Act and so there is no requirement for biodiversity offsets under the EPBC Act and associated policy (DSEWPaC, 2012).

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1. Introduction

1.1 Overview

Australian Rail Track Corporation (ARTC) proposes to construct and operate a passing loop for up to 1,300 metre length trains on the Southern Sydney Freight Line (SSFL) between Sydney Trains' Cabramatta and Warwick Farm stations. The Cabramatta Loop Project ("the project") would allow freight trains to pass and provide additional rail freight capacity along the SSFL.

The project is State significant infrastructure in accordance with Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As State significant infrastructure, the project needs approval from the NSW Minister for Planning and Public Spaces.

This report has been prepared to accompany the environmental impact statement (EIS) to support the application for approval of the project, and address the environmental assessment requirements of the Secretary of the Department of Planning and Environment (the SEARs), issued on 17 May 2018.

1.2 The project

1.2.1 Location

The project is generally located within the existing rail corridor between the Hume Highway and Cabramatta Road East road overbridges in the suburbs of Warwick Farm and Cabramatta. In addition, the project includes works to Broomfield Street adjacent to the rail corridor in Cabramatta.

The rail corridor is owned by the NSW Government (RailCorp) and leased to ARTC.

The location of the project is shown in Figure 1.1.

1.2.2 Key features

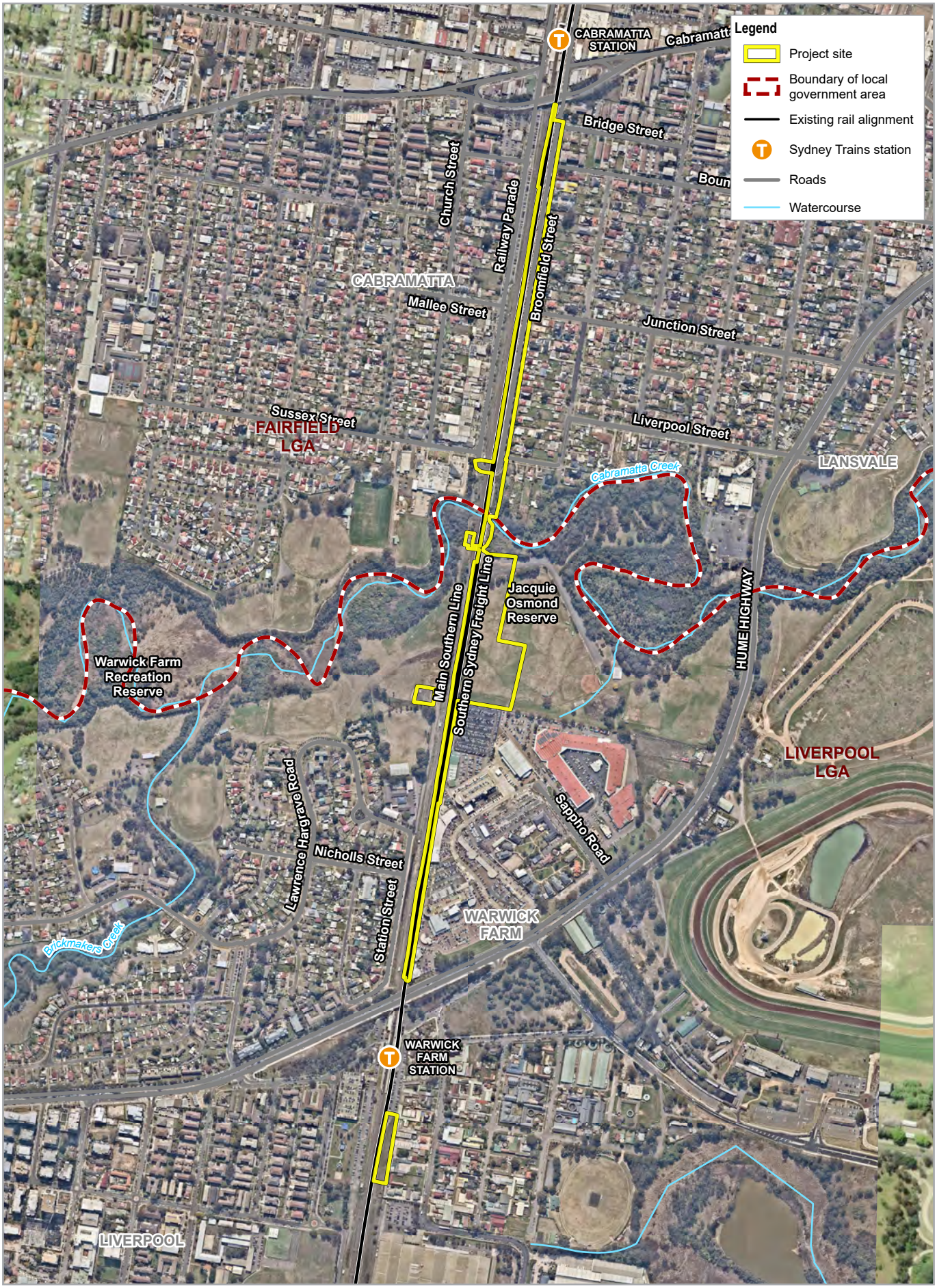
The key features of the project include:

- New rail track – providing a 1.65 kilometre long section of new track with connections to the existing track at the northern and southern ends
- Track realignment – moving about 550 metres of existing track sideways (slewing) to make room for the new track
- Bridge works – constructing two new bridge structures adjacent to the existing rail bridges over Sussex Street and Cabramatta Creek
- Road works – reconfiguring Broomfield Street for a distance of about 680 metres between Sussex and Bridge streets.

Ancillary work would include communication upgrades, works to existing retaining and noise walls, drainage work and protecting/relocating utilities. In addition, minor works in the form of new signalling would be installed at a number of locations within the rail corridor (indicative locations provided in the EIS).

The key features of the project are shown in Figure 1.2.

Further information on the project is provided in the EIS.



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Kilometres

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Cabramatta Rail Loop
Biodiversity Assessment Report

Project No. **22-19800**
Revision No. **0**
Date **17/04/2019**

Site map

FIGURE 1.1

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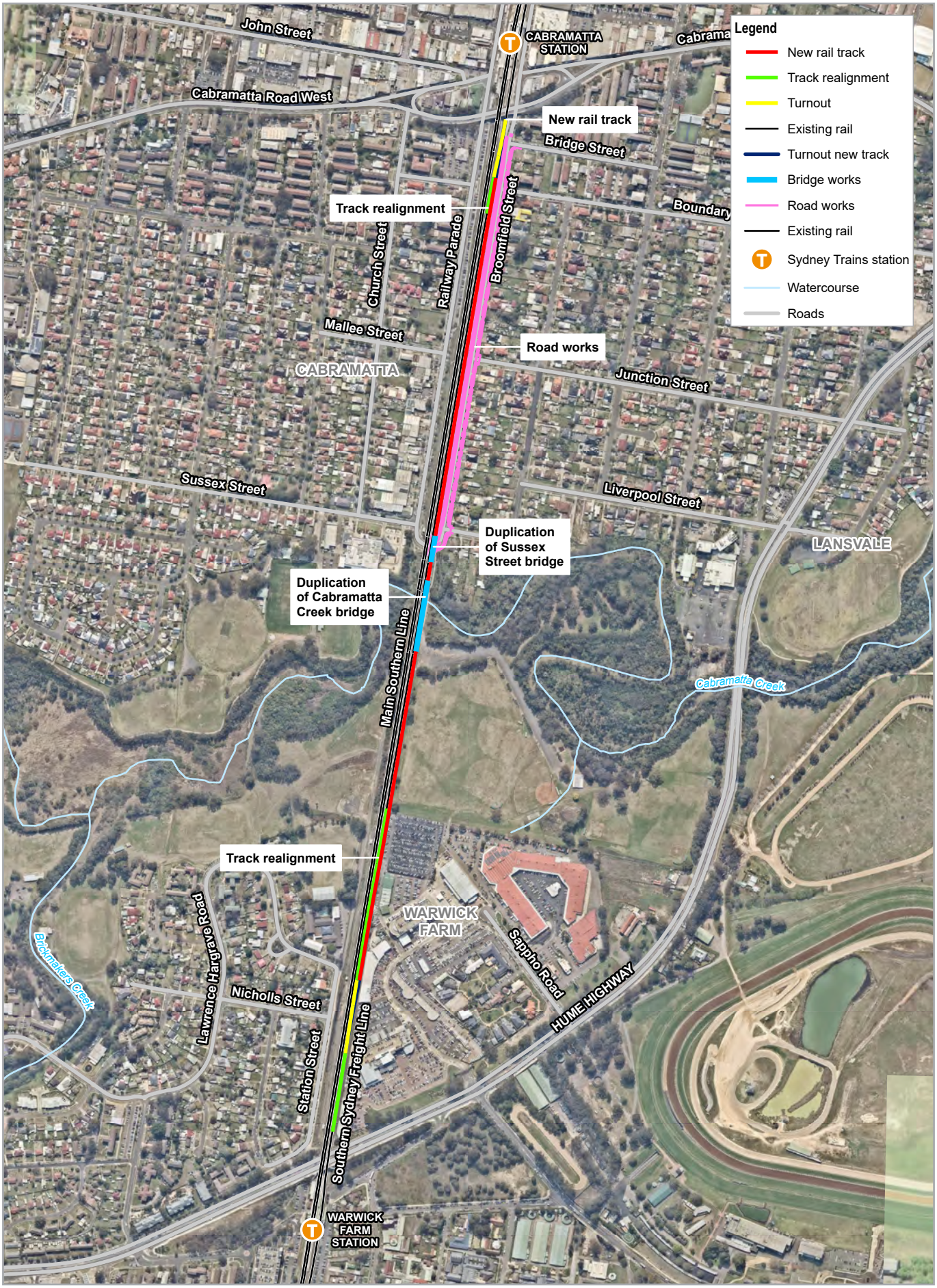
Print date: 17 Apr 2019 - 15:17

Data source: NearMap: Imagery, 2018. LPI:DCDB/DTDB, 2017LPI_Imagery_Best: © Department of Finance, Services & Innovation 2017 Created by: tmorton



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Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: Australian 1966
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Date **17/04/2019**

Key features

FIGURE 1.2

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Data source: NearMap: Imagery, 2018. LPI:DCDB/DTDB, 2017LPI_Imagery_Best: © Department of Finance, Services & Innovation 2017 Created by: tmorton

1.2.1 Timing

Subject to approval of the project, construction is planned to start in early 2021, and is expected to take about two years. Construction is expected to be completed in early 2023.

It is anticipated that some features of the project would be constructed while the existing rail line continues to operate. Other features of the project would need to be constructed during programmed weekend rail possession periods when rail services along the line cease to operate. Possession periods typically occur for 48 hours four times per year.

1.2.2 Operation

The project would operate as part of the SSFL and would continue to be managed by ARTC. ARTC is not responsible for the operation of rolling stock. Train services are currently, and would continue to be, provided by a variety of operators.

Following the completion of works, the existing functionality of Broomfield Street would be restored, with one travel lane in each direction, kerb-side parking on both sides and a shared path on the western side of the street.

1.3 Purpose and scope of this report

The purpose of this BDAR is to assess the potential biodiversity impacts from the operation and construction of the proposal. This BDAR considers the biodiversity values of the study area with a particular focus on threatened biota listed under the *Biodiversity Conservation Act 2016* and protected matters listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). This biodiversity assessment addresses the relevant SEARs for the EIS, and the requirements of OEH as outlined in Table 1.2.

This BDAR has been prepared to assess the impacts of the project on threatened biota and their habitats in accordance with the BAM. The objectives of this BDAR are to:

- outline the methods used in the biodiversity assessment
- describe the landscape features that relate to the assessment, including the physical environment and regional context of the project site
- describe the biophysical environment of the project site, including extent of native vegetation, type and condition of Plant Community Types (PCTs), flora and fauna species and terrestrial and aquatic habitats
- describe the conservation significance of the project site in terms of threatened biota and their habitats that are known or predicted to occur
- provide a description of the project, including potential impacts on biodiversity values
- identify measures undertaken to avoid and minimise impacts on biodiversity values
- present the data used to perform the BAM assessment and credit calculations for the project
- identify the need or otherwise to provide biodiversity offsets for residual impacts of the project
- briefly discuss options to deliver the required quantum of biodiversity offset for the project.

The works associated with this BDAR enable the achievement of Level 1 of the credit Eco-1 Ecological Assessment and Risk Management of the Infrastructure Sustainability Rating Scheme v2.0, to facilitate no net loss of biodiversity value.

The following terms are used in this BDAR:

- The ‘project’ refers to the construction and operation of the Cabramatta Loop.
- The ‘project site’ refers to the area that would be directly affected by construction. It includes the location of operational project infrastructure, the area that would be directly disturbed by the movement of construction plant and machinery, and the location of the storage areas/compounds etc that would be used to construct that infrastructure.
- The ‘study area’ refers to the wider area including and surrounding the project site, with the potential to be directly or indirectly affected by the project (eg by noise and vibration, visual or traffic impacts) and that was the subject of the field surveys conducted for this BDAR.
- The ‘locality’ refers to the area within a 10 km radius of the project site.

1.4 Legislative and policy context

1.4.1 Biodiversity Offsets Scheme and Biodiversity Assessment Methodology

The BC Act, together with the *Biodiversity Conservation Regulations 2017*, provides a mechanism to address impacts on biodiversity from land clearing associated with development. Under this legislation, there are provisions for a Biodiversity Offsets Scheme (BOS), which includes a framework to avoid, minimise and offset impacts of development on biodiversity.

The aim of the BOS is to provide a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting. It also allows for the establishment of biodiversity stewardship agreements, which are in-perpetuity agreements entered into by landholders, to secure offset sites and generate biodiversity credits, which can be used to offset impacts of development. The aim of the BOS is to ensure that the impacts of development, clearing or biodiversity certification will result in no net loss of biodiversity.

The Biodiversity Assessment Method (BAM) was established by the New South Wales (NSW) Office of Environment and Heritage (OEH) as a standard method to implement the aims of the BOS and to address the loss of biodiversity and threatened species. The scheme creates a market framework for the conservation of biodiversity values and the offsetting of development impacts. It also provides the mechanisms to offset impacts of development, clearing or biodiversity certification such that there is no loss of biodiversity values.

The BAM sets out how biodiversity values will be assessed, proscribes requirements to avoid and minimise impacts, establishes rules for calculating the number and class of credits required for unavoidable impacts, and determines the trading rules that will apply. The methodology includes a software package known as the Biodiversity Assessment Method Calculator (the credit calculator) which processes site survey and assessment data. The credit calculator specifies the type and extent of surveys required for a biodiversity assessment and then processes survey data to calculate the number and type of biodiversity credits that are either required at a development site or will be generated at a biodiversity stewardship site. The BAM must be applied by a person accredited under the BC Act.

The Biodiversity Conservation Trust Fund (BCTF) ensures that landowners have the funds needed to carry out the management actions required each year on a stewardship site and provides a financial incentive to landowners to carry out those actions. The scheme is administered by the BCT and ensures accountability and compliance through legislation, regular reporting requirements and financial measures.

The BAM will be used to assess the impacts of this project and the biodiversity offset requirement because the project is a state significant infrastructure project.

1.4.2 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements relating to biodiversity are presented in Table 1.1 along with a summary of where these requirements are addressed in this BDAR. Additional environmental assessment requirements related to biodiversity that were recommended by OEH in their letter to the Secretary are presented in Table 1.2.

Table 1.1 SEARs relevant to this assessment - biodiversity

Requirements	Where addressed in this report
3 (2) Assessment of key issues	
For each key issue the Proponent must: a) describe the biophysical and socio-economic environment, as far as it is relevant to that issue;	Section 3 and Section 4
b) describe the legislative and policy context, as far as it is relevant to the issue;	Section 1.4
c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts;	Section 6
d) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	Section 6.2
e) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant); and	Section 6.2
f) detail how any residual impacts will be managed or offset, and the approach and effectiveness of these measures.	Section 6.4 and Section 7
1. Where multiple reasonable and feasible options to avoid or minimise impacts are available, they must be identified and considered and the proposed measure justified taking into account the public interest.	Section 6.2
5. Biodiversity	
1. The proponent must assess biodiversity impacts in accordance with the current guidelines including the Biodiversity Assessment Method (BAM), and documented in a Biodiversity Development Assessment Report (BDAR).	This BDAR

Requirements	Where addressed in this report
2. The BDAR must include details of the measures proposed to address the offset obligation as follows: a) the total number and classes of biodiversity credits required to be retired for the development/project; b) the number and classes of like-for-like biodiversity credits proposed to be retired; c) the number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; d) any proposal to fund a biodiversity conservation action; and e) any proposal to make a payment to the Biodiversity Conservation Fund	No biodiversity offsets are required for the project (see section 7).
3. The Proponent must assess any impacts on biodiversity values not covered by the BAM as specified in s2.3.	The project would not result in any impacts on biodiversity values not covered by the BAM (i.e. marine mammals; wandering sea birds; Lord Howe Island biodiversity; and category 1 – exempt land). None of these matters are relevant to this BDAR.
4. The Proponent must assess impacts on the following … and provide the information specified in s8, s9 and s10 of the BAM, specifically the Grey Headed Flying Fox colony located in the Jacquie Osmond Reserve.	Section 6.7
5. The Proponent must identify whether the project as a whole, or any component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the *Biodiversity Conservation Act 2016* (NSW) (BC Act), *Fisheries Management Act 1994* (FM Act) and *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).	KTPs of relevance to the assessment of the project are presented in section 6.5
6. Soils, Protected and Sensitive Lands	
6. The Proponent must assess the impacts of the project on environmentally sensitive land and processes (and the impact of processes on the project), including:	
a) Key Fish Habitat as mapped and defined in accordance with the Fisheries Management Act 1994 (FM Act);	Cabramatta Creek is mapped as Key Fish Habitat (see section 4.2.2). Potential impacts on aquatic habitats are discussed in section 5.4.

Table 1.2 OEH recommendations relevant to this assessment

Secretary's environmental assessment requirements	Where addressed
1. 1. Biodiversity impacts related to the proposed development are to be assessed in accordance with Section 7.9 of the Biodiversity Conservation Act 2016 using the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016* (s6.12), *Biodiversity Conservation Regulation 2017* (s6.8) and the Biodiversity Assessment Method.	A biodiversity survey has been completed and a BDAR prepared in accordance with the BAM.
2. The BDAR must document the application of the avoid, minimise and offset hierarchy including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method.	Section 5.4 Section 3 and Section 4
3. The BDAR must include details of the measures proposed to address the offset obligation as follows: a) the total number and classes of biodiversity credits required to be retired for the development/project; b) the number and classes of like-for-like biodiversity credits proposed to be retired; c) the number and classes of biodiversity credits proposed to be retired in accordance with the any proposal to fund a biodiversity conservation action d) any proposal to conduct ecological rehabilitation (if a mining project) e) any proposal to make a payment to the Biodiversity Conservation Fund f) if seeking variation rules; g) approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.	No biodiversity offsets are required for the project (see section 7).
4. The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 11 of the BAM.	The BDAR has been submitted with all digital spatial data.
5. 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 *Biodiversity Conservation Act 2016*.	See 2.8
6. Impacts on the following biodiversity not assessed by the Biodiversity Assessment Method will require consideration and assessment under a separate assessment: a) impacts on the Grey Headed Flying Fox colony that is located nearby in Jacquie Osmond Reserve including the impacts from the developments construction (including noise and light impacts).	Section 6.7

1.5 Structure of this report

The structure of the report is outlined below.

- Section 1 – provides an introduction to the report
- Section 2 – describes the methodology for the assessment, including the legislative and policy context for the assessment, and relevant guidelines
- Section 3 – describes the existing landscape features as relevant to the assessment
- Section 4 – describes the existing vegetation as relevant to the assessment
- Section 5 – outlines the conservation significance of the identified flora, fauna and ecological communities at the study area
- Section 6 – provides the impact assessment
- Section 7 – describes measures to avoid, minimise and offset biodiversity impacts of the project
- Section 8 – presents the conclusions of the assessment.

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2. Methodology

2.1 Methodology overview

The main components of the methodology for this BDAR include:

- Desktop assessment to describe the existing environment and landscape features of the study area and to identify the suite of threatened biota potentially affected by the project. Broader desktop assessment included consideration of cumulative impacts and climate change threats to species and communities.
- Stakeholder consultation to help identify sensitive biodiversity values in the study area and management practices or issues that could affect the assessment.
- Field survey in accordance with the BAM to describe the biodiversity values of the project site and surrounding study area and determine the likelihood of threatened biota and their habitats occurring in the study area or being affected by the project.
- Determination of reasonable actions to avoid and minimise impacts to biodiversity values and assessment of residual biodiversity impacts of the project.
- Completion of offset calculations using the BAM credit calculator if required to determine the ecosystem and species credits that would be required to offset these impacts.

2.2 Desktop assessment

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities (threatened biota) listed under the BC Act, FM Act, and EPBC Act, that could be expected to occur at the project site and to obtain the necessary data to perform BAM calculations.

Information sources used in the preparation of this report include:

- Office of Environment and Heritage (OEH) *NSW BioNet* (OEH 2018a) data, including *NSW Wildlife Atlas* database records and *Threatened Species Data Collection* profiles of threatened species listed under the BC Act.
- OEH *Threatened biodiversity profile search* online database for threatened ecological communities listed under the BC Act (OEH 2018b).
- Department of the Environment and Energy (DEE) *Protected Matters Online Search Tool* for Matters of National Environmental Significance (MNES) listed under the EPBC Act and predicted to occur in the locality (DEE 2018a).
- DEE online Species profiles and threats database (SPRAT) (DEE 2018b).
- NSW *BioNet Vegetation Classification* (OEH 2018c) to identify PCTs in the study area.
- Aerial photographs and satellite imagery of the study area.
- Available regional-scale vegetation mapping of the site (NPWS 2002a; b).
- OEH and Macquarie University *NSW Threatened Species & Communities* online search tool for climate change threats to species and communities by LGA.
- Macquarie University and National Climate Change Adaptation Research Facility (NCCARF) *Weed Futures* online search tool for invasive species habitat suitability under climate change.

The threatened biota and migratory species identified in the desktop assessment are presented in Appendix A. Following collation of database records and threatened species and community profiles, a list of threatened species requiring assessment was compiled according to the 'steps for identifying habitat suitability for threatened species' presented in section 6.4 of the BAM. This was further refined following field surveys and identification and assessment of habitat present within the project site. A likelihood of occurrence ranking was attributed to these biota based on this information and used to compile lists of 'predicted threatened species' (i.e. ecosystem credit species) and 'candidate threatened species' (i.e. species credit entities requiring targeted survey) according to Step 2 'assessment of habitat constraints' of section 6.4 of the BAM.

2.3 Stakeholder consultation

GHD developed a *Tactical Stakeholder Engagement Plan* (TSEP) which outlines the engagement process during the environmental assessment and reference design phases for the project. The TSEP has been developed to plan, implement and manage the engagement process through to project approval. The process adopted for stakeholder engagement seeks to address issues identified throughout the course of the project and to consider these issues in the development of the project.

The TSEP was developed based on current knowledge of the project and its adjacent environment, the activities planned for the design and environmental assessment stages of the project and the potential community and stakeholder concerns relating to this type of development. Identified stakeholder groups and potential concerns or areas of interest that were identified in the TSEP and which contributed to the development of this BDAR include:

- Fairfield City Council and Liverpool City Council with regards potential impacts to biodiversity values at Jacqui Osmond Reserve.
- The NSW Environment Protection Authority and OEH regarding potential impacts to biodiversity values at Jacqui Osmond Reserve.
- The Cabramatta Flying-fox Committee regarding potential impacts to the Cabramatta Creek flying-fox roost camp.
- Fairfield Creeks and Wetlands Group regarding potential impacts to biodiversity values at Jacqui Osmond Reseve as well as ongoing bush regeneration activities.

Potential impacts to the Cabramatta Creek flying-fox roost camp were identified as a key concern through the community and stakeholder consultation process as documented in the Social Impact Assessment for the project (GHD 2019a). This particular concern was considered in this BDAR through focussed desktop assessment and site inspection of the Cabramatta Creek flying-fox roost camp and specific assessment of potential impacts to the roost camp (see section 6.7 and Appendix C).

A Community and Stakeholder Engagement Plan will be developed for the construction and operational stages of the project and will continue under ARTC's Environmental Management System. Implementation of the plan will include consideration of opportunities to enhance ecological features and values in the study area, such as through revegetation of areas that are temporarily disturbed for construction of the project (see section 6.3.2).

2.4 Site survey

2.4.1 Survey effort and timing

Staged surveys of the study area were conducted with reference to the BAM and appropriate threatened species survey guidelines for targeted species. Site surveys included:

- initial site stratification and vegetation mapping
- sampling of vegetation integrity plot/transects
- habitat assessments
- opportunistic fauna surveys
- targeted surveys for threatened flora
- targeted surveys for threatened fauna
- rapid assessment of aquatic habitats.

Survey effort that has directly contributed to this BDAR is summarised in Table 2.1 and is described in detail below.

The study area for biodiversity surveys and the locations of particular survey techniques and sample points are shown on Figure 4.1. For the purpose of this assessment 'study area' is defined as the area that would be potentially subject to indirect impacts arising from the project and that was formally assessed in accordance with the BAM and in which comprehensive vegetation mapping and habitat assessments were completed. Some field survey techniques were employed outside of this study area, including call playback, spotlighting and diurnal bird surveys in order to sample better condition habitats to assist with detection of mobile fauna species that could occur in the study area from time to time. Fauna species detected by these techniques outside of the study area would also be likely to occur in similar habitats within the study area.

Table 2.1 Survey techniques and timing

Stage	Date	Survey Technique
Preliminary investigation of biodiversity values	12 October 2018	Vegetation mapping General flora area searches within the rail corridor Targeted threatened flora surveys Habitat assessment
BAM assessment survey, including targeted surveys for candidate threatened species	14-15 November 2018	Vegetation integrity plots Targeted threatened flora surveys Opportunistic fauna observations Habitat assessment Spotlighting Call Playback Nocturnal streamside searches Ultrasonic call (Anabat) recording Dawn bird surveys Habitat assessment Active searches for scats and other signs Systematic traverses targeting candidate threatened flora species

Stage	Date	Survey Technique
Supplementary site inspection	16 January 2019	Fine-scale mapping of native vegetation and biodiversity constraints in the vicinity of the project site Consultation with the project design team to help avoid impacts to biodiversity values Supplementary survey for Tall Knotweed (*Persicaria elatior*), specifically targeting wetland and aquatic habitat for this species in the project site

2.4.2 Vegetation mapping

Existing vegetation mapping of the site (NPWS, 2002a; b) was ground-truthed in the field via systematic walked transects across the project site. Necessary adjustments were made by hand on aerial photographs of the project site with reference to a handheld Global Positioning System (GPS) unit. Native vegetation was divided into vegetation map units which represented a distinct PCT or a broad vegetation type. PCTs were identified based on vegetation structure, species composition, soil type and landscape position and with reference to the *BioNet Vegetation Classification* (OEH 2018c). Non-native vegetation was mapped based on observed species composition and structure.

2.4.3 Vegetation integrity survey plots

Plot/transect surveys were conducted in accordance with the BAM to help confirm the classification of native vegetation, to identify PCTs and to obtain vegetation integrity data for the calculation of biodiversity credits (if required). Vegetation integrity was determined by assessing ten attributes used to assess function, composition and structure of vegetation within a 50 metre X 20 metre plot centred on a 50 metre transect. These attributes were then assessed against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (DECC, 2009). The overall condition of vegetation was assessed through general observation of species composition and structure.

All flora species within a 20 metre x 20 metre quadrat nestled within the 50 metre x 20 metre plot were identified according to the nomenclature of the Royal Botanic Gardens and Domain Trust (2018). Each species identified was allocated a growth form group and designated as either native, exotic or high threat exotic in accordance with lists provided by OEH.

Two plots were sampled within the vegetation map units across the project site according to the minimum number of plots required by Table 4 in the BAM (OEH 2017a). The location of survey plots is shown on Figure 4.1. An additional four plots were sampled in the study area to help refine vegetation mapping.

The overall condition of vegetation was assessed through general observation and comparison against the PCT condition benchmark data (where practical) as well as using parameters such as species diversity, history of disturbance, weed invasion and canopy health.

2.4.4 Targeted threatened flora surveys

Targeted surveys were undertaken for threatened flora species that were either predicted to occur at the site by the BAM calculator or identified during the desktop review as having potential to occur within the study area given known distributions, previous records in the locality and habitat requirements for each species (refer to Appendix A). Systematic searches were completed throughout the entire project site and across parts of the study area that support native vegetation, using the random meander technique.

Candidate threatened flora species that were targeted during these surveys and the appropriate survey period specified in the BAM calculator are listed in Table 5.2. Targeted threatened flora surveys were undertaken in Spring (14-15 November 2018) which, according to the BAM calculator, is a suitable time of the year to identify the majority of the candidate threatened flora species identified as having potential to occur in the study area. A supplementary targeted survey was conducted for Tall Knotweed (*Persicaria elatior*) in January 2019, specifically targeting the small area of wetland and aquatic habitat for this species in the project site.

2.4.5 Terrestrial fauna survey

Fauna habitat assessment

Fauna habitat assessments were undertaken throughout the study area during all survey periods, including observation of potential shelter, basking, roosting, nesting and/or foraging sites. Specific habitat features and resources such as water bodies, food trees, the density of understorey vegetation, the composition of ground cover, the soil type, presence of hollow-bearing trees, leaf litter and ground debris were noted.

Indicative habitat criteria for targeted threatened species (i.e. those determined as having the potential to occur within the project site following the desktop review) were identified prior to fieldwork. Habitat criteria were based on information provided in OEH and DEE threatened species profiles, field guides, and the knowledge and experience of GHD field ecologists.

Habitat assessments included searches for resources of potential value to threatened fauna including:

- trees with bird nests or other potential fauna roosts
- rock outcrops or overhangs providing potential shelter sites for fauna
- burrows, dens and warrens
- distinctive scats or latrine sites, owl white wash and regurgitated pellets under roost sites
- tracks or animal remains
- evidence of activity such as feeding scars, scratches and diggings
- specific food trees and evidence of foraging.

The locations and quantitative descriptions of significant habitat features were captured with a handheld GPS unit and photographed where appropriate.

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. This included a conscious focus on suitable areas of habitat during flora surveys, for instance fallen timber was scanned and/or turned for reptiles and mature trees and stags were scanned for roosting birds.

Targeted surveys

Targeted, seasonal surveys are required for candidate threatened species entities i.e. species credit species and specific habitat resources such as nesting or roosting habitat for dual credit species. Candidate species credit entities were identified as those with at least a moderate potential to occur at the study area based on the desktop assessment as refined through the habitat assessments conducted during field surveys.

Targeted threatened fauna surveys were undertaken between 14-15 November 2018 which, according to the BAM, is a suitable time of the year to survey each of the candidate threatened fauna identified for this assessment (see Table 5.2).

Targeted fauna survey techniques and effort conducted in the study area are summarised in Table 2.2. Survey effort was stratified across the entire study area, noting that fauna species are mobile and may rely upon habitat resources in the project site even if not directly observed at the project site. All fauna observations were recorded on pro forma field data sheets.

Under the BAM, targeted surveys are not required for threatened fauna species that can be reliably predicted to occur at the project site based on habitat surrogates (ie predicted / ecosystem credit species). These species are assumed to be present within certain PCTs, given a certain patch size and condition. Nonetheless these species and their habitats were recorded along with fauna that are not listed as threatened, as a general guide to the condition and biodiversity value of the project site.

Table 2.2 Targeted fauna survey techniques and effort

Survey technique	Survey effort
Observation of potential roost sites	Two ecologists closely monitored separate potential roost sites in stags, hollow bearing trees, bridges or culverts in the project site at night fall between 7:45 pm and 8:30 pm. Total effort = four potential roost sites monitored for 45 minutes, on a single evening, each.
Spotlighting	Two ecologists walked separate transects over approximately 2 km of habitat throughout the study area over at least 1.5 hours on each of 2 consecutive nights between 8:30 pm and ~10:30 pm. Total effort = 6 person-hours.
Call Playback	Two consecutive nights of call broadcasting in three different locations targeting Powerful Owl, Bush Stone Curlew and Green and Golden Bell Frog.
Daytime traverses Active reptile/ amphibian searches Active searches for scats and signs	Targeted searches and inspection of habitat resources, conducted by 2 ecologists during all daylight hours on site. Dedicated searches for any signs of fauna occupation. Included searching for evidence of feeding, foraging and signs of fauna presence (such as pellets, whitewash, nests, scats, scratchings, diggings, nests etc.). Active searches of woody debris, under rocks and leaf litter were conducted throughout the project site targeting frogs and reptiles. Total effort = up to 32 person-hours.
Ultrasonic call recording	A total of 2 x Anabats positioned in different flyways within the project site over two nights (12 hours each/per night from 14-16 November 2018). Total effort = 48 recording hours.
Diurnal bird surveys	Walked transects through approximately three hectares of suitable habitat over 1.5 hours on the mornings of 15 and 16 November 3 person hours x 2 days. Total effort = 6 person hours.

2.5 Survey conditions

The field surveys were undertaken in October and November in 2018 and January in 2019. Wind during opportunistic fauna surveys was low to none and so would not have hampered the detection of bird species. A small amount of rain had fallen on the first day of the November surveys.

Bureau of Meteorology (BOM) records for the survey date are outlined in Table 2.3. These records were taken at Bankstown Airport weather station (66137) located approximately 5 kilometres from the project site (BOM 2018b).

Table 2.3 Daily weather observations during the survey period

Date	Minimum temp (Deg Celsius)	Max temp (Deg Celsius)	Rainfall (mm)
12/10/2018	12.2	17.8	15.6
14/11/2018	17.4	23.4	0
15/11/2018	14.9	26.7	0.2
16/01/2019	21.6	34.3	0.2

2.6 Geographical Information System (GIS) analysis

GIS analysis is an integral part of the BAM. GIS was used to:

- Plot the project site on a high resolution aerial photo base and to map vegetation zones, survey effort, habitat resources and biodiversity values across the site.
- Calculate the extent of native vegetation to be impacted.
- Confirm the relevant Interim Biogeographic Regionalisation for Australia (IBRA) bioregion, IBRA subregion and Mitchell Landscape for the site.

Additional GIS analysis was used to plot a 1,500 m buffer area surrounding the project site boundary in which site context components were calculated. Native vegetation cover, extent and connectivity were assessed using aerial photography. Air photo interpretation was used to identify and record distinct vegetation patches, determine the broad condition state of vegetation types and the location and extent of vegetated habitat corridors. The buffer area and GIS area calculations were used to enter information about landscape value and to determine the change in Landscape Value score by assessing the impact of the project on native vegetation cover and connectivity as well as the patch size.

2.7 BAM calculations

The project was assessed according to the methodology presented in the BAM (OEH, 2017a), and the *Biodiversity Assessment Methods Calculator Users Guide* (OEH 2017b). The credit calculator is a software application that is used to apply the BAM. Data is entered into the credit calculator based on information collected in the desktop assessment, site surveys and from using GIS mapping software.

No BAM credit calculations need to be completed and submitted to accompany this BDAR because there is no native vegetation at the project site (see section 4.1) and there would be no impacts requiring offset (see section 7.1). Preliminary BAM credit calculations were completed prior to field surveys so that the suite of threatened species predicted by the BAM credit calculator could be included as an input to the threatened species assessment presented in section 5 and Appendix A. For the purposes of this preliminary assessment:

- the landscape assessment was completed in accordance with the BAM as shown on Figure 3.1 and summarised in section 3
- native vegetation zones in the broader study area were entered as though they were part of a development site
- BAM plot data was entered at benchmark values.

The preliminary BAM credit calculations were performed by Ben Harrington (GHD) using credit calculator version 1.2.1. The biodiversity credit report is included in Appendix C. The data and assumptions used to perform the BAM credit calculations are summarised in section 5.4.

2.8 Team qualifications

This BDAR was prepared by Ben Harrington (accredited assessor number BAAS17023) in accordance with the BAM, based on field surveys completed by Ben Harrington and other GHD staff. A technical review of the report was undertaken Jayne Tipping. Team qualifications are presented in Table 2.4.

Table 2.4 GHD ecology staff and qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Technical Director – Biodiversity / field surveys, prelilminary BAM credit calculations, report writing	BSc, MSc Accredited BAM Assessor	15+ years
Mal Weerakoon	Ecologist / desktop assessment and field surveys, report writing	BSc, Mphil by research	5+ years
Jayne Tipping	Principal / technical review	BSc MEnvLaw	24+ years