Appendix F – Flora and Fauna Assessment

Cessnock City Council

Richmond Vale Rail Trail - Stockrington to Kurri Kurri
Flora and Fauna Assessment

September 2020

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Purpose and scope of this report

Cessnock City Council and Lake Macquarie City Council propose to construct approximately 14 kilometres (km) of recreational pathway, within the Cessnock and Lake Macquarie local government areas (LGAs) in the Lower Hunter region of New South Wales (NSW) (the proposal) (see Figure 1-1).

This Flora and Fauna Assessment (FFA) forms an appendix to the Review of Environmental Factors (REF) for the proposal.

The purpose of this report is to assess the significance of impacts of the proposed works on biodiversity values, in particular threatened species and communities listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act); and relevant Matters of National Environmental Significance (MNES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The aims of the FFA are to:

- Outline the methods used for the biodiversity assessment.
- Describe the existing environment of the site, including the results of the desktop assessment and site survey.
- Identify the presence or likely presence of threatened species, populations and ecological communities and their habitats listed under the BC Act and FM Act.
- Assess the potential for any MNES listed under the EPBC Act to occur within the proposed development site and/or to be affected by the proposal.
- Identify the potential impacts of the proposal on threatened biota and their habitats.
- Recommend mitigation and environmental management measures to avoid or minimise adverse impacts on threatened biota and biodiversity values.
- Assess the likely significance of impacts on threatened biota listed under the BC Act and EPBC Act that would be affected by the proposal.

The scope of this FFA is limited to assessment of terrestrial and freshwater aquatic/estuarine biodiversity values: assessment of marine values and impacts are not covered within the scope of this report.

1.2 Background

1.2.1 Site history

The Richmond Vale railway is a former rail line that runs from Hexham to Pelaw Main in the Lower Hunter region of NSW. The first section of the railway was opened in 1857 and it originally ran from Hexham to Minmi. In 1905 the line was extended from Minmi to the Richmond Main and Pelaw Main Collieries, near Kurri Kurri. A number of small branch lines were also established from the 1920s to the 1950s to service collieries in the Stockrington area to the east of Pelaw Main.

Industrial operation of the railway ceased in 1987 following the closure of the collieries in the region. In 1991, a direct passenger line was re-opened along a section of railway from the former Richmond Main Colliery to the former Pelaw Main Colliery. This passenger line continues to operate as a tourist facility managed by the Richmond Vale Railway Museum. The balance of the line has remained closed since 1987 (Richmond Vale Railway Museum, 2010).

An opportunity now exists to utilise the disused sections of the former rail line, along with a disused section of the former Chichester to Newcastle water main corridor, to establish a multi-use recreational trail for non-motorised travel. Once constructed, the trail would extend for 32 km, from Shortland in the east, to Kurri Kurri in the west. There would also be a number of branch lines from the main trail alignment that would provide connections to the suburbs of Tarro, Fletcher and Minmi. The trail would be located within the Newcastle, Cessnock and Lake Macquarie local government areas (LGAs).

The rail trail would provide a safe cycling and walking experience between Cessnock and Newcastle that does not utilise existing road networks and would attract both local and regional users to enjoy the environmental and heritage attractions along the route. The Richmond Vale Rail Trail provides an opportunity for the communities of the Lower Hunter region to develop the key economic growth areas of tourism and recreation while providing social, health and conservation benefits for users and the region. These opportunities were identified in a feasibility study undertaken by Mike Halliburton Associates (2014), which recommended the Richmond Vale Rail Trail based on the constructability, value, community benefit and tourism potential of the trail.

1.2.2 Site location

The proposal is located within the Cessnock and Lake Macquarie LGAs (Figure 1-1). The proposal starts in the suburb of Stockrington and extends west through the suburbs of Seahampton, Buchanan, Richmond Vale, Pelaw Main and Kurri Kurri. The combined length of the proposal site is approximately 14 km, comprising a main corridor extending from Stockrington in the east to Kurri Kurri in the west.

The majority of the proposal site would be constructed on the existing embankments of the former Richmond Vale railway. Commencing at Stockrington, the alignment runs west from Pambalong Nature Reserve and runs along relatively flat ground between two hill rises on Seahampton Rd. Once out of this valley, the proposal would run underneath the Hunter Expressway at Seahampton before descending north into Stockrington. The proposed rail trail would traverse Surveyors Creek and Wallis Creek via new bridges (Section 1.3.1) before gradually ascending to the town of Kurri Kurri over Werakata Creek where a new, short bridge would be constructed.

1.2.3 Land use

The proposal is located within the Lower Hunter region of NSW, immediately to the west of the city of Newcastle, south of the regional centre of Maitland and east of the town of Kurri Kurri. Newcastle is the second largest city in NSW, and is the major centre for the Lower Hunter region. The city supports a range of regional services focused around transport, education and health. The area surrounding Newcastle supports a diversity of land uses, including urban and rural residential, industrial and commercial, transport and communication corridors, recreation, conservation, agriculture, mining, forested land and wetlands.

The proposal is located alongside the vegetated areas of Stockrington, Seahampton, Buchanan and Richmond Vale and the residential suburbs of Pelaw Main and Kurri Kurri (Figure 1-2). The majority of the proposal route is located on land zoned SP 2- Infrastructure, with some areas passing through E1 – National Parks and Nature Reserves and RU2- Rural Landscapes associated with Stockrington to Richmond Vale. The proposal route also runs through land zoned RE1- Public Recreation within the town of Kurri Kurri.

The proposal site contains multiple ephemeral drainage lines that connect to Blue Gum Creek, Surveyors Creek, Wallis Creek and Werakata Creek, which drain to the Pacific Ocean after joining with the Hunter River approximately 17 km from the proposal site.

1.3 Proposal description

1.3.1 Overview

The proposal involves the establishment of approximately 14 km of recreational pathway, constructed for the most part within existing cleared road corridors or the former Richmond Vale railway alignment. The proposal would enable non-motorised travel between the suburbs of Kurri Kurri, Pelaw Main, Buchanan, Richmond Vale, Seahampton and Stockrington.

The proposal would generally comprise construction of the following:

- Removal of unsuitable subgrades and the construction of pavements using imported gravel, asphalt and concrete.
- At-grade crossings at the following roads:
  - Dog Hole Road, Stockrington
  - Quarry access road, Richmond Vale
  - Hunter Expressway construction yard off George Booth Drive, Richmond Vale
  - Pokolbin Street, Kurri Kurri
- Construction of a 15 metre two-span concrete bridge at Surveyors Creek and demolition of the existing timber bridge at this location.
- Construction of a new 70 metre single span bridge at Wallis Creek, and demolition of the existing timber bridge.
- Construction of a new, short bridge at Werekata Creek, with removal of the existing bridge abutments as the bridge structure has been previously removed.
- Construction of four new parking facilities at various access points along the proposal route.

The key features of the proposal are shown in Figure 3-1 and Appendix A of the REF.

1.3.2 Considerations for this flora and fauna assessment

As the majority of the proposal site consists of an existing cleared railway track, ecological impacts will primarily be associated with the removal of vegetation within areas outside of the previously cleared railway track and compound areas that would be used during the construction stages of the proposal. As sections of the proposal is situated in areas zoned E1-National Parks and E2- Environmental Conservation indirect impacts also need to be considered. A detailed description of construction activities is provided in Section 3.3 of the REF (GHD, 2020)

Previous field surveys as part of report

Previous field surveys were completed in 2016 and 2017 in accordance with Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A) Act and the repealed *Threatened Species Conservation Act 1995* (TSC Act) (Sections 2 and 3). These survey results in addition to field surveys conducted in 2020 have been used for this report to support a flora and fauna impact assessment of the proposal.

Additional assessment and approval

To seek relevant development approvals, the Richmond Vale Rail has been divided into two sections, Shortland to Tarro and Pambalong, and Stockington to Kurri Kurri. The Stockington to Kurri Kurri section of the rail trail is addressed in this FFA, apart from a small area adjacent to the Pambalong Nature Reserve that requires development consent.

The Shortland to Tarro and Pambalong sections, are subject to assessment and approval under Part 4 of the EP&A Act. Environmental impact statements (EIS) have been prepared for both projects (GHD, 2019; GHD, 2020) to accompany a development application to the City of Newcastle and Cessnock City Council for approval. These areas are not addressed in this FFA.

1.4 Terms and definitions

Terms used in this report are defined in Table 1-1.

Table 1-1 Terms and definitions

Term	Definition
Proposal site	The areas that would be directly impacted by the proposal. This area is approximately 7 metres wide to account for the 3 metre wide proposed pathway plus 2 metres either side to be used during the construction phase.
Study area	The proposal site, immediate surrounds, and areas that may directly or indirectly be impacted by the proposal
Locality	The 10 km buffer area around the proposal site

1.5 Assumptions

This FFA has been prepared based on the proposal description, concept plans and proposal site provided in the REF (GHD, 2020). This report has been prepared based on the assumption that all vegetation within the proposal site would be cleared.

It is also assumed that there would be no direct impact to vegetation outside of the proposal site boundary. It is assumed that the description and spatial data accurately represent the extent of direct impacts arising from the proposal and so these data have been used to calculate the extent of removal of vegetation and habitat arising from the proposal using Geographical Information Systems (GIS).

1.6 Scope and limitations

This report: has been prepared by GHD for Cessnock City Council and may only be used and relied on by Cessnock City Council for the purpose agreed between GHD and the Cessnock City Council as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Cessnock City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared. Specifically, this Report does not take into account the effects, implications and consequences of or responses to COVID-19, which is a highly dynamic situation and rapidly changing. These effects, implications, consequences of and responses to COVID-19 may have a material effect on the opinions, conclusions, recommendations, assumptions, qualifications and limitations in this Report, and the entire Report must be re-examined and revisited in light of COVID-19. Where this Report is relied on or used without obtaining this further advice from GHD, to the maximum extent permitted by law, GHD disclaims all liability and responsibility to any person in connection with, arising from or in respect of this Report whether such liability arises in contract, tort (including negligence) or under statute.

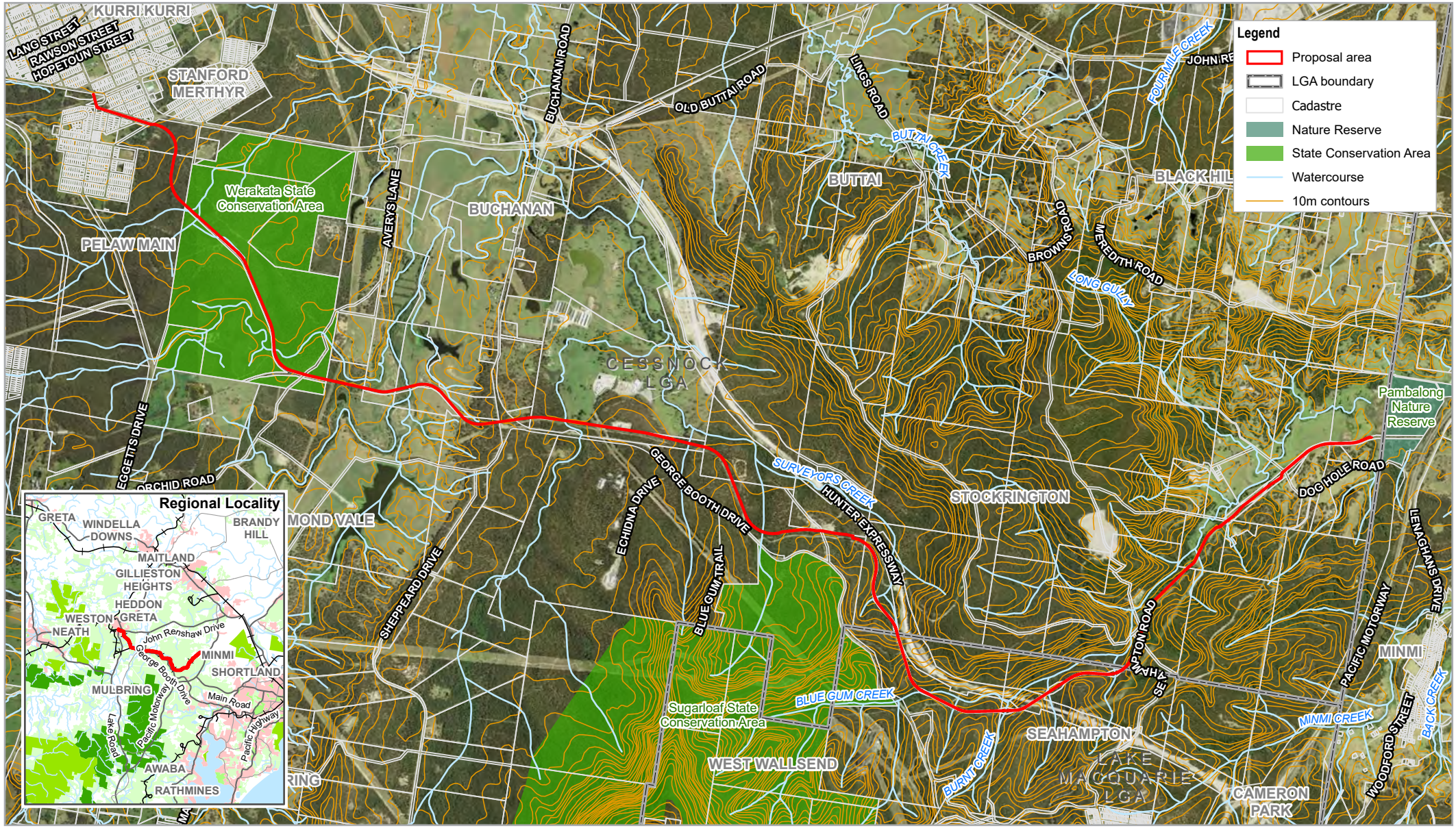
The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer Sections 1.1 and 1.5 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Cessnock City Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.



Paper Size ISO A4

0 0.35 0.7 1.05 1.4

Kilometers

N

GHD

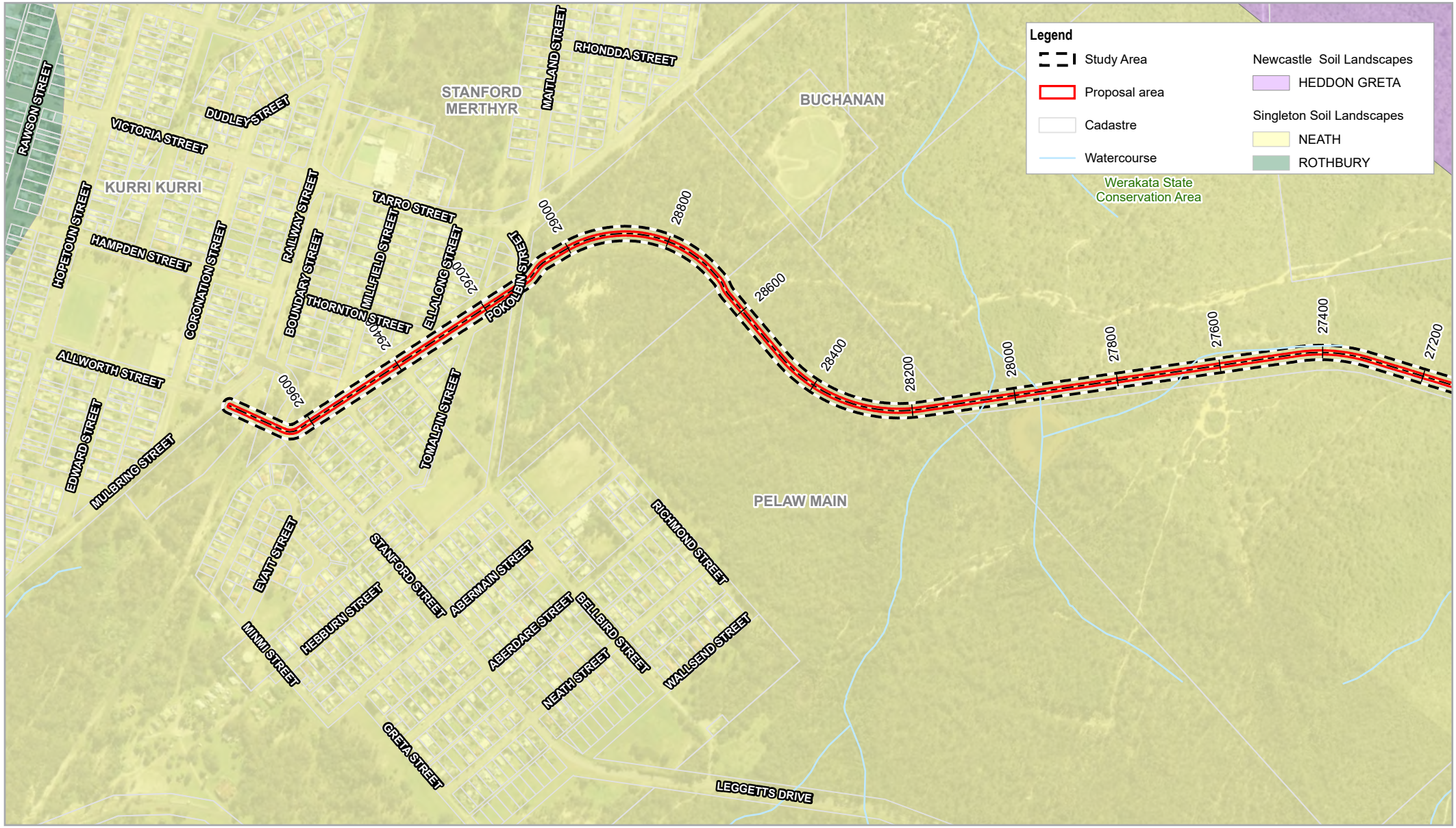
Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

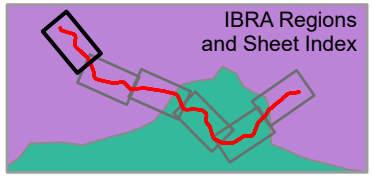
Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Proposal location

Figure 1-1

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:02





Inset Legend

- IBRA Region - Sydney Basin, IBRA Subregion - Hunter
- IBRA Region - Sydney Basin, IBRA Subregion - Wyong

Paper Size ISO A4

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

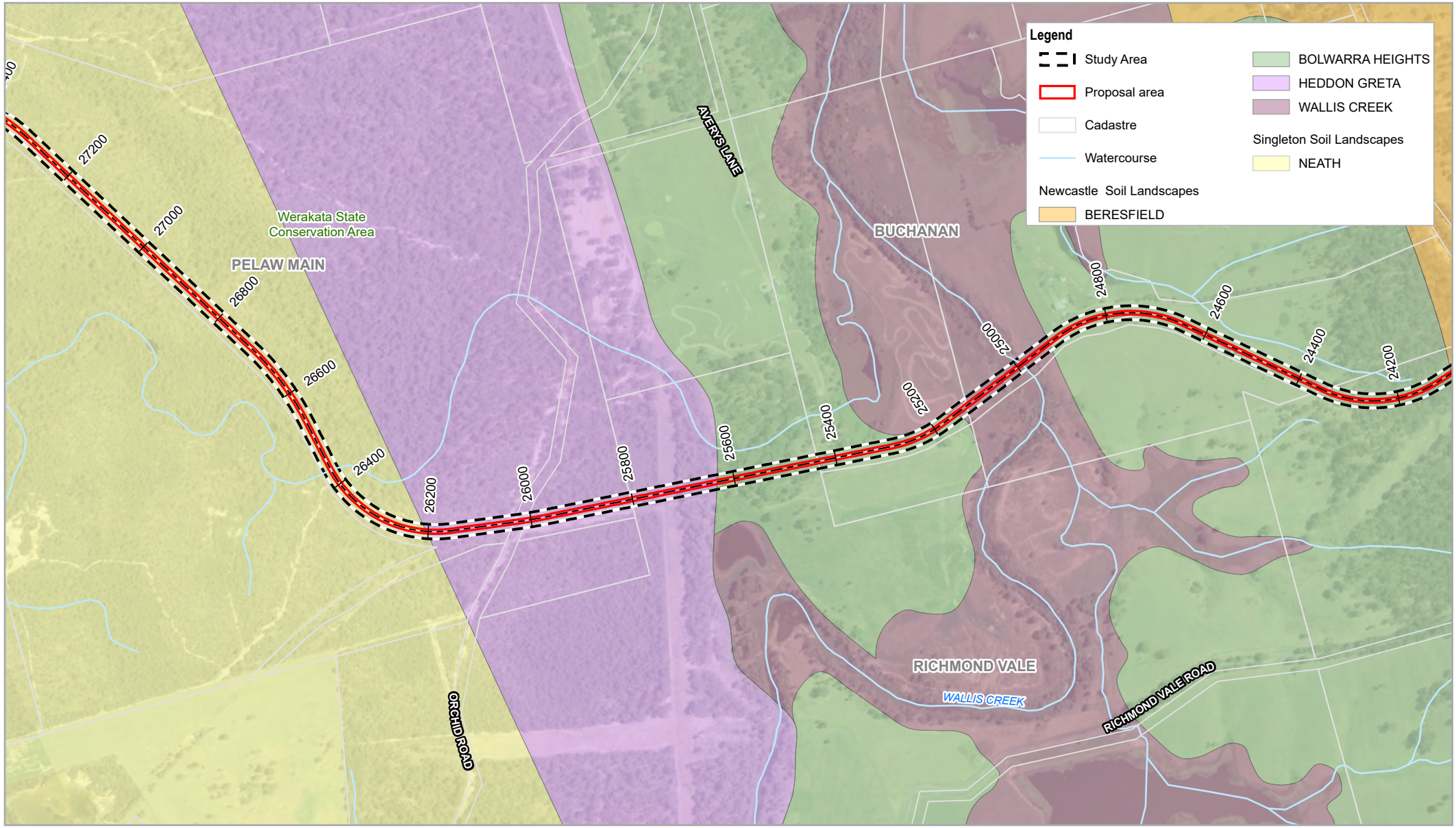
Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

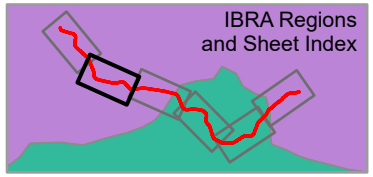
Proposal area
Sheet 1 of 6

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 1-2a

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:03





Inset Legend

- IBRA Region - Sydney Basin, IBRA Subregion - Hunter
- IBRA Region - Sydney Basin, IBRA Subregion - Wyong

Paper Size ISO A4

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

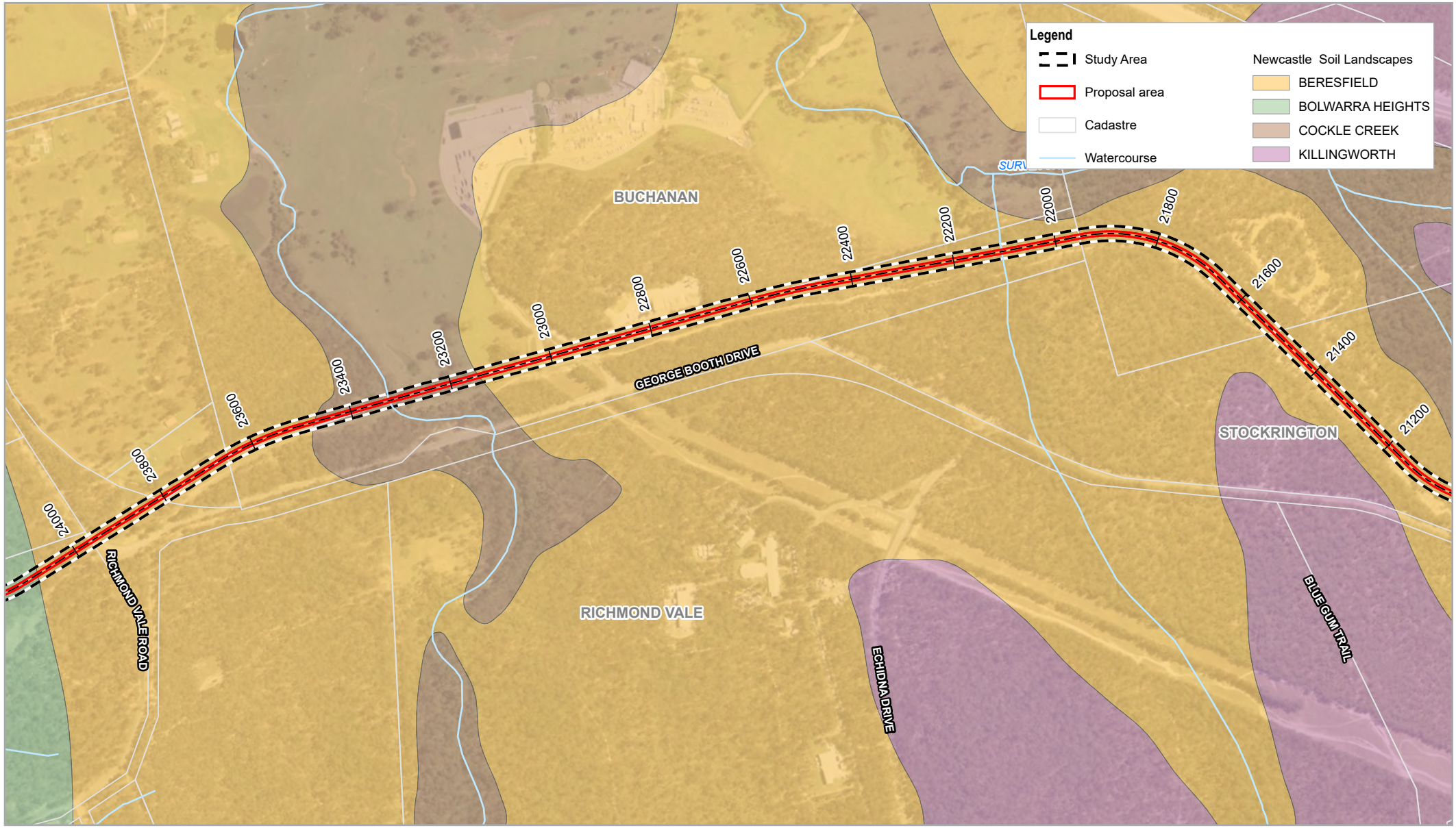
Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

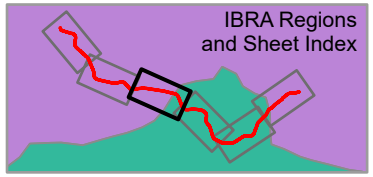
Proposal area
Sheet 2 of 6

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 1-2b

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:03





Inset Legend

- IBRA Region - Sydney Basin, IBRA Subregion - Hunter
- IBRA Region - Sydney Basin, IBRA Subregion - Wyong

Paper Size ISO A4

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

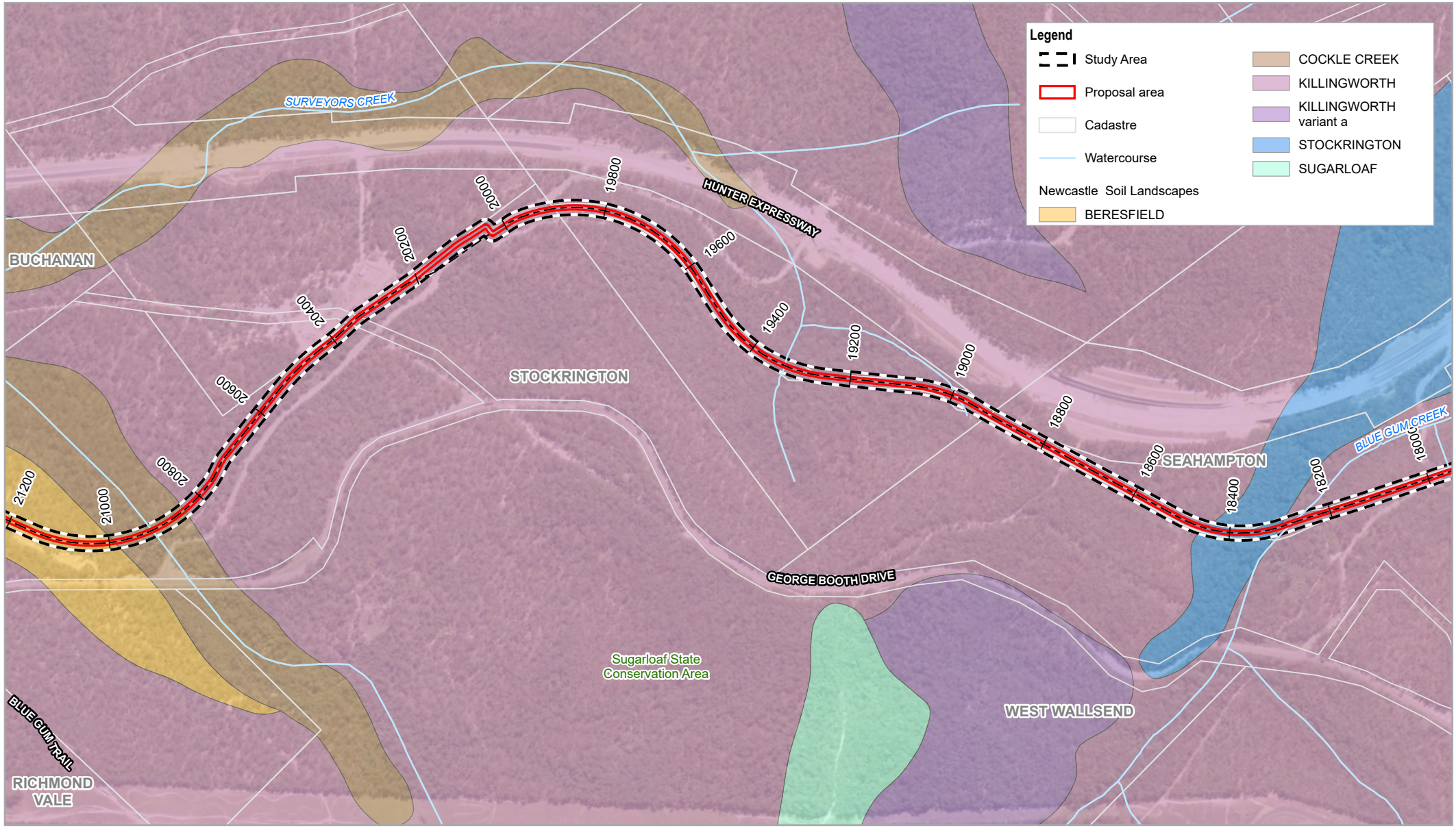
Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

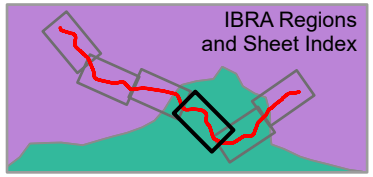
Proposal area
Sheet 3 of 6

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 1-2c

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:03





Inset Legend

- IBRA Region - Sydney Basin, IBRA Subregion - Hunter
- IBRA Region - Sydney Basin, IBRA Subregion - Wyong

Paper Size ISO A4

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

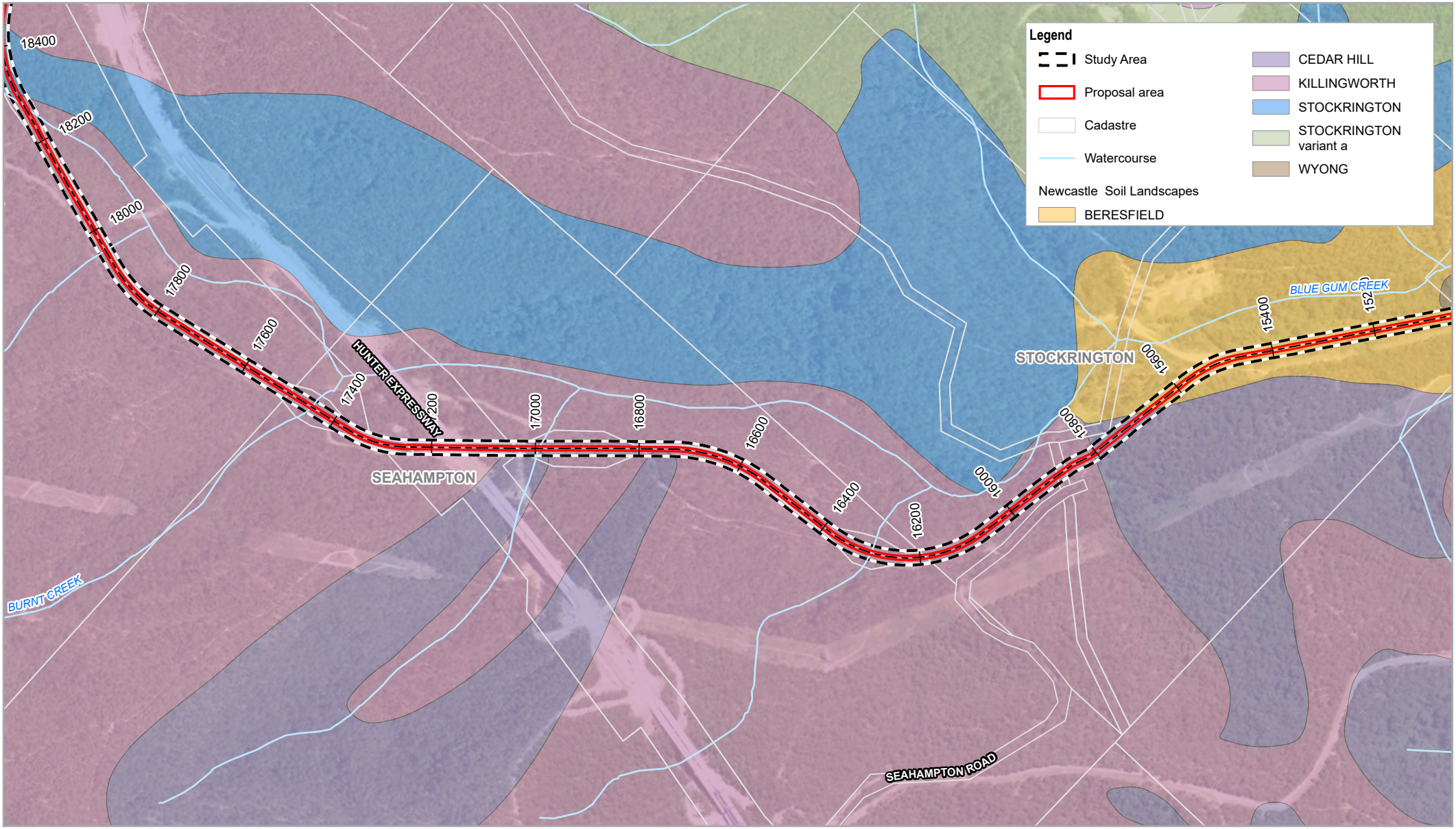
Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

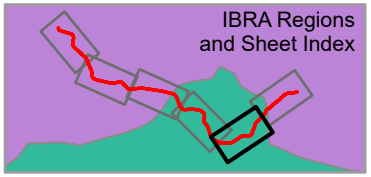
Proposal area
Sheet 4 of 6

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 1-2d

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:03





Inset Legend

- IBRA Region - Sydney Basin, IBRA Subregion - Hunter
- IBRA Region - Sydney Basin, IBRA Subregion - Wyong

Paper Size ISO A4

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

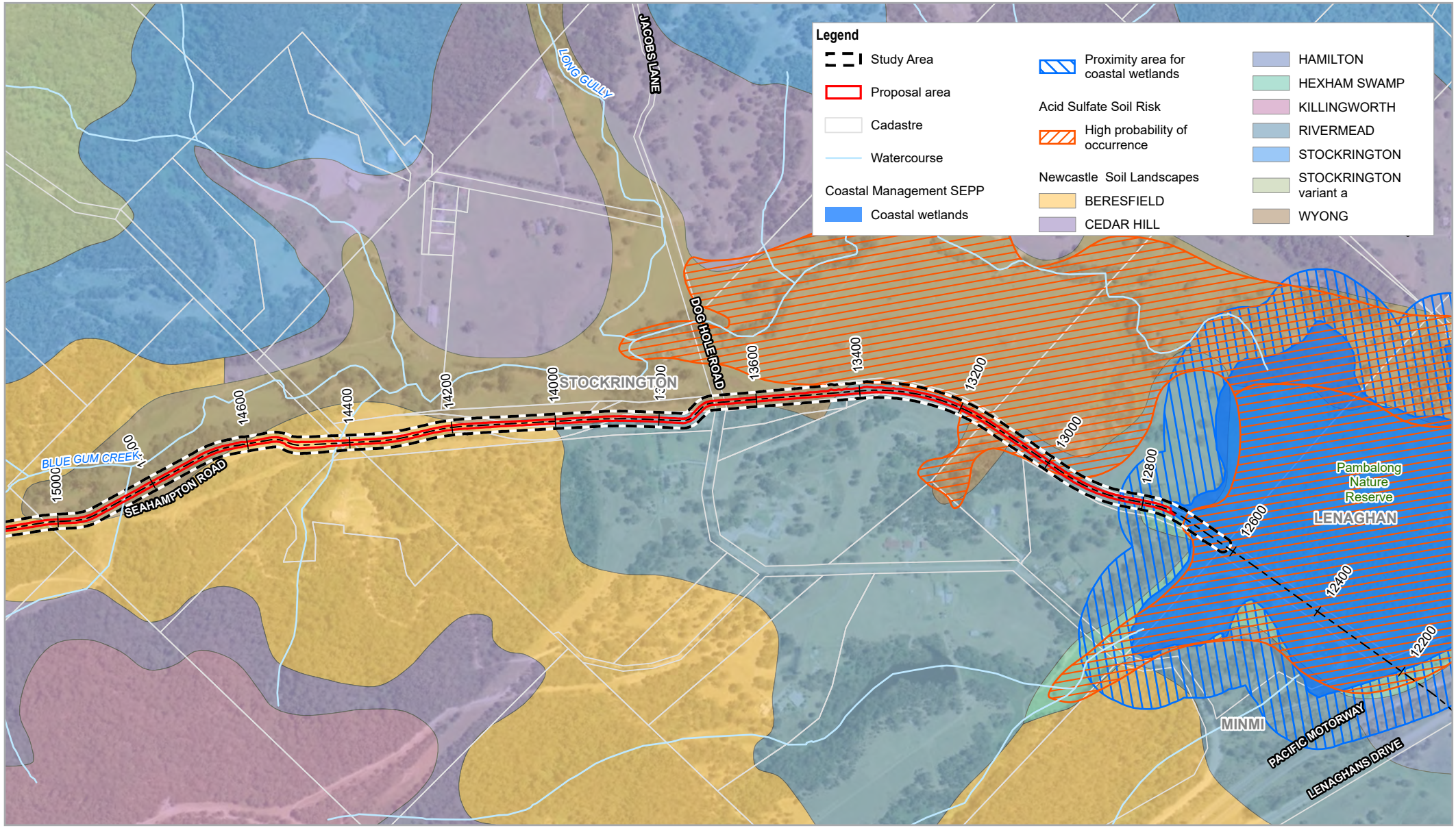
Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

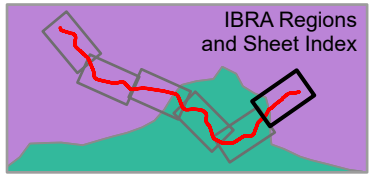
Proposal area
Sheet 5 of 6

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 1-2e

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:03





Inset Legend

- IBRA Region - Sydney Basin, IBRA Subregion - Hunter
- IBRA Region - Sydney Basin, IBRA Subregion - Wyong

Paper Size ISO A4

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

Proposal area
Sheet 6 of 6

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 1-2f

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:03

2. Legislative framework

2.1 NSW legislation

2.1.1 Environmental Planning and Assessment Act 1979

The EP&A Act forms the legal and policy platform for proposal assessment and approval in NSW and aims to 'encourage the proper management, development and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and EP&A Regulation 2000.

The proposal is subject to assessment under Division 5.1 of the EP&A Act with Council as the determining authority for the purposes of the Act. Under section 5.5 (1) of the EP&A Act, determining authorities must 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. This report addresses the ecological components of the environment to assist the determining authorities to address the requirements of Section 5.5 (1) of the EP&A Act.

2.1.2 Biodiversity Conservation Act 2016

The BC Act provides for listing of threatened species, populations and ecological communities as well as critical habitat and key threatening processes.

Determination of activities under Part 5 of the EP&A Act requires an assessment of the impacts of the proposal on land that is critical habitat or is likely to significantly affect threatened species, populations or ecological communities, or their habitats, as listed under the BC Act. This assessment is undertaken in the form of a 'Test of Significance' in accordance with Section 7.3 of the BC Act. The Test of Significance includes five factors that are used to assist in the determination of whether the proposed activity is 'likely' to have a 'significant effect' on threatened biota listed under the BC Act.

The potential presence or likely occurrence of threatened biota in the proposal site and potential impacts on threatened biota are addressed in Sections 5 and 6 of this report. Assessments of significance for threatened biota potentially impacted by the proposal are provided in Appendix C.

2.1.3 Fisheries Management Act 1994

The objectives of the FM Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. It includes provisions to list threatened species of fish and marine vegetation, including endangered populations, ecological communities and key threatening processes. One of the objectives of the FM Act is to 'conserve key fish habitats' which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species.

The proposal requires potential work which may constitute dredging or reclamation to be undertaken within creeks or key fish habitat. Such works require permits issued under the FM Act.

2.1.4 Biosecurity Act 2015

The *Biosecurity Act 2015* (Biosecurity Act) provides for modern, flexible tools and powers that allow effective, risk-based management of biosecurity in NSW. It provides a streamlined statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds. The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Legal requirements to minimise the potential for the introduction and/or spread of weeds as a result of the proposal are discussed further in Section 4.2.1 of this report.

2.1.5 State Environmental Planning Policy (Koala Habitat Protection) 2019

State Environmental Planning Policy (Koala Habitat Protection) 2019 (Koala Habitat Protection SEPP) aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline by:

- Identifying land to which an approved Koala plan of management applies
- Identifying feed trees within LGAs to which the SEPP applies
- Encouraging the identification of areas of core Koala habitat

As development consent is not required for the proposal, the Koala Habitat Protection SEPP does not apply however, impacts on the Koala have been considered in this report as part of threatened species assessments provided in Section 5 and 6.

2.1.6 State Environmental Planning Policy (Coastal Management) 2018

State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) aims to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objectives of the Coastal Management Act 2016. The objectives of the Coastal Management SEPP are to manage development in the coastal zone and establish a framework for land use planning and decision making in the coastal zone.

A small section of Pambalong Nature Reserve, within the Cessnock LGA, is mapped as coastal wetland under the Coastal Management SEPP. Development consent would be required for proposal works in this area. This area is not included in this FFA.

As such, the proposal is not located within land mapped as coastal wetlands or littoral rainforest, therefore Divisions 1 and 2 of Coastal Management SEPP do not apply. However, it is adjacent to mapped coastal wetlands and within the proximity area for coastal wetlands, coastal environment area and within coastal use area. Potential impacts to the biophysical, hydrological and ecological integrity of the adjacent coastal wetland are discussed in Section 6.2.

2.2 Commonwealth legislation

2.2.1 Environment Protection and Biodiversity Conservation Act 1999

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on 'matters of national environmental significance' undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, undertaking or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Government Minister for the Environment. Potential impacts on MNES are subject to an assessment of significance in accordance with the EPBC Act Significant Impact Guidelines (DotE, 2013). If a significant impact is considered likely, a referral under the EPBC Act must be submitted to the Minister.

Potential impacts from the proposal on matters of MNES are discussed in Section 7 of this report.

3. Methodology

3.1 Desktop assessment

3.1.1 Database searches and literature review

A desktop assessment was undertaken in 2016 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 in the locality, based on previous records, known distribution ranges, and habitats present. An updated database search was then undertaken in May 2020, to ensure that all recent observations and habitat assessments were included within the assessment.

In order to assess the suitability of the habitat within the proposal site for threatened species and ecological communities, the following biodiversity databases and literature pertaining to the proposal site and locality (within a 10 km radius of the proposal site) were reviewed prior to conducting field investigations:

- The NSW BioNet atlas database to help identify threatened species that may occur in the proposal site (OEH, 2020a).
- OEH threatened biota profiles for descriptions of the ecology, distribution and habitat requirements of threatened biota (OEH, 2020b).
- Department of the Environment and Energy (DEE) Protected Matters Online Search Tool for MNES listed under the EPBC Act predicted to occur in the locality (DEE, 2020a).
- DEE online species profiles and threats database (SPRAT) (DEE, 2020b).
- The NSW BioNet Vegetation Classification database to help identify Plant Community Types (PCTs) that occur in the proposal site (DPIE, 2020c).
- Previous vegetation mapping of the proposal site (DPIE, 2010; LMCC, 2016) and supporting vegetation descriptions in Bell (2016).
- Department of Primary Industries (DPI) freshwater threatened species distribution maps. For distribution of threatened aquatic species that may occur in the locality (DPI, 2019).
- DPI key fish habitat mapping (DPI, 2007).
- Groundwater Dependent Ecosystem Atlas (BOM, 2020a).
- Aerial photographs and satellite imagery.
- DPIE Biodiversity Values Map, which identifies declared areas of outstanding biodiversity values (AOBV) (DPIE, 2020a).
- Priority weed declarations under the Biosecurity Act for species listed in the Hunter region, including the Cessnock and Lake Macquarie LGA (DPI, 2020).

3.1.2 Likelihood of occurrence of threatened species

Following collation of database records and species and community profiles, a ‘likelihood of occurrence’ assessment was prepared with reference to the broad habitats contained within the proposal site. This was further refined following field surveys, as described below. The likelihood of threatened and migratory biota occurring in the proposal site was assessed based on presence of records from the locality since 1980, species distribution and habitat preferences, the suitability of potential habitat present in the proposal site and broader study area. The assessment of the likely occurrence of threatened species within the proposal site is provided in Appendix A and the results summarised in Section 5.

3.2 Site surveys

3.2.1 Survey overview

Site surveys of the study area were conducted by GHD ecologists in September, October and November 2016, January 2017 and May 2020 for a total of 13 days overall. Site surveys were conducted in consultation with the Cessnock Development Control Plan (DCP) 2010- Flora and fauna survey guidelines (Cessnock City Council, 2010). Site surveys included:

- Initial site stratification and vegetation mapping
- Floristic vegetation plots
- Flora and fauna habitat assessments
- Threatened flora surveys
- Targeted surveys for threatened fauna
- Opportunistic fauna observations
- Aquatic habitat assessment.

Survey effort that has directly contributed to this FFA is summarised in Table 3-1 and is described in detail below.

Table 3-1 Survey techniques and timing

Stage	Date	Technique	Effort
2016-2017 survey period			
Vegetation mapping verification and refinement	21-23 Sept 2016	Vegetation mapping verification Flora habitat assessments	2 persons over 3 days (6 person days)
Floristic vegetation plots	13 - 14 Oct 2016	Plot and transect surveys	5 plots
Threatened flora searches	21-23 Sept 2016	Systematic traverses targeting candidate threatened flora species	2 persons over 3 days (6 person days)
Fauna habitat assessment	21-23 Sept 2016	Hollow-bearing tree searches Frog searches	9 habitat assessments
Fauna habitat assessment	23 November 2016	Koala SAT assessments Feed tree assessments	3 Koala SAT tests
Targeted microbat surveys	30 Sept - 2 Oct 2016	Anabat recordings	3 locations for 3 nights (3 recording nights)
Targeted microbat surveys	12 and 30 January 2017	Spotlighting/Dusk observations	2 x 1 hr spotlighting surveys (4 person hours)
Opportunistic fauna observations	All survey days	Opportunistic fauna observations	Throughout each site visit (11 days total)
2020 survey period			
Vegetation mapping verification and refinement	21-22 May 2020	Vegetation mapping verification Habitat assessments Aquatic habitat assessment RDP flora survey	2 persons over 1 day (2 person days)
Fauna habitat assessment	21-22 May 2020	RDP flora survey	2 persons over 1 day (2 person days)
Opportunistic fauna observations	All survey days	Opportunistic fauna observations	Throughout each site visit (2 days total)

3.2.2 Vegetation mapping

Regional vegetation mapping was ground-truthed in the field to verify community type and boundaries, floristic and structural homogeneity within patches and to update mapping as required (DPIE, 2010; LMCC, 2016).

Native vegetation communities in the study area were assigned to the closest equivalent Plant Community Type (PCT) held in the BioNet Vegetation Classification database (DPIE, 2020c). The closest equivalent PCT for each vegetation community was determined through a comparison of the floristic descriptions of PCTs in the database with the floristic vegetation plots and rapid data points collected from the study area (Section 3.2.3). In addition to floristic and structural similarity, the landscape position, soil type and other diagnostic features of the vegetation communities on the sites were also compared to the descriptions in the database in order to determine the most suitable PCT. Threatened ecological communities (TECs) as defined in NSW and Commonwealth legislation were also identified.

3.2.3 Floristic plot surveys and rapid data points

Floristic plot survey

Floristic plot surveys were informed by the vegetation mapping discussed above (Section 3.2.2) and were used to classify PCTs. Plot locations were selected using air photo interpretation, vegetation mapping and field habitat assessment.

Due to the narrowness of the proposal site (7 metres) throughout the alignment, plots were positioned to include vegetation outside the proposal site as well as within vegetation to be removed. Percent cover and abundance data was collected for each species within a 20 metre x 20 metre plot. Plots were distributed throughout the study area to supplement the rapid data points discussed below. A total of five plots were sampled within the study area as shown on Figure 3-1.

Structural vegetation communities were described according to classifications made by Specht (1970). Plant identifications were made according to nomenclature in Harden (1990-93) and Royal Botanic Gardens Trust (2018). Plant specimens which were difficult to identify (either insufficient sample collected or buds/fruiting bodies were not available at the time of the survey) were identified to genus level.

Rapid data points

Due to the time period between surveys, rapid data points were collected during the 2020 survey period to confirm the previous vegetation mapping conducted in September and October 2016. Dominant species within areas were recorded to allow for rapid verification of PCTs within the proposal site. These points were then compared with the previous vegetation mapping; the vegetation mapping was subsequently revised as required to represent the PCTs that currently occur.

3.2.4 Flora and fauna habitat assessment

Flora habitat assessment

Flora habitat assessments were made to inform the likelihood of occurrence and requirements of targeted flora surveys based on habitat requirements of threatened flora species previously recorded or predicted to occur within the locality during the desktop assessment (Section 3.1.2).

The habitat assessments allowed for identification of habitat resources for cryptic species, in order to make an assessment of their likelihood of occurring within the proposal site. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values within the proposal site in order to predict potential impacts of the proposal, with particular emphasis on threatened biota and their habitats. The habitat assessment aimed to identify areas of suitable habitat for cryptic species where possible.

Fauna habitat assessment

Fauna habitat assessments were undertaken throughout the proposal site, including searches for potential shelter, basking, roosting, nesting and/or foraging sites. Specific habitat features and resources such as water bodies, food trees, density of understorey vegetation, composition of ground cover, soil type, presence of hollow-bearing trees, leaf litter and ground debris were noted. Artificial structures, such as culverts, stormwater drains and pipes, were also noted where present.

Indicative habitat criteria for targeted threatened species (i.e. those determined as having the potential to occur within the proposal 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 recording (if present) 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 (e.g. chewed Allocasuarina cones)

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

Feed tree assessment

In order to determine the availability of potential foraging habitat for threatened species with specific feed tree requirements, an assessment of the relative cover abundance of dominant canopy tree species was undertaken. This assessment was undertaken in conjunction with the floristic plot surveys described in Section 3.2.3. As part of these plots, the percentage foliage cover is usually estimated for the canopy and midstorey layers every five metres along a 50 m transect. For this assessment, the percentage foliage cover of each component canopy species was recorded as well as the overall cover at each point along the transect.

Koala SAT assessment

Potential Koala habitat and signs of Koala presence such as faecal pellets and claw marks were identified using the Spot Assessment Technique (SAT) (Phillips and Callaghan, 1995). This technique involves the selection of a centre tree (survey point) which is chosen according to the following criteria:

- A tree of any species beneath which one or more Koala faecal pellets have been observed
- A tree in which a Koala is observed
- Any other tree known or considered to be potentially important for Koalas, or for other assessment purposes

A minimum of 30 trees (including the centre tree) with a diameter at breast height (DBH) of 100 mm or greater must be surveyed. Surveys involve the inspection of the ground surface within 100 centimetres from the base of the tree. If faecal scats are identified, the survey concludes.

Activity levels were calculated as the percentage equivalent of the quotient derived by dividing the number of trees that had one or more Koala faecal pellets recorded beneath them, by the total number of trees sampled. In total, three SAT tests were conducted across the proposal site. These were conducted within the following PCTs where Koala feed tree species were identified:

- PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area.
- PCT 1593: Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter.

Hollow bearing tree assessment

2016-2017 survey period

Counts of hollow-bearing trees were undertaken within the floristic plot surveys in order to provide an indication of the density of hollow-bearing trees within each vegetation type. Additional information was collected on the tree species, height, diameter at breast height, evidence of use and number, size and location of hollows for all hollow-bearing trees within the plot-transects. Any hollow-bearing trees encountered during other surveys were also inspected for signs of use, and their location recorded using a handheld GPS unit.

2020 survey period

Additional hollow-bearing tree searches were conducted throughout the proposal site to ensure habitat values within the proposal site are identified. Hollow-bearing tree searches were conducted by two GHD ecologists, with locations of hollow-bearing trees being recorded using ESRI's Collector for ArcGIS (version 20.2.0). This recorded the GPS locations of these habitat values.

Frog searches

Drainage lines within the proposal site were inspected to see if any frogs were calling from leaf litter or fringing riparian vegetation. Any frogs heard calling were identified by call or by visual inspection where possible.

3.2.5 Threatened flora surveys

The habitat requirements for threatened flora predicted to occur by the desktop assessment were identified prior to the field survey. Consideration was also given to the following management guidelines for threatened flora species:

- Interim Lake Macquarie *Grevillea parviflora subsp*. *parviflora* Planning and Management Guidelines.
- Lake Macquarie *Tetratheca juncea* Planning and Management Guidelines.
- Bell, S.A.J. (2016) *Volume 2: Vegetation Community Profiles, Lake Macquarie Local Government Area*. Unpublished Report to Lake Macquarie City Council. March 2016. Eastcoast Flora Survey.
- Biodiversity Planning Policy and Guidelines for (LEP) Rezoning Proposals. Lake Macquarie City Council 2015.

Threatened species habitat requirements were then compared with those habitats present within the site during the field survey and an assessment of the likelihood of occurrence was completed based on consideration of known distributions, previous records in the locality and habitat requirements for each species. Searches for threatened plants in areas of suitable habitat were conducted during all traverses across the proposal site, typically when walking between quadrats or similar.

The timing of field surveys was suitable for the detection/identification of the majority of threatened flora previously recorded or predicted to occur within 10 km of the proposal site (Table 3-2). Where the survey timing fell outside of the recommended survey period, the likely presence of these species was assumed to ensure a conservative approach (Section 5.1.2).

Table 3-2 Flora species targeted during surveys

Scientific name	Common name	Recommended survey period
Acacia bynoeana	Bynoe's Wattle	All year
Callistemon linearifolius	Netted Bottle Brush	October - January
Cymbidium canaliculatum	-	All year
Eucalyptus parramattensis subsp. decadens	-	All year
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	August - November
Pterostylis gibbosa	Illawarra Greenhood	September - October
Rutidosis heterogama	Heath Wrinklewort	All year
Tetratheca juncea	Black-eyed Susan	September - October

3.2.6 Targeted fauna surveys

Microbat surveys

Bat calls were recorded during field surveys using Anabat detectors (Titley Scientific Brisbane). Stationary Anabat recordings were undertaken within and immediately adjacent to the proposal site over 3 nights on the 30 September to 2 October 2016. Anabats were placed in positions which would yield adequate detection results in addition to being placed in discrete positions along the proposal site. Recording commenced approximately half an hour before dusk and continued until the following morning.

Calls were identified using zero-crossing analysis and AnalookW software (version 4.1z, Chris Corben 2015) by visually comparing the time-frequency graph and call characteristics (e.g. characteristic frequency and call shape) with reference calls and/or species call descriptions from available reference material. The Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats (Pennay *et al.*, 2004) was used to assist call analysis. Call identification was also assisted by consulting distribution information for possible species (Churchill, 2008; Pennay *et al.*, 2011; Van Dyke *et al.*, 2013) and records from BioNet (October 2016). No reference calls were collected during the survey.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency and shape. Calls with less than three defined consecutive pulses of similar frequency and shape were not unambiguously identified to a species but were used as part of the activity count for the survey area. Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see (Mills *et al.*, 1996; Duffy *et al.*, 2000)) as summarised in Table 3-3. Due to the absence of reference calls from the study area, high level of variability within a bat call and overlap in call characteristics between some species, a conservative approach was taken when analysing calls.

Species nomenclature follows van Dyck et al. (2013) and Reardon et al (2014).

Table 3-3 Confidence ratings applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
SG - Species Group	Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species e.g. Chalinolobus gouldii/Ozimops sp. Nyctophilus sp.: the calls of Nyctophilus geoffroyi/gouldi cannot be distinguished during the analysis process and are therefore lumped together. Nyctophilus sp./Myotis macropus: the calls of these species can be easily confused during the analysis process and are therefore often lumped together.

3.2.7 Opportunistic fauna observations

Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Survey effort was concentrated on suitable areas of habitat throughout the course of the survey, for instance burrows and diggings were noted, fallen timber or rocks were scanned and lifted to search for frogs and reptiles, and mature trees were scanned for roosting birds.

Bird surveys within the 2016-2017 and 2020 survey period were performed opportunistically during daylight hours within the proposal site. All vegetation types were examined to compile a list of native birds present. Species were identified by sight and call. Incidental observations made outside the targeted survey period were also recorded.

3.2.8 Aquatic habitat assessment

Aquatic habitat occurs within the proposal site: namely Blue Gum Creek, Surveyors Creek, Wallis Creek and Werakata Creek. A number of ephemeral tributaries also occur.

A rapid visual aquatic habitat assessment was undertaken along these creeks where appropriate. The character and condition of this area was noted.

An assessment of potential habitat for threatened aquatic species was based on the habitat assessments undertaken during the field survey and published habitat preferences of threatened biota. Key fish habitat maps for the area (DPI, 2007) were reviewed and key fish habitat was identified (DPI, 2018).

3.2.9 Survey conditions

Weather conditions during the survey period were generally good for detecting flora and fauna. Days were generally warm to hot and sunny with light winds. Weather conditions during the survey are summarised in Table 3-4.

(BOM, 2020b). These records were taken at the Newcastle University Weather Station [station 061390], located about 9 km east of the proposal site.

Table 3-4 Daily weather observations during field survey period

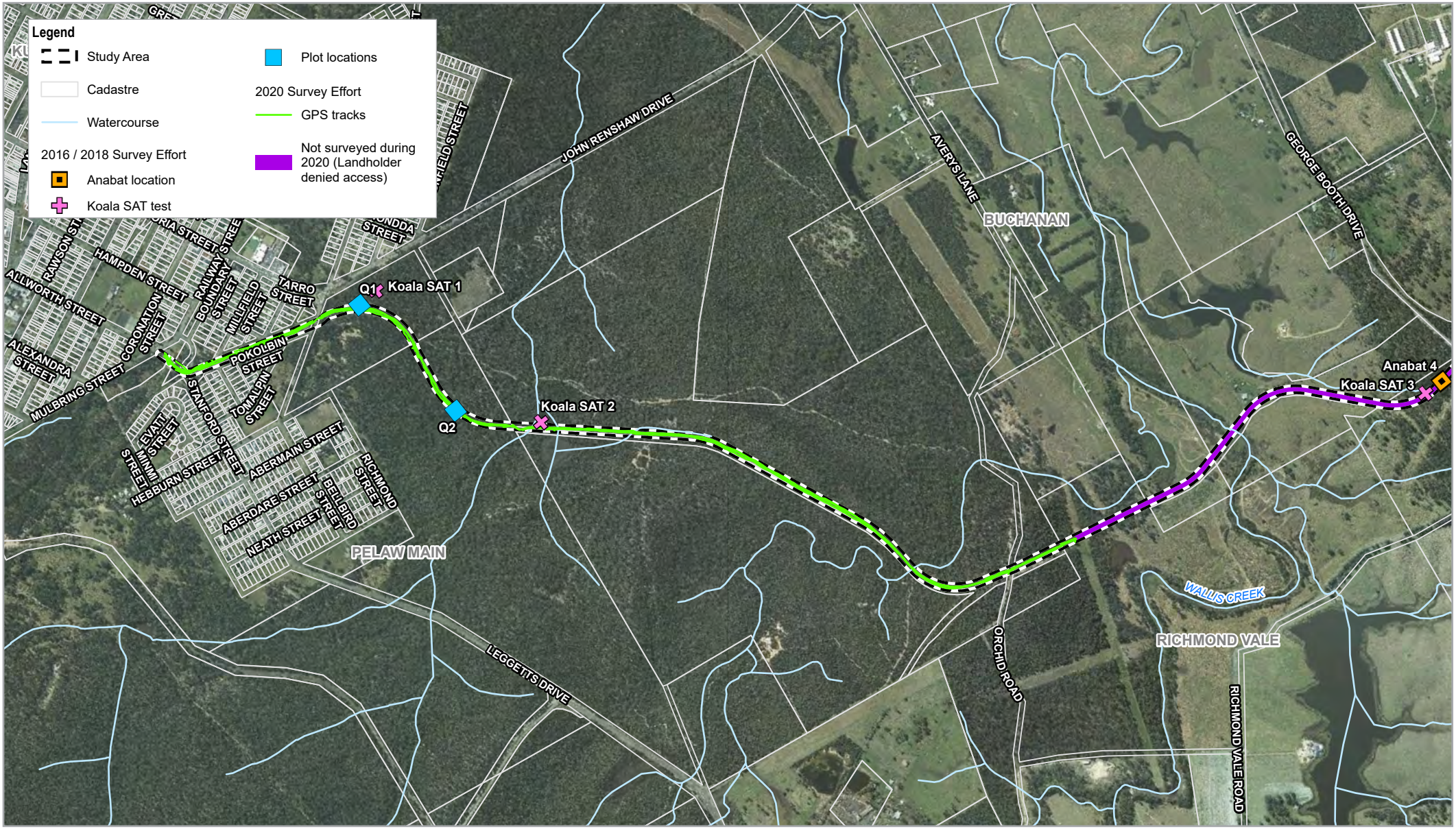
Date	Survey Period	Min temp (°C)	Max temp (°C)	Rainfall (mm)
2016/2017 survey period				
20/09/2016	Pre-survey	8	20.2	0
21/09/2016	Survey	12.4	19.2	0.4
22/09/2016	Survey	12	21.5	6
23/09/2016	Survey	13.3	21.8	0
29/09/2016	Pre-survey	11	22.3	0
30/09/2016	Survey	8.8	20.9	2.4
1/10/2016	Survey	12.9	22	0
2/10/2016	Survey	9.5	26.8	0
12/10/2016	Pre-survey	6.8	22.5	0
13/10/2016	Survey	11.4	16.4	11.8
14/10/2016	Survey	9	20	0
22/11/2016	Pre-survey	17.6	33.8	0
23/11/2016	Survey	17.2	34	0
11/01/2017	Pre-survey	23.2	41	0
12/01/2017	Survey	23.5	28.2	0
29/01/2017	Pre-survey	-	32.4	0
30/01/2017	Survey	21.5	40.2	0
2020 survey period				
20/05/2020	Pre-survey	10.6	23.8	0
21/05/2020	Survey	12.6	16.8	2
22/05/2020	Survey	8	16.6	8.2

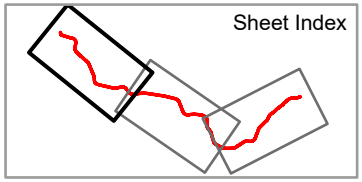
3.2.10 Survey limitations

Given the length of the proposed pathway, it is likely that some flora and fauna species that utilise the proposal site (permanently, seasonally or transiently) were not detected during the survey. These species may include flora species such as annual, ephemeral or cryptic species. Some fauna species are also mobile and transient in their use of resources, and some are seasonal migrants, and it is likely that not all species that potentially occur in the proposal site were recorded during the survey period.

The habitat assessment conducted for the site allows for identification of habitat resources for species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on site in order to predict potential impacts of the proposal, with particular emphasis on EECs, threatened species and their habitats.

Some areas within the proposal site where not able to be accessed due to land owner permits and safety of on site personnel (see Figure 3-1). Where access was not possible, data has been taken from the desktop assessment and extrapolated where appropriate.





Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

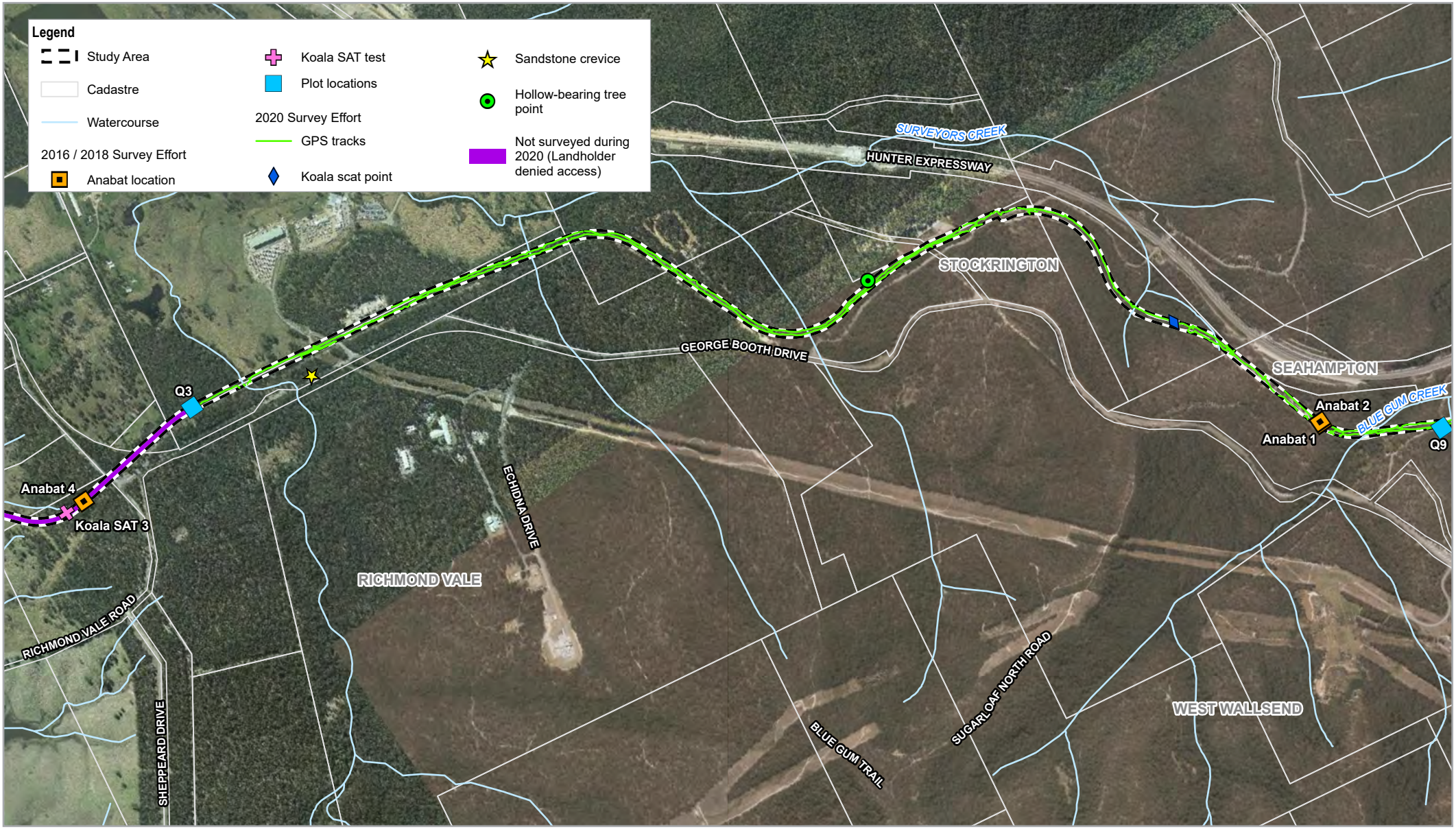
Survey effort
Sheet 1 of 3

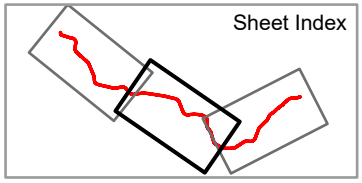
Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 3-1a

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:04

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton





Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

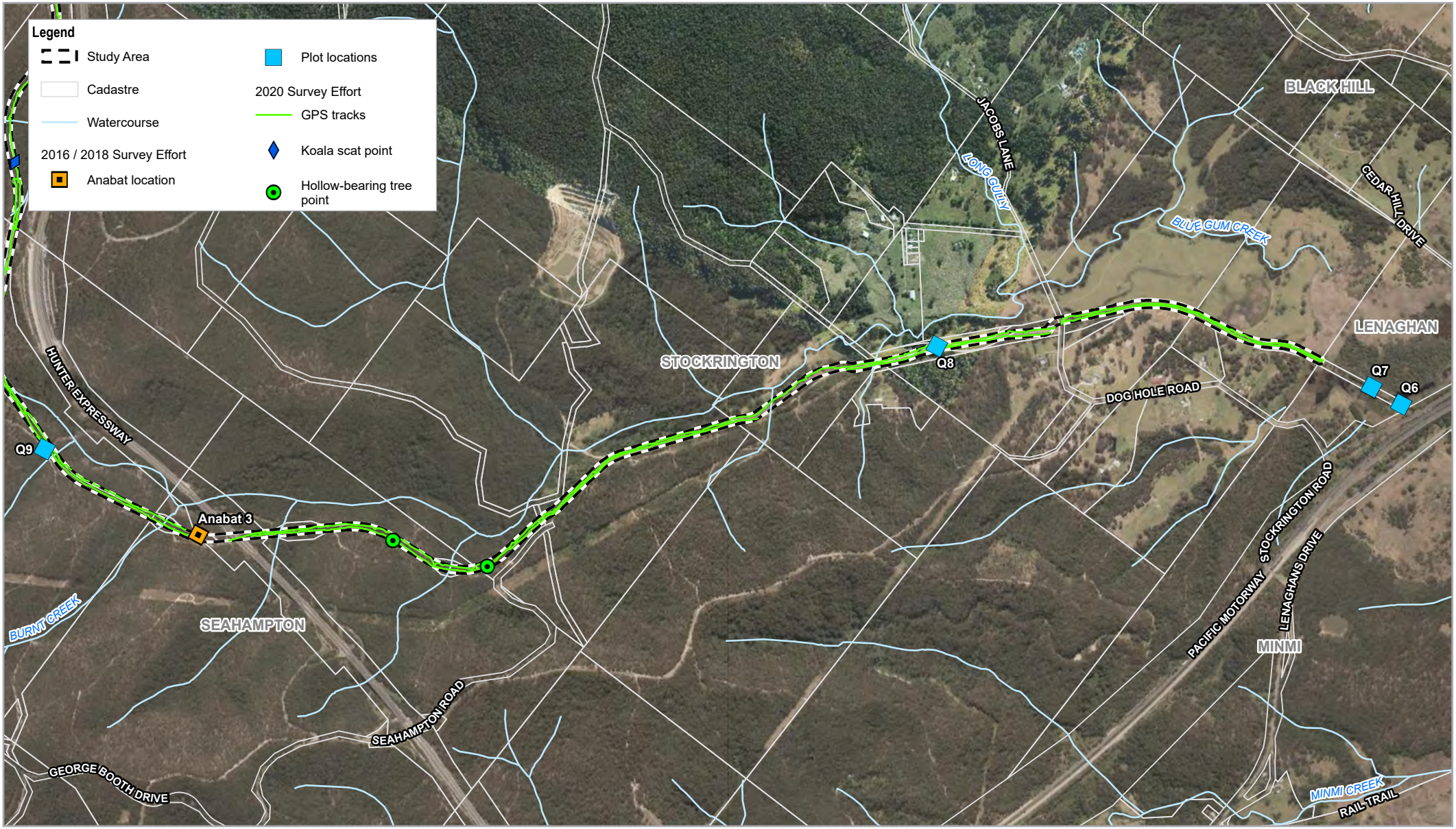
Survey effort
Sheet 2 of 3

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

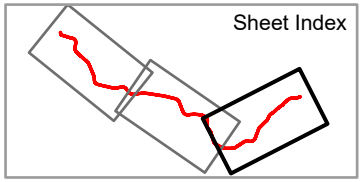
Figure 3-1b

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:04

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Sheet Index



Paper Size ISO A4

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

Survey effort
Sheet 3 of 3

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 3-1c

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:04

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton

4. Results

4.1 Existing environment

4.1.1 Land use

The Hunter region, including Cessnock and Lake Macquarie LGAs, has a long history associated with agriculture, mining, and more recently, urban expansion (Newcastle LEP). The locality has historically been subject to clearing for mining, agricultural and residential purposes. The proposal site itself runs along the once operational Richmond Vale railway which serviced collieries in the Stockrington area. Most of the previous railway remains unused, however a section of railway from the former Richmond Main Colliery to the former Pelaw Main Colliery remains operational as a passenger line tourist facility managed by the Richmond Vale Railway Museum (Richmond Vale Railway Museum, 2010).

Other land uses surrounding the proposal include Werakata State Conservation Area and Sugarloaf Conservation Area, which is used for bike riding and other public recreation (NPWS, 2020).

4.1.2 Interim Biogeographic Regionalisation for Australia (IBRA) region

The proposal site occurs within the Hunter and Wyong IBRA subregion of the Sydney Basin bioregion. The Sydney Basin bioregion lies on the central east coast of NSW and covers an area of about 3,624,008 ha which includes about 4.53 per cent of NSW. The region extends north from Batemans Bay to Nelson Bay and west to Mudgee and includes a significant proportion of the catchments of the Hawkesbury-Nepean, Hunter and Shoalhaven river systems (BCD, 2016).

The majority of the proposal lies within the Hunter subregion which is characterised by rolling hills and wide valleys, forming meandering river systems on a wide flood plain. Several estuarine swamps, brackish and saline steams and river terraces occur within this subregion (BCD, 2019).

The Wyong subregion has been mapped as the coastal fall of the Sydney Basin: this subregion is characterised by rolling hills and sandstone plateau outliers. Beach, dune and lagoons of coastal barriers interspersed with coastal cliffs and rock platforms are also a common feature (BCD, 2019).

4.1.3 Soils, geology, topography

Topography

The topography of the eastern and western portions of the proposal site comprises a relatively flat embankment which runs through swampy and alluvial landscapes which gradually increases in elevation, ranging from approximately 6 metres to 40 metres AHD. Within the central portion of the proposal site, the topography increases up to approximately 75 metres AHD, associated with the Sugarloaf Mt Range which primarily occurs to the south of the proposal site. However, the majority of the alignment is located on existing cut and fill embankment associated with the former Chichester to Newcastle water main and the former Richmond Vale railway.

Geology and soils

Soil landscapes for the proposal site are characterised by quaternary deposits and Permian sediments associated with the low rolling hills and local relief characteristic of floodplain and alluvial processes. The proposal site is mapped as occurring across 14 soil landscapes (DPIE, 1991; Murphy and Tille, 1993). These are summarised in Table 4-1; descriptions are taken from Murphy (1993).

Reference to the Acid Sulfate Soil (ASS) Risk Map indicates that the majority of the proposal site is not located within areas that have a risk of ASS occurrence (Figure 1-2) (DEH, 2016). A small section of the proposal site to the west is mapped as having high probability of occurrence of ASS.

These ASS risk areas are characterised as occurring within the wetland areas adjacent to the proposal site and are associated with Pambalong Nature Reserve. The surrounding undisturbed ground encompassing the wetland areas is also likely to contain ASS, which are commonly associated with the habitat found within the locality (DEH, 2016).

4.1.4 Climate

The Australian Government Bureau of Meteorology website provides climatic information for the proposal site, taken from the Newcastle University Weather Station [station 061390], which is the closest station to the proposal site with detailed long-term climate statistics. The mean annual rainfall for this area is 1114.5 mm. Rainfall is typically highest in summer and early autumn and lowest in late winter and early spring. Mean daily maximum temperatures range from 29.5°C in summer to 18°C in winter with mean minimum temperatures ranging from 19.6°C in summer down to 7.3°C in winter (BOM, 2020b). The weather conditions during the field survey are outlined in Table 3-4.

4.1.5 Streams, wetlands and waterways

The proposal site contains multiple ephemeral drainage lines that connect to Blue Gum Creek, Surveyors Creek, Wallis Creek and Werakata Creek, which drain to the Pacific Ocean after passing through the Hunter River approximately 17 km from the proposal site.

Two wetlands listed in the Directory of Important Wetlands in Australia (DIWA) occur downstream of the proposal site. Both Hexham Swamp and Shortland Wetlands Centre wetlands occur approximately 2.5 and 3.5 kilometres respectively to the east of the proposal site. Coastal Wetlands defined under the Coastal Management SEPP is also mapped directly adjacent to the proposal site and within the locality (refer to Section 2.1.6 and Figure 4-1).

Table 4-1 Soil landscapes within the proposal site

Landscape type	Description
Newcastle Sheet (Murphy and Tille, 1993)	
Bolwarra Heights landscape	Characterised by rolling low hills on Permian sediments in the centre-west of the sheet in the East Maitland Hills region. Local relief is up to 80 metres and slope gradients are in the range of 5% to 20%. The landscape is characterised by cleared tall open-forest.
Killingworth landscape	Characterised by undulating to rolling hills and low hills on the Newcastle Coal Measures of the Awaba Hills region. Local relief is between 30 metres to 100 metres and slope gradients are in the range of 3% to 20%. The landscape is characterised by predominantly uncleared tall open-forest.
Stockrington landscape	Characterised by steep rises on conglomerates of the Newcastle Coal Measures Adamstown Subgroup. Steep slopes have gradients between 25% to 40% and benches have 15% to 20% slopes. Local relief is up to 180 metres. The landscape is characterised by uncleared tall open-forest.
Beresfield landscape	Characterised by undulating low hills and rises on Permian sediments in the East Maitland Hills region. Local relief is up to 50 m and slope gradients are in the range of 3% to 15%. The landscape is characterised by partially cleared tall open-forest.
Rivermead landscape	Characterised by moderately broad to extensive, level to gently undulating alluvial terraces in the Hunter Plain and Paterson Mountains regions. Local relief is between 5 metres and 10 metres and slope gradients are up to 4%. The landscape is characterised by cleared tall open-forest.
Hamilton landscape	Characterised by level to gently undulating well-drained plain on Quaternary deposits in the Hunter Plain region. Local relief is less than 1 metre and slope gradients are less than 2%. The landscape is primarily cleared.
Wyong landscape	Characterised by poorly drained, deltaic floodplains and alluvial flats. Local relief is less than 10 metres and slope gradients are less than 3%. Levees, meander scrolls, ox-bows and swamps are common. Low lying, slightly elevated terraces are occasionally present.
Wallis Creek landscape	Characterised by narrow (<500 m) to moderately broad (1 000 m), level to gently undulating floodplains on Quaternary alluvium. Local relief is up to 2 m and slope gradients are up to 3%. The landscape is characterised by cleared tall open-forest.
Heddon Greta landscape	Characterised by gently undulating to undulating rises on shallow windblown sand deposits which blanket Permian sediments in the East Maitland Hills region. Local relief is up to 20 metres and slope gradients are in the range of 2% to 10%. The landscape is characterised by uncleared low woodland.
Bobs Farm landscape	Characterised by broad interbarrier estuarine flat on the Tomago Coastal Plain. Local relief is less than 1 metre and slope gradients are also less than 1%. The landscape is characterised by open-woodland.
Cedar Hill landscape	Characterised by rolling to steep rises on siltstones and sandstones in the Awaba Hills and Sugarloaf Range. Local relief is up to 100 m and slope gradients are in the range of 15% to 40%. The landscape is characterised by cleared tall open-forest.

Landscape type	Description
Cockle Creek landscape	Characterised by narrow floodplains, alluvial fan deposits and broad delta deposits in the Awaba Hills. Local relief is less than 1 metre and slope gradients are up to 2%. The landscape is characterised by cleared open-forest.
Hexham Swamp landscape	Characterised by broad, swampy, estuarine backplains on the Hunter delta. Local relief is less than 2 metres and slope gradients are less than 1%. The landscape is characterised by sedgeland with open-woodland on swamp margins.
Singleton sheet (DPIE, 1991)	
Neath landscape	Characterised by undulating low rises and swamps with elevations of 40 metres to 80 metres. Local relief is under 30 m and slope gradients are up to 3%. This soil landscape covers gently undulating rises and melaleuca swamps to the east of Cessnock. The main soils are Grey Solodic Soils in the poorly drained areas associated with exposed coal seams. There are Yellow Solodic Soils on the better drained lower slopes.

4.2 Vegetation

4.2.1 Flora species and priority weeds

A total of 217 flora species were recorded within the proposal site during field surveys (refer to Appendix B). The native species assemblage is represented by 165 species across 74 families and is dominated by Myrtaceae (25 species), Fabaceae (26 species) and Poaceae (15 species) species.

Five species recorded within the proposal and study area are listed as threatened under the BC Act or the EPBC Act. Discussion on the likely occurrence of threatened flora species is provided in Section 5.1.2.

The floral assemblage recorded within the proposal site also includes 52 exotic species. These species predominantly occur within previously cleared areas as well as along the disturbed margins of remnant native vegetation within the proposal site.

Five of the exotic species recorded within the proposal site are priority weeds for the Hunter region, which includes Cessnock and Lake Macquarie LGA (DPI, 2020). These weeds occur in moderate abundance within the proposal site. The priority weeds recorded are listed in Table 4-2 along with their relevant control measures.

Table 4-2 Priority weeds recorded within the proposal site

Priority weed	Regional recommended measure	State mandatory measure	Weed of national environmental significance
Anredera cordifolia (Madeira Vine)	n/a	Prohibition on dealings Must not be imported into the State or sold	Yes
Bryophyllum delagoense (Mother of millions)	Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment. Land managers reduce impacts from the plant on priority assets.	General Biosecurity Duty All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.	No
Lantana camara (Lantana)	n/a	Prohibition on dealings: Must not be imported into the State or sold	Yes

Priority weed	Regional recommended measure	State mandatory measure	Weed of national environmental significance
Rubus fruticosus aggregate (Blackberry)	The plant should not be bought, sold, grown, carried or released into the environment. Land managers should mitigate the risk of the plant being introduced to their land. Land managers should mitigate spread from their land. Land managers to reduce impacts from the plant on priority assets.	Prohibition on dealings: Must not be imported into the State or sold	Yes
Senecio madagascariensis (Fireweed)	n/a	Prohibition on dealings: Must not be imported into the State or sold	Yes

4.2.2 Vegetation in the proposal site

General description

The proposal site is located within the Hunter and Wyong IBRA subregion of the Sydney Basin bioregion. The Hunter subregion is broadly comprised of a complex of Permian shales, sandstones, conglomerates, volcanics and coal measures. This supports a variety of vegetation types including rainforest, open forest and woodland, coastal dune vegetation and estuarine swamps (BCD, 2019). The Wyong subregion is underlain by triassic Narrabeen sandstones, Quaternary estuarine fills, and coastal barrier complexes which support forest and open woodland on hills and slopes, swampy woodland, sedges and common reeds on flats and open heathland on barrier dunes and mangroves in coastal lake entrances (BCD, 2019).

The proposal has been designed such that the majority of the proposal site occurs within historically cleared areas, with the proposed bike path generally aligned to follow the existing cleared railway trail (Photograph 4-1 and Photograph 4-2). Vegetation that would be disturbed within the proposal site is part of a much larger contiguous patch that extends to the north and south of the proposal site.

Blue Gum Creek, Surveyors Creek, Wallis Creek and Werakata Creek occur within the proposal site. These creeks are likely to have been degraded and modified as a result of historic land uses. The vegetation along these creeks is likely a mixture of native and introduced species.

The total area of land within the proposal site is 13.64 hectares, within this area the extent of native vegetation is approximately 3.59 hectares. Areas of native vegetation occur along the margins of remnant native woodland and shrubland patches (see Figure 4-1).

Within previously cleared areas where groundcover vegetation persists, the vegetation is largely dominated by exotic grasses, including *Briza maxima* (Quaking Grass), *Megathyrsus maximus* (Guinea Grass), *Andropogon virginicus* (Whiskey Grass) and *Melinis repens* (Red Natal Grass).

Photograph 4-1 Cleared railway track within the proposal site with fringing vegetation

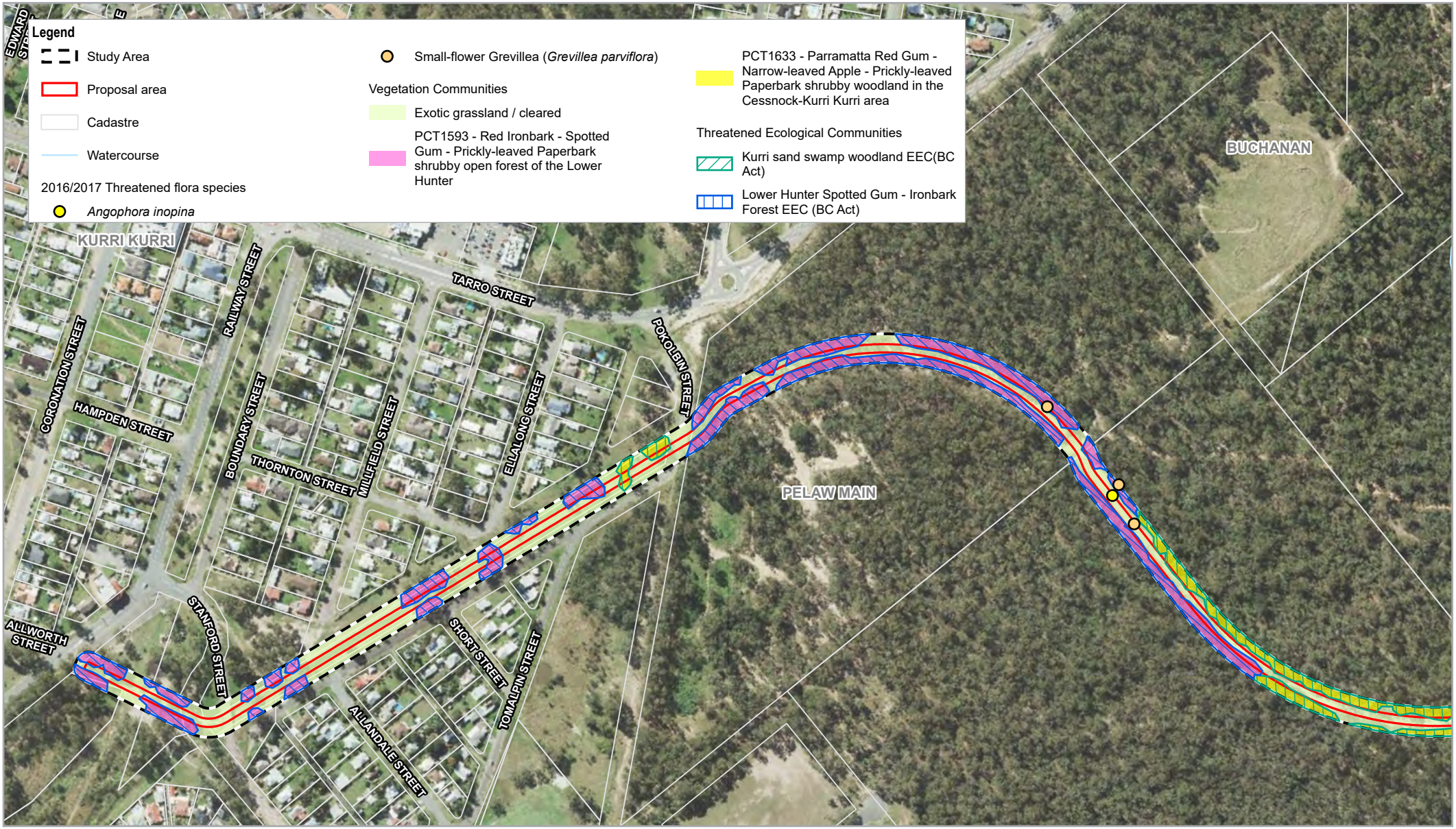
Photograph 4-2 Native forest vegetation within the proposal site

Plant community types

The native vegetation within the proposal site is mostly restricted to the edges of the previously cleared rail line. Parts of the proposed route also run along exotic grassland and cleared areas associated with residential development. Remnant native vegetation throughout the proposal site is broadly consistent with regional vegetation mapping and is characteristic of six PCTs. These include:

- PCT 1568: Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast.
- PCT 1588: Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast.
- PCT 1589: Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast.
- PCT 1593: Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter.
- PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of the coastal lowlands.
- PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area.

PCTs that occur within the proposal site are shown on Figure 4-1 and briefly described in the following tables.



Sheet Index

Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

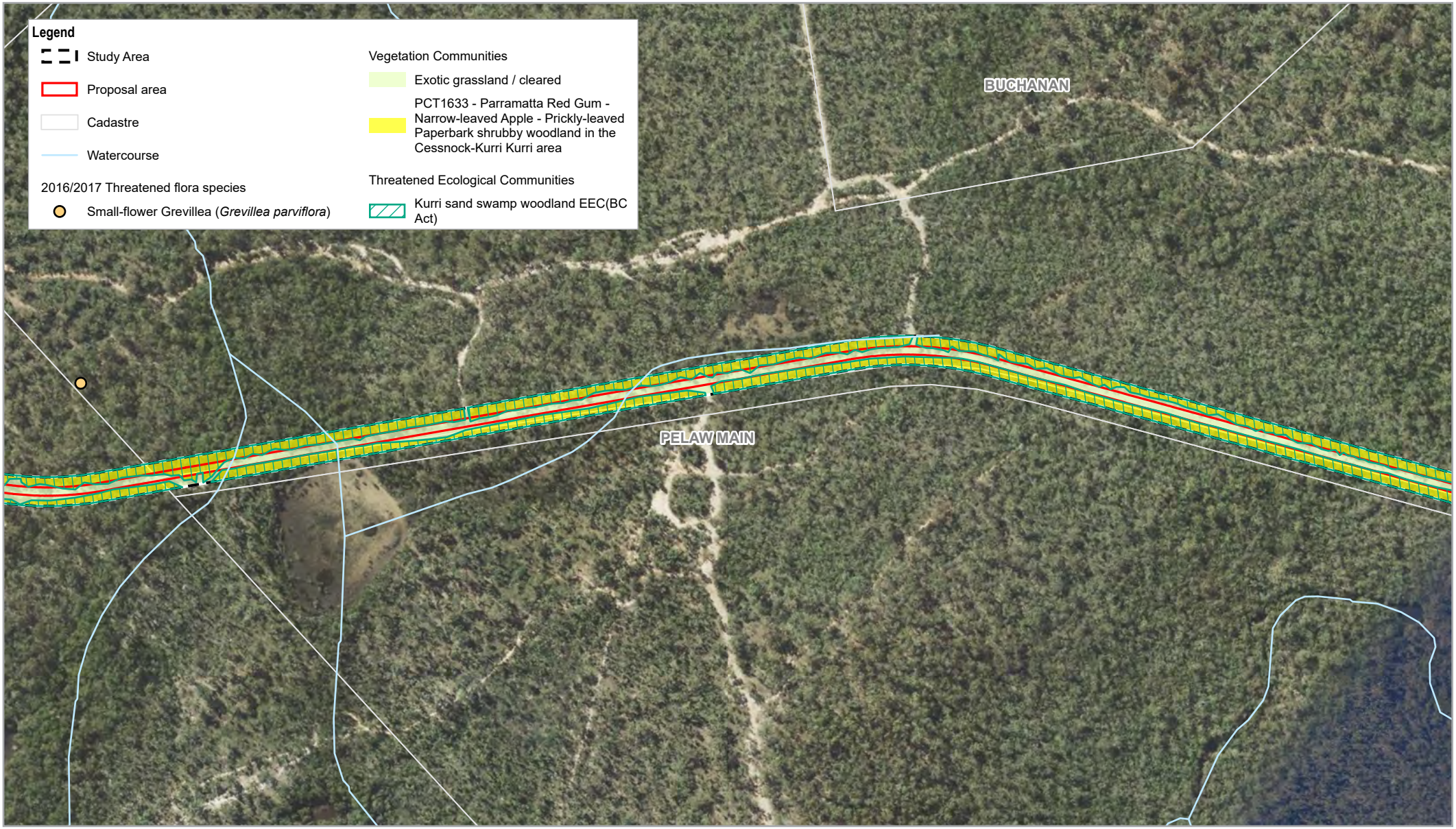
Vegetation communities within the proposal area
Sheet 1 of 12

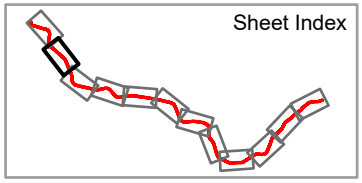
Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 4-1a

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:05

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton





Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

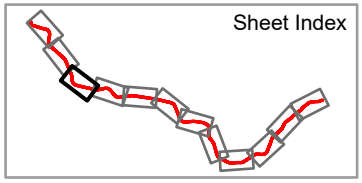
Vegetation communities within the proposal area Sheet 2 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 4-1b

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:05

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

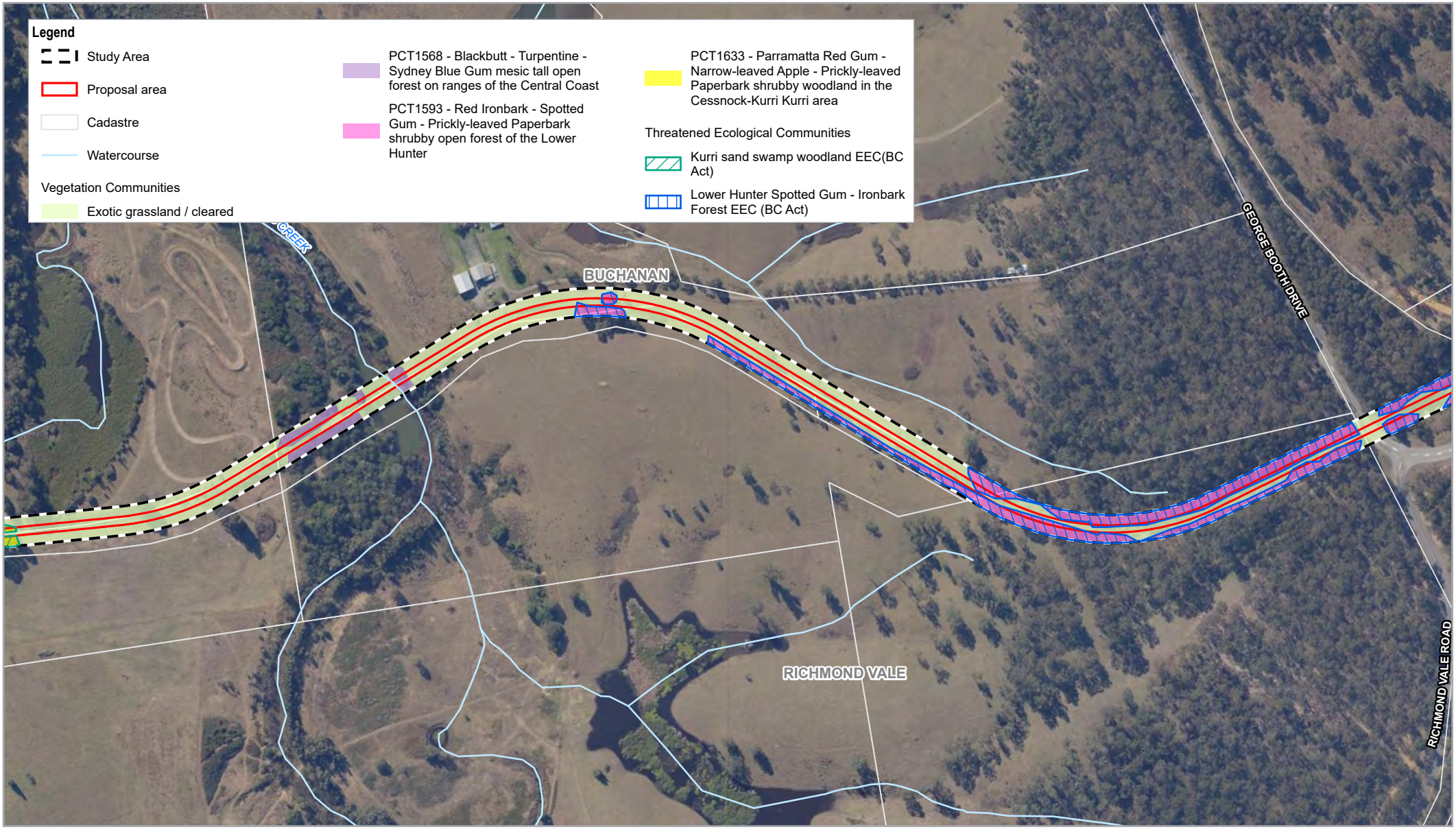
Vegetation communities within the proposal area Sheet 3 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

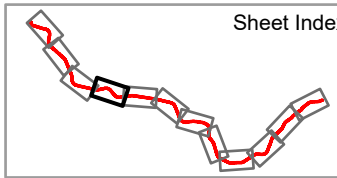
Figure 4-1c

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:05

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Sheet Index



Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

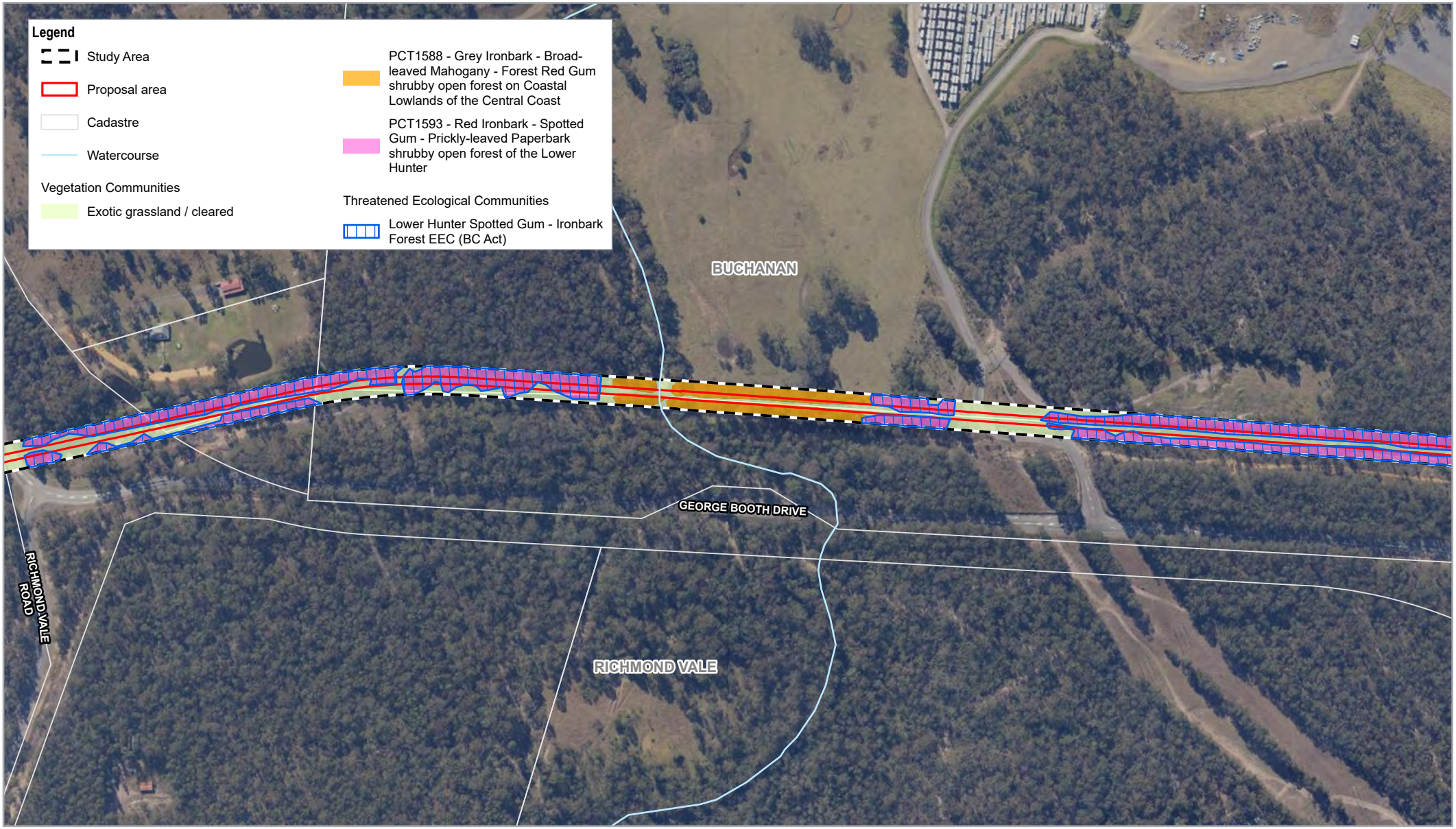
Vegetation communities within the proposal area Sheet 4 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

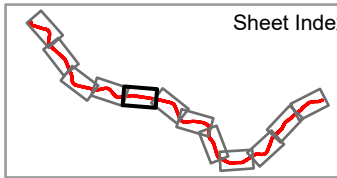
Figure 4-1d

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Sheet Index



Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

Vegetation communities within the proposal area

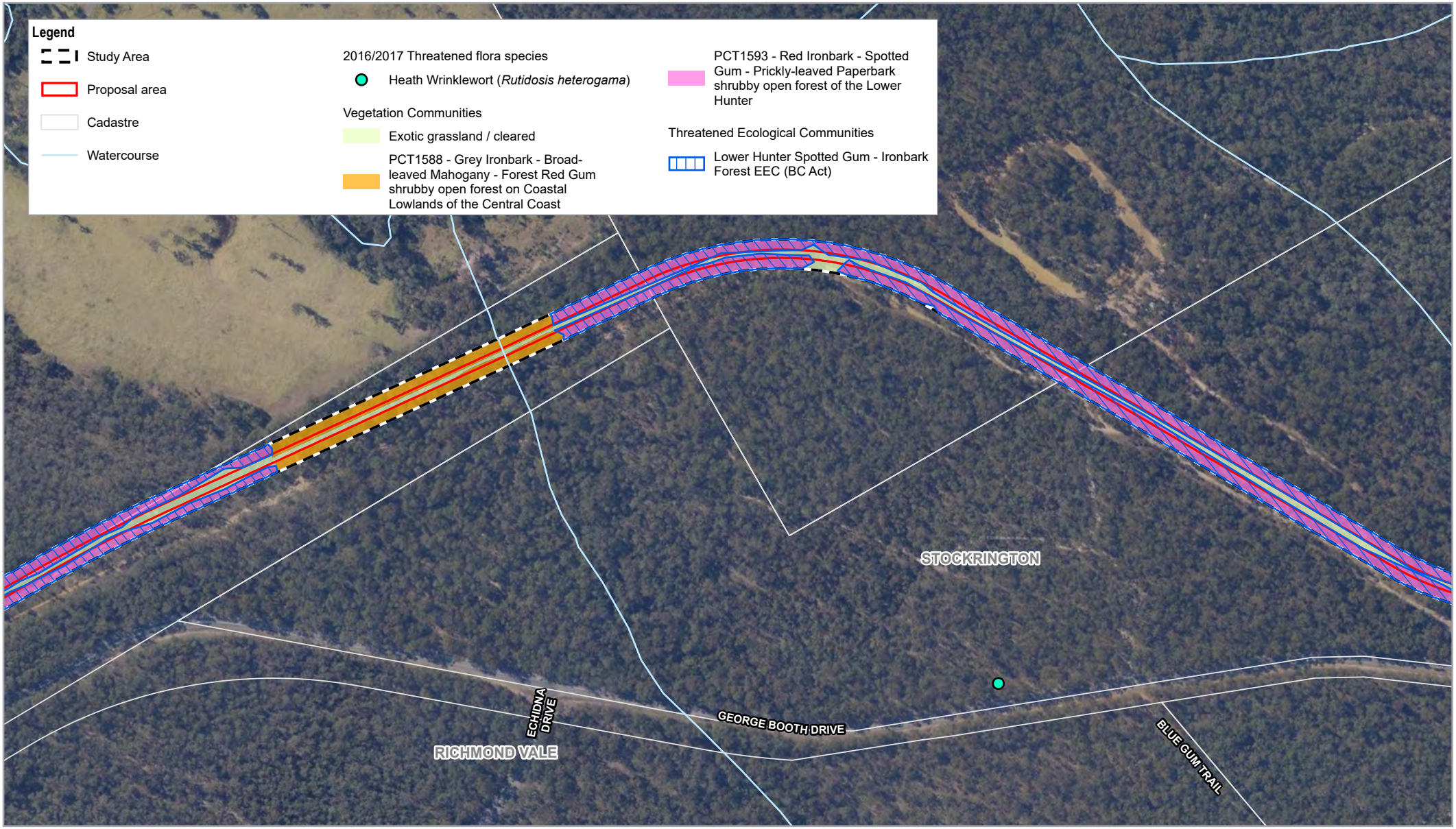
Sheet 5 of 12

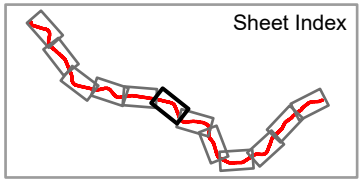
Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 4-1e

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton





Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

Vegetation communities within the proposal area

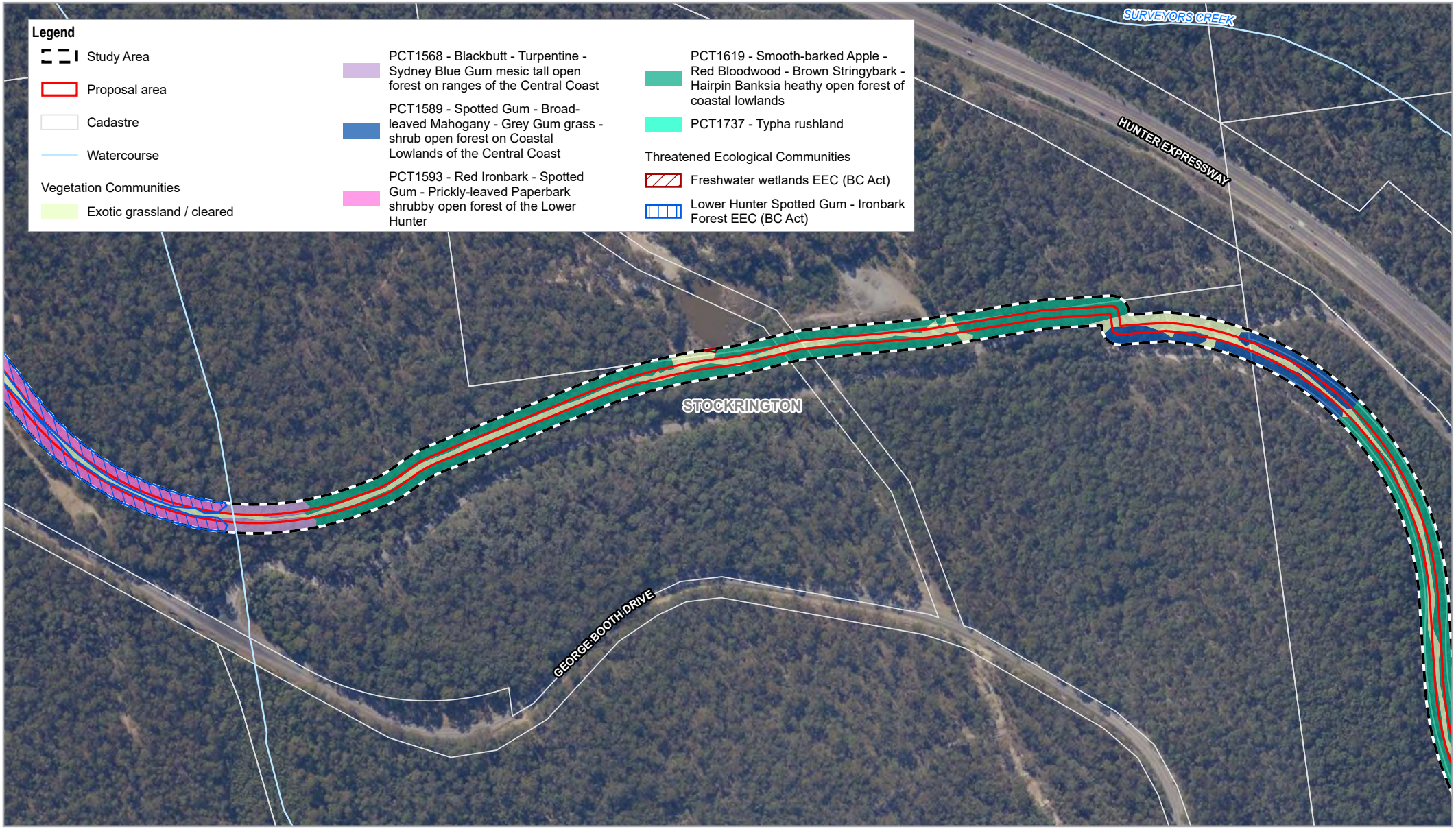
Sheet 6 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

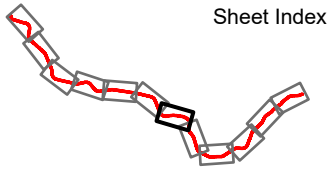
Figure 4-1f

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Sheet Index



Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

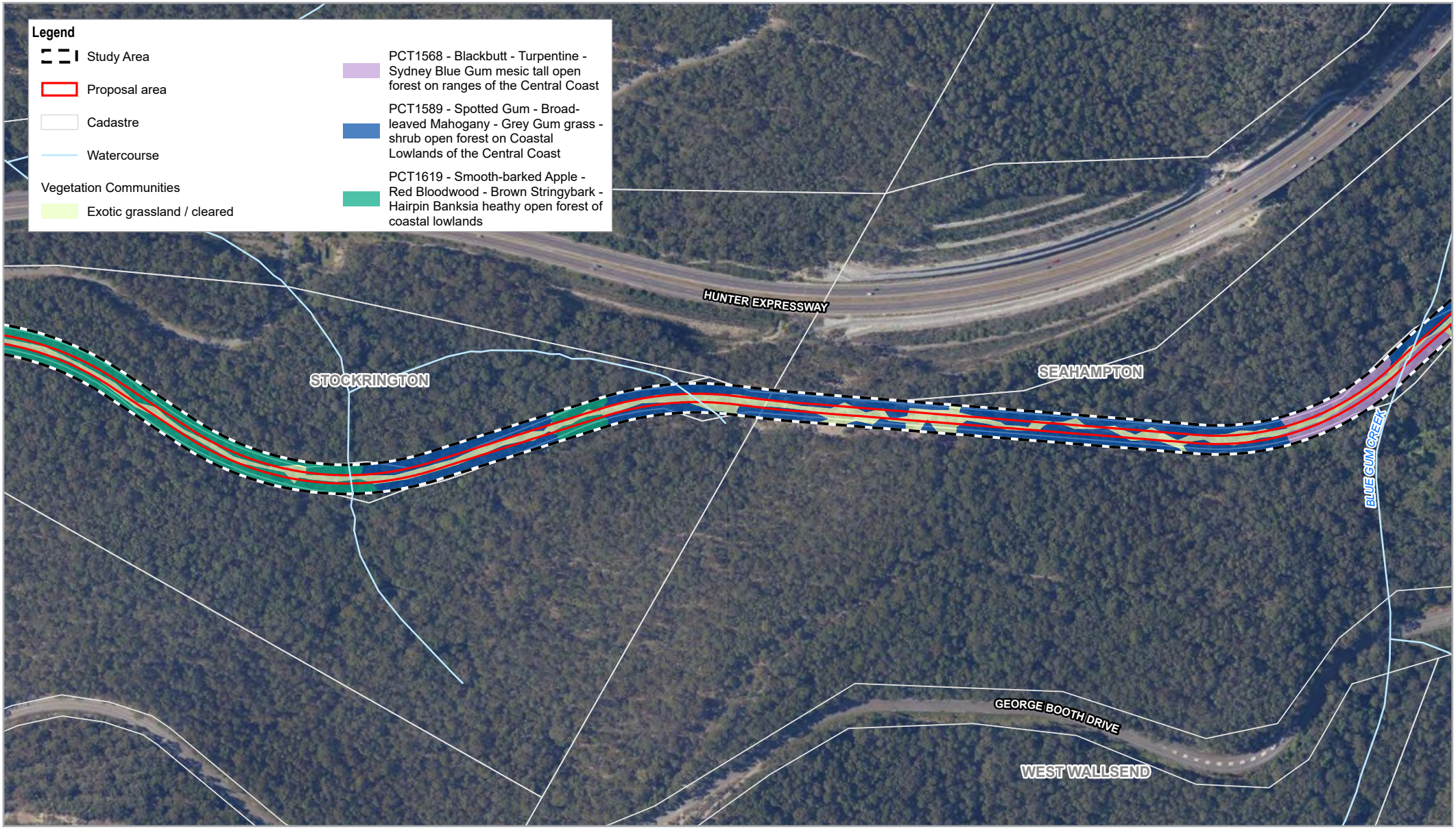
Vegetation communities within the proposal area
Sheet 7 of 12

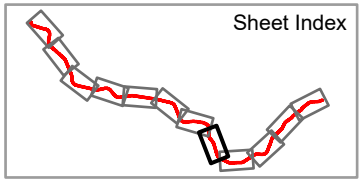
Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 4-1g

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton





Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

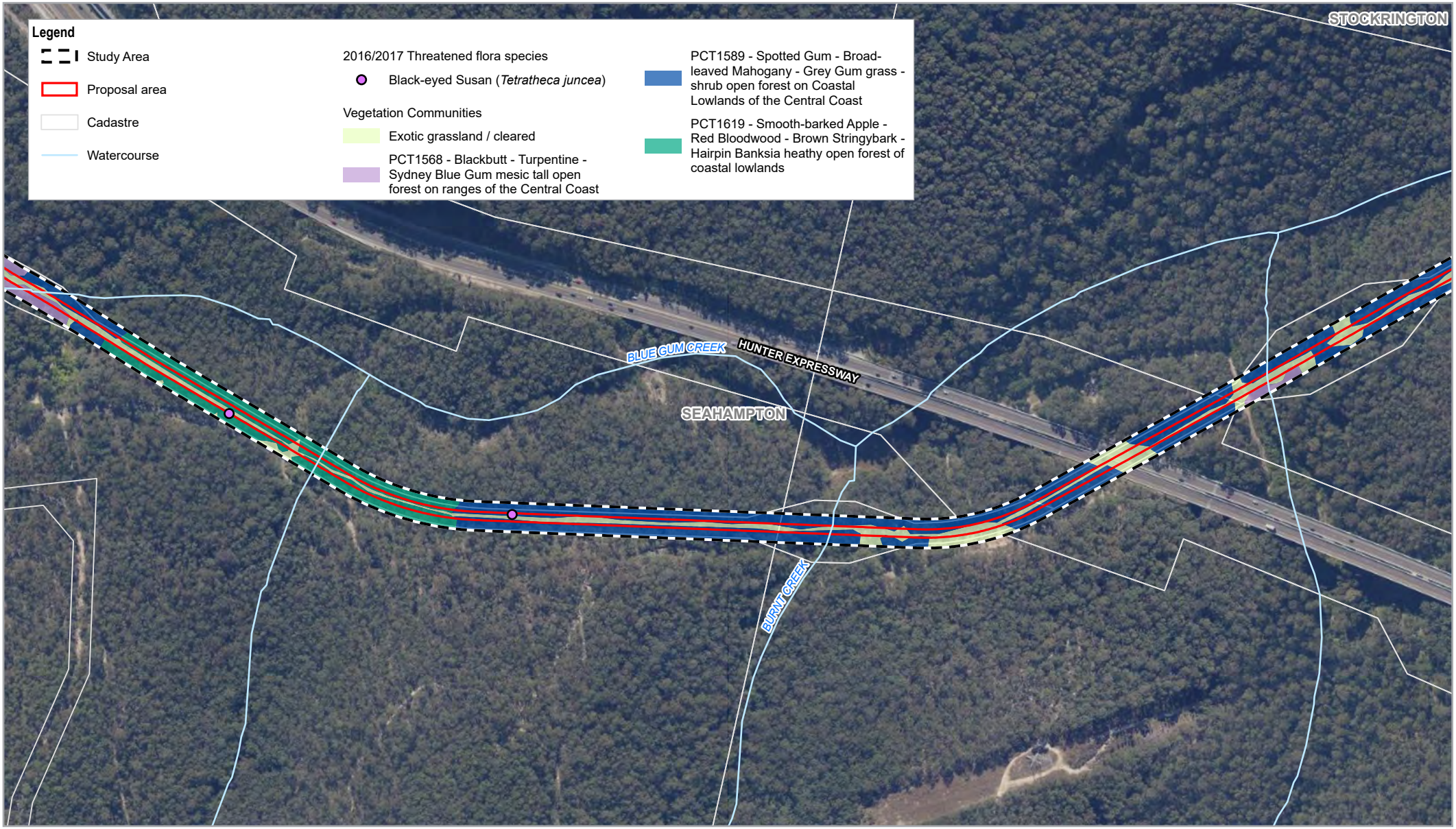
Vegetation communities within the proposal area
Sheet 8 of 12

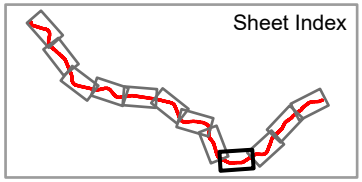
Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 4-1h

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton





Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

Vegetation communities within the proposal area

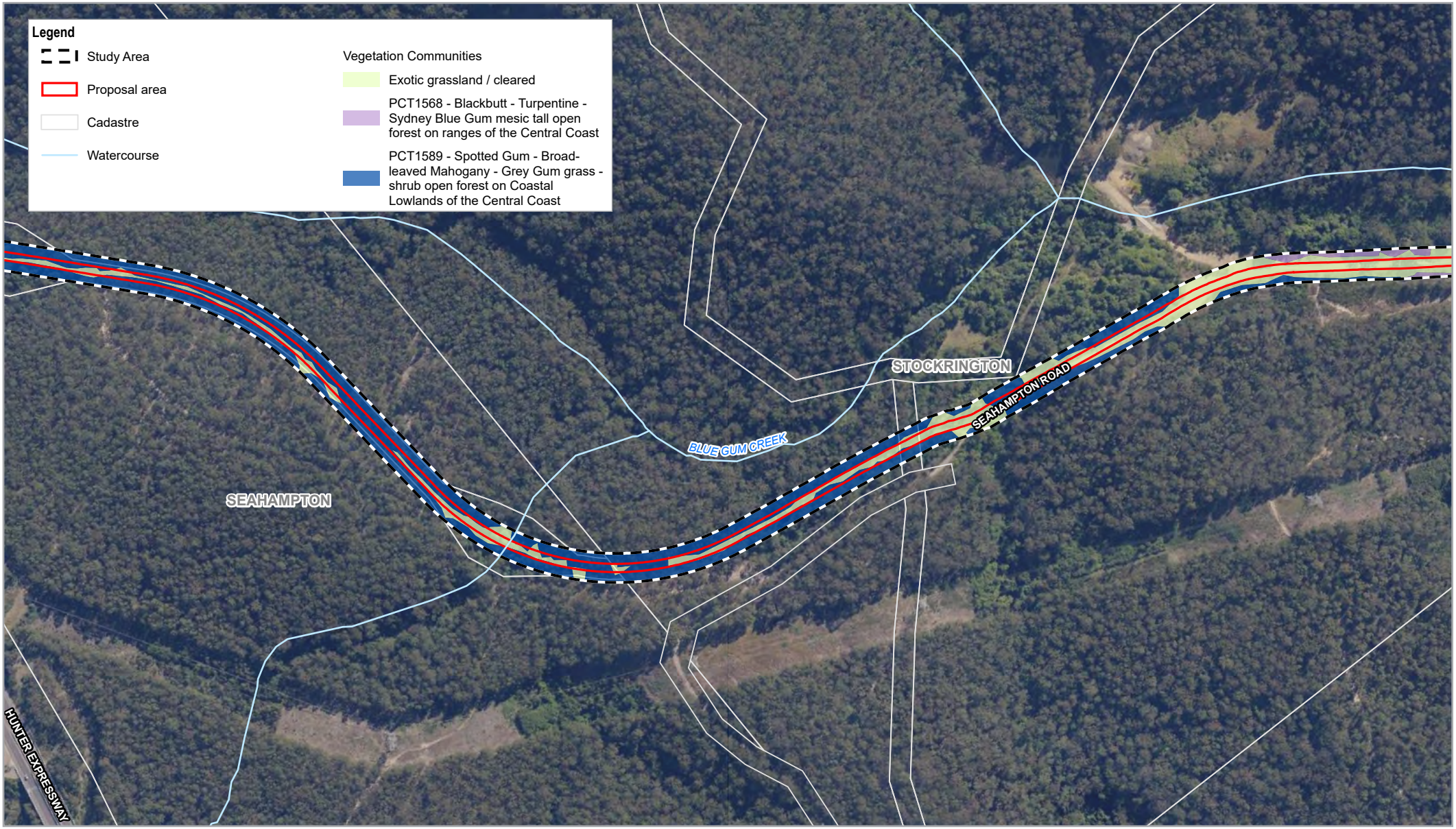
Sheet 9 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 4-1i

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Sheet Index

Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

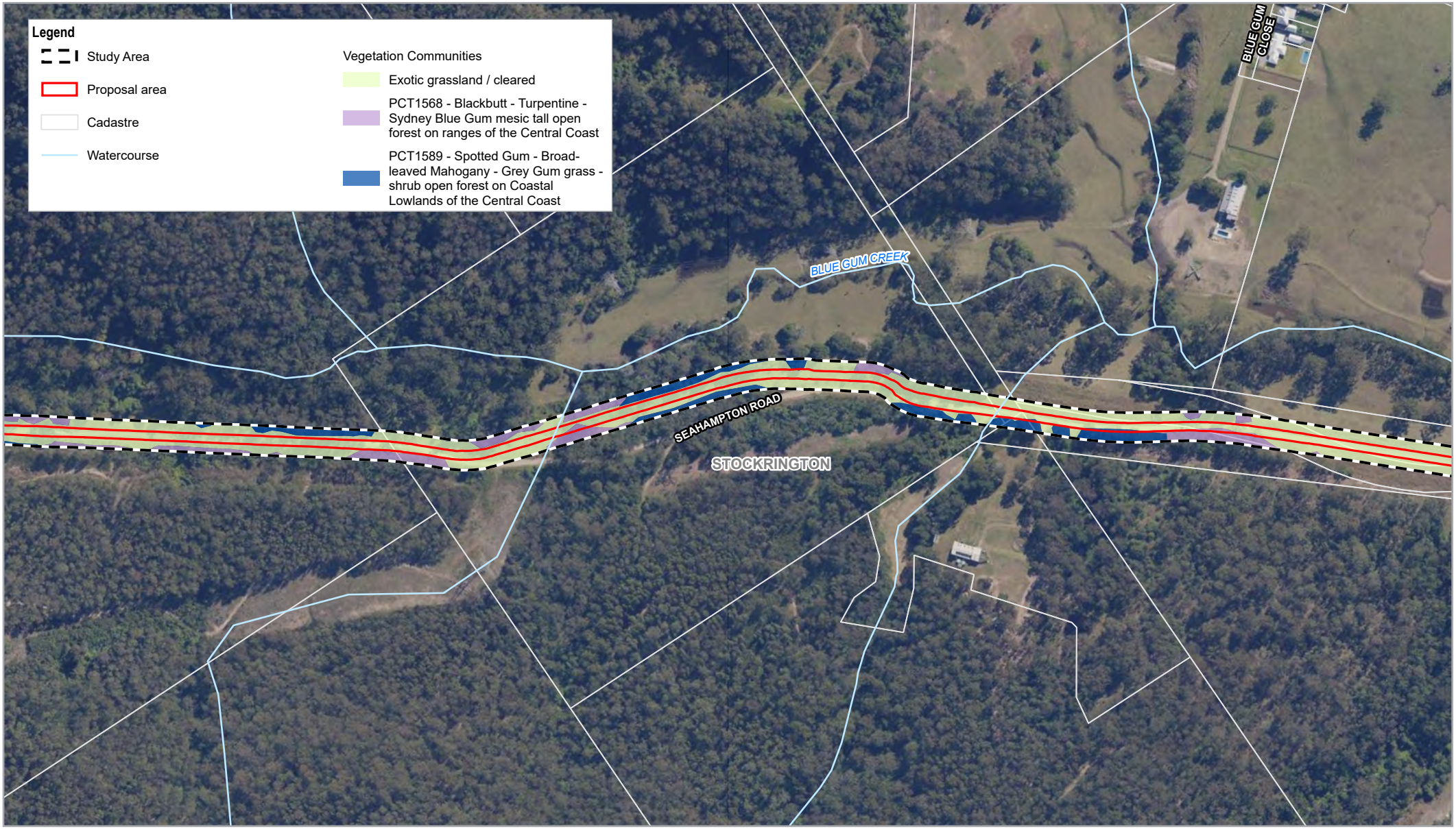
Vegetation communities within the proposal area Sheet 10 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

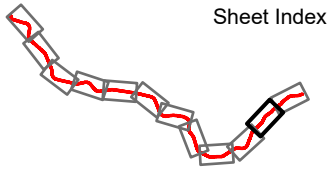
Figure 4-1j

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Sheet Index



Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

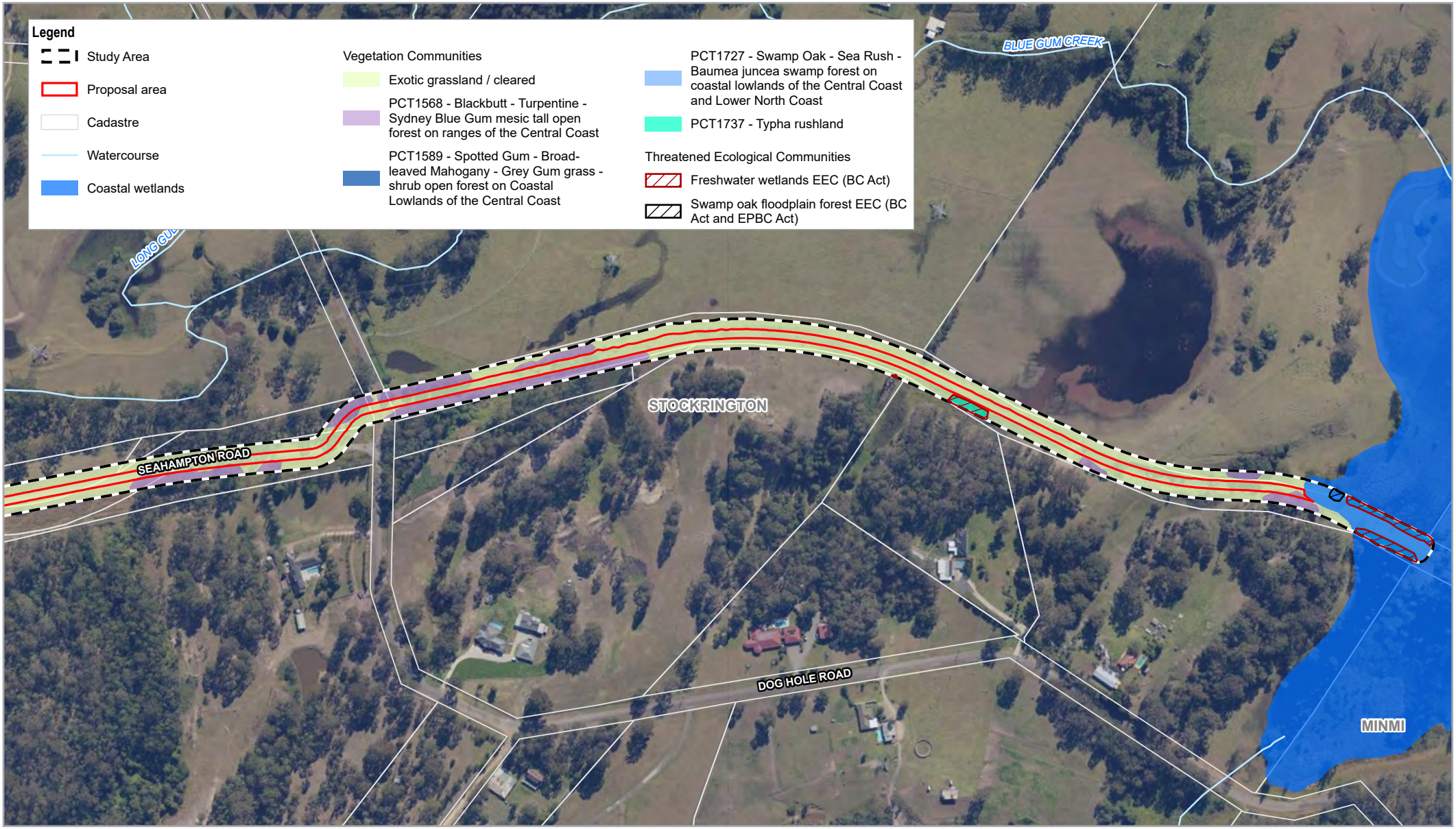
Vegetation communities within the proposal area Sheet 11 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

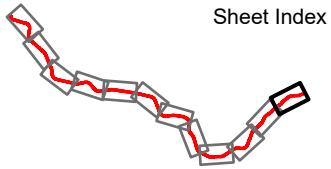
Figure 4-1k

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton



Sheet Index



Paper Size ISO A4

0 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

GHD

Cessnock City Council
Richmond Vale Rail Trail
Flora and Fauna Assessment

Vegetation communities within the proposal area Sheet 12 of 12

Project No. **12529257**
Revision No. **0**
Date **11/09/2020**

Figure 4-1l

\\ghdnet\ghd\AU\Newcastle\Projects\22\12529257\GIS\Maps\FFA_0.aprx
Print date: 11 Sep 2020 - 12:06

Data source: DPE: Coastal Wetlands, 2016; LPI: DTDB / DCDB, 2017;public_NSW_Imagery: © Department of Customer Service 2020. Created by: tmorton

Table 4-3 PCT 1568: Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast

Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast	
Vegetation formation	Wet Sclerophyll Forests (Shrubby sub-formation)
Vegetation class	North Coast Wet Sclerophyll Forests
PCT % cleared	40
Occurrence within the proposal site	This PCT occurs primarily at the eastern end of the of the proposal site, just north of the Hunter Expressway along Seahampton Road. This community also occurs in small patches further east, however with a minor extent.
Extent within the proposal site	0.19 hectares
Floristic description	In forested areas, the community has a tall open forest structure. The dominant canopy species include *Eucalyptus saligna* (Sydney Blue Gum) and *Eucalyptus grandis* (Flooded Gum). Other species which occur to a lesser extent include *Eucalyptus pilularis* (Blackbutt) and *Syncarpia glomulifera* (Turpentine). The shrub layer is dominated mainly by *Acacia irrorata* (Green Wattle), *Glochidion ferdinandi* (Cheese Tree) and *Cissus antarctica* (Water Vine). In deeper gullies, mesic species also occur including *Cryptocarya microneura* (Murrogun), *Synoum glandulosum* (Scentless Rosewood), *Wilkiea huegeliana* (Veiny Wilkiea) and *Acmena smithii* (Lilly Pilly). The groundcover is dominated by mainly by *Dianella caerulea* (Blue Flax-lily) and *Pteridium esculentum* (Bracken fern). Other species which occur to a lesser extent include *Blechnum cartilagineum* (Gristle Fern), *Doodia aspera* (Prickly Rasp Fern), *Calochlaena dubia* (Rainbow Fern) and *Gymnostachys anceps* (Settler's Twine). Several large infestation of *Lantana camara* (Lantana) were observed. The surrounding exotic grassland is dominated by *Pennisetum clandestinum* (Kikuyu) and a range of other exotic species.
Condition	Moderate/good- The community although fragmented is in relatively good condition.
Conservation significance	This PCT does not conform to any TECs listed under the BC Act or EPBC Act
Photo	Refer to Photograph 4-3

Photograph 4-3 PCT 1568: Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast

Table 4-4 PCT 1588: Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast

Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	
Vegetation formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation class	Hunter-Macleay Dry Sclerophyll Forests
PCT % cleared	56
Occurrence within the proposal site	This vegetation community occurs in two patches within the proposal site on either side of the easement, north of George Booth Drive
Extent within the proposal site	0.21 hectares
Floristic description	The community has an open forest structure. The dominant canopy species include *Eucalyptus paniculata* (Grey Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). The dominant shrubs consists mostly of exotic species such as *Lantana camara* (Lantana) and some native species including *Breynia oblongifolia* (Coffee Bush), *Eustrephus latifolius* (Wombat Berry), *Pandorea pandorana* (Wonga Wonga Vine) and *Dodonaea triquetra* (Large-leaf Hop-bush).The dominant groundcover species included a range of grass species including *Imperata cylindrica* (Blady Grass). Herbs include *Pratia purpurascens* (Whiteroot), and *Pomax umbellata* (Pomax). *Senecio madagascariensis* (Fireweed) is common along forest edges.
Condition	The community ranges from poor to moderate condition with infestations of *Lantana camara* (Lantana) within most of the patches of this community
Conservation significance	This PCT does not conform to any TECs listed under the BC Act or EPBC Act
Photo	Refer to Photograph 4-4

Photograph 4-4 PCT 1588: Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast

Table 4-5 PCT 1589: Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast

Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast	
Vegetation formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation class	Hunter-Macleay Dry Sclerophyll Forests
PCT % cleared	71
Occurrence within the proposal site	The vegetation occurs within the eastern half of the proposal site. Large continuous patches occur from the Hunter Expressway up to the edge of Pambalong Nature Reserve.
Extent within the proposal site	1.1 hectares
Floristic description	The community has an open forest structure. The dominant canopy species include *Corymbia maculata* (Spotted Gum) and *Eucalyptus umbra* (Broad-leaved White Mahogany). *Eucalyptus punctata* (Grey Gum) also occurs to a lesser extent. The shrub layer is dominated by *Daviesia ulicifolia* (Gorse Bitter Pea), *Jacksonia scoparia* (Winged Broom Pea), *Bursaria spinosa* (Blackthorn), *Pultenaea villosa* (Hairy Bush-pea), *Breynia oblongifolia* (Coffee Bush) and *Podolobium ilicifolium* (Prickly Shaggy Pea). The groundcover is dominated by *Entolasia stricta* (Wiry panic), *Themeda australis* (Kangaroo Grass), *Rytidosperma pallidum* (Silvertop Wallaby Grass), *Imperata cylindrica* (Blady Grass), *Lomandra confertifolia* (Matrush), *Dianella caerulea* (Blue Flax-lily) and *Lomandra longifolia* (Spiny-headed Mat-rush).
Condition	The community is in relatively good condition, however, several large infestation of *Lantana camara* (Lantana) were observed. *Senecio madagascariensis* (Fireweed) was also observed along the former rail corridor.
Conservation significance	This PCT does not conform to any TECs listed under the BC Act or EPBC Act
Photo	Refer to Photograph 4-5

Photograph 4-5 PCT 1589: Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast

Table 4-6 PCT 1593: Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter

Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter	
Vegetation formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Vegetation class	Hunter-Macleay Dry Sclerophyll Forests
PCT % cleared	49
Occurrence within the proposal site	The vegetation occurs within the western half of the proposal site. Large continuous patches occur from between the Hunter Expressway and George Booth Drive up to the town of Kurri Kurri.
Extent within the proposal site	1.04 hectares
Floristic description	The community has an open forest structure. Canopy species include *Corymbia maculata* (Spotted Gum), *Eucalyptus fibrosa* (Red Ironbark) and *Eucalyptus punctata* (Grey Gum). Other species which occur to a lesser extent include *Eucalyptus paniculata* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus umbra* (White Mahogany). The dominant shrubs include *Melaleuca nodosa* (Ball Honeymyrtle), *Bursaria spinosa* (Native Blackthorn), *Pultenaea spinosa* (Bush Pea), *Acacia elongata* (Swamp Wattle), *Persoonia linearis* (Narrow-leaved Geebung), *Daviesia ulicifolia* (Gorse Bitter Pea) and *Podolobium ilicifolium* (Prickly Shaggy Pea). The groundcover is dominated by *Aristida vagans* (Three-awn Speargrass), *Entolasia stricta* (Wiry Panic), *Microlaena stipoides* (Weeping Grass), *Lepidosperma laterale* (Variable Sword-sedge), *Dianella revoluta* (Blueberry Lily), *Pomax umbellata* (Pomax) and *Goodenia rotundifolia*.
Condition	The community is in generally good condition although managed parkland areas near Kurri Kurri contain only canopy and sparse shrubby remnants of the community. Areas south-east of Kurri Kurri contain large intact forests which contain minor infestations of *Lantana camara* (Lantana) and *Olea europaea* (African Olive).
Conservation significance	This PCT conforms to the EEC listed under the BC Act as Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions
Photo	Refer to Photograph 4-6

Photograph 4-6 PCT 1593: Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter

Table 4-7 PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of the coastal lowlands

Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of the coastal lowlands	
Vegetation formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation class	Sydney Coastal Dry Sclerophyll Forests
PCT % cleared	45
Occurrence within the proposal site	The vegetation occurs centrally within the proposal site, between George Booth Drive and the Hunter Expressway
Extent within the proposal site	0.66 hectares
Floristic description	The community has an open forest structure and is dominated by *Angophora costata* (Sydney Red Gum), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus umbra* (White Mahogany). A shrub layer is dominated by *Allocasuarina littoralis* (Black She-Oak) and *Banksia spinulosa* (hairpin banksia). Other shrubs which occur to a lesser extent include *Leptospermum polygalifolium* (Tantoon), *Acacia myrtifolia* (Red-stemmed Wattle), *Persoonia levis* (Broad-leaved Geebung) and *Persoonia linearis* (Narrow-leaved Geebung). The groundcover is dominated by *Entolasia stricta* (Wiry Panic) and *Themeda australis* (Kangaroo Grass). Other species which occur to a lesser extent include *Lepidosperma laterale* (Variable Sword-sedge), *Lomandra obliqua* and *Goodenia heterophylla*.
Condition	The community is in relatively good condition with few infestation of *Lantana camara* (Lantana).
Conservation significance	This PCT does not conform to any TECs listed under the BC Act or EPBC Act
Photo	Refer to Photograph 4-7

Photograph 4-7 PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of the coastal lowlands

Table 4-8 PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area

Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	
Vegetation formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation class	Sydney Sand Flats Dry Sclerophyll Forests
PCT % cleared	75
Occurrence within the proposal site	This vegetation is restricted to the western end of the proposal site adjacent to the town of Kurri Kurri within the Werrikata State Conservation Area.
Extent within the proposal site	0.39 hectares
Floristic description	The community has an open woodland structure. Canopy species include *Eucalyptus parramattensis* (Parramatta Red Gum), *Angophora bakeri* (Narrow-leaved Apple). *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus agglomerata* (Blue-leaved Stringybark) also occur to a lesser extent. The midstorey is dense in most places and contains several shrub species including *Allocasuarina littoralis* (Black She-oak), *Melaleuca nodosa* (Ball Honeymyrtle), *Leptospermum trinervium* (Flaky-bark Tea-tree), *Melaleuca thymifolia* (Thyme Honey-myrtle), *Banksia spinulosa* (Hairpin Banksia), *Callistemon linearis* (Narrow-leaved Bottlebrush), *Dillwynia retorta*, *Leptospermum parvifolium* and *Hakea sericea* (Needlebush). In wetter areas *Gahnia clarkei* (Tall Sword Sedge) is abundant. The groundcover is also dense and dominated by grasses such as *Imperata cylindrica* (Blady Grass), *Entolasia stricta* (Wiry Panic) and *Themeda australis* (Kangaroo Grass). Other species include *Lomandra longifolia* (Spiny-headed Matt-rush) and *Lomandra glauca* (Pale Mat-rush).
Condition	The community is in good condition with very few infestations of weeds. Patches of *Andropogon virginicus* (Whiskey Grass) and other common weeds were observed on the edges of the woodland in some places.
Conservation significance	This PCT conforms to the EEC listed under the BC Act as Kurri Sand Swamp Woodland in the Sydney Basin Bioregion
Photo	Refer to Photograph 4-8

Photograph 4-8 PCT 1633: Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area

4.3 Groundwater dependent ecosystems

The NSW State Groundwater Dependent Ecosystems Policy defines groundwater dependent ecosystems (GDEs) as ecosystems which have their species composition, and their natural ecological processes determined by groundwater (DLWC, 2002). Ecosystems vary dramatically in the degree of dependency of groundwater, from having no apparent dependence through to being entirely dependent (DLWC, 2002).

Dependence (or interaction) of the vegetation communities identified within the proposal site on groundwater was determined by searching the Atlas of GDEs (BOM, 2020a). This Atlas predicts the occurrence of groundwater dependent ecosystems and ecosystems that potentially use groundwater. It shows ecosystems that interact with the subsurface expression of groundwater (including vegetation ecosystems) or the surface expression of groundwater (such as rivers and wetlands. The Atlas also shows the likelihood that landscapes are accessing water in addition to rainfall, such as soil water, surface water or groundwater.

Native vegetation within the proposal site is mapped as vegetation that has high potential for being reliant on the subsurface presence of groundwater, and a likelihood of 10 that the vegetation type is an in-flow dependent ecosystem, namely an ecosystem that is “accessing a water source in addition to rainfall, such as water stored in the unsaturated zone, surface water or groundwater”.

4.4 Fauna species and habitats

4.4.1 Fauna species

A total of 62 fauna species, comprising 60 natives and two exotics were recorded in the proposal site. These comprised 41 birds, 19 mammals (including 13 microbat species: eight definite; and 5 probable), and two amphibians. The full species list is included in Appendix B. Species are discussed in the following section in terms of their habitat use within the proposal site.

4.4.2 Fauna habitat

The majority of the proposal site occurs within exotic grassland (10.05 hectares) that lacks many of the microhabitats used by fauna species for foraging, sheltering and breeding (e.g. tree hollows, flowering myrtaceous species). The area mapped as exotic grassland also contains areas of bare earth as a result of vehicle access. The other vegetation within the proposal site consists of regrowth vegetation (3.6 hectares) in the form of acacia thickets, infestations of exotic species such as Lantana. Occasional mature trees are present in some areas: however, lack fauna habitat features such as an abundance of tree hollows.

The proposal area contains a range of different fauna habitats along its length, which is likely to influence the distribution of different native fauna species within the proposal site. Broadly, the eastern end of the proposal site is influenced by wetland habitats and swamp floodplain vegetation associated with the Pambalong Nature Reserve, whilst the western end features sand swamp and red gum woodlands, Spotted Gum forests and other dry sclerophyll forest types. It is expected that the majority of wetland specialists like wading birds would be more likely to occur on the eastern end of the proposal site. Other species associated with waterbodies and coastal lagoons or estuaries, such as White-bellied Sea-eagle or Southern Myotis, would also be more likely to occur on the eastern end of the proposal site.

Two tunnels occur within the proposal area around Stockrington and may be used as roost sites by cave-roosting microbats. Although no microbats were observed roosting in the tunnels within the proposal site, microbats are known to roost within the locality in the tunnel under the M1 Motorway at Pambalong Nature Reserve. Therefore these tunnels at Stockrington were assessed as potential roost sites.

The proposal site may also contain small hollows that may be used by tree roosting microbat species such as Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*). However a low number of tree hollows and trees containing loose bark were observed during field surveys.

An important RAMSAR listed wetland occurs downstream of the proposal site that provides habitat for a variety of wetland bird species and amphibians. Ephemeral waterbodies also occur within the proposal site, often in low points and along tracks eroded by vehicle access. These waterbodies may provide suitable breeding habitat for some native frog species. Habitat features identified within the proposal site included the following:

- Isolated myrtaceous trees that would provide potential foraging resources for woodland birds and mammals.
- Tunnels, crevices and overhanging rock that may provide roosting habitat and/or a ‘flyway’ for foraging microbats. Additionally, open areas through native vegetation may comprise important ‘flyways’ for foraging microbats.
- Watercourse habitat for aquatic species such as fish and amphibians, birds and mammals.

- Shallow ephemeral pools that may provide breeding habitat for native frogs.
- Exotic groundcover and a low density of woody debris (fallen logs) which may provide shelter and foraging habitat for native reptiles and amphibians, and foraging substrate for native insectivorous birds and mammals.

These habitat resources are discussed in Table 4-9. Habitat features and resources are described in terms of the native fauna they may support with reference to species observed during surveys and threatened species potentially present within the proposal site.

Table 4-9 Fauna habitat descriptions

Habitat type	Description	Associated fauna species
Feed trees	Myrtaceous species present within the study area provide foraging resources, including sap, foliage or nectar for arboreal mammals and woodland bird species.	Nectarivorous birds, mammals, Koala
Groundcover and woody debris	Groundcover and woody debris such as fallen logs and bark provides foraging and shelter substrate for a range of native birds, mammals, reptiles and frogs. Small areas of regrowth were observed in several locations throughout the proposal site	Reptiles, small terrestrial mammals, ground dwelling and foraging birds
Hollow bearing trees	Around 300 vertebrate species use tree hollows and shedding bark for shelter and roosting sites in Australia, and the shelter provided by these habitat features is essential for the survival of many of these species (Gibbons and Lindenmayer, 2002). The majority of the woody vegetation within the impact footprint is regrowth vegetation and the majority of the trees are too young to contain large hollows. Small, less visible hollows may be present in some trees and these may provide habitat for smaller fauna species such as reptiles and amphibians.	Gliders, large forest owls, hollow-nesting birds, microbats
Ephemeral aquatic habitat	A number of water holding depressions exist within the proposal site, many of these occur in areas eroded by vehicle access and some occurring in drainage lines throughout the proposal site. Such ephemeral habitat may be used by some amphibian species as breeding habitat.	Amphibians
Tunnels and rock crevices	Two tunnels occur within the proposal site near Stockrington. Some species of microbats such as Little bent-wing bat (*Miniopterus australis) and* Southern Myotis (*Myotis macropus*) are known to roost and breed within tunnels. Tunnels can also be used by microbats as 'flyways' for foraging on insects. Rock crevices occur within the proposal site near Richmond Vale and may provide marginal (due to their small size) roosting habitat for some cave roosting microbats.	Microbats

4.5 Aquatic habitats

A large number of creeks intersect the proposal site in addition to several ephemeral tributaries. The major creeks include the following:

- Wallis Creek
- Surveyors Creek
- Werakata Creek
- Blue Gum Creek

Many of these creeks and tributaries have well defined channels and support riparian and emergent aquatic vegetation of varying composition and condition. These areas are likely to be important breeding habitat for amphibians and wetland birds and may represent foraging habitat for terrestrial birds and mammals.

The Policy and guidelines for fish habitat conservation and management (DPI, 2013) was reviewed with respect to classification of waterways for fish passage. It was determined from the policy that Wallis Creek is likely to be major Key fish habitat (Class 1) and the remaining creeks are likely to be moderate key fish habitat (Class 2). Wallis Creek and Blue Gum Creek are also mapped within Purple-Spotted Gudgeon (*Mogurnda adspersa*) range.

Due to the presence of existing infrastructure (i.e. bridges, embankments, culverts) for the former Richmond railway, the proposal will mainly require an upgrade and in some cases, replacement of these structures.

5. Conservation significance

5.1 Conservation significance under the BC Act

5.1.1 Threatened ecological communities

Two threatened ecological communities listed under the BC Act occur within the proposal site:

- Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC

These communities are also referred to informally in the below sections of this report as Lower Hunter Spotted Gum Ironbark Forest and Kurri Sand Swamp Woodland. The extent of each of these EECs within the proposal site, their legal names, and their status under the BC Act are listed in Table 5-1. The location of EECs within the proposal site are shown on Figure 4-1. A discussion of the conforming attributes of the PCTs mapped in the proposal site is provided below.

Table 5-1 Threatened ecological communities recorded within the proposal site

PCT ID	PCT name	BC Act name and status	EPBC Act name and status	Extent within the proposal site (ha)	Extent within study area (ha)
1593	Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter	Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC (Lower Hunter Spotted Gum Ironbark Forest)	Not listed	1.04	7.44
1633	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC (Kurri Sand Swamp Woodland)	Not listed	0.39	5.76

Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC

Lower Hunter Spotted Gum Ironbark Forest is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark) while *Eucalyptus punctata* (Grey Gum) and *Eucalyptus crebra* (Grey Ironbark) occur occasionally (NSW Threatened Species Scientific Committee, 2019d).

A number of other eucalypt species occur at a low frequency, but may be locally common in the community. One of these species, *Eucalyptus canaliculata*, intergrades extensively in the area with *Eucalyptus punctata*. The understorey is marked by the tall shrub, *Acacia parvipinnula*, and by the prickly shrubs, *Daviesia ulicifolia, Bursaria spinosa, Melaleuca nodosa* and *Lissanthe strigosa*. Other shrubs include *Persoonia linearis, Maytenus silvestris* and *Breynia oblongifolia*.

The ground layer is diverse; frequent species include *Cheilanthes sieberi, Cymbopogon refractus, Dianella revoluta, Entolasia stricta, Glycine clandestina, Lepidosperma laterale, Lomandra multiflora, Microlaena stipoides, Pomax umbellata, Pratia purpurascens, Themeda australis* and *Phyllanthus hirtellus*.

In an undisturbed condition, the structure of the community is typically open forest. If thinning has occurred, it may take the form of woodland or a dense thicket of saplings, depending on post-disturbance regeneration. Lower Hunter Spotted Gum-Ironbark Forest belongs to the Hunter - Macleay Dry Sclerophyll Forests vegetation class of Keith (2004).

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is restricted to a range of approximately 65 km by 35 km centred on the Cessnock – Beresfield area in the Central and Lower Hunter Valley (NSW NPWS, 2000). Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, and Port Stephens but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.

BC Act listing

PCT 1593 within the proposal site conforms to the BC Act Final Determination for the Lower Hunter Spotted Gum Ironbark Forest EEC (NSW Threatened Species Scientific Committee, 2019d) on the following points:

- Occurs in the Sydney Basin Bioregion.
- Is located on yellow podsolic soils characteristic of Tomago and Newcastle Coal Measures in addition to Neath Singleton soil landscape.
- Occurs within the known range, the proposal site located approximately 12 kilometres from the centre of Cessnock.
- Observed flora species are consistent with the assemblage outlined within the determination.
- The PCT contains a complex structure of open tree canopy, shrubs, and grass species.

Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC

Kurri Sand Swamp Woodland is a low woodland or heathland, generally with a low open canopy rarely exceeding 15 m in height and a shrubby understorey.

The overstorey is usually dominated by *Eucalyptus parramattensis subsp. decadens* (Parramatta Red Gum) and *Angophora bakeri* (Narrow-leaved Apple) while other tree species that occur less frequently include *Eucalyptus signata* (Scribbly Gum) and *Eucalyptus sparsifolia* (Narrow-leaved Stringybark) and *Eucalyptus agglomerate* (Blue-leaved Stringybark). The shrub layer is typified by *Banksia spinulosa* (Hairpin Banksia), *Dillwynia retorta, Jacksonia scoparia* (Dogwood), *Hakea dactyloides* (Finger Hakea), *Acacia ulicifolia* (Prickly Moses), *Melaleuca nodosa* (Prickly-leaved Paperbark) and *Lambertia formosa* (Mountain Devil). The common ground species include *Entolasia stricta* (Wiry Panic), *Pimelea linifolia* (Slender Rice Flower), *Lissanthe strigosa* and *Melaleuca thymifolia*.

Kurri Sand Swamp Woodland is or has been known to occur in the Kurri Kurri - Cessnock area in the lower Hunter Valley, in the local government area of Cessnock. The community has been fragmented and is subject to weed invasion and ongoing disturbances. Threats include increased urbanisation, transport and utility corridors, industrial development, changes to drainage conditions, weed invasion, rubbish dumping and inappropriate fire regimes.

The only known occurrence of Kurri Sand Swamp Woodland reported from conservation areas is in the Lower Hunter National Park.

BC Act listing

PCT 1633 within the proposal site conforms to the BC Act Final Determination for the Kurri Sand Swamp Woodland EEC (NSW Threatened Species Scientific Committee, 2019c) on the following points:

- Occurs in the Sydney Basin Bioregion within the Cessnock LGA.
- Occurs on soils developed over poorly-drained landscape deposits that blanket Permian sediments around Kurri Kurri.
- The PCT contains an open woodland structure with a shrubby midstorey.
- Observed flora species are consistent with the assemblage outlined within the determination.
- The threatened species *Eucalyptus parramattensis* subsp. *decadens* and *Grevillea parviflora* subsp. *parviflora* occur within the PCT.

5.1.2 Threatened flora

Twenty-eight flora species listed as threatened under the BC Act have been previously recorded or are predicted to occur in the locality of the proposal site (see Appendix A).

Twenty of these threatened flora species have been assessed as unlikely to occur and have been reliably eliminated from further assessment as they are associated with a range of habitats that do not occur within the proposal site (i.e. they are associated vegetation communities, soil types, other associated flora species and preferred microsites not present within the proposal site) (refer to Appendix A).

Of the remaining eight species, three were found within the proposal area with a further two within the study area. The remaining four species were determined to have the potential to occur based habitat associations. The eight species that were found or have the potential to occur within the study area are listed in Table 5-2. The majority of these species are characteristic of dry sclerophyll forests, which occur throughout the length of the proposal site. *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea), *Eucalyptus parramattensis* subsp. *decadens* (Earp's Gum) and *Rutidosis heterogama* (Heath Wrinklewort) are more likely to occur in wet sclerophyll forests, mainly located on the western edges of the proposal site.

Table 5-2 Threatened flora species found or have the potential to occur within the study area

Species	Potential to occur within proposal site	BC Act status	EPBC Act status
Eucalyptus parramattensis subsp. *decadens* (Earp's Gum)	Found within study area	V	V
Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)	Found within proposal site	V	V
Rutidosis heterogama (Heath Wrinklewort)	Found within study area	*V*	*V*
Tetratheca juncea (Black-eyed Susan)	Found within proposal site	*V*	*V*
Angophora inopina (Charmhaven Apple)	Found within proposal site	V	V
Acacia bynoeana (Bynoe's Wattle)	Potential to occur	E	V

Species	Potential to occur within proposal site	BC Act status	EPBC Act status
Callistemon linearifolius (Netted Bottle Brush)	Potential to occur	V	Not listed
Pterostylis gibbosa (Illawarra Greenhood)	Potential to occur	E	E

5.1.3 Threatened fauna

Species recorded in the study area during survey

A total of six vulnerable fauna species were recorded within the proposal site consisting of one arboreal mammal, Koala (*Phascolarctos cinereus*); and five microbat species, Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Free-tailed Bat (*Mormopterus norfolkensis*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Little Bentwing Bat (*Miniopterus australis*) and Southern Myotis (*Myotis macropus*). Both Koala and Large-eared Pied Bat are also listed under the EPBC Act listed as vulnerable.

Koala faecal pellets were observed on bare ground within the proposal site along the former rail corridor adjacent to red gum woodland vegetation. This suggests that although there are not a significant amount of feed tree species within the proposal site itself, the proposal site is likely used occasionally by Koalas moving through the landscape. Koalas have often been recorded within Sugarloaf Sate Conservation Area and it would be reasonable to expect the species would be accessing feed species on either side of the proposal site due to the abundance of feed species and relatively connected habitat.

Of the microbat species recorded within the proposal site, Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and Little Bentwing Bat (*Miniopterus australis*) are obligate cave-roosting bats. These may have potential roosting habitat within tunnels occurring near Stockrington along the proposed trail. These tunnels are unlikely to be used as breeding locations due to the lack of deeper cavities that would provide the temperature and humidity conditions required for breeding. The nearby Sugarloaf Sate Conservation Area is likely to contain more suitable breeding habitat for cave roosting bat species.

Eastern Free-tailed Bat (*Mormopterus norfolkensis*) and Southern Myotis (*Myotis macropus*) are also known to roost within tunnels and culverts in addition to tree hollows. The tunnels contained within the proposal site do not represent significant roosting habitat for this species as Southern Myotis often roost within close proximity to water bodies which they use for foraging. However, the tunnels within the proposal site may contain roosting microbats on occasion.

Table 5-3 Threatened fauna recorded within the proposal site

Scientific name	Common name	BC Act Status	EPBC Act status	Likely use of the proposal site
Phascolarctos cinereus	Koala	V	V	Foraging
Chalinolobus dwyeri	Large-eared Pied Bat[1]	V	V	Foraging, potential roosting
Mormopterus norfolkensis	Eastern Free-tailed Bat[1]	V	-	Foraging and roosting
Miniopterus schreibersii oceanensis	Eastern Bentwing Bat[1]	V	-	Foraging, roosting
Miniopterus australis	Little Bentwing Bat[1]	V	-	Foraging and roosting
Myotis macropus	Southern Myotis[2]	V	-	Foraging and roosting

[1] Identified from anabat recordings with a confidence level of “Definite”

[2] Identified from anabat recordings with a confidence level of “Probable”

Species with potential to occur within the proposal site

An additional 34 fauna species listed under the BC Act have been previously recorded or have the potential to occur within the proposal site based on the likelihood of occurrence assessment (see Appendix A). These species are listed in Table 5-4 and discussed briefly below.

Microbats: The habitat within the proposal site has a varying level of significance to the species that have the potential to occur. Tree-roosting bats are most likely to use the proposal site as foraging habitat rather than roosting habitat, since the proposal site habitat lacks significant numbers of hollow bearing trees and loose bark that may be used as roosting habitat.

Wetland birds: The habitat towards the eastern end and nearest to Pambalong Nature Reserve is likely to be used by wetland bird species in comparison to the remainder of the proposal site. The main reason for including these species in impact assessments is due to the possibility of being affected by indirect impacts which are discussed in detail in Section 6.

Amphibians: May potentially occur in areas of the proposal site with ephemeral water bodies, such as eroded tracks from vehicle access that fill with water after rain. Other potential amphibian habitat within the proposal site occurs within deeper gullies and drainage lines within forested sections near Stockrington. These areas may contain dense, moist leaf litter used by many common species of amphibian for foraging and breeding. Most vulnerable species of amphibian are unlikely to occur due to the lack of microhabitats required for breeding such as high reaches of permanent water bodies. One threatened species such as the Green and Golden Bell Frog (*Litoria aurea*) has the potential to occur near the Pambalong Nature Reserve end of the proposal site and is known from the locality. This species has been considered throughout this assessment.

Woodland and forest birds: Have been grouped for this assessment due to their highly mobile nature and the low significance of the habitat within the proposal site to these species. Parrots (e.g. Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Little Lorikeet (*Glossopsitta pusilla*)) require hollows for breeding and mature tree for foraging. Other woodland birds such as Grey-crowned Babbler (*Pomatostomus temporalis temporalis*) require areas of dense leaf litter-litter used to forage for insects. Many of these microhabitats (hollows, logs and dense leaf-litter) have been removed from the proposal site due to the clearing for the former rail line. Therefore, these woodland and forest bird species have been grouped together to primarily address indirect impacts that may occur to these species due to the proposal.

Forest owls: Are likely to forage within the proposal site. Breeding habitat for forest owls does not occur within the proposal site, these species require large hollows greater than 20 cm in diameter. **Raptor species** such as the White-bellied Sea-eagle (*Haliaeetus leucogaster*) may include the proposal site as part of their foraging range, however are unlikely to depend on the habitat to any extent. Breeding habitat generally occurs adjacent to the proposal site as the proposal site lacks the large mature trees usually chosen by these species for nesting.

Grey-headed Flying-fox: The proposal site may provide foraging habitat for one threatened megabat species Grey-headed Flying Fox (*Pteropus poliocephalus*). This species feeds on the blossom of myrtaceous species and can travel great distances nightly to forage. As the majority of the myrtaceous species within the proposal site occur as regrowth the area is unlikely to provide a significant amount of foraging resources for this species. This species is also known to roost in camps which they have a high fidelity to. No Grey-Headed Flying Fox camps occur within the proposal site.

Arboreal mammals: May occur within the proposal site to forage on sap and blossom of myrtaceous tree species. However, these species are more likely to obtain most of their food resources from the adjacent areas to the proposal site due to the much higher density of mature tree species. These species may be observed within the forested areas of the proposal site as they move throughout the broader habitat.

Terrestrial mammals: Also have the potential to occur within the proposal site, although similarly as mentioned for arboreal mammals, the habitat adjacent to the proposal site would be of higher importance to this species. This is due to the higher density of foraging resources and habitat features such as logs and leaf litter. These species may use the proposal site to move throughout the broader habitat.

Reptiles: Striped Legless Lizard (*Delma impar*) has the potential to occur within the exotic grass land of the proposal site. This species is not known from the locality, however is a very cryptic species and is known to occur within farmland containing tussock type grasses (including exotic species) similar to those that occur within and adjacent to the proposal site. For this reason it has been assumed that this species does have the potential to occur within the proposal site.

The potential impacts of the proposal on these species are assessed in Section 6.

Table 5-4 BC Act listed threatened fauna with potential to occur within the proposal site

Group	Scientific name	Common name	BC Act Status	Likely use of the proposal site
Cave-roosting microbat	*Vespadelus troughtoni*	Eastern Cave Bat	V	Foraging, potentially roosting
Tree-roosting microbats	*Saccolaimus flaviventris*	Yellow-bellied sheathtail bat	V	Foraging, potentially roosting
Tree-roosting microbats	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	Foraging, potentially roosting
Tree-roosting microbats	*Falsistrellus tasmaniensis*)	Eastern False Pipistrelle	V	Foraging, potentially roosting
Wetland birds	*Anseranas semipalmata*	Magpie Goose	V	Potential habitat within wetland downstream
Wetland birds	*Botaurus poiciloptilus*	Australasian Bittern	E	Potential habitat within wetland downstream
Wetland birds	*Irediparra gallinacea*	Comb-crested Jacana	V	Potential habitat within wetland downstream
Wetland birds	*Oxyura australis*	Blue-billed Duck	V	Potential habitat within wetland downstream
Wetland birds	*Rostratula benghalensis*	Painted Snipe	E	Potential habitat within wetland downstream
Amphibians	*Litoria aurea*	Green and Golden Bell Frog	E	Known to occur in locality
Woodland and forest birds	*Melithreptus gularis gularis*	Black-chinned Honeyeater	V	Foraging, marginal breeding habitat
Woodland and forest birds	*Climacteris picumnus victoriae*	Brown Treecreeper	V	Foraging, marginal breeding habitat
Woodland and forest birds	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V	Foraging, marginal breeding habitat
Woodland and forest birds	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	Foraging only

Group	Scientific name	Common name	BC Act Status	Likely use of the proposal site
Woodland and forest birds	*Pomatostomus temporalis temporalis*	Grey-crowned Babbler	V	Foraging, marginal breeding habitat
Woodland and forest birds	*Glossopsitta pusilla*	Little Lorikeet	V	Foraging only
Woodland and forest birds	*Grantiella picta*	Painted honeyeater	V	Foraging, marginal breeding habitat
Woodland and forest birds	*Anthochaera Phrygia*	Regent Honeyeater	CE	Foraging, marginal breeding habitat
Woodland and forest birds	*Petroica boodang*	Scarlet Robin	V	Foraging, marginal breeding habitat
Woodland and forest birds	*Chthonicola sagittata*	Speckled Warbler	V	Foraging, marginal breeding habitat
Woodland and forest birds	*Lathamus discolour*	Swift Parrot	E	Foraging only
Woodland and forest birds	*Daphoenositta chrysoptera*	Varied Sittella	V	Foraging, marginal breeding habitat
Forest owls and raptors	*Ninox connivens*	Barking Owl	V	Foraging only
Forest owls and raptors	*Ninox strenua*	Powerful Owl	V	Foraging only
Forest owls and raptors	*Tyto novaehollandiae*	Masked Owl	V	Foraging only
Forest owls and raptors	*Tyto tenebricosa*	Sooty Owl	V	Foraging only
Forest owls and raptors	*Circus assimilis*	Spotted Harrier	V	Foraging and marginal breeding habitat
Forest owls and raptors	*Hieraaetus morphnoides*	Little Eagle	V	Foraging and marginal breeding habitat
Forest owls and raptors	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V	Foraging and marginal breeding habitat
Megabat	*Pteropus poliocephalus*	Grey-headed Flying Fox	V	Foraging only
Arboreal Mammals	*Petaurus norfolcensis*	Squirrel Glider	V	Foraging only

Group	Scientific name	Common name	BC Act Status	Likely use of the proposal site
Arboreal Mammals	*Petaurus australis*	Yellow-bellied Glider	V	Foraging only
Terrestrial mammals	*Dasyurus maculatus*	Spotted-tailed Quoll	V	Foraging only
Terrestrial mammals	*Potorous tridactylus*	Long-nosed Potoroo	V	Foraging only
Reptile	*Delma impar*	Striped Legless Lizard	V	Potential foraging and breeding habitat

V= vulnerable, E= endangered, CE= Critically endangered

5.2 Matters of national environmental significance

5.2.1 Threatened ecological communities

No threatened ecological communities listed under the EPBC Act occur within the proposal site (See Table 5-1).

5.2.2 Threatened flora and fauna species

Database records indicate that there are approximately 24 flora species and 87 threatened fauna species listed under the EPBC Act that have been recorded, or are predicted to occur within the locality of the proposal site (See Appendix A).

Flora species

Seven flora species listed under the EPBC Act were recorded during targeted searches or are considered to have potential to occur within the proposal site due to presence of suitable habitat and number of previous records within the locality (Table 5-2).

Fauna species

A total of two fauna species listed under the EPBC Act were recorded within the proposal site; Koala (*Phascolarctos cinereus*) and Large-eared Pied Bat (*Chalinolobus dwyeri*) (refer to Section 4.4.1).

An additional 13 fauna species (refer to Table 5-5) either are known from the proposal site or have the potential to be affected by the proposal despite most not being recorded during site surveys. This is mainly due to potential foraging habitat for these species being observed within the proposal site. Assessments of significance have been completed for these species in accordance with the EPBC MNES significant impact guidelines (DoE, 2013b) and are provided in Appendix D.

Table 5-5 EPBC listed threatened fauna with potential to occur within the proposal site

Group	Scientific name	Common name	EPBC Act status	Likely use of the proposal site
Wetland birds	*Botaurus poiciloptilus*	Australasian Bittern	E	Potential habitat within wetland downstream
Wetland birds	*Rostratula benghalensis*	Painted Snipe	E	Potential habitat within wetland downstream
Amphibians	*Litoria aurea*	Green and Golden Bell Frog	V	Known to occur in locality
Woodland and forest birds	*Grantiella picta*	Painted honeyeater		Foraging, marginal breeding habitat
Woodland and forest birds	*Anthochaera phrygia*	Regent Honeyeater	CE	Foraging, marginal breeding habitat
Woodland and forest birds	*Lathamus discolor*	Swift Parrot	CE	Foraging only
Megabat	*Pteropus poliocephalus*	Grey-headed Flying Fox	V	Foraging only
Terrestrial Mammals	*Dasyurus maculatus*	Spotted-tailed Quoll	E	Foraging only
Terrestrial Mammals	*Potorous tridactylus*	Long-nosed Potoroo	V	Foraging only
Terrestrial Mammals	*Pseudomys novaehollandiae*	New Holland Mouse	V	Foraging, potential breeding habitat
Reptile	*Delma impar*	Striped Legless Lizard	V	Potential foraging and breeding habitat

V= Vulnerable, E= Endangered, CE= Critically endangered

5.2.3 Migratory species

In addition to the fauna species mentioned above in Section 5.2.2, the following migratory species were identified as having potential foraging habitat within the proposal site:

Table 5-6 EPBC listed migratory fauna with potential to occur within the proposal site

Scientific name	Common name	EPBC Act status	Likely use of the proposal site
Haliaeetus leucogaster	White-bellied Sea-Eagle	Mi	Aerial foraging
Merops ornatus	Rainbow Bee-eater	Mi	Aerial foraging, potentially breeding
Ardea ibis	Cattle Egret	Mi	Foraging
Hirundapus caudacutus	White-throated Needletail	Mi	Aerially foraging

A further 56 migratory fauna species were identified by the PMST as having potential to occur within the proposal site. These species all of which are birds are considered unlikely to occur within the proposal site or be impacted by the proposal and were subsequently eliminated from further assessment due to a lack of suitable habitat and/or the highly mobile nature of these bird species (refer to Appendix A).

5.2.4 Wetlands of international importance (RAMSAR wetlands)

One RAMSAR wetland (the Hunter Estuary Wetlands) is located approximately 7 km to the east of the proposal site. The proposal is unlikely to have any impact on this RAMSAR wetland (refer to discussion in following sections).

5.3 Threatened fish

Indicative distributions for threatened fish distributions have been modelled across NSW using records collected over two decades (DPI, 2016). The endangered Purple Spotted Gudgeon (*Mogurnda adspersa*) distribution has been mapped within the Hunter River and within the Ironbark Creek catchment (DPI, 2018). This distribution is shown on Figure 4-1.

The Southern Purple Spotted Gudgeon occurs in NSW as two broad populations; an eastern population found in coastal catchments north of the Clarence River, and a western population found throughout Murray-Darling Basin (DPI, 2017). The known distribution of the eastern population (Richmond and Clarence River catchments), is very far north of the study area. It is unclear why the species distribution has been modelled for the Ironbark Creek catchment, except that records for the species exist for Goorangoola Creek (Hunter River catchment), which is approximately 20 km north of Singleton. These records are generally considered to be outside of the natural range of the species (DPI, 2017).

This species is a freshwater fish and is benthic in nature. It can be found in a variety of habitats such as rivers, creeks and billabongs, within slow-moving or still waters, or in streams with low turbidity. Cover in the form of aquatic vegetation, overhanging vegetation from river banks, leaf litter, rocks or snags are important for the species (DPI, 2017). They feed on terrestrial insects and their larvae, worms, small fish, tadpoles and some plant matter. Spawning occurs over summer when water temperatures are warmer. Individuals will migrate from deep water to streams in summer but otherwise do not disperse far from preferred habitat (Llewellyn, 2006).

The freshwater habitats in the study area that could provide potential habitat for the Purple Spotted Gudgeon are generally limited. Considering the natural distribution of the species and the typical aquatic habitats within these catchments, the species is unlikely to occur within the study area.

6. Impact assessment

The construction of the proposal has the potential to result in direct impacts to native biota and their habitats within the proposal site. There is also potential for indirect impacts on retained areas of vegetation and associated habitats. A detailed discussion of these impacts is provided below.

6.1 Direct impacts

6.1.1 Vegetation clearing

The proposal will result in the removal of up to 13.64 hectares of vegetation including approximately 3.59 hectares of native vegetation. For the purposes of this impact assessment, it has been assumed that all vegetation will be cleared. A summary of the direct impacts to vegetation within the proposal site is provided in Table 6-1 below.

Table 6-1 Extent of direct impact on vegetation within the proposal site

PCT ID	PCT name	BC Act Status	EPBC Act status	Extent within proposal site (ha)
1568	Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast	Not listed	Not listed	0.19
1588	Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	Not listed	Not listed	0.21
1589	Spotted Gum - Broad-leaved Mahogany - Grey Gum grass - shrub open forest on Coastal Lowlands of the Central Coast	Not listed	Not listed	1.1
1593	Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter	Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC	Not listed	1.04
1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of the coastal lowlands	Not listed	Not listed	0.66
1633	Parramatta Red Gum - Narrow-leaved Apple - Prickly-leaved Paperbark shrubby woodland in the Cessnock-Kurri Kurri area	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC	Not listed	0.39
-	Exotic grassland/cleared	-	-	10.05
	Total			**13.64**

6.1.2 Injury and mortality of native fauna

The proposal may cause displacement or in some cases possible mortality of fauna that are present at the time of vegetation clearing activities. Less mobile terrestrial fauna, such as common species of frogs and reptiles present within groundcover are at most risk of mortality resulting from vegetation clearing activities. The majority of more mobile species such as birds and bats that may use the proposal site would do so as part of a broad foraging area and would likely disperse into surrounding habitat to avoid the noise and disturbance associated with clearing activities. Most terrestrial fauna would be able to move away from construction activities to avoid mortality.

There is a small risk that microbat species such as Southern Myotis (*Myotis macropus*) if breeding in the vicinity of the proposal site may have their breeding disrupted if the construction phase was to coincide with the breeding season, as a result of increased noise and visitation.

Increased traffic movements during construction also have the potential to result in fauna being struck by vehicles.

Mitigation measures to reduce the risk of injury and mortality to native fauna are described in Section 7.

6.1.3 Loss or disturbance of fauna habitat

The proposal would result in the removal of 3.6 hectares of regenerating forest that may provide foraging habitat and potential breeding habitat for woodland birds. This habitat may also be used for foraging by Koalas and microbat species. Microbat species may also roost within tree hollows in this area, although it is noted that no suitable hollows were observed within the proposal site during field surveys.

Tunnels that occur within the middle of the proposal site may provide roosting habitat for some bat species such as Little Bentwing-bat (*Miniopterus australis*). Microbat species are susceptible to impacts from artificial lighting. Mitigation of lighting impacts to microbat species must be considered before installing lights in the tunnels such as timed or sensor lighting, false ceilings or sensor activated lights.

Disturbance to wetland bird species may occur due to indirect impacts on the eastern end of the proposal area nearest to Pambalong Nature Reserve. This disturbance is likely to be minimal with appropriate stormwater, sediment and erosion control implemented during construction

A total of 10.05 hectares of exotic grassland and bare earth will also be removed by the proposal. The impacts to fauna species in the locality are likely to be negligible as the areas adjacent to the proposal site contain higher quality or similar quality habitat to the proposal site. Exotic grassland may be suitable for reptile species such as Striped legless lizard (*Delma impar*) although significant impacts to such species are unlikely (refer to Appendix D).

Potential impacts on threatened and migratory fauna are discussed further in Sections 6.3 and 6.4.

6.2 Indirect impacts

6.2.1 Soil and water pollution

The location of the proposal site and nature of the proposal means that there is potential for soil and water pollution if appropriate controls are not adopted during vegetation clearing and soil disturbance activities. Management of soil and water pollution is particularly important around the wetland and swamp areas throughout the length of the proposal site.

Potential sources of soil pollution include:

- Inappropriate management of soil and material stockpiles
- Hydrocarbon leaks or spills from vehicles or equipment used in construction or vegetation clearance activities
- Increased runoff
- Increased sediment transfer and erosion potential in areas cleared of vegetation due to wind and water erosion

Mitigation measures to avoid soil and water pollution are described in Section 7.

6.2.2 Edge effects and fragmentation

Removal of vegetation can cause a number of new environmental conditions to develop along the edges of cleared environments, in particular in environments where the removal of the woody strata promotes the invasion of exotic species due to increased light and physical space. Impacts from edge effects as a result of the proposal are considered to be minimal, as the proposal site is already heavily edge impacted from historical disturbance. The proposal would not lead to any increased in fragmentation of vegetation of habitats beyond what is already present in within and surrounding the proposal site.

6.2.3 Introduction and spread of weeds

A high diversity and abundance of exotic flora species are already present within the proposal site. The proposal has the potential to increase the introduction and spread of exotic plants through increased visitation and disturbance of soil. Increased weed invasion can lead to decreased diversity of native flora, compromised structural integrity of native vegetation communities and a decrease in habitat quality for native fauna. Weed control measures to reduce the potential for introduction of weeds are outlined in Section 7.

6.2.4 Introduction of pathogens

Construction activities have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) throughout the proposal site. Diseases and pathogens can be introduced or spread to site via dirt or organic material attached to machinery, vehicles, equipment and employees or through water imported to site for dust suppression.

Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can lead to the extinction of local populations once introduced into an area. Pathogen control measures are outlined in Section 7.

6.2.5 Noise and vibration

Noise and vibration impacts are expected during the various stages of construction as a result of vegetation clearing, vehicle movement and operation of plant for construction. Raised levels of noise and vibration may deter native fauna from using the proposal site during construction. These impacts are likely to be temporary and short-term and unlikely to result in permanent impacts to fauna.

6.3 Impacts to biota listed as threatened under the BC Act

Section 7.3 of the BC Act refers to five factors that must be considered to assist in determining if a proposed development or activity "is likely to have a significant effect on the threatened species, populations or ecological communities, or their habitats" as listed under the BC Act (the '5-part test') and hence whether a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is required for the proposal.

The field surveys and habitat assessments undertaken for this study have found construction of the proposal would have direct impacts on three threatened ecological communities listed under the BC Act and on known and potential habitat for a number of flora and fauna species listed as threatened under the Act. Potential impacts on EECs and threatened flora and fauna species are discussed further below.

In accordance with 7.3 of the BC Act, tests of significance (also known as '5-part tests') have been completed for threatened biota likely to be impacted be the proposal. The tests of significance are provided in full in Appendix C and the key findings and conclusions are summarised in the following sections.

Based on the results of the assessments of significance, it is unlikely that the proposal will have a significant effect on any threatened biota listed under the BC Act. Consequently, a SIS or BDAR is not required for determination of the project under Part 5, Division 5.1 of the EP&A Act.

6.3.1 Threatened ecological communities

Two EECS listed under the BC Act occur within the proposal site and would be impacted by the proposal. These EECs include:

- Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion

A summary of these assessments are outlined below.

Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC

A linear extent of Lower Hunter Spotted Gum Ironbark Forest EEC occurs within the proposal site (Figure 4-1). The linear extent is located to the western portion of the proposal site on the northern and southern sides of the proposal site, at the edges of larger vegetation patches which cover an area of approximately 401.6 hectares within the connected locality. A total of 1.04 hectares of this EEC is likely to be impacted by the proposal. This represents approximately 0.25% of the total extent of the EEC within the locality.

The removal of 1.04 hectares of this EEC is unlikely to adversely affect the extent or modify the composition of the EEC such that its local occurrence is likely to be placed at risk of extinction for the following reasons:

- The EEC is located on the edges of a historically cleared rail trail which runs east to west. Removal of this EEC will reduce the connectivity to a minor extent however the proposal is unlikely to fragment the habitat such that a hostile barrier for flora and fauna dispersal would be created. No areas of the ecological community will be isolated from other areas of habitat as a result of the proposal.
- The habitat being removed is not considered critical to the long-term survival of the ecological community in the local area as it represents only a very small proportion of the local extent of the EEC. The EEC is also not in any mapped areas of outstanding biodiversity value.

The proposal may impact on a number of key threatening processes including clearing of native vegetation, invasion by exotic species and introduction of disease to native vegetation. These potential impacts would be mitigated through minimising clearing where possible and the implementation of standard weed and pathogen hygiene practices.

With consideration of the above the proposal is unlikely to have a significant impact on Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions. Mitigation measures would be implemented to minimise the potential for indirect impacts to the ecological community through the implementation of a CEMP as outlined in Section 7.

Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC

A linear extent of Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC occurs within the proposal site (Figure 4-1). The linear extent is located to the western portion of the proposal site on the northern and southern sides of the proposal site, at the edges of larger vegetation patches which cover an area of approximately 225.2 hectares within the connected locality. A total of 0.03 hectares of this EEC is likely to be impacted by the proposal. This represents approximately 0.01% of the total extent of the EEC within the locality. The removal of 0.39 hectares of this EEC is unlikely to adversely affect the extent or modify the composition of the EEC such that its local occurrence is likely to be placed at risk of extinction.

The EEC is located on the edges of a historically cleared rail trail which runs east to west. Removal of this EEC will reduce the connectivity to a minor extent however the proposal is unlikely to fragment the habitat such that a hostile barrier for flora and fauna dispersal would be created. No areas of the ecological community will be isolated from other areas of habitat as a result of the proposal.

The habitat being removed is not considered critical to the long-term survival of the ecological community in the local area as it represents only a very small proportion of the local extent of the EEC. The EEC is also not in any mapped areas of outstanding biodiversity value.

The proposal may impact on a number of key threatening processes including clearing of native vegetation, invasion by exotic species and introduction of disease to native vegetation. These potential impacts would be mitigated through minimising clearing where possible and the implementation of standard weed and pathogen hygiene practices.

With consideration of the above the proposal is unlikely to have a significant impact on Kurri Sand Swamp Woodland in the Sydney Basin Bioregion. Mitigation measures would be implemented to minimise the potential for indirect impacts to the ecological community through the implementation of a CEMP as outlined in Section 7.

6.3.2 Flora species

Eight threatened flora species listed under the BC Act have been found within the proposal site, within close proximity to the proposal site, or have the potential to occur within the proposal site and may be impacted by the proposal. These threatened flora species include:

- *Acacia bynoeana* (Bynoes Wattle)
- *Callistemon linearifolius* (Netted Bottle Brush)
- *Rutidosis heterogama* (Heath Wrinklewort)
- *Tetratheca juncea* (Black-eyed Susan)
- *Pterostylis gibbosa* (Illawarra Greenhood)
- *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
- *Eucalyptus parramattensis subsp. decadens* (Earp's Gum)
- *Angophora inopina* (Charmhaven Apple)

Assessments of significance in accordance with the BC determinations were completed for these species (Appendix C). These assessment determined that the proposal is unlikely to result in a significant impact to these nine species. A summary of these assessments are outlined below.

Acacia bynoeana (Bynoes Wattle)

The proposal would remove 3.41 ha of potential dry sclerophyll habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat within the proposal site. The proposal is unlikely to substantially modify the habitat for *Acacia bynoeana* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Acacia bynoeana,* the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Acacia bynoeana.*

Callistemon linearifolius (Netted Bottle Brush)

The proposal would remove 3.41 ha of potential dry sclerophyll habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat within the proposal site. The proposal is unlikely to substantially modify the habitat for *Callistemon linearifolius* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Callistemon linearifolius*, the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Callistemon linearifolius.*

Grevillea parviflora subsp. parviflora (Small-flower Grevillea)

The proposal would remove 0.59 ha of potential wet sclerophyll habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. Two individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site, in addition to being recorded within the study area. Based on an estimated population size of 94 individuals (Ecovision Consulting 2006) within the Cessnock LGA, the removal of two individuals is considered unlikely to have a significant adverse impact on the local population. The proposal is unlikely to substantially modify the habitat for *Grevillea parviflora* subsp*. parviflora* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Grevillea parviflora* subsp*. parviflora*, the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Grevillea parviflora* subsp*. parviflora.*

Rutidosis heterogama (Heath Wrinklewort)

The proposal would remove 0.59 ha of potential wet sclerophyll habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site, despite being recorded within the study area. The proposal is unlikely to substantially modify the habitat for *Rutidosis heterogama* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Rutidosis heterogama*, the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Rutidosis heterogama.*

Tetratheca juncea (Black-eyed Susan)

The proposal would remove 3.41 ha of potential dry sclerophyll habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. Two individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat within the proposal site. Based on an estimated population size of between 190 to 15,000 individuals (DoE 2020) within the Cessnock and Lake Macquarie LGA, the removal of two individuals is unlikely to be significant. The proposal is unlikely to substantially modify the habitat for *Tetratheca juncea* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Tetratheca juncea*, the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Tetratheca juncea.*

Pterostylis gibbosa (Illawarra Greenhood)

The proposal would remove 0.59 ha of potential wet sclerophyll habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal or study area during field surveys of the wet sclerophyll forest habitat. The proposal is unlikely to substantially modify the habitat for *Pterostylis gibbosa* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Pterostylis gibbosa*, the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Pterostylis gibbosa.*

Eucalyptus parramattensis subsp. decadens (Earp's Gum)

The proposal would remove 0.59 ha of potential wet sclerophyll habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site, despite being recorded within the study area. The proposal is unlikely to substantially modify the habitat for *Eucalyptus parramattensis* subsp*. decadens* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Eucalyptus parramattensis* subsp*. decadens*, the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Eucalyptus parramattensis* subsp*. decadens.*

Angophora inopina (Charmhaven Apple)

The proposal would remove 0.59 ha of potential wet sclerophyll habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. One individual was recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site. The removal of one individual species is unlikely to be adversely affected to place a viable local population at risk of extinction. The proposal is unlikely to substantially modify the habitat for *Angophora inopina* due to the already fragmented and modified habitat within the proposal site. Whilst the proposal would enhance key threatening processes for *Angophora inopina*, the proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Angophora inopina.*

6.3.3 Fauna species

Koala

Habitat was identified within the proposal site for Koala (*Phascolarctos cinereus*) in areas containing suitable feed tree species. The assessment was prepared for the direct removal of 3.6 hectares of foraging habitat, and indirect impacts to habitat adjacent to the proposal site.

The proposal is unlikely to have a significant impact on the Koala, given that:

- Vegetation to be removed comprises a negligible proportion of the habitat for the Koala present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for this species would be isolated as a result of the proposal.
- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of arboreal species which may be present within vegetation to be removed.

Cave-roosting microbats

The following cave-roosting microbats were identified within the proposal site:

- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)
- Little Bentwing Bat (*Miniopterus australis*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)

Habitat was also identified for the following cave-roosting microbat species:

- Eastern Cave Bat (*Vespadelus troughtoni*)

The tunnels and rock cuttings constructed as part of the former Richmond Vale rail corridor may be being utilised by these species as diurnal roosting habitat. The removal of loose rock for stabilisation works is proposed in a limited number of areas and has the potential to affect these species if no mitigation measures (such as a spotter catcher) are applied.

Lighting is also proposed within tunnels that occur along the proposal site. Lighting mitigation measures (such as monitor sensor or timed lighting) to avoid and mitigate impacts on foraging or roosting bats will be implemented as part of the proposal.

Considering the application of appropriate mitigation measures it is unlikely that the proposal will have a significant impact on these species.

Tree-roosting Microbats

- Eastern Freetail bat (*Mormopterus norfolkensis*)
- Southern Myotis (*Myotis macropus*)
- Yellow-bellied Sheathtail bat (*Saccolaimus flaviventris*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)

The proposal is unlikely to have a significant impact on these hollow-roosting microbats, pursuant to section 7.3 of the BC Act, given that:

- No suitable tree hollows for these species will be removed as a result of the proposal.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes extensive areas within conservation reserves.
- Mitigation measures, including having a suitable qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of hollow-roosting species.
- Habitat connectivity would be retained for these highly mobile species.

Wetland Birds

Habitat was identified adjacent to the proposal site for the following threatened wetland birds, these species were assessed due to the potential for indirect impacts that may result from the proposal:

- Magpie Goose (*Anseranas semipalmata*).
- Australasian Bittern (*Botaurus poiciloptilus*).
- Comb-crested Jacana (*Irediparra gallinacean*).
- Blue-billed Duck (*Oxyura australis*).
- Painted Snipe (*Rostratula benghalensis*).

The proposal is unlikely to have a significant impact on these wetland species given that:

- No wetland habitat will be removed as a result of this proposal.
- Mitigation measures are to be implemented to reduce the potential for disturbance to wetland species during the construction phase.
- Provided that adequate water quality management is undertaken, changes to hydrology would be relatively minor in the context of the existing and historic modifications to hydrology in the proposal site.
- The proposal would not isolate any areas of habitat for these species, and habitat connectivity would not be affected throughout the wetland habitats.

Green and Golden Bell Frog

Potential habitat was identified within the proposal site for the threatened Green and Golden Bell Frog (*Litoria aurea*).

The proposal site contains some marginal foraging habitat for this species, with higher quality habitat adjacent to the proposal site. For this reason this species was assessed for potential indirect impacts on the adjacent habitat as a result of the proposal. The proposal site does not contain suitable breeding habitat for these species (e.g. deep leaf litter, upper reaches of permanent streams).

The proposal is unlikely to have a significant impact on this species given that:

- Potential impacts on habitats through altered hydrology would be minor.
- Vegetation to be removed represents only marginally suitable foraging and shelter habitat.
- The proposal would not isolate any areas of habitat for the species, and habitat connectivity would not be affected throughout the most suitable habitats.

Woodland and forest birds

There is potential for the following woodland birds to occur within the proposal site due to potential foraging habitat:

- Black-chinned Honeyeater (*Melithreptus gularis gularis*).
- Brown Treecreeper (*Climacteris picumnus victoriae*).
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*).
- Gang-gang Cockatoo (*Callocephalon fimbriatum*).
- Grey crowned babbler (*Pomatostomus temporalis temporalis*).
- Little Lorikeet (*Glossopsitta pusilla*).
- Painted honeyeater (*Grantiella picta*).
- Regent Honeyeater (*Anthochaera phrygia*).
- Scarlet Robin (*Petroica boodang*).
- Speckled Warbler (*Chthonicola sagittata*).
- Swift Parrot (*Lathamus discolour*).
- Varied Sittella (*Daphoenositta chrysoptera*).

The proposal is unlikely to have a significant impact on threatened woodland and forest birds given that the proposal site is degraded due to past land uses. The habitat within the site lacks many of the habitat features required by these species for breeding such as hollows (for Gang-gang cockatoo, Little Lorikeet). The site also lacks an abundance of fallen timber and ground cover required by some of these species (such as the Grey-crowned Babbler) for foraging.

The proposal would not affect potential breeding habitat for the species, and would remove a negligible proportion of foraging habitat. The areas of habitat likely to have the highest value for these species within the locality would not be affected by the proposal.

Habitat connectivity would be retained as these species would readily traverse the resulting gap in vegetation created by the proposal.

Considering these factors it is unlikely that the proposal will result in significant impacts to these woodland bird species.

Forest owls and raptors

The following forest owl and raptor species were identified as potentially having habitat within the proposal site:

- Barking Owl (*Ninox connivens*).
- Powerful Owl (*Ninox strenua*).
- Masked Owl (*Tyto novaehollandiae*).
- Sooty Owl (*Tyto tenebricosa*).
- Spotted Harrier (*Circus assimilis*).
- Little Eagle (*Hieraaetus morphnoides*).
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*).

The proposal site consists of 3.6 hectares of regenerating forest habitat and 10.05 hectares of exotic grassland that may potentially be used for foraging by these species.

These species are considered unlikely to breed within the habitats to be removed, with higher quality habitat for these species occurring adjacent to the proposal site and throughout the broader locality. The vegetation to be removed comprises a negligible proportion of foraging habitat present in the locality. Additionally, habitat connectivity would be retained for these highly mobile species.

Grey-headed Flying-Fox

Habitat was identified within the proposal site for Grey-headed Flying Fox (*Pteropus poliocephalus*). Given that this species manly forages in vegetation containing myrtaceous species such as dry and wet sclerophyll forests, the assessment was prepared for the direct removal of 3.6 hectares of habitat, and indirect impacts to habitat adjacent to the disturbance footprint.

The proposal is unlikely to have a significant impact on the Grey-headed Flying Fox given that:

- The proposal would be unlikely to remove any breeding habitat for the species.
- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of species which may be present within vegetation to be removed.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for this species would be isolated as a result of the proposal.

Arboreal mammals

Habitat was identified within the proposal site for the following arboreal mammals:

- Squirrel Glider (*Petaurus norfolcensis*)
- Yellow-bellied Glider (*Petaurus australis*)

Given that these species manly forage in vegetation containing myrtaceous species such as dry and wet sclerophyll forests, the assessment was prepared for the direct removal of 3.6 hectares of habitat, and indirect impacts to habitat adjacent to the disturbance footprint.

The proposal is unlikely to have a significant impact on the Yellow-bellied Glider, or Squirrel Glider due to:

- The proposal would be unlikely to remove any breeding habitat for the species.
- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of hollow-dependent species which may be present within vegetation to be removed.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for these species would be isolated as a result of the proposal.

Terrestrial mammals

Habitat was identified within the proposal site for the following terrestrial mammals:

- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Long-nosed Potoroo (*Potorous tridactylus*)
- New Holland Mouse (*Pseudomys novaehollandiae*)

Given that these species may forage in a range of habitats, the assessment was prepared for the direct removal of 3.6 hectares of potential foraging habitat (within the regenerating forest habitat), and indirect impacts to habitat adjacent to the disturbance footprint.

All three of these terrestrial mammal species are unlikely to breed within the proposal site due to a lack of microhabitat elements such as fallen trees and hollow logs. The removal of 3.6 hectares of potential foraging habitat is unlikely to impact on these species due to much larger potions of remnant habitat occurring adjacent to the proposal suite that will be retained.

These species are also highly mobile and the gap in vegetation created by the proposal will be easily traversed by these species. Considering these factors it is unlikely that the proposal will have a significant impact on these species.

6.4 Impacts to biota listed under the EPBC Act

6.4.1 Threatened ecological communities

As outlined in Section 5.2.1, the proposal does not contain any vegetation communities listed as threatened under the EPBC Act. It is therefore unlikely that there will be an impact to TECs considered MNES.

6.4.2 Threatened flora

As outlined in Section 5.2.2, seven threatened flora species under the EPBC Act were recorded or are likely to occur within the proposal site and may be impacted by the proposal. These threatened flora species include:

- *Acacia bynoeana* (Bynoes Wattle)
- *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
- *Rutidosis heterogama* (Heath Wrinklewort)
- *Tetratheca juncea* (Black-eyed Susan)
- *Pterostylis gibbosa* (Illawarra Greenhood)
- *Eucalyptus parramattensis subsp. decadens* (Earp's Gum)
- *Angophora inopina* (Charmhaven Apple)

Assessments of significance in accordance with the EPBC determinations were completed for these species (Appendix D). These assessment determined that the proposal is unlikely to result in a significant impact to these nine species. A summary of these assessments are outlined below.

Acacia bynoeana (Bynoes Wattle)

Due to the high number of records within the locality, and the location of the proposal site, the species is likely to conform to an important population in the Hunter district. The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. No critical habitat has been identified for *Acacia bynoeana* and the proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As pollination occurs by highly mobile insect species such as small native bees and wasps, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the breeding cycle of the species due to the mobile nature of the species pollinators. The proposal has the potential to increase exotic flora species and introduce disease within the proposal site and adjacent intact vegetation within the study area, however mitigation measures will be in place prior to construction and operation.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Acacia bynoeana.*

Grevillea parviflora subsp. parviflora (Small-flower Grevillea)

Due to the high number of records within the locality, and the location of the proposal site, the species is likely to conform to an important population in the Cessnock - Kurri Kurri area. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. Two individual species within this important population will be removed as a result of the proposal. Due to an estimated population size of 94 individuals within the Cessnock LGA, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species. No critical habitat has been identified for *Grevillea parviflora* subsp. *parviflora* and the proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As pollination occurs by highly mobile insect species, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the breeding cycle of the species due to the mobile nature of the species pollinators. The proposal has the potential to increase exotic flora species and introduce disease within the proposal site and adjacent intact vegetation within the study area, however mitigation measures will be in place prior to construction and operation.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Grevillea parviflora* subsp. *parviflora.*

Rutidosis heterogama (Heath Wrinklewort)

Due to the moderate number of records within the locality, the species limited known range and the location of the proposal site, the occurrence of the species within the study area is likely to conform to an important population in the Cessnock/Kurri Kurri area. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. No critical habitat has been identified for *Rutidosis heterogama* and the proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As seeds are dispersed by wind, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect dispersal or the breeding cycle of the species. The proposal has the potential to increase exotic flora species and introduce disease within the proposal site and adjacent intact vegetation within the study area, however mitigation measures will be in place prior to construction and operation.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Rutidosis heterogama*.

Tetratheca juncea (Black-eyed Susan)

Due to the moderate number of records within the locality, the species limited known range and the location of the proposal site, the occurrence of the species within the study area is likely to conform to an important population in the Cessnock and Lake Macquarie LGAs. The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. Two individual species will be removed as a result of the proposal. Although marginal, the proposal is likely to lead to a long-term decrease in the size of an important population of a species. No critical habitat has been identified for *Tetratheca juncea* and the proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. The removal of two individual species which are estimated to occur at a population between 190 and 15 000 individuals, indicates that whilst the soil seed bank may not be further enriched by these two individuals, the breeding cycle of the species is unlikely to be significantly disrupted. The proposal has the potential to increase exotic flora species and introduce disease within the proposal site and adjacent intact vegetation within the study area, however mitigation measures will be in place prior to construction and operation.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Tetratheca juncea*.

Pterostylis gibbosa (Illawarra Greenhood)

The species has potential habitat which occurs marginally within the proposal site (0.59 ha). No records of the species have previously been recorded within 10 km of the proposal site, indicating that the known population in the Hunter region does not occur within the locality and that the proposal is unlikely to lead to a long-term decrease in the size of a population. No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No critical habitat has been identified for *Pterostylis gibbosa* within the recovery plan and the proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. The proposal has the potential to increase exotic flora species and introduce disease within the proposal site and adjacent intact vegetation within the study area, however mitigation measures will be in place prior to construction and operation.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Pterostylis gibbosa*.

Eucalyptus parramattensis subsp. decadens (Earp's Gum)

Due to the high number of records within the locality, and the location of the proposal site, the species is likely to conform to the Kurri Kurri/Cessnock important population. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat. The Kurri Kurri population occurs over an expansive area within the locality and is already fragmented by the cleared rail track in addition to roads and infrastructure. As such, the proposal is unlikely to further fragment this existing important population into two or more populations. As pollination occurs by highly mobile fauna species such as bats and birds, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the breeding cycle of the species due to the ranges of the species pollinators. The proposal has the potential to increase exotic flora species and introduce disease within the proposal site and adjacent intact vegetation within the study area, however mitigation measures will be in place prior to construction and operation.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Eucalyptus parramattensis* subsp. *decadens*.

Angophora inopina (Charmhaven Apple)

Due to the absence of previous records within the locality, and the location of the proposal site away from known populations, the known occurrence of this species is likely to occur on the western edge of the species range. As such, the occurrence of the species within the proposal site may conform to an important population. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. One individual species will be removed as a result of the proposal. Despite not occurring within the known populations of the Wyee-Charmhaven or Buladelah and the mid-north coast, the occurrence of this one individual is not likely to be solitary. As the species is insect pollinated, the one individual record is likely to be supported by a greater population within the locality. Considering the above, the proposal is marginally likely to lead to a long-term decrease in the size of an important population of a species. No critical habitat has been identified for *Angophora inopina* and the proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. The proposal has the potential to increase exotic flora species and introduce disease within the proposal site and adjacent intact vegetation within the study area, however mitigation measures will be in place prior to construction and operation.

Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Angophora inopina*.

6.4.3 Threatened fauna

Assessments of significance in accordance with the EPBC determinations were completed for the following fauna species (Appendix D). These assessments determined that the proposal is unlikely to result in a significant impact to these species. A summary of the assessments are outlined below.

Koala

The proposal is unlikely to have a significant impact on the Koala, given that:

- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of arboreal species which may be present within vegetation to be removed.
- Vegetation to be removed comprises a negligible proportion of the habitat for the Koala present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for this species would be isolated as a result of the proposal.

Large-eared Pied Bat (Chalinolobus dwyeri)

The proposal is unlikely to have a significant impact on this cave-roosting microbat, given that:

- Minor rock stabilisation works are proposed as a result of the proposal and the majority of rock cuttings will be unaffected.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes extensive areas within conservation reserves.
- Mitigation measures, including having a suitable qualified fauna-spotter-catcher present during rock stabilisation works to minimise the risk of mortality of cave-roosting species.
- Habitat connectivity would be retained for this mobile species.
- Further surveys for microbats are proposed prior to the construction phase.
- A microbat management plan will be prepared as part of the Flora and Fauna Management.

Wetland Birds

- Painted Snipe (*Rostratula benghalensis*).
- Australasian Bittern (*Botaurus poiciloptilus*).

The proposal is unlikely to have a significant impact on these wetland species given that:

- No wetland habitat will be removed.
- Mitigation measures are to be implemented to reduce the potential for disturbance to wetland species during the construction phase.
- Provided that adequate water quality management is undertaken, changes to hydrology would be relatively minor in the context of the existing and historic modifications to hydrology in the proposal site.

The proposal would not isolate any areas of habitat for these species, and habitat connectivity would not be affected throughout the wetland habitats.

Green and Golden Bell Frog *(Litoria aurea)*

The proposal site lacks many of the microhabitat features to support a significant population of this species. Given the low quality habitat within the impacted former Richmond Vale rail line it is unlikely that impacts to the habitat within the proposal site will result in a long-term decrease in this threatened amphibian species.

The Construction Environmental Management Plan will provide details on the prevention spreading environmental pathogens (Chytrid fungus) that would impact this species. Mitigation measures such as sterilising footwear, vehicles and machinery would reduce the likelihood of environmental pathogens being spread as part of the proposal.

Woodland birds

A total of 3.6 hectares of forest within the proposal site was identified as potential foraging habitat for the following woodland species:

- Painted Honeyeater (*Grantiella picta*)
- Regent Honeyeater (*Anthochaera phrygia*)
- Swift Parrot (*Lathamus discolour*)

The proposal site contains only marginal foraging habitat for these species due to historic disturbances associated with the Richmond Vale rail line. Regent honeyeaters and painted honeyeaters are unlikely to use the proposal site for breeding due to the disturbed nature of the habitat and would most likely choose to breed within the more intact, large remnants either side of the proposal site if they were to occur within the study area.

The Swift Parrot is known only to breed in Tasmania and therefore breeding habitat does not occur within the locality of the proposal site. These points have been considered whilst completing the below assessment of significance for these species.

Grey-headed Flying-fox *(Pteropus poliocephalus)*

The Grey-headed Flying-fox feeds on nectar and pollen from flowers of canopy trees and fleshy fruits from rainforest trees and vines. The species generally moves through the landscape feeding on suitable trees when they come into flower/fruit. The proposal would involve the removal of 3.6 hectares of foraging habitat for this species. This habitat includes a number of tree species that would provide food for this species at certain times of the year when in fruit/flower including; *Eucalyptus tereticornis* (Forest Red Gum), *Corymbia maculata* (Spotted Gum) and *Corymbia gummifera* (Red Bloodwood), which have been identified as significant feed species (Eby and Law, 2008).

The proposal would result in the removal of 3.6 hectares of regrowth that may provide some foraging habitat. However, there is a much large area of forest in the locality that would provide food resources for this species.

Given the proposal will not result in the removal of a large amount of foraging habitat or cause isolation it is unlikely that the proposal would have significant impacts on this species.

*Striped Legless Lizard (*Delma impar*)*

This species is most often found in tussock grassland habitats consisting of both exotic and native vegetation. This species was assessed due to 10.05 hectares of exotic grassland that may be foraging habitat for the species being removed as a result of the proposal.

This species is not known from the locality and similar habitat exists for this species adjacent to the proposal site.

This species is unlikely to be impacted by the proposal due to its ability easily cross traverse gaps such as the approximate three metre wide gap that would be created as part of the proposal.

Terrestrial mammals

The proposal is unlikely to have a significant impact on the Spotted-tailed Quoll, Long-Nosed Potoroo and New Holland Mouse, given that:

- Species are considered unlikely to breed within the areas of habitat to be removed.
- Vegetation to be removed is subject to historic and ongoing disturbances which would limit its value as foraging habitat for both species.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality.
- Habitat connectivity would be retained around the proposal site.

6.4.4 Migratory species

Consideration of the DotE (2013) 'significant impact criteria' indicates that the proposed action is unlikely to impose a significant impact on the Cattle Egret, White-throated Needletail, White-bellied Sea-eagle and Rainbow Bee-eater due to:

- The proposal not substantially modifying and/or destroying an area of important habitat for these species.
- The study area is not considered to be important habitat for these species.
- Vegetation within the study area is only likely to represent potential foraging habitat for these species and marginal breeding habitat for Cattle Egret, White-bellied Sea-eagle and Rainbow Bee-eater. Given the extensive other areas of habitat in the locality it is unlikely that impacts from the proposal would be significant to this species.
- The proposal would not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of these species.
- The proposal is unlikely to result in an invasive species becoming established in an area of important habitat.

6.4.5 Wetlands of international importance (Ramsar wetlands)

As discussed in Section 5.2.4, The Hunter Estuary Wetlands are located approximately 7 km to the east of the proposal site. The proposal is unlikely to cause impacts to this wetland as they are of sufficient distance from the proposal site to not be directly impacted by the proposal. Furthermore ephemeral drainage lines within the proposal site are not tributaries to the Hunter Estuary Wetland and therefore these wetlands are highly unlikely to be indirectly impacted by the proposal.

6.4.6 Key threatening processes

The proposal has the potential to contribute to a number of Key Threatening Processes listed under the BC Act and / or the EPBC Act including:

- Clearing of native vegetation
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of Lantana (*Lantana camara*)
- Invasion, establishment and spread of weeds
- Removal of dead wood and dead trees

Mitigation measures to avoid and minimise these potential KTPs are provided in Section 7.

7. Mitigation measures

As described in Section 6 the proposal would result in direct impacts on native biota and their habitats within the proposal site. There is also the potential for indirect impacts on retained areas of native vegetation adjacent to the proposal site, both during construction and from the resulting operation of the trail.

Specific mitigation measures are provided below to minimise likely impacts on biodiversity values.

7.1 Avoidance of impacts

The proposal avoided impacts on native vegetation and habitat values by designing the pathway such that the majority of the proposal site occurs along the former railway line, which is predominantly cleared or dominated by exotic species and priority weeds.

The proposal site has been minimised and optimised as far as practical by implementing the following:

- The proposed pathway route follows the old railway line and access tracks to vastly reduce the amount of vegetation clearing required, as the majority of the proposal site width comprises the track / road itself.
- Avoiding areas of high biodiversity values (by locating the proposal predominantly on previously cleared land).
- Replacing bridges at Surveyors Creek, Wallis Creek and Werakata Creek in the same location as existing structures, thus limiting the area of impact as much as possible.
- Limiting impacts on riparian vegetation and in-stream flora to the area immediately adjacent to proposed bridges.

The area of vegetation to be removed has been minimised as far as practical during design development, particularly with consideration of minimising clearing of native vegetation and habitat for sensitive fauna species. Site access, compounds and stockpile sites would be located in existing cleared areas within the proposal site.

7.1.1 Detailed design phase

Measures to further avoid minimise impacts would be incorporated into the detailed design and are summarised below. In particular, the majority of opportunities to minimise impacts on roosting microbat species are design considerations rather than construction measures.

Artificial lighting

- The key impacts regarding the installation of artificial lighting to microbats is the potential for delayed roost emergence and roost abandonment. Roost abandonment may in turn lead to increased predation particularly if viable alternative roosting options are not available in the local area. This is of particular consequence for the threatened Southern Myotis that may roost in the tunnels year round and other species (e.g. Little Bent-wing Bat, Miniopterus australis) that may occasionally use the tunnels for roosting.
- Incorporating design features to minimise light spill onto the roof of the tunnels where there are substantial numbers of bat roosts, such as constructing ‘shields’ or false ceilings around roost sites to maintain darkness within roosts. Creation of these light exclusion zones will reduce the potential for delayed roost emergence and roost abandonment. These shields/false ceilings will also provide a barrier between roosting bats and pedestrians using the tunnel during daylight hours.

- Incorporating variable lighting regimes along the alignment and in the tunnels reduce the potential for light spill impacting foraging habitat, and minimise the chance of roost abandonment. This could involve switching off or dimming lights for part of the night, or use of movement sensor lights along the alignment and in the tunnels that switch on upon approach and turn off after people pass.
- Incorporating design features to limit light spill into areas of adjoining sensitive habitat along the alignment, as far as practicable, to minimise the impacts of lighting to foraging habitat along the alignment. This could include the use of low intensity lamps to reduce the spread of illumination, directed lighting or light shields to create dark refuges between lamps.
- Use of certain light types such as long wavelength “warm white” lights rather than short wavelength “blue” lights.

Bridge design

- Other design considerations (such as height, orientation, construction materials) to minimise shading of marine vegetation such as mangroves and saltmarshes.
- Incorporating design features for instream structures to avoid impact to river flow and fish passage.
- Incorporating design features to facilitate fish and amphibian passage, if required.
- Considering the installation of habitat boxes for bats on the underside of new bridges.

Fence design

- Fence design to be of suitable height above ground level and material to enable fauna movement.

Construction methods

- Using construction methods that will limit the need for vegetation clearance in riparian areas.
- Aboricultural assessment to be completed of all trees in close proximity to final design to determine potential impacts to mature tree health and identify appropriate management measures.

7.2 Construction environment management plan

A range of measures will be implemented to mitigate impacts on biodiversity values, particularly at the construction phase of the proposal. Prior to construction, a Construction Environmental Management Plan (CEMP) would be prepared specifying environmental safeguards to be implemented to avoid or minimise impacts arising from construction activities. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water and pollutants, acid sulfate soils, as well as flora- and fauna-specific mitigation measures.

Key impact mitigation measures during construction that would be included in the CEMP and its sub-plans are described in Table 7-1.

Table 7-1 Key mitigation measures

Mitigation measure	Description	Responsibility	Timing
General	Ensure all workers are provided with an environmental induction prior to starting work on site. This would include information on the ecological values of the proposal site and measures to be implemented to protect biodiversity	Construction contractor	Pre-construction
	Minimisation of clearing areas of native vegetation as far as practicable.	Construction contractor	During construction
	Minimise removal of native trees as far as practicable. Where possible, trim tree limbs rather than completely removing.	Construction contractor	During construction
	Clearly mark clearing limits with a high visibility barrier to prevent accidental clearing or disturbance of adjacent vegetation.	Construction contractor	Pre-construction
	Designate and clearly mark any areas of EEC located adjacent to the proposal site as NO-GO areas.	Construction contractor	Pre-construction
	Locate stockpiles within existing cleared areas or areas of non-native vegetation within proposal site.	Construction contractor	Pre-construction
	Avoid or minimise light spill into areas of adjoining sensitive habitat during construction.	Construction contractor	During construction
	Implement erosion and sediment controls in accordance with the mitigation measures outlined in Section 6.3.3 of the REF.	Construction contractor	Pre-construction
Waterway protection	Implementation of erosion and sediment control measures during construction to minimise pollution and sediment impacts on waterways and downstream aquatic environments, including estuarine communities. This could include measures such as the use of silt curtains during substrate disturbance activities (e.g. pile driving) to minimise the potential for migration of turbid plumes outside of the immediate proposal site	Construction contractor	Pre-construction
	Implementation of measures to manage fuels, chemicals, and liquids required during construction	Construction contractor	Pre-construction
	Minimisation of impacts to riparian and instream habitats at creek crossings, for example using barge access rather than shore-based access during bridge construction.	Construction contractor	During construction
Weed and pathogen control	Designated parking in existing cleared areas. Vehicles to keep to existing tracks wherever possible.	Construction contractor	During construction
	Weed material is to be cleared and stockpiled separately to all other vegetation, removed from site and disposed of at an appropriately licenced disposal facility. When transporting weed waste from the site to the waste facility, trucks must be covered to avoid the spread of weed-contaminated material.	Construction contractor	During construction

Mitigation measure	Description	Responsibility	Timing
	Hygiene measures are to be implemented in accordance with national best practice guidelines for Phytophthora (DPIE, 2020b) to prevent the introduction or spread of the pathogen during the vegetation clearing phases of the proposal. This includes decontamination of plant equipment prior to entering the proposal site.	Construction contractor	During construction
	Hygiene measures are to be implemented to prevent the introduction or spread of chytrid fungus during the vegetation clearing including decontamination of plant equipment working within 40 m of waterbodies. Hygiene measures should be carried out with reference to the hygiene guidelines outlined by DECC (DECC, 2008).	Construction contractor	During construction
	Ongoing weed management to be incorporated into operational procedures.	Council	Operation
Flora and fauna	Fauna handling and release protocols are to be implemented during any clearing works.	Qualified ecologist	During construction
	A pre-clearance survey must be completed prior to clearing works and would be outlined in the CEMP.	Qualified ecologist	During construction
	A suitably qualified and appropriately licenced ecologist will be present during the clearance of all native vegetation and/or fauna habitats. Animals that require handling must not be approached or handled until the ecologist is present, unless in an emergency (e.g. when there are both no authorised persons present and where the failure to immediately intervene would place the animal at significant risk). In such an emergency, the site manager may obtain over the phone instructions from the project ecologist to ameliorate the situation. A wildlife rescue organisation (e.g. 1300 094 737) or a similar organisation in the event of injured fauna being discovered. Contact WIRES (1300 094 737) or a similar organisation in the event of injured fauna being discovered.	Qualified ecologist and construction contractor	During construction
	Disturbed areas are to be stabilised immediately following construction and revegetated with native endemic groundcover species characteristic of the vegetation types identified within the proposal site, which would be detailed in the CEMP.	Construction contractor	Post-construction

8. Conclusion

This Flora and Fauna Impact Assessment has been prepared to describe the biodiversity values present within the study area, assess impacts of the proposal and outline mitigation measures to limit the impacts of the proposal on the ecological values of the site.

The majority of the study area has been subject to historical disturbance associated with the construction and operation of the former Richmond Vale railway. The margins of proposal site, contain better condition vegetation connected to larger patches of native forest extending offsite. Vegetation identified in the proposal site includes exotic vegetation and dry and wet sclerophyll forests. Two of the vegetation communities within the proposal site are classified as threatened ecological communities listed under the BC Act:

- Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC

Given the modified nature of the proposal site, disturbed condition of the community and location at the edge of large, undisturbed extents of this community in the broader locality, assessments of significance concluded that the proposal is unlikely to have a significant impact on these ecological communities.

A habitat assessment was used to identify the likelihood of occurrence of threatened biota listed under the BC Act, FM Act or EPBC Act that were predicted to occur, or have previously been recorded in the locality.

Eight threatened flora species listed under the BC Act and seven under the EPBC Act were assessed as occurring or having potential to occur within the proposal site. Assessments of significance concluded that the proposal was unlikely to result in significant impacts to these species.

A total of 44 threatened and migratory fauna species, including a range of threatened microbats and threatened and migratory birds, could potentially occur transiently in the proposal site on occasion. No breeding habitat is likely to be impacted for any of these species. Given the disturbed nature of the vegetation to be removed, location along the edge of the existing cleared rail corridor, and transient nature of the species' occurrence, the proposal was considered unlikely to result in any significant impacts to these species or alter the suitability of the habitat.

The proposal is located within land that has historically been cleared for the construction and operation of the former Richmond Vale railway. Construction of the proposal has been purposefully designed to avoid or reduce impacts on biodiversity values as far as practicable. This has included:

- Minimising clearing of native vegetation, particularly areas of TEC
- Implementing mitigation measures to limit impacts to biodiversity during the construction phase of the proposal

Despite measures taken to avoid and mitigate impacts, the proposal would result in some unavoidable residual impacts on some elements of the natural environment, including removal of native vegetation and associated fauna habitat resources. These residual impacts are small in extent and magnitude and would comprise a minor reduction in biodiversity values in the study area, particularly given the large undisturbed extents of native forest in the locality.

The proposal is unlikely to have a significant impact on any MNES and referral of the proposal to the Minister for the Environment is not considered necessary.

9. References

Bartier, F., et al. (2001). Understanding the biology and ecology of a vulnerable plant species - a case study with Tetratheca juncea occurring over coal leases. ACARP Project C8012. University of Queensland, St Lucia, Queensland.

BCD (2016). "Sydney Basin Bioregion." from https://www.environment.nsw.gov.au/bioregions/sydneybasinbioregion.htm.

BCD (2019). "Sydney Basin - subregions." from https://www.environment.nsw.gov.au/bioregions/SydneyBasin-Subregions.htm.

Bell, S. (2006). Eucalyptus parramattensis subsp. decadens: Status, Distribution and Habitat. Report to Department of Environment and Conservation, NSW. Eastcoast Flora Survey.

Bell, S. A. (2004). "Distribution and habitat of the vulnerable tree species, Angophora inopina (Myrtaceae), on the Central Coast of New South Wales." Cunninghamia 8(4): 477-484.

Bell, S. A. J. (2016). Volume 2: Vegetation community profiles, Lake Macquarie Local Government Area. Working draft v2. Unpublished report to Lake Macquarie City Council. March 2016. Eastcoast Flora Survey.

Bellairs, S. M., et al. (2006). "Seed biology implications for the maintenance and establishment of Tetratheca juncea (Tremandraceae), a vulnerable Australian species." Australian Journal of Botany 54(1): 35-41.

Benson, D. and K. L. McDougall (1996). Ecology of Sydney plant species Part 4: Dicotyledon family Fabaceae. Cunninghamia. Sydney: Royal Botanic Gardens.

Benson, D. and L. McDougall (1998). "Ecology of Sydney plant species: Part 6 Dicotyledon family Myrtaceae." Cunninghamia 5(4): 809-987.

Benson, D. and L. McDougall (2000). "Ecology of Sydney plant species: part 7b Dicotyledon families Proteaceae to Rubiaceae." Cunninghamia 6(4): 1016-1202.

BOM (2020a). "Atlas of groundwater dependent ecosystems." from http://www.bom.gov.au/water/groundwater/gde/.

BOM (2020b). "Climate Data Online." from http://www.bom.gov.au/climate/data/.

Cessnock City Council (2010). Development Control Plan 2010- Part C: General Guidelines; Chapter 2: Flora and Fauna Survey Guidelines.

Churchill, S. (2008). Australian Bats. Second edition. Allen & Unwin, St Leonards.

Clarke, P. J., et al. (1998). The Vegetation and Plant Species of Torrington State Recreation Area. Univeristy of New England, Division of Botany, Armidale.

DECC (2008). Hygiene protocol for the control of disease in frogs. Information Circular Number 6. NSW Department of Environment and Climate Change, Sydney South.

DECCW (2009). Draft National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus, Sydney.

DEE (2017). Draft National Recovery Plan for the Grey-headed Flying-fox (Pteropus poliocephalus). Commonwealth of Australia.

DEE (2020a). "Protected Matters Online Search Tool." from http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst.jsf.

DEE (2020b). Species profiles and threats database (SPRAT). Australian Government Department of the Environment and Energy.

DEH (2016). Acid Sulfate Soil Risk Data. Bioregional Assessment Source Dataset. NSW Government, http://data.bioregionalassessments.gov.au/dataset/8209e37a-5f5e-4d07-bd54-851ce1167797.

DEWHA (2008a). Approved Conservation Advice for Angophora inopina, Canberra.

DEWHA (2008b). Approved Conservation Advice for Grevillea parviflora subsp. parviflora (Small-flower Grevillea), Canberra.

DEWHA (2008c). Approved Conservation Advice for Rutidosis heterogama (Heath Wrinklewren), Canberra.

DEWHA (2008d). Approved Conservation Advice for Tetratheca juncea, Canberra.

DLWC (2002). The NSW State Groundwater Dependent Ecosystem policy: A component policy of the NSW State Groundwater Policy Framework Document. New South Wales Department for Land and Water Conservation.

DoE (2013a). Approved Conservation Advice for Acacia bynoeana (Bynoe's wattle), Canberra.

DoE (2013b). Matters of National Environmental Significance - Significant impact guidelines 1.1. Australian Government, Canberra.

DoE (2014a). Approved Conservation Advice for Eucalyptus parramattensis subsp. decadens (Earp's gum). Canberra.

DoE (2014b). EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory). Commonwealth of Australia.

DoE (2020a). Acacia bynoeana. Department of the Environment, Canberra.

DoE (2020b). Angophora inopina. Department of the Environment, Canberra.

DoE (2020c). Eucalyptus parramattensis subsp. decadens. Department of the Environment, Canberra.

DoE (2020d). Grevillea parviflora subsp. parviflora. Department of the Environment, Canberra.

DoE (2020e). Pterostylis gibbosa. Department of the Environment, Canberra.

DoE (2020f). Rutidosis heterogama, Canberra.

DoE (2020g). Tetratheca juncea. Department of the Environment, Canberra.

DotE (2013). Matters of National Environmental Significance Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999. Australian Government Department of the Environment, Canberra.

DPI (2007). "Key Fish Habitat maps." from https://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps.

DPI (2013). Policy and guidelines for fish habitat conservation and management. Update 2013. NSW Department of Primary Industries.

DPI (2018). Freshwater threatened species distribution maps. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/669589/fish-communities-and-threatened-species-distributions-of-nsw.pdf.

DPI (2019). Freshwater threatened species distribution maps. NSW Department of Primary Industries.

DPI (2020). "NSW Weedwise." from https://weeds.dpi.nsw.gov.au/.

DPIE (1991). "Soil Landscapes of the Singleton 1:250,000 Sheet." from https://datasets.seed.nsw.gov.au/dataset/soil-landscapes-of-the-singleton-1-250000-sheetac783.

DPIE (2010). Lower Hunter and Central Coast Regional vegetation survey VIS_ID 2225.

DPIE (2020a). "Biodiversity Values Map." from https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/biodiversity-offsets-scheme/entry-requirements/biodiversity-values-map.

DPIE (2020b). Hygiene guidelines- Protocols to protect priority biodiversity areas in NSW from Phytophthora cinnamomi, myrtle rust, amphibian chytrid fungus and invasive plants.

DPIE (2020c). NSW Bionet Vegetation Classification. NSW Government.

Driscoll, C. (2006). Acacia bynoeana: a review of species information. Unpublished Report prepared for the Deparment of Environment and Conservation, Newcastle.

Duffy, A. M., et al. (2000). "The efficacy of Anabat ultrasonic detectors and harp traps for surveying microchiropterans in southeastern Australia." Acta Chiropterologica 2: 127-144.

Eby, P. (1996). Interactions between the Grey-headed Flying-fox Pteropus poliocephalus (Chiroptera: Pteropodidae) and its diet plants-seasonal movements and seed dispersal, University of New England.

Eby, P. (1999). "Low reproductive output in grey-headed flying foxes associated with a short period of food scarcity." Australasian Bat Society Newsletter 14: 17-20.

Eby, P. and B. S. Law (2008). Ranking the feeding habitats of Grey-headed flying foxes for conservation management., Sydney South.

Ecovision Consulting (2006). Ecological Impact Assessment, Proposed Recovery of Carbonaceous Materials and Site Rehabilitation of former coal mines at Neath, Aberdare East and Richmond Main East. Environmental Assessment Report, Chitter and Tailings Reclamation Project.

GHD (2020). Cessnock City Council- Richmond Vale Rail Trail - Stockrington to Kurri Kurri: Review of Environmental Factors.

Gibbons, P. and D. B. Lindenmayer (2002). Tree hollows and wildlife conservation in Australia CSIRO Publishing.

Harden, G. J. (1990-93). Flora of New South Wales NSW University Press, Sydney.

Keith, D. A. (2004). Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT. NSW Department of Environment and Conservation, Sydney.

LMCC (2016). Lake Macquarie City Council Native Vegetation & Corridors 2015 Map 1. Lake Macquarie City Council.

Mike Halliburton Associates (2014). Richmond Vale Rail Trail Feasibility Study.

Mills, D. J., et al. (1996). "Designing surveys for microchiropteran bats in complex forest landscapes – a pilot study from south-east Australia." Forest Ecology and Management 85(1-3): 149-161.

Murphy, C. L. (1993). Soil Landscapes of the Gosford - Lake Macquarie 1:100,000 Sheet. Report. Department of Conservation and Land Management, Sydney.

Murphy, C. L. and P. J. Tille (1993). Soil Landscapes of the Gosford - Lake Macquarie 1:100,000 Sheet. Map. Department of Conservation Land Management, Canberra.

NPWS (2002). Pterostylis gibbosa (R.Br.) Illawarra Greenhood Orchid Recovery Plan. NSW National Parks and Wildlife Service, Hurstville.

NPWS, N. (2020). "Werakata State Conservation Area." from https://www.nationalparks.nsw.gov.au/visit-a-park/parks/werakata-state-conservation-area.

NSW NPWS (2000). Vegetation Survey, Classification and Mapping: Lower Hunter and Central Coast Region, Sydney.

NSW Threatened Species Scientific Committee (2019a). "Angophora inopina (a tree) - vulnerable species listing ", from https://www.environment.nsw.gov.au/Topics/Animals-and-plants/Threatened-species/NSW-Threatened-Species-Scientific-Committee/Determinations/Final-determinations/1996-1999/Angophora-inopina-a-tree-vulnerable-species-listing.

NSW Threatened Species Scientific Committee (2019b). "Callistemon linearifolius (a shrub) - vulnerable species listing ", from https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/1996-1999/callistemon-linearifolius-a-shrub-vulnerable-species-listing.

NSW Threatened Species Scientific Committee (2019c). "Kurri Sand Swamp Woodland in the Sydney Basin Bioregion - Determination to make a minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act ", from https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2011-2012/kurri-sand-swamp-woodland-in-the-sydney-basin-bioregion-determination-to-make-a-minor-amendment.

NSW Threatened Species Scientific Committee (2019d). "Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion - Determination to make minor amendment to Part 3 of Schedule 1 of the Threatened Species Conservation Act ", from https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2008-2010/lower-hunter-spotted-gum-ironbark-forest-minor-amendment-determination.

OEH (2017). "Heath Wrinklewort - profile." from https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10737.

OEH (2018). "Illawarra Greenhood - profile." from https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10701.

OEH (2019a). "Black-eyed Susan - profile." from https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10799.

OEH (2019b). "Charmhaven Apple - profile." from https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10053.

OEH (2019c). "Netted Bottle Brush - profile." from https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10129.

OEH (2019d). "Small-flower Grevillea - profile." from https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10373.

OEH (2020a). NSW Bionet Atlas. NSW Government, http://www.bionet.nsw.gov.au/.

OEH (2020b). Threatened biodiversity profile search.

Orchard, A. E. and A. J. G. Wilson (2001). "Flora of Australia". In Flora of Australia-Mimosaceae, Acacia Part 2. editor /. ABRS and CSIRO, Canberra, ACT. pp.

Parry-Jones, K. and M. L. Augee (1991). "Food Selection by Grey-headed Flying Foxes (Pteropus poliocephalus) Occupying a Summer Colony Site near Gosford, New South Wales." Wildlife Research 18: 111-124.

Pennay, M., et al. (2011). "Review of the Distribution and status of the bat fauna of NSW and the ACT". In The Biology and Conservation of Australian Bats. editor / B. Law, P. Eby and D. Lunney. pp. 226-256

Pennay, M., et al. (2004). Bat calls of New South Wales: Region based guide to the echolocation calls of Microchiropteran bats. NSW Department of Environment and Climate Change, Hurstville.

Phillips, S. and J. Callaghan (1995). The Spot Assessment Technique for Determining the Significance of Habitat Utilisation by Koalas.

Reardon, T. B., et al. (2014). "A molecular and morphological investigation of species boundaries and phylogenetic relationships in Australian free-tailed bats Mormopterus (Chiroptera : Molossidae)." Australian Journal of Zoology 62: 109-136.

RGBT (2018). "PlantNET - The Plant Information Network System of The Royal Botanic Gardens and Domain Trust, Sydney, Australia.", from http://plantnet.rbgsyd.nsw.gov.au.

Richmond Vale Railway Museum (2010). "History of the Richmond Vale Railway Museum." from http://www.richmondvalerailwaymuseum.org/history/index.html.

Specht, R. L. (1970). "Vegetation". In Australian Environment. editor / G. W. Leeper. Melbourne University Press, Melbourne. pp. 44-67.

State of NSW; OEH (2018). Threatened species test of significance guidelines.

Van Dyke, S., et al. (2013). Field Companion To The Mammals of Australia. New Holland Publishers.

Appendices

Appendix A– Threatened species occurrence

An evaluation of the likelihood and extent of impact to threatened and migratory fauna recorded within a 10 km radius of the proposal site is provided below. Databases searched included the Office of Environment and Heritage (OEH) NSW Wildlife Atlas Search Tool (licensed), EPBC Protected Matters Search Tool (PMST) and the Atlas of Living Australia. Ecological information has been obtained from the Threatened Species Profiles on the NSW Office of Environment and Heritage (OEH) website (http://www.environment.nsw.gov.au/threatenedspecies/) and from the Species Profiles and Threats Database on the Commonwealth DEE website (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl).

Status

- E Endangered
- CE Critically Endangered
- EP Endangered population
- V Vulnerable
- Mi Migratory

Likelihood of occurrence in study area

Known – The species was observed in the study area during surveys.

High – It is highly likely that a species inhabits the proposal area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (within 10 kilometres) and is known or likely to maintain resident populations in the proposal area. Also includes species known or likely to visit the proposal area during regular seasonal movements or migration

Moderate – Potential habitat is present in the proposal area. Species unlikely to maintain sedentary populations, however may seasonally use resources within the proposal area opportunistically or during migration. The species is unlikely to be dependent (ie. for breeding or important life cycle periods such as winter flowering resources) on habitat within the proposal area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.

Low – It is unlikely that the species inhabits the proposal site and has not been recorded recently in the locality (within 10 kilometres). It may be an occasional visitor, but habitat similar to the proposal area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the proposal area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.

None – Suitable habitat is absent from the proposal area.

Likelihood of impact

Unlikely impact - The proposal would have a low possibility of impact on this species/community or its habitats. No five part test and/or assessment of significance is required for this species/community.

Likely impact - The proposal could impact on this species/community and its habitat. A five part test and/or assessment of significance is required for this species/community.

Appendix B – Species list

Flora Species List

Family	Exotic	Scientific name	Common name	BC Act status	EPBC Act status
Fabaceae	-	*Acacia brownii*	Heath Wattle	-	-
Fabaceae	-	*Acacia dealbata*	Silver Wattle	-	-
Fabaceae	-	*Acacia elongata*	Swamp Wattle	-	-
Fabaceae	-	*Acacia falcata*	Hickory Wattle	-	-
Fabaceae	-	*Acacia fimbriata*	Fringed Wattle	-	-
Fabaceae	-	*Acacia Irrorata*	Green Wattle	-	-
Fabaceae	-	*Acacia linifolia*	White Wattle	-	-
Fabaceae	-	*Acacia longifolia*	-	-	-
Fabaceae	-	*Acacia maidenii*	Maiden's Wattle	-	-
Fabaceae	-	*Acacia parvipinnula*	Silver-stemmed Wattle	-	-
Fabaceae	-	*Acacia terminalis*	Sunshine Wattle	-	-
Ericaceae	-	*Acrotriche divaricate*	-	-	-
Pteridaceae	-	*Adiantum aethiopicum*	Common Maidenhair	-	-
Adiantaceae	-	*Adiantum hispidulum*	Rough Maidenhair	-	-
Casuarinaceae	-	*Allocasuarina littoralis*	Black She-Oak	-	-
Rhamnaceae	-	*Alphitonia excels*	Red Ash	-	-
Loranthaceae	-	*Amyema pendula*	-	-	-
Myrsinaceae	*	*Anagallis arvensis*	Scarlet Pimpernel	-	-
Poaceae	*	*Andropogon virginicus*	Whisky Grass	-	-
Myrtaceae	-	*Angophora bakeri*	Narrow-leaved Apple	-	-
Myrtaceae	-	*Angophora costata*	Sydney Red Gum	-	-
Basselaceae	*	*Anredera cordifolia*	Madeira Vine	-	-
Fabaceae	-	*Aotus ericoides*	-	-	-
Apocynaceae	*	*Araujia sericifera*	Moth Vine	-	-
Poaceae	-	*Aristida vagans*	Threeawn Speargrass	-	-
Anthericaceae	-	*Arthropodium milleflorum*	Pale Vanilla-lily	-	-
Poaceae	*	*Avena fatua*	Wild Oats	-	-
Proteaceae	-	*Banksia spinulosa*	Hairpin Banksia	-	-
Ateraceae	*	*Bidens pilosa*	Cobbler's Pegs	-	-
Pittosporaceae	-	*Billardiera scandens*	Hairy Apple Berry	-	-
Poaceae	-	*Bothriochloa macra*	Red Grass	-	-
Phyllanthaceae	-	*Breynia oblongifolia*	Coffee Bush	-	-
Poaceae	*	*Briza maxima*	Quaking Grass	-	-
Poaceae	*	*Briza minor*	Shivery Grass	-	-
Poaceae	*	*Briza subaristata*	-	-	-
Crassulaceae	*	*Bryophyllum delagoense*	Mother of millions	-	-
Colchicaceae	-	*Burchardia umbellata*	Milkmaids	-	-
Pittosporaceae	-	*Bursaria spinosa*	Native Blackthorn	-	-
Myrtaceae	-	*Callistemon rigidus*	Stiff Bottlebrush	-	-
Myrtaceae	-	*Callistemon salignus*	Willow Bottlebrush	-	-
Lauraceae	-	*Cassytha glabella*	-	-	-
Pteridaceae	-	*Cheilanthes sieberi*	Rock Fern	-	-
Poaceae	*	*Chloris gayana*	Rhodes Grass	-	-
Asteraceae	-	*Chrysocephalum apiculatum*	Common Everlasting	-	-
Lauraceae	*	*Cinnamomum camphora*	Camphor Laurel	-	-
Asteraceae	*	*Cirsium vulgare*	Spear Thistle	-	-
Vitaceae	-	*Cissus antarctica*	Water Vine	-	-
Vitaceae	-	*Cissus Hypoglauca*	Giant Water Vine	-	-
Ranunculaceae	-	*Clematis aristata*	Old Man's Beard	-	-
Ranunculaceae	-	*Clematis glycinoides*	Headache Vine	-	-
Lamiaceae	-	*Clerodendrum tomentosum*	Hairy Clerodendrum	-	-
Polygalaceae	-	*Comesperma ericinum*	Pyramid Flower	-	-
Asteraceae	*	*Conyza bonariensis*	Flaxleaf Fleabane	-	-
Myrtaceae	-	*Corymbia eximia*	Yellow Bloodwood	-	-
Myrtaceae	-	*Corymbia maculata*	Spotted Gum	-	-
Asteraeae	*	*Crassocephalum crepidioides*	Thickhead	-	-
Poaceae	-	*Cynodon dactylon*	Common Couch	-	-
Cyperaceae	*	*Cyperus eragrostis*	Umbrella Sedge	-	-
Goodeniaceae	-	*Dampiera stricta*	-	-	-
Fabaceae	-	*Daviesia genistifolia*	Broom Bitter Pea	-	-
Fabaceae	-	*Daviesia ulicifolia*	Gorse Bitter Pea	-	-
Celastraceae	-	*Denhamia silvestris*	Narrow-leaved Orangebark	-	-
Fabaceae	-	*Desmodium rhytidophyllum*	-	-	-
Phormiaceae	-	*Dianella caerulea* var. *producta*	Blue Flax-lily	-	-
Phormiaceae	-	*Dianella revoluta*	Blueberry Lily	-	-
Convolvulaceae	-	*Dichondra repens*	Kidney Weed	-	-
Fabaceae	-	*Dillwynia retorta*	-	-	-
Dioscoreaceae	-	*Dioscorea transversa*	Native Yam	-	-
Orchidaceae	-	*Diuris sulphurea*	Tiger Orchid	-	-
Sapindaceae	-	*Dodonaea triquetra*	Large-leaf Hop-bush	-	-
Doryanthaceae	-	*Doryanthes excelsa*	Gymea Lily	-	-
Poaceae	-	*Echinopogon ovatus*	Forest Hedgehog Grass	-	-
Poaceae	*	*Ehrharta erecta*	Panic Veldtgrass	-	-

Flora Species List

Family	Exotic	Scientific name	Common name	BC Act status	EPBC Act status
Elaeocarpaceae	-	*Elaeocarpus obovatus*	Hard Quandong	-	-
Poaceae	-	*Entolasia stricta*	Wiry Panic	-	-
Fabaceae	*	*Erythrina crista-galli*	Cockspur Coral Tree	-	-
Myrtaceae	-	*Eucalyptus acmenoides*	White Mahogany	-	-
Myrtaceae	-	*Eucalyptus agglomerata*	Blue-leaved Stringybark	-	-
Myrtaceae	-	*Eucalyptus crebra*	Narrow-leaved Ironbark	-	-
Myrtaceae	-	*Eucalyptus fibrosa*	Red Ironbark	-	-
Myrtaceae	-	*Eucalyptus grandis*	Flooded Gum	-	-
Myrtaceae	-	*Eucalyptus mollucana*	Grey Box	-	-
Myrtaceae	-	*Eucalyptus parramattensis*	Parramatta Red Gum	V	V
Myrtaceae	-	*Eucalyptus piperita*	Sydney Peppermint	-	-
Myrtaceae	-	*Eucalyptus siderophloia*	Grey Ironbark	-	-
Myrtaceae	-	*Eucalyptus tereticornis*	Forest Red Gum	-	-
Myrtaceae	-	*Eucalytpus paniculata*	Grey Ironbark	-	-
Myrtaceae	-	*Eucalytpus punctata*	Grey Gum	-	-
Myrtaceae	-	*Eucalytpus umbra*	Broad-leaved White Mahogony	-	-
Luzuriagaceae	-	*Eustrephus latifolius*	Wombat Berry	-	-
Santalaceae	-	*Exocarpos cupressiformis*	Cherry Ballart	-	-
Santalaceae	-	*Exocarpos strictus*	Dwarf Cherry	-	-
Apiaceae	*	*Foeniculum vulgare*	Fennel	-	-
Oleaceae	*	*Fraxinus angustifolia*	Ash	-	-
Iridaceae	*	*Freesia* spp.	-	-	-
Cyperaceae	-	*Gahnia clarkei*	Tall Saw-sedge	-	-
Rubiaceae	-	*Galium propinquum*	Maori Bedstraw	-	-
Luzuriagaceae	-	*Geitonoplesium cymosum*	Scrambling Lily	-	-
Geraniaceae	-	*Geranium homeanun*	-	-	-
Geraniaceae	-	*Geranium solanderi*	Native Geranium	-	-
Fabaceae	-	*Glycine clandestine*	-	-	-
Fabaceae	-	*Gompholobium latifolium*	Golden Glory Pea	-	-
Fabaceae	-	*Gompholobium pinnatum.*	Pinnate Wedge Pea	-	-
Haloragaceae	-	*Gonocarpus teucrioides*	Germander Raspwort	-	-
Goodeniaceae	-	*Goodenia rotundifolia*	-	-	-
Proteaceae	-	*Grevillea montana*	-	-	-
Proteaceae	-	*Grevillea parviflora*	Small-flowered Grevillea	V	V
Haemodoraceae	-	*Haemodorum planifolium*	-	-	-
Proteaceae	-	*Hakea dactyloides*	Finger Hakea	-	-
Proteaceae	-	*Hakea sericea*	Needlebush	-	-
Proteaceae	-	*Hakea* spp.	-	-	-
Fabaceae	-	*Hardenbergia violacea*	False Sarsaparilla	-	-
Dilleniaceae	-	*Hibbertia dentata*	Twining Guinea Flower	-	-
Dilleniaceae	-	*Hibbertia linearis*	-	-	-
Dilleniaceae	-	*Hibbertia scandens*	Climbing Guinea Flower	-	-
Asteraceae	*	*Hypochaeris radicata*	Catsear	-	-
Poaceae	-	*Imperata cylindrica*	Blady Grass	-	-
Proteaceae	-	*Isopogon anemonifolius*	Broad-leaf Drumsticks	-	-
Fabaceae	-	*Jacksonia scoparia*	Dogwood	-	-
Juncaceae	-	*Juncus planifolius*	-	-	-
Juncaceae	-	*Juncus usitatus*	-	-	-
Fabaceae	-	*Kennedia rubicunda*	Dusky Coral Pea	-	-
Poaceae	-	*Lachnagrostis filiformis*	-	-	-
Proteaceae	-	*Lambertia formosa*	Mountain Devil	-	-
Verbenaceae	*	*Lantana camara*	Lantana	-	-
Malvaceae	-	*Lasiopetalum parviflorum*	-	-	-
Anthericaceae	-	*Laxmannia gracilis*	Slender Wire Lily	-	-
Cyperaceae	-	*Lepidosperma exolasius*	-	-	-
Cyperaceae	-	*Lepidosperma laterale*	Variable Sword-sedge	-	-
Myrtaceae	-	*Leptospermum polygalifolium*	Tantoon	-	-
Myrtaceae	-	*Leptospermum trinervium*	Slender Tea-tree	-	-
Ericaceae	-	*Leucopogon lanceolatus*	-	-	-
Lindsaeaceae	-	*Lindsaea microphylla*	Lacy Wedge Fern	-	-
Ericaceae	-	*Lissanthe strigose*	Peace Heath	-	-
Loganiaceae	-	*Logania albiflora*	-	-	-
Poaceae	*	*Lolium perenne*	Perennial Ryegrass	-	-
Lomandraceae	-	*Lomandra confertifolia*	Matrush	-	-
Lomandraceae	-	*Lomandra glauca*	Pale Mat-rush	-	-
Lomandraceae	-	*Lomandra longifolia*	Spiny-headed Mat-rush	-	-
Lomandraceae	-	*Lomandra multiflora*	Many-flowered Mat-rush	-	-
Lomandraceae	-	*Lomandra obliqua*	-	-	-
Caprifoliaceae	*	*Lonicera japonica*	Japanese Honeysuckle	-	-
Zamiaceae	-	*Macrozamia flexuosa*	-	-	-
Poaceae	*	*Megathyrsus maximus*	Guinea Grass	-	-
Myrtaceae	-	*Melaleuca nodosa*	Prickly-leaved Paperbark	-	-
Myrtaceae	-	*Melaleuca sieberi*	-	-	-

Flora Species List

Family	Exotic	Scientific name	Common name	BC Act status	EPBC Act status
Myrtaceae	-	*Melaleuca thymifolia*	Thyme Honey-myrtle	-	-
Ericaceae	-	*Melichrus urceolatus*	Urn Heath	-	-
Poaceae	*	*Melinis repens*	Red Natal Grass	-	-
Poaceae	-	*Microlaena stipoides*	Weeping Grass	-	-
Myrtaceae	-	*Micromyrtus ciliatata*	Fringed Heath-myrtle	-	-
Fabaceae	-	*Mirbelia rubiifolia*	Heathy Mirbelia	-	-
Ericaceae	-	*Monotoca scoparia*	-	-	-
Myrsinaceae	-	*Myrsine variabilis*	-	-	-
Lomariopsidaceae	*	*Nephrolepis cordifolia*	Fishbone Fern	-	-
Oleaceae	-	*Notelaea longifolia*	Large Mock-olive	-	-
Ochnaceae	*	*Ochna serrulata*	Mickey Mouse Plant	-	-
Onagraceae	*	*Oenotheca* sp.	-	-	-
Rubiaceae	-	*Opercularia diphylla*	-	-	-
Asteraceae	*	*Osteospermum ecklonis*	Cape Daisy	-	-
Oxalidaceae	-	*Oxalis perennans*	-	-	-
Asteraceae	-	*Ozothamnus diosmifolius*	White Dogwood	-	-
Poaceae	-	*Panicum simile*	Two-colour Panic	-	-
Caryophyllaceae	*	*Paronychia brasiliana*	Chilean Whitlow Wort	-	-
Apocynaceae	-	*Parsonsia straminea*	Common Silkpod	-	-
Poaceae	-	*Paspalidium distans*	-	-	-
Iridaceae	-	*Patersonia sericea*	Silky Purple-Flag	-	-
Proteaceae	-	*Persoonia levis*	Broad-leaved Geebung	-	-
Proteaceae	-	*Persoonia linearis*	Narrow-leaved Geebung	-	-
Caryophyllaceae	*	*Petrorhagia dubia*	-	-	-
Phyllanthaceae	-	*Phyllanthus hirtellus*	Thyme Spurge	-	-
Thymelaeaceae	-	*Pimelea linifolia*	Slender Rice Flower	-	-
Pittosporaceae	-	*Pittosporum revolutum*	Rough Fruit Pittosporum	-	-
Pittosporaceae	-	*Pittosporum undulatum*	Sweet Pittosporum	-	-
Plantaginaceae	*	*Plantago lanceolata*	Lamb's Tongues	-	-
Poaceae	-	*Poa labillardierei*	Tussock Grass	-	-
Fabaceae	-	*Podolobium ilicifolium*	Prickly Shaggy Pea	-	-
Araliaceae	-	*Polyscias sambucifolia*	Elderberry Panax	-	-
Rhamnaceae	-	*Pomaderris ferruginea*	Rusty Pomaderris	-	-
Rubiaceae	-	*Pomax umbellata*	Pomax	-	-
Phyllanthaceae	-	*Poranthera microphylla*	Small Poranthera	-	-
Lobeliaceae	-	*Pratia purpurascens*	Whiteroot	-	-
Acanthaceae	-	*Pseuderanthemum variabile*	Pastel Flower	-	-
Dennstaedtiaceae	-	*Pteridium esculentum*	Common Bracken	-	-
Cyperaceae	-	*Ptilothrix deusta*	-	-	-
Fabaceae	-	*Pultenaea euchila*	Orange Pultenaea	-	-
Fabaceae	-	*Pultenaea villosa*	Hairy Bush-pea	-	-
Rubiaceae	*	*Richardia humistrata*	-	-	-
Rosaceae	*	*Rubus fruticosis*	-	-	-
Rosaceae	-	*Rubus moluccanus*	Molucca Bramble	-	-
Polygonaceae	-	*Rumex conglomeratus*	Clustered Dock	-	-
Asteraceae	-	*Rutidosis heterogama*	Heath Wrinklewort	V	V
Poaceae	-	*Rytidosperma pallidum*	Redanther Wallaby Grass	-	-
Chenopodiaceae	-	*Sarcocornia quinqueflora*	Samphire	-	-
Asteraceae	*	*Senecio madagascariensis*	Fireweed	-	-
Fabaceae	*	*Senna pendula*	-	-	-
Malvaceae	*	*Sida rhombifolia*	Paddy's Lucerne	-	-
Solanaceae	*	*Solanum mauritianum*	Wild Tobacco Bush	-	-
Asteraceae	*	*Sonchus aspera*	Prickly Sowthistle	-	-
Poaceae	-	*Sporobolus virginicus*	Saltwater Couch	-	-
Caryophyllaceae	*	*Stellaria media*	Common Chickweed	-	-
Poaceae	*	*Stenotaphrum secundatum*	Buffalo Grass	-	-
Menispermaceae	-	*Stephania japonica*	Snake vine	-	-
Stylidiaceae	-	*Stylidium graminifolium*	Grass Triggerplant	-	-
Ericaceae	-	*Styphelia triflora*	Pink Five-corners	-	-
Asteraceae	*	*Tagetes minuta*	Stinking Roger	-	-
Elaeocarpaceae	-	*Tetratheca juncea*	Black-eyed Susan	V	V
Poaceae	-	*Themeda triandra*	Kangaroo Grass	-	-
Commelinaceae	*	*Tradescantia fluminensis*	Wandering Jew	-	-
Fabaceae	-	*Trifolium dubium*	Yellow-suckling Clover	-	-
Fabaceae	*	*Trifolium pratense*	Red Clover	-	-
Fabaceae	*	*Trifolium repens*	White Clover	-	-
Verbenaceae	*	*Verbena bonariensis*	Purpletop	-	-
Poaceae	*	*Vulpia bromoides*	Squirrel Tail Fesque	-	-
Campanulaceae	-	*Wahlenbergia communis*	Tufted Bluebell	-	-
Xanthorrhoeaceae	-	*Xanthorrhoea media*	Grass Tree	-	-

Note: *= Exotic species; V= Vulnerable

Fauna species list

Class	Scientific name	Common name	BC Act status	EPBC Act status
Amphibia	*Crinia signifera*	Clicking froglet	-	-
Amphibia	*Limnodynastes peronii*	Striped marsh frog	-	-
Aves	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	-	-
Aves	*Acanthorhynchus tenuirostris*	Eastern Spinebill	-	-
Aves	*Anas superciliosa*	Pacific Black Duck	-	-
Aves	*Anthus novaeseelandiae*	Australasian Pipit	-	-
Aves	*Ardea ibis*	Cattle Egret	-	Mi
Aves	*Artamus leucorynchus*	White-breasted Woodswallow	-	-
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	-	-
Aves	*Cacatua tenuirostris*	Long-billed Corella	-	-
Aves	*Cacomantis variolosus*	Brush Cuckoo	-	-
Aves	*Cisticola exilis*	Golden-headed Cisticola	-	-
Aves	*Colluricincla harmonica*	Grey Shrike-thrush	-	-
Aves	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	-	-
Aves	*Corcorax melanorhamphos*	White-winged Chough	-	-
Aves	*Cormobates leucophaea*	White-throated treecreeper	-	-
Aves	*Coturnix ypsilophora*	Brown quail	-	-
Aves	*Cracticus tibicen*	Australian Magpie	-	-
Aves	*Cygnus atratus*	Black Swan	-	-
Aves	*Dacelo novaeguineae*	Laughing Kookaburra	-	-
Aves	*Egretta novaehollandiae*	White-faced Heron	-	-
Aves	*Eurystomus orientalis*	Dollarbird	-	-
Aves	*Geopelia humeralis*	Bar-shouldered dove	-	-
Aves	*Grallina cyanoleuca*	Magpie-lark	-	-
Aves	*Haliastur sphenurus*	Whistling Kite	-	-
Aves	*Hirundo neoxena*	Welcome Swallow	-	-
Aves	*Lichenostomus chrysops*	Yellow-faced Honeyeater	-	-
Aves	*Malurus cyaneus*	Superb Fairy-wren	-	-
Aves	*Manorina melanophrys*	Bell Miner	-	-
Aves	*Menura novaehollandiae*	Superb Lyrebird	-	-
Aves	*Milvus migrans*	Black Kite	-	-
Aves	*Neochmia temporalis*	Red-browed Finch	-	-
Aves	*Ocyphaps lophotes*	Crested pigeon	-	-
Aves	*Pardalotus punctatus*	Spotted Pardalote	-	-
Aves	*Platycercus eximius*	Eastern rosella	-	-
Aves	*Porphyrio porphyrio*	Purple Swamphen	-	-
Aves	*Psophodes olivaceus*	Eastern Whipbird	-	-
Aves	*Rhipidura albiscapa*	Grey Fantail	-	-
Aves	*Rhipidura leucophrys*	Willie Wagtail	-	-
Aves	*Sericornis frontalis*	White-browed scrub wren	-	-
Aves	*Trichoglossus chlorolepidotus*	Scaly-breasted lorikeet	-	-
Aves	*Trichoglossus haematodus*	Rainbow Lorikeet	-	-
Aves	*Vanellus miles*	Masked Lapwing	-	-
Mammalia	*Austronomus australis*	White Striped Free-tailed Bat	-	-
Mammalia	*Chalinolobus dwyeri*	Large-eared Pied bat	V	V
Mammalia	*Chalinolobus gouldii*	Gould's Wattle Bat	-	-
Mammalia	*Chalinolobus morio*	Chocolate Wattle bat	-	-
Mammalia	*Macropus giganteus*	Eastern Grey Kangaroo	-	-
Mammalia	*Miniopterus australis*	Little Bent-wing Bat	V	-
Mammalia	*Miniopterus schreibersii oceanensis*	Eastern bent-wing Bat	V	-

Fauna species list

Class	Scientific name	Common name	BC Act status	EPBC Act status
Mammalia	*Mormopterus norfolkensis*	Eastern Free-tailed Bat	V	-
Mammalia	*Nyctophilus* sp.	A Long-eared Bat	-	-
Mammalia	*Oryctolagus cuniculus*	European Rabbit	-	-
Mammalia	*Ozimops ridei*	Ride's Free-tailed Bat	-	-
Mammalia	*Phascolarctos cinereus*	Koala	V	V
Mammalia	*Rattus rattus*	Black Rat	I	-
Mammalia	*Rhinolophus megaphyllus*	Smaller Horse Shoe Bat	-	-
Mammalia	*Vespadelus darlingtoni*	Large-eared Forest Bat	-	-
Mammalia	*Vespadelus pumilus*	Eastern Forest Bat	-	-
Mammalia	*Vespadelus vulturnus*	Little Forest Bat	-	-
Mammalia	*Vulpes vulpes*	Red Fox	I	-
Mammalia	*Wallabia bicolor*	Swamp wallaby	-	-

* V=Vulnerable; I=Introduced; Mi=Migratory

Appendix C– Tests of significance (BC Act)

Section 7.3 of the BC Act lists five factors that must be taken into account in the determination of the significance of potential impacts of an activity on 'threatened species, populations or ecological communities (or their habitats)' listed under the BC Act. The test of significance ('five part test') is used to determine whether an activity is 'likely' to impose 'a significant effect' on threatened biota and thus whether a SIS or BDAR is required.

Tests of significance have been completed in accordance with the Threatened species assessment Test of Significance Guidelines (State of NSW; OEH, 2018) to determine the significance of the potential impacts of the proposal on threatened flora, fauna and communities listed under The BC Act. The assessments of significance has been conducted for those threatened flora, fauna and communities that have been recorded or have a moderate or high likelihood of occurrence (based on results of the likelihood of occurrence assessment provided in Appendix A). These include the following:

Threatened ecological communities

- Lower Hunter Spotted Gum ironbark Forest in the Sydney Basin and NSW North Coast Bioregions
- Kurri Sand Swamp Woodland in the Sydney Basin Bioregion

Threatened Flora

- *Acacia bynoeana* (Bynoes Wattle)
- *Callistemon linearifolius* (Netted Bottle Brush)
- *Rutidosis heterogama* (Heath Wrinklewort)
- *Tetratheca juncea* (Black-eyed Susan)
- *Pterostylis gibbosa* (Illawarra Greenhood)
- *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
- *Eucalyptus parramattensis subsp. decadens* (Earp's Gum)
- *Angophora inopina* (Charmhaven Apple)

Threatened Fauna

Koala (Phascolarctos cinereus)

Cave-roosting bats

- Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)
- Little Bentwing Bat (*Miniopterus australis*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Eastern Cave Bat (*Vespadelus troughtoni*)

Tree-roosting Bats

- Eastern Free-tailed Bat (*Mormopterus norfolkensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Southern Myotis (*Myotis macropus*)

Wetland Birds

- Magpie Goose (*Anseranas semipalmata*)
- Australasian Bittern (*Botaurus poiciloptilus*)
- Comb-crested Jacana (*Irediparra gallinacean*)
- Blue-billed Duck (*Oxyura australis*)
- Painted Snipe (*Rostratula benghalensis*)

Green and Golden Bell Frog (*Litoria aurea*)

Forest Owls and Raptors

- Barking Owl (*Ninox connivens*)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (*Tyto novaehollandiae*)
- Sooty Owl (*Tyto tenebricosa*)
- Spotted Harrier (*Circus assimilis*)
- Little Eagle (*Hieraaetus morphnoides*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

Woodland and Forest Birds

- Black-chinned Honeyeater (*Melithreptus gularis gularis*)
- Brown Treecreeper (*Climacteris picumnus victoriae*)
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Gang-gang Cockatoo (*Callocephalon fimbriatum*)
- Grey crowned Babbler (*Pomatostomus temporalis temporalis*)
- Little Lorikeet (*Glossopsitta pusilla*)
- Painted Honeyeater (*Grantiella picta*)
- Regent Honeyeater (*Anthochaera Phrygia*)
- Scarlet Robin (*Petroica boodang*)
- Speckled Warbler (*Chthonicola sagittata*)
- Swift Parrot (*Lathamus discolour*)
- Varied Sittella (*Daphoenositta chrysoptera*)

Grey-headed Flying Fox (Pteropus poliocephalus)

Terrestrial mammals

- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Long-nosed Potoroo (*Potorous tridactylus*)
- New Holland Mouse (*Pseudomys novaehollandiae*)

Arboreal mammals / gliders

- Squirrel Glider (Petaurus norfolcensis)
- Yellow-bellied Glider *(Petaurus australis*)

Threatened ecological communities

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC

Lower Hunter Spotted Gum Ironbark Forest is dominated by *Corymbia maculata* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark) while *Eucalyptus punctata* (Grey Gum) and *Eucalyptus crebra* (Grey Ironbark) occur occasionally (NSW Threatened Species Scientific Committee, 2019d). A number of other eucalypt species occur at a low frequency, but may be locally common in the community. One of these species, *Eucalyptus canaliculata*, intergrades extensively in the area with *Eucalyptus punctata*. The understorey is marked by the tall shrub, *Acacia parvipinnula*, and by the prickly shrubs, *Daviesia ulicifolia, Bursaria spinosa, Melaleuca nodosa* and *Lissanthe strigosa*. Other shrubs include *Persoonia linearis, Maytenus silvestris* and *Breynia oblongifolia*. The ground layer is diverse; frequent species include *Cheilanthes sieberi, Cymbopogon refractus, Dianella revoluta, Entolasia stricta, Glycine clandestina, Lepidosperma laterale, Lomandra multiflora, Microlaena stipoides, Pomax umbellata, Pratia purpurascens, Themeda australis* and *Phyllanthus hirtellus*.

In an undisturbed condition, the structure of the community is typically open forest. If thinning has occurred, it may take the form of woodland or a dense thicket of saplings, depending on post-disturbance regeneration. Lower Hunter Spotted Gum-Ironbark Forest belongs to the Hunter - Macleay Dry Sclerophyll Forests vegetation class of Keith (2004).

Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion is restricted to a range of approximately 65 km by 35 km centred on the Cessnock – Beresfield area in the Central and Lower Hunter Valley (NSW NPWS, 2000). Within this range, the community was once widespread. A fragmented core of the community still occurs between Cessnock and Beresfield. Remnants occur within the Local Government Areas of Cessnock, Maitland, Singleton, Lake Macquarie, Newcastle, and Port Stephens but may also occur elsewhere within the bioregion. Outliers are also present on the eastern escarpment of Pokolbin and Corrabare State Forests on Narrabeen Sandstone.

The EEC is mainly restricted to the western portion of the proposal site on the northern and southern sides of the proposal site (Figure 4-1). Moderate and good condition vegetation occurs on the edges of the proposal site, characteristic of previously cleared vegetation. The majority of the vegetation within the proposal site is juvenile or encroached by exotic species and lacks the full floristic diversity generally associated with the EEC.

This assessment has been prepared for direct impacts to vegetation within the proposal site and indirect impacts to EEC vegetation adjacent to the proposal site within the proposal site.

Kurri Sand Swamp Woodland in the Sydney Basin Bioregion EEC

Kurri Sand Swamp Woodland is a low woodland or heathland, generally with a low open canopy rarely exceeding 15 m in height and a shrubby understorey (NSW Threatened Species Scientific Committee, 2019c). The overstorey is usually dominated by *Eucalyptus parramattensis subsp. decadens* (Parramatta Red Gum) and *Angophora bakeri* (Narrow-leaved Apple) while other tree species that occur less frequently include *Eucalyptus signata* (Scribbly Gum) and *Eucalyptus sparsifolia* (Narrow-leaved Stringybark) and *Eucalyptus agglomerate* (Blue-leaved Stringybark). The shrub layer is typified by *Banksia spinulosa* (Hairpin Banksia), *Dillwynia retorta, Jacksonia scoparia* (Dogwood), *Hakea dactyloides* (Finger Hakea), *Acacia ulicifolia* (Prickly Moses)*, Melaleuca nodosa* (Prickly-leaved Paperbark) and *Lambertia formosa* (Mountain Devil). The common ground species include *Entolasia stricta* (Wiry Panic), *Pimelea linifolia* (Slender Rice Flower), *Lissanthe strigosa* and *Melaleuca thymifolia*.

Kurri Sand Swamp Woodland is or has been known to occur in the Kurri Kurri - Cessnock area in the lower Hunter Valley, in the local government area of Cessnock. The community has been fragmented and is subject to weed invasion and ongoing disturbances. Threats include increased urbanisation, transport and utility corridors, industrial development, changes to drainage conditions, weed invasion, rubbish dumping and inappropriate fire regimes. The only known occurrence of Kurri Sand Swamp Woodland reported from conservation areas is in the Lower Hunter National Park.

The vegetation community is mainly restricted to the western portion of the proposal site on the northern and southern sides of the proposal site (Figure 4-1). Moderate and good condition vegetation occurs on the edges of the proposal site, characteristic of previously cleared vegetation. The majority of the vegetation within the proposal site is juvenile or encroached by exotic species and lacks the full floristic diversity generally associated with the EEC.

This assessment has been prepared for direct impacts to vegetation within the proposal site and indirect impacts to EEC vegetation adjacent to the proposal site within the proposal site.

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	n/a	n/a
b) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	The proposal would remove 1.04 ha of this EEC. The potential local extent of this EEC is 401.6 hectares. Considering this, it is unlikely that the removal 1.04 ha of the EEC (approximately 0.25% of the locality) would place the local occurrence at risk of extinction. The local occurrence of Lower Hunter Spotted Gum-Ironbark Forest has also been mapped outside of the study area and extends at least 500 metres from the study area in large patches.	The proposal would remove 0.39 ha of this EEC. The potential local extent of this EEC is 225.2 hectares. Considering this, it is unlikely that the removal 0.39 ha of the EEC (approximately 0.01% of the study area) would place the local occurrence at risk of extinction. The local occurrence of Kurri Sand Swamp Woodland has also been mapped outside of the study area and extends at least 500 metres from the study area in one large patch.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	The local occurrence is situated to the north and south of an existing cleared railway trail, the latter of which has been heavily modified for the purposes of previously utilised rail transport from the west at Kurri Kurri to Newcastle from the east. The proposal would impact on the edges of the local occurrence of EEC, which is currently edge-affected from exotic species and increased run-off. As part of the proposal, a new bike pathway would be constructed to facilitate pedestrian access to the old railway trail. The new bike path would continue to result in edge-effects and increased runoff. As such the proposal is unlikely to modify the composition of the EEC such that the remainder of the 7.44 ha within the study area is likely to be placed at risk of extinction. Notwithstanding, standard construction measures to minimise and control weed establishment and spread will be implemented, including measures to mitigate sedimentation risks during earthworks.	The local occurrence is situated to the north and south of an existing cleared railway trail, the latter of which has been heavily modified for the purposes of previously utilised rail transport from the west at Kurri Kurri to Newcastle from the east. The proposal would impact on the edges of the local occurrence of EEC, which is currently edge-affected from exotic species and increased run-off. As part of the proposal, a new bike pathway would be constructed to facilitate pedestrian access to the old railway trail. The new bike path would continue to result in edge-effects and increased runoff. As such the proposal is unlikely to modify the composition of the EEC such that the remainder of the 5.76 ha within the study area is likely to be placed at risk of extinction. Notwithstanding, standard construction measures to minimise and control weed establishment and spread will be implemented, including measures to mitigate sedimentation risks during earthworks.

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion
c) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	The proposal has the potential to directly impact on up to 1.04 hectares of vegetation commensurate with Lower Hunter Spotted Gum – Ironbark Forest within the proposal site. The proposal site is already modified from historical activities such as construction of the Richmond railway. The vegetation that may be indirectly impacted represents a very small portion of the EEC which is mapped within the study area (7.44 hectares). Given the small area of modified and degraded vegetation within the proposal site that will be impacted, any indirect impacts to a small area of this community is unlikely to impact the long-term survival of the community within the locality.	The proposal has the potential to directly impact on up to 0.039 hectares of Kurri Sand Swamp Woodland vegetation within the proposal site. The proposal site is already modified from historical activities such as construction of the Richmond railway. The vegetation that may be indirectly impacted represents a very small portion of the EEC which is mapped within the study area (5.76 hectares). Given the small area of modified and degraded vegetation within the proposal site that will be impacted, any indirect impacts to a small area of this community is unlikely to impact the long-term survival of the community within the locality.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	The encroachment of vegetation within the now disused Richmond railway corridor has increased connectivity between the Lower Hunter Spotted Gum – Ironbark Forest on either side of the proposal site. Removal of this vegetation will therefore reduce connectivity to a minor extent. However, given that the proposal site is relatively narrow (7 metres), the proposal is unlikely to fragment the habitat such that the movement of flora and fauna species will be impeded within the locality. The proposal site is also already fragmented due to the historical disturbance. The proposal is unlikely to enhance further fragmentation.	The encroachment of vegetation within the now disused Richmond railway corridor has increased connectivity between the Kurri Sand Swamp Woodland on either side of the proposal site. Removal of this vegetation will therefore reduce connectivity to a minor extent. However, given that the proposal site is relatively narrow (7 metres), the proposal is unlikely to fragment the habitat such that the movement of flora and fauna species will be within the locality. The proposal site is also already fragmented due to the historical disturbance. The proposal is unlikely to enhance further fragmentation. No areas of Kurri Sand Swamp Woodland will be isolated from other areas of habitat as a result of the proposal.

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	The majority of vegetation to be removed for the proposal is juvenile or encroached by exotic species, which is low in floristic diversity and contains few habitat features for fauna species. This vegetation is not considered to be of high importance to the long-term survival of Lower Hunter Spotted Gum – Ironbark Forest within the locality due to the age of the individual species and general floristic condition. Floristic analysis of the Lower Hunter Spotted Gum – Ironbark Forest within the study area and locality confirmed that is in good condition. This vegetation is therefore considered to be of higher importance to the long-term survival of the EEC as opposed to the vegetation located in the proposal site.	The majority of vegetation to be removed for the proposal is juvenile or encroached by exotic species, which is low in floristic diversity and contains few habitat features for fauna species. This vegetation is not considered to be of high importance to the long-term survival of Kurri Sand Swamp Woodland within the locality due to the age of the individual species and general floristic condition. Floristic analysis of the Kurri Sand Swamp Woodland within the study area and locality confirmed that is in good condition. This vegetation is therefore considered to be of higher importance to the long-term survival of the EEC as opposed to the vegetation located in the proposal site.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No area of outstanding biodiversity value has been declared for this EEC.	No area of outstanding biodiversity value has been declared for this EEC.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The proposal has the potential to introduce or increase the operation of the following KTPs within the Lower Hunter Spotted Gum – Ironbark Forest during the construction phase and through increased visitation to the area: • Invasion of native plant communities by exotic perennial grasses. • Clearing of native vegetation • Infection of native plants by *Phytophthora cinnamomi*	The proposal has the potential to introduce or increase the operation of the following KTPs within the Kurri Sand Swamp Woodland during the construction phase and through increased visitation to the area: • Invasion of native plant communities by exotic perennial grasses. • Clearing of native vegetation • Infection of native plants by *Phytophthora cinnamomi* • Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Invasion and establishment of exotic vines and scramblers

	Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions	Kurri Sand Swamp Woodland in the Sydney Basin Bioregion
	• Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Invasion and establishment of exotic vines and scramblers • Invasion, establishment and spread of *Lantana camara* Five priority weeds were identified within the proposal site. The proposal has the potential to result in an increase in these or other exotic species within this vegetation type as it occurs within the proposal site. Mitigation measures are provided in order to reduce the potential for the proposal to influence these KTPs (refer to Section 7).	• Invasion, establishment and spread of *Lantana camara* Five priority weeds were identified within the proposal site. The proposal has the potential to result in an increase in these or other exotic species within this vegetation type as it occurs within the proposal site. A number of mitigation measures are provided in order to reduce the potential for the proposal to influence these KTPs (refer to Section 7).
Conclusion	The proposal is unlikely to have a significant impact on Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions given that: • Only a small area (up to 1.04 hectares) is being removed, representing approximately 0.25% of the extent of this ecological community within the study area. • The areas of EEC to be removed have previously been disturbed. • Vegetation to be removed occurs at the margins of larger patches, and would not result in the isolation or further fragmentation of the ecological community. • Mitigation measures would be implemented to minimise the potential for indirect impacts to the ecological community through the implementation of a CEMP as outlined in Section 7.	The proposal is unlikely to have a significant impact on Kurri Sand Swamp Woodland in the Sydney Basin Bioregion given that: • Only a small area (up to 0.39 hectares) is being removed, representing approximately 0.01% of the extent of this ecological community within the study area. • The areas of EEC to be removed have previously been disturbed. • Vegetation to be removed occurs at the margins of larger patches, and would not result in the isolation or further fragmentation of the ecological community. • Mitigation measures would be implemented to minimise the potential for indirect impacts to the ecological community through the implementation of a CEMP as outlined in Section 7.

Threatened flora

Acacia bynoeana (Bynoes Wattle)

Acacia bynoeana is an erect or spreading shrub which grows in heath and dry sclerophyll forest (Orchard and Wilson, 2001). Broadly, *Acacia bynoeana* is recorded in open woodland with a heath understorey or open woodland with a sparse shrub cover and a grass/sedge ground cover (Driscoll, 2006). It is also found in open and sometimes slightly disturbed sites (Benson and McDougall, 1996) such as trail margins, edges of roadsides, grading spoil mounds and in recently burnt patches (DoE, 2020a). *Acacia bynoeana* is often associated with road/trail edges and disturbed ground. This association could be due to a preference for flat topography.

Acacia bynoeana is found in central eastern NSW, from the Hunter District (Morisset) 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.

The flowers are borne in the summer from September to March, and the pods occur from November to January (Benson and McDougall, 1996; DoE, 2020a). *Acacia bynoeana* is likely to be pollinated by small native bees and wasps. The species is clonal and is capable of spreading vegetatively via underground stems. The species is currently known from about 30 locations. The size of populations where known is very small (1-5 plants) with only a few sites with 30-50 individuals.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of dry sclerophyll forest within the proposal and study area.

Callistemon linearifolius (Netted Bottle Brush)

Callistemon linearifolius is a shrub which grows in dry sclerophyll forest on the coast and adjacent ranges (OEH, 2019c).

Callistemon linearifolius has been recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. *Callistemon linearifolius* was more widespread across its distribution in the past. The spread of urbanisation is the most likely cause of its decline. There are currently only 5-6 populations in the Sydney area, of the 22 populations recorded in the past (NSW Threatened Species Scientific Committee, 2019b). Three of these 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.

Callistemon linearifolius flowers in Spring to Summer. Plant numbers in any one population are largely unknown but there are a number of locations with low population numbers.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of dry sclerophyll forest within the proposal and study area.

Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)

Grevillea parviflora subsp. *parviflora* is a low open to erect shrub, which suckers readily from rhizomes. The species occurs on ridge crests, upper slopes or flat plains in both low-lying areas between 30–70 m above sea level and can occur in exposed slightly disturbed sites close to roads and tracks (OEH, 2019d).

Grevillea parviflora subsp. *parviflora* occurs in a range of vegetation types from heath and scrubby woodland to open forest (OEH, 2019d). It occurs in Kurri Sand Swamp Woodland, open forest of *Corymbia maculata* (Spotted Gum) - *Angophora costata* (Smooth-barked Apple) at Dooralong, Sydney Sandstone Ridgetop Woodland at Wedderburn and Castlereagh Ironbark Woodland at Kemps Creek (NSW NPWS 2002g). *Grevillea parviflora* subsp. *parviflora* has been recorded growing with several threatened species including *Acacia bynoeana* (Bynoe's Wattle) at Heddon Greta, the *Persoonia bargoensis* (Bargo Geebung) south of Appin and at Bargo, and *Eucalyptus parramattensis* subsp. *decadens* (Earp's Gum) (DoE, 2020d). *Grevillea parviflora* subsp. *parviflora* flowers in April, May and between July and December (OEH, 2019d). Flowers are insect pollinated and one to two seeds are produced (Benson and McDougall, 2000) but have limited seed dispersal, probably of less than 2 m (DoE, 2020d).

There are at least 21 known populations, of which, three are thought to be extinct and several need to be confirmed (DoE, 2020d). In more urbanised areas closer to Sydney, the isolation of populations is likely to be increasing and perhaps reflected in the smaller population sizes in these areas (DoE, 2020d). The subspecies is known from sizeable populations in the Hunter Valley in the Cessnock - Kurri Kurri area (particularly Werakata NP), with a northern limit of Heddon Greta in the Lower Hunter Valley (OEH, 2019d), in addition to a number of other locations within the Sydney Basin (Putty to Wyong; Liverpool, Prospect to Woronora Plateau, western shores of Lake Macquarie, Picton to Bargo). The population within the Cessnock LGA has previously been estimated at least 94 individuals (Ecovision Consulting, 2006), with 49 of those plants on roadside verges that were planned for development.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of wet sclerophyll forest within the proposal and study area including Kurri Sand Swamp Woodland.

	Acacia bynoeana (Bynoes Wattle)	*Callistemon linearifolius* (Netted Bottle Brush)	*Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal would remove 3.41 ha of potential dry sclerophyll habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat within the proposal site. Considering the above, the proposal is unlikely to place a viable local population at risk of extinction.	The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat within the proposal site. Considering the above, the proposal is unlikely to place a viable local population at risk of extinction.	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. Two individuals were recorded on the edge of the proposal site during field surveys of the wet sclerophyll forest habitat. The species was also found within the study area. Large patches of wet sclerophyll forest also occur outside of the study area, and are likely to provide habitat for the species. The removal of two individual species which are pollinated by insects and occur within a population of an estimated 94 individuals, the life cycle of the species is unlikely to be adversely affected to place a viable local population at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	n/a	n/a	n/a

	Acacia bynoeana (Bynoes Wattle)	*Callistemon linearifolius* (Netted Bottle Brush)	*Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	n/a	n/a	n/a
c) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	The proposal would remove 3.41 ha of habitat for this threatened species. The remainder of the 29.1 ha habitat within the study area will not be removed as a result of the proposal. Extensive dry sclerophyll forest is also mapped to the north and south of the proposal site, indicating that approximately 11.6% potential habitat removal is conservative. Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.	The proposal would remove 3.41 ha of habitat for this threatened species. The remainder of the 29.1 ha habitat within the study area will not be removed as a result of the proposal. Extensive dry sclerophyll forest is also mapped to the north and south of the proposal site, indicating that approximately 11.6% potential habitat removal is conservative. Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.	The proposal would remove 0.59 ha of habitat for this threatened species. The remainder of the 7.87 ha habitat within the study area, and subsequent known occurrences of this species, will not be removed as a result of the proposal. Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.

	Acacia bynoeana (Bynoes Wattle)	*Callistemon linearifolius* (Netted Bottle Brush)	*Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	The proposal would impact on the edge of the patch of potential dry sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 29.1 ha habitat within the study area is in better condition.	The proposal would impact on the edge of the patch of potential dry sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 29.1 ha habitat within the study area is in better condition.	The proposal would impact on the edge of the patch of potential wet sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No area of outstanding biodiversity value has been declared for this threatened species.	No area of outstanding biodiversity value has been declared for this threatened species.	No area of outstanding biodiversity value has been declared for this threatened species.

	Acacia bynoeana (Bynoes Wattle)	*Callistemon linearifolius* (Netted Bottle Brush)	*Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi*. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi*. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi*. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

	Acacia bynoeana (Bynoes Wattle)	*Callistemon linearifolius* (Netted Bottle Brush)	*Grevillea parviflora subsp. parviflora* (Small-flower Grevillea)
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Acacia bynoeana* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 3.41 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 12% of potential habitat would be removed. This percentage is conservative due to the extensive mapping of dry sclerophyll forest within the locality. • No individuals will be removed by the proposal and known occurrences within the larger patch of habitat will not be impacted by the proposal.	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Callistemon linearifolius* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 3.41 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 12% of potential habitat would be removed. This percentage is conservative due to the extensive mapping of dry sclerophyll forest within the locality. • No individuals will be removed by the proposal and known occurrences within the larger patch of habitat will not be impacted by the proposal	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Grevillea parviflora subsp. parviflora* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 0.59 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 7.5% of potential habitat would be removed • A new bike pathway would not further modify the habitat due to the existing disturbance from the rail trail. • Only two individuals will be removed by the proposal and known occurrences within the study area will not be impacted by the proposal

Rutidosis heterogama (Heath Wrinklewort)

Rutidosis heterogama is a small perennial herb which grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides (OEH, 2017).

It has been recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. On the Central Coast it is located north from Wyong to Newcastle. There are north coast populations between Wooli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes (OEH, 2017).

Rutidosis heterogama flowers from March to Autumn or November to January (DEWHA, 2008c). Seeds are dispersed by wind (Clarke *et al.*, 1998) and the species appears to require soil disturbance for successful recruitment (Clarke *et al.*, 1998).

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of wet sclerophyll forest within the proposal and study area including Kurri Sand Swamp Woodland.

Tetratheca juncea (Black-eyed Susan)

Tetratheca juncea is a low shrub that grows in clumps of single or multiple stems (OEH, 2019a). The species is confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock (OEH, 2019a).

The current extent of occurrence is estimated to be between 1594 and 1861 km² (DoE, 2020g), whilst the current area of occupancy is estimated at 46 km². In 2006, 28 *Tetratheca juncea* plants were recorded by Ecovision Consulting (2006) in the Cessnock LGA between Cessnock and Kurri Kurri, on land rezoned for development. The number of plant clumps within Cessnock and Lake Macquarie LGAs is estimated at around 190 and 15 000 respectively.

The seeds of *Tetratheca juncea* are produced in late spring and mature from November to February. However, seeds have very low viability (Bellairs *et al.*, 2006) and the longevity of the soil seed bank is short (Bartier *et al.*, 2001; Bellairs *et al.*, 2006) indicating that *Tetratheca juncea* is dependent on annual seed set for seedling recruitment.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of dry sclerophyll forest within the proposal and study area.

	Rutidosis heterogama (Heath Wrinklewort)	*Tetratheca juncea (Black-eyed Susan)*
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat. The species was found within the study area however, which indicates increasingly suitable habitat within the wet sclerophyll vegetation adjacent to the proposal site. Considering the above, the proposal is unlikely to place a viable local population at risk of extinction.	The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. Two individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat. Large patches of dry sclerophyll forest also occur outside of the study area, and are likely to provide habitat for the species. The removal of two individual species which are estimated to occur at a population between 190 and 15 000 individuals, indicates that whilst the soil seed bank may not be further enriched by these two individuals, the life cycle of the species is unlikely to be adversely affected to place a viable local population at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	n/a	n/a
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	n/a	n/a
c) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result	The proposal would remove 0.59 ha of habitat for this threatened species. The remainder of the 7.87 ha habitat within the study area, and subsequent known occurrences of this species, will not be removed as a result of the proposal.	The proposal would remove 3.41 ha of habitat for this threatened species. The remainder of the 29.1 ha habitat within the study area, and subsequent known occurrences of this species, will not be removed as a result of the proposal.

	Rutidosis heterogama (Heath Wrinklewort)	*Tetratheca juncea (Black-eyed Susan)*
of the proposed development or activity, and	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	The proposal would impact on the edge of the patch of potential dry sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As seeds are dispersed by wind, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect dispersal or the life cycle of the species.	The proposal would impact on the edge of the patch of potential dry sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 29.1 ha habitat within the study area is in better condition. As the proposal is unlikely to remove any individuals, the life cycle of the species is unlikely to impact on the local population.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No area of outstanding biodiversity value has been declared for this threatened species.	No area of outstanding biodiversity value has been declared for this threatened species.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers

	Rutidosis heterogama (Heath Wrinklewort)	*Tetratheca juncea (Black-eyed Susan)*
	• Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi.* • Invasion, establishment and spread of Lantana (*Lantana camara*) The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.	• Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi.* • Invasion, establishment and spread of Lantana (*Lantana camara*) The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Rutidosis heterogama* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 0.59 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 7.5% of potential habitat would be removed. This percentage is conservative due to the extensive mapping of dry sclerophyll forest within the locality. • No individuals will be removed by the proposal and known occurrences within the larger patch of habitat will not be impacted by the proposal	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Tetratheca juncea* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 3.41 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 12% of potential habitat would be removed • A new bike pathway would not further modify the habitat due to the existing disturbance from the rail trail. • Only two individuals will be removed by the proposal and known occurrences within the study area will not be impacted by the proposal

Eucalyptus parramattensis subsp. *decadens* (Earp's Gum)

Eucalyptus parramattensis subsp. *decadens* is a woodland tree which occurs in two separate meta-populations. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. The population within the Cessnock area has been estimated at 2500 to more than 8000 individuals (Bell, 2006).

Eucalyptus parramattensis subsp. *decadens* occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland (DoE, 2014a). *Eucalyptus parramattensis* subsp. *decadens* often occurs as a community dominant. *Eucalyptus parramattensis* subsp. *decadens* is also a characteristic species of Kurri Sand Swamp Woodland in the Sydney Basin Bioregion.

Eucalyptus parramattensis subsp. *decadens* is a long-lived species which flowers and fruits profusely throughout its range. Flowering usually occurs from November to January and seed dispersal is mainly by wind. Pollination is mostly likely to occur by the foraging activities of bats, birds and insects (DoE, 2020c). Earp's Gum germinates easily and readily re-sprouts after bushfire or other disturbance (Bell, 2006).

Seed maturation takes several months. Mature seed is largely retained in woody capsules in the canopy, and is released by the disturbance of fire in hot, dry conditions (DoE, 2020c).

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact wet sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of wet sclerophyll forest within the proposal and study area.

Angophora inopina (Charmhaven Apple)

Angophora inopina is small to large tree which is endemic to the Central Coast region of NSW (NSW Threatened Species Scientific Committee, 2019a). The known northern limit is near Karuah where a disjunct population occurs; to the south populations extend from Toronto to Charmhaven with the main population occurring between Charmhaven and Morisset (Bell, 2004). There is an unconfirmed record of the species near Bulahdelah. Approximately 1250 ha of occupied habitat has been mapped in the Wyong–southern Lake Macquarie area.

Angophora inopina is found in open dry sclerophyll woodland of *Eucalyptus haemastoma* and *Corymbia gummifera* with a dense shrub understorey (OEH, 2019b). The woodland occurs on deep white sandy soils over sandstone, often with some gravelly laterite.

The species flowers from mid-December to mid-January, and is most likely insect-pollinated (Benson and McDougall, 1998). Flowering is generally poor and sporadic (DoE, 2020b). Population numbers for *Angophora inopina* is not well known.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact wet sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of dry sclerophyll forest within the proposal and study area.

	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	*Angophora inopina* (Charmhaven Apple)
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat. The species was found within the study area however, which indicates increasingly suitable habitat within the wet sclerophyll vegetation adjacent to the proposal site. Considering the above, the proposal is unlikely to place a viable local population at risk of extinction.	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. One individual tree was recorded on the edge of the proposal site during field surveys of the wet sclerophyll forest habitat. Large patches of wet sclerophyll forest also occur outside of the study area, and are likely to provide habitat for the species. The removal of one individual species is unlikely to be adversely affected to place a viable local population at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	n/a	n/a
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	n/a	n/a

	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	*Angophora inopina* (Charmhaven Apple)
c) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	The proposal would remove 0.59 ha of habitat for this threatened species. The remainder of the 7.87 ha habitat within the study area, and subsequent known occurrences of this species, will not be removed as a result of the proposal. Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.	The proposal would remove 0.59 ha of habitat for this threatened species. The remainder of the 7.87 ha habitat within the study area, will not be removed as a result of the proposal. Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	The proposal would impact on the edge of the patch of potential habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As pollination occurs by highly mobile fauna species such as bats and birds, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the life cycle of the species due to the ranges of the species pollinators.	The proposal would impact on the edge of the patch of potential habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As pollination likely occurs by highly mobile insect species, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the life cycle of the species due to the range of the species pollinators.

	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	*Angophora inopina* (Charmhaven Apple)
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No area of outstanding biodiversity value has been declared for this threatened species.	No area of outstanding biodiversity value has been declared for this threatened species.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi*. • Invasion, establishment and spread of Lantana (*Lantana camara*) The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi*. • Invasion, establishment and spread of Lantana (*Lantana camara*) The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.

	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	*Angophora inopina* (Charmhaven Apple)
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Eucalyptus parramattensis subsp. decadens* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 0.59 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 7.5% of potential habitat would be removed. This percentage is conservative due to the extensive mapping of dry sclerophyll forest within the locality. • No individuals will be removed by the proposal and known occurrences within the larger patch of habitat will not be impacted by the proposal	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Angophora inopina* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 0.59 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 7.5% of potential habitat would be removed. This percentage is conservative due to the extensive mapping of dry sclerophyll forest within the locality. • Only two individuals will be removed by the proposal

Pterostylis gibbosa (Illawarra Greenhood)

Pterostylis gibbosa is a ground-dwelling orchid 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) (OEH, 2018). In the Hunter region, the species grows in open woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus tereticornis* (Forest Red Gum) and *Callitris endlicheri* (Black Cypress Pine). Total population numbers are estimated at around 4200 plants (DoE, 2020e).

Pterostylis gibbosa is a deciduous, perennial plant that dies back to an underground tuberoid during the summer season (NPWS, 2002). The species flowers from late August and can last until early December in favourable seasons and is generally pollinated by male gnats of the genus Mycomya or ‘fungus gnats’ (NPWS, 2002).

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact wet sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of wet sclerophyll forest within the proposal and study area including Kurri Sand Swamp Woodland.

	Pterostylis gibbosa (Illawarra Greenhood)
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site. Considering the above, the proposal is unlikely to place a viable local population at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	n/a
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	n/a
c) in relation to the habitat of a threatened species, population or ecological community: (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and	The proposal would remove 0.59 ha of habitat for this threatened species. The remainder of the 7.87 ha habitat within the study area, and subsequent known occurrences of this species, will not be removed as a result of the proposal. Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	The proposal would impact on the edge of the patch of potential habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As pollination occurs by gnats, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the life cycle of the species due to the mobile nature of the pollinator.

	Pterostylis gibbosa (Illawarra Greenhood)
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No area of outstanding biodiversity value has been declared for this threatened species.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The proposal has the potential to cause or increase the operation of the following key threatening processes: • Human-caused climate change • Clearing of native vegetation • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Infection of native plants by *Phytophthora cinnamomi*. • Invasion, establishment and spread of Lantana (Lantana camara) The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these key threatening processes.
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Pterostylis gibbosa* as: • The viability of a potential local population is unlikely to be adversely affected • The removal of 0.59 ha of potential habitat will be along the edges of larger patches of habitat, which is unlikely to further isolate or fragment those patches • Less than 7.5% of potential habitat would be removed. This percentage is conservative due to the extensive mapping of dry sclerophyll forest within the locality. • No individuals will be removed by the proposal and known occurrences within the larger patch of habitat will not be impacted by the proposal

Threatened fauna species

Koala (*Phascolarctos cinereus*)

Habitat was identified within the proposal site for Koala (*Phascolarctos cinereus*) in areas containing suitable feed tree species. This assessment has been prepared for the direct removal of 3.6 hectares of habitat, and indirect impacts to habitat adjacent to the disturbance footprint.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Koala spot assessments conducted in 2016 revealed no evidence of Koalas within the proposal site. However, Koala faecal pellets were found at one location during 2020 field surveys.

The proposal would remove up to 3.6 hectares of Potential Koala Habitat (i.e. vegetation containing feed tree species that comprise >15% of the canopy). The vegetation removal represents a very small proportion of native vegetation present within the locality, which includes extensive areas, which are protected within conservation reserves.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any Koalas in these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any locally occurring Koala individuals.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

As discussed above, the proposal would remove up to 3.6 hectares of potential habitat for the Koala. The area of habitat to be removed represents a small proportion of mapped native vegetation in the locality, of which a large proportion is protected within conservation reserves

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Vegetation clearing for the proposal would widen existing gaps by 3 meters in vegetation in some areas of the proposal site. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by this mobile species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Up to 3.6 hectares of potential habitat for the Koalas would be removed as a result of the proposal. The area of habitat to be removed represents a small proportion of mapped native vegetation in the locality, of which extensive areas are currently protected within conservation reserves. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of Koalas in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity to the proposal site. It is therefore unlikely that the proposal will adversely affect any declared area/s of outstanding biodiversity value

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs of relevance to this species as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents potential foraging habitat for this species.
- Removal of dead wood and dead trees – the proposal would remove few dead trees and may disturb dead wood within the disturbance footprint.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and better quality habitat occurs adjacent to the proposal site that would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on the Koala, pursuant to section 7.3 of the BC Act, given that:

- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of arboreal species which may be present within vegetation to be removed.
- Vegetation to be removed comprises a negligible proportion of the habitat for the Koala present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for this species would be isolated as a result of the proposal.

Cave-roosting Microbats

The following cave-roosting microbats were identified within the proposal site:

- Eastern Bentwing Bat (Miniopterus schreibersii oceanensis)
- Little Bentwing Bat (Miniopterus australis)
- Large-eared Pied Bat (Chalinolobus dwyeri)

Habitat was also identified for the following cave-roosting microbat species:

- Eastern Cave Bat (Vespadelus *troughtoni*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Nocturnal surveys revealed no evidence of microbats roosting in the tunnels within the proposed disturbance area. Large numbers of microbats were observed foraging outside tunnel entrances, and some microbats were observed entering tunnels to forage.

Several rock cuttings were constructed as part of the former Richmond Vale railway. These cuttings through sandstone contain large fissures that may provide roosting habitat for cave-roosting microbat species, although the majority of fissures appear to be too shallow to sustain microbat roosts. Approximately ten cuttings will require minor stabilisation works as part of the proposal to prevent rock falls.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, is already subject to relatively high levels of noise disturbance. It is therefore assumed that any bats roosting in these areas would therefore be habituated to some level of noise disturbance.

In consideration of the fact that no microbat roosts have been identified, the minor scale of rock stabilisation proposed, it is unlikely that these works would cause significant impacts upon the breeding, foraging or dispersive movements of these species.

The proposal site is likely to make up a small proportion of the home ranges of these highly mobile species. Given the extent of rock cuttings in the proposal site that would not be affected by the proposal, it is unlikely that the lifecycle of these species would be adversely affected such that viable local populations would be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The tunnels and rock cuttings constructed as part of the former Richmond Vale rail corridor may be being utilised by these species as diurnal roosting habitat. The removal of loose rock for stabilisation works is proposed in a limited number of areas and stable rock cuttings will be unaffected by the proposal.

Upon completion of the proposal, flyways will be maintained above the proposed recreational trail and it is therefore likely that many of these species will continue to forage within the proposal site. The area of habitat to be modified represents a small proportion of that likely to be present in the locality, of which large unaffected areas are also present in the proposal site.

Lighting is also proposed within tunnels that occur along the proposal site. Lighting mitigation measure to avoid and mitigate impacts on foraging or roosting bats will be implemented as part of the proposal.

With appropriate mitigation measures addressing lighting impacts (such as monitor sensor or timed lighting) the proposal in unlikely to have a significant impact on habitat for these species.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The potential impacts to roosting microbats as a result of artificial lighting of tunnels and the removal of loose rock for stabilisation works will not isolate areas of suitable habitat for these highly mobile species. The proposal would, however, widen existing gaps in vegetation in the proposal site by approximately 3 metres. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile, aerial species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Rock cuttings occur throughout the proposal site in a number of locations. Mitigation measures are recommended to reduce the likelihood of mortality of cave roosting microbats, and include the presence of a suitably qualified fauna-spotter-catcher who will supervise stabilisation works (see Section 7).

It is therefore considered that the modification of habitats as described above would be unlikely to threaten the long-term persistence of any of these threatened microbat species in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs of relevance to these species as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents potential foraging habitat for these species.

As previously discussed, vegetation clearing is minor in scale and the majority of the foraging habitat within the proposal site are likely to be unaffected by the proposal. The proposal would therefore represent a minor increase in the operation of this KTP. Mitigation measures are recommended to reduce the likelihood of mortality of cave microbats (see Section 7).

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on these cave-roosting microbats, pursuant to section 7.3 of the BC Act, given that:

- Minor rock stabilisation works are proposed as a result of the proposal and the majority of rock cuttings will be unaffected.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes extensive areas within conservation reserves.
- Mitigation measures, including having a suitable qualified fauna-spotter-catcher present during rock stabilisation works to minimise the risk of mortality of cave-roosting species.
- Habitat connectivity would be retained for these mobile species.
- Further surveys for microbats are proposed prior to the construction phase.

A microbat management plan will be prepared as part of the Flora and Fauna Management Plan (FFMP).

Tree-roosting Microbats

Habitat was identified within the proposal site for the following tree-roosting microbats:

- Eastern Free-tailed Bat (*Mormopterus norfolkensis*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Yellow-bellied Sheath-tailed Bat (*Saccolaimus flaviventris*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Southern Myotis (*Myotis macropus*)

This assessment has been prepared for removal of small habitat hollows (although none were observed within the proposal site during field surveys), modification of foraging habitat for these microbat species and indirect impacts to habitat adjacent to the disturbance footprint.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

No hollow bearing trees were identified within the disturbance footprint as potential breeding habitat for these species. The proposal site contains mainly regrowth vegetation that has not yet developed suitable hollows.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. It is therefore assumed that any bats roosting in these areas would therefore be habituated to some level of noise disturbances.

The majority of these species may forage for insects within vegetated and/or open areas of the proposal site. The Southern Myotis is a fishing bat which trawls for insects and small fish over water and may forage within the drainage lines (when full) or over the dams directly adjacent to the proposal site. The proposal would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of these highly mobile species.

The proposal site would make up a small proportion of the home ranges of these highly mobile species. Given the large areas of native vegetation in the locality, including extensive areas in conservation reserves, the proposal is unlikely to impact the lifecycle of the species such that viable local populations of these species would be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

No roosting habitat for tree-roosting microbats will be removed as a result of the proposal. It is likely that the former Richmond Vale rail corridor is being utilised by these species as foraging habitat. Upon completion of the proposal, flyways will be maintained above the proposed recreational trail and it is therefore likely that many of these species will continue to forage within the proposal site.

The area of habitat to be modified represents a small proportion of mapped native vegetation in the locality, of which large areas are protected within conservation reserves.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Clearing for the proposal would not isolate any areas of native vegetation. The proposal would, however, widen existing gaps in vegetation in the proposal site by approximately 3 metres. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile, aerial species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

No suitable roost trees were identified within the disturbance footprint. Hollow-dependent bats are likely to require multiple roost trees, generally in close proximity. There are extensive areas of similar vegetation in adjoining areas and in the broader locality, including over extensive areas under secure tenure within conservation reserves. Mitigation measures are recommended to reduce the likelihood of mortality of hollow-dependent fauna, and include the presence of a suitably qualified fauna-spotter-catcher who will supervise vegetation clearing (see Section 7).

No aquatic foraging habitat would be removed for the Southern Myotis. Up to 13.65 hectares of potential foraging habitat would be modified for the remaining four species. The area of habitat to be removed represents a small proportion of mapped native vegetation in the locality, of which extensive areas are protected within conservation reserves. It is therefore considered that the modification of habitats as described above would be unlikely to threaten the long-term persistence of any of these threatened microbat species in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs of relevance to these species as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation and 10.05 hectares exotic grassland that represents potential foraging habitat for these species.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and areas with the highest densities of hollows within the proposal site would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs. Mitigation measures are recommended to reduce the likelihood of mortality of hollow-dependent fauna (refer to section 7).

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on these hollow-roosting microbats, pursuant to section 7.3 of the BC Act, given that:

- No suitable tree hollows for these species will be removed as a result of the proposal.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes extensive areas within conservation reserves.
- Mitigation measures, including having a suitable qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of hollow-roosting species.
- Habitat connectivity would be retained for these highly mobile species.

Wetland Birds

Habitat was identified adjacent to the proposal site for the following threatened wetland birds:

- Magpie Goose (Anseranas semipalmata)
- Australasian Bittern (*Botaurus poiciloptilus*)
- Comb-crested Jacana (*Irediparra gallinacean*)
- Blue-billed Duck (*Oxyura australis*)
- Painted Snipe (Rostratula benghalensis)

An assessment of the potential impacts to these species has been undertaken. As no wetland habitat would be directly removed as part of the proposal this assessment mainly focused on potential indirect impacts to these species.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

There is potential for indirect impacts on wetland birds during the construction phase such as increase in, noise, visitation of people and vehicle movements during daylight hours.

The proposal also has the potential to indirectly impact on aquatic habitats through alterations to hydrology including changes to surface flows. These impacts have been considered during the design of the Richmond Vale Rail Trail and design features such as the construction of bridges of creeks to maintain the current natural hydrology and reduce potential impacts.

The potential for hydrocarbon contamination or increased nutrient or sediment inputs would be avoided or minimised through the implementation of appropriate mitigation measures as outlined in Section 7.

Given the minor nature of indirect impacts on aquatic habitats, it is unlikely the proposal would have an adverse effect on the life cycle of these species such that a viable local population would be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposal will not directly remove habitat for these wetland species. There is the possibility of minor indirect impacts to wetland species, however these indirect impacts are considered minor and in most cases temporary (e.g. construction noise).

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The proposal will require the removal of approximately 3.6 hectares of mainly regrowth forest along the former Richmond Vale railway. Habitat connectivity would be retained around the edges of the proposal site. Therefore the clearing of this vegetation to create a 3 metre wide pathway is not likely to significantly isolate or fragment habitat for these highly mobile species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Given that this vegetation is mainly regrowth vegetation, it is not considered to have high importance. The proposal may have indirect impacts on wetland habitats through alterations in hydrology or increases in noise during the construction phase, however these are considered unlikely to significantly reduce the habitat quality of these areas (see above).

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of one KTP of relevance to these species as follows:

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

As previously discussed, alterations to surface water flows would be mitigated by design measures.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on these wetland species, pursuant to section section 7.3 of the BC Act, given that:

- No wetland habitat will be removed as a result of this proposal.
- Mitigation measures are to be implemented to reduce the potential for disturbance to wetland species during the construction phase.
- Provided that adequate water quality management is undertaken, changes to hydrology would be relatively minor in the context of the existing and historic modifications to hydrology in the proposal site.
- The proposal would not isolate any areas of habitat for these species, and habitat connectivity would not be affected throughout the wetland habitats.

Green and Golden Bell Frog (Litoria aurea)

Potential habitat was identified within the proposal site for the Green and Golden Bell Frog. The proposal site contains some marginal foraging habitat for this species, with higher quality habitat adjacent to the proposal site. For this reason this species has been assessed, mainly for potential indirect impacts on the adjacent habitat as a result of the proposal. The proposal site does not contain suitable breeding habitat for these species (e.g. densely vegetated wetland habitat).

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

There is some potential for indirect impacts on wetland habitat through altered surface flows and impacts to water quality, however, provided appropriate water quality management is undertaken these impacts are likely to be minor.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the proposal. These disturbances are likely to have minimal potential to disturb the breeding calls of this mainly nocturnal species.

It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any locally occurring frogs in these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any locally occurring individuals.

The proposal would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of this species. Connectivity along the drainage lines within the proposal site would be unaffected due to design options such as bridges over existing creeks.

The proposal would therefore have negligible impacts on breeding habitats for this species, and vegetation clearing would be negligible (3.6 hectares) in areas of marginally suitable foraging and shelter habitat. There are extensive areas of alternative habitat for the species within the locality, including within adjacent wetland areas. The proposal is therefore considered unlikely to have an adverse impact on the life cycle of this species such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to this threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to this threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposal has the potential to indirectly impact on aquatic habitats through alterations to hydrology in the proposal site, including changes to surface flows and increased sedimentation or contamination in runoff. These changes are likely to be relatively minor and would be within the range of fluctuations in water levels naturally experienced within these ephemeral systems.

The potential for hydrocarbon contamination or increased nutrient or sediment inputs would be avoided or minimised through the implementation of appropriate mitigation measures as outlined in Section 7. Provided that adequate water quality management is undertaken, the proposal is unlikely to modify the habitat such that it would become unsuitable for this species.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

The proposal would not isolate any areas of habitat within the proposal site or at a landscape scale habitat connectivity would be maintained for this species

The proposal would reduce connectivity within areas of marginal foraging and shelter habitat for this species, by widening existing gaps in vegetation by approximately 3 meters and increase the rate of vehicle visitation to the site (and therefore the difficulty in safely crossing access tracks). These impacts would be unlikely to prevent movement of this species throughout suitable habitats within the proposal site as connectivity would be retained in adjacent habitat.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The habitat within the proposal site provides marginal foraging habitat for this species and is not considered important for breeding due to the lack of microhabitats required by Green and Golden Bell Frog for breeding.

The proposal will result in the removal of 10.05 hectares of exotic grassland and 3.6 hectares of regenerating forest habitat. The proposal site has historically been subjected to heavy industrial usage and with the habitat within the proposal site already highly modified. Many areas within the proposal site have been cut or filled during the construction of the Richmond Vale rail line.

The removal of 13.65 hectares of vegetation within the proposal site is considered minor in relation to the amount of higher quality habitat to be retained in adjacent remnants. The proposal would, however, widen existing gaps in vegetation in the proposal site by approximately 3 metres. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by this highly mobile species.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents marginally suitable foraging and shelter habitat for this species.
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands – the proposal would result in increased surface water flows

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality. Alterations to surface water flows would be mitigated by water quality management. Changes to hydrology would be relatively minor in the context of the ephemeral nature of drainage lines within the proposal site. The proposal would therefore represent a minor increase in the operation of these KTPs.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on Green and Golden Bell Frogs; given that:

- Potential impacts on habitats through altered hydrology would be minor.
- Vegetation to be removed represents only marginally suitable foraging and shelter habitat.
- The proposal would not isolate any areas of habitat for the species, and habitat connectivity would not be affected throughout the most suitable habitats.

Forest Owls and Raptors

- Barking Owl (Ninox connivens)
- Powerful Owl (*Ninox strenua*)
- Masked Owl (Tyto novaehollandiae)
- Sooty Owl (Tyto tenebricosa)
- Spotted Harrier (*Circus assimilis*)
- Little Eagle (Hieraaetus morphnoides)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposal is unlikely to directly impact breeding habitat for these species. The Powerful, Barking, Masked and Sooty Owls all require large tree hollows in large, mature trees for nesting. As discussed in Section 4.4.2 large mature trees suitable for nesting were not identified within the disturbance footprint of the proposal.

The raptor species are likely to forage over the open areas that exist within and adjacent to some portions of the proposal site. These species forage from a perch high in a tree or whilst flying over open areas, looking for prey such as mammals, birds, reptiles and carrion.

Breeding habitat for these raptor species usually consist of a large stick nest made in an emergent tree or dead stag within an open landscape. The proposal would not remove any potential breeding habitat for these species.

The proposal would remove up to 13.65 hectares of potential foraging habitat for these species. The forest habitat adjacent to the proposal site contains higher value foraging habitat for these species and would be retained. This includes areas outside the disturbance footprint in drainage lines and lower slopes areas with the highest densities of woody debris and other shelter sites for prey such as reptiles, frogs, small mammals and other birds. All of these species tend have very large territories (in the order of hundreds to thousands of hectares). The vegetation to be removed would therefore comprise a very small proportion of the home ranges of these highly mobile species.

The proposal would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of these highly mobile species.

There are extensive areas of alternative foraging habitat available for locally occurring individuals of these species, including large areas of vegetation under secure tenure in conservation reserves. In this context, the removal of up to 13.65 hectares of potential foraging habitat is unlikely to impact the lifecycle of these highly mobile species such that viable local population would be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable these threatened species

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable these threatened species

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposal would not remove any areas of suitable breeding habitat for these species. The proposal would remove up to 13.65 hectares of potential foraging habitat, representing a small proportion of available habitat in the locality. Habitats of highest quality for these species within the proposal site would be retained as discussed above.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Clearing for the proposal would not significantly isolate any areas of native vegetation. The proposal would, however, widen existing gaps in vegetation in the proposal site. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile, aerial species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposal would remove up to 13.65 hectares of potential foraging habitat for these species. As discussed above, vegetation within the proposal site likely to have the highest value for these species in terms of prey availability and potential nest sites would be retained, and the proposal would be unlikely to remove any potential breeding habitat for these species.

The vegetation to be removed would represent a very small proportion of the home ranges of these highly mobile species. There are extensive areas of similar vegetation in adjoining areas and in the broader locality. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of these species in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity to the proposal site. The proposal would therefore have no adverse effect to any declared area of outstanding biodiversity value.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of three KTPs of relevance to these species as follows:

- Clearing of vegetation – the proposal would remove about 13.65 hectares of regrowth native vegetation that represents potential foraging habitat for these species.
- Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood, which would provide potential shelters for prey species.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and areas with the highest densities of dead wood and trees within the proposal site would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on these forest owls pursuant to section 7.3 of the BC Act, given that:

- These species are considered unlikely to breed within the habitats to be removed.
- Better quality habitat for these species would be retained within adjacent areas of the proposal site.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality.
- Habitat connectivity would be retained for these highly mobile species.

Woodland and Forest Birds

- Black-chinned Honeyeater (Melithreptus gularis gularis)
- Brown Treecreeper (Climacteris picumnus victoriae)
- Dusky Woodswallow (Artamus cyanopterus cyanopterus)
- Gang-gang Cockatoo (Callocephalon fimbriatum)
- Grey crowned babbler (Pomatostomus temporalis temporalis)
- Little Lorikeet (Glossopsitta pusilla)
- Painted honeyeater (*Grantiella picta*)
- Regent Honeyeater (*Anthochaera Phrygia*)
- Scarlet Robin (*Petroica boodang*)
- Speckled Warbler (Chthonicola sagittata)
- Swift Parrot (Lathamus discolour)
- Varied Sittella (Daphoenositta chrysoptera)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The majority of these insectivorous and nectarivorous species are generally found in habitats with abundant woody debris and flowering myrtaceous species, which are important foraging resources. Areas of highest value for these species within the proposal site would therefore be found along the drainage lines and lower slope areas, which have the greatest densities of fallen logs and other woody debris. These higher value areas would be retained. Habitats to be removed contain lower densities of woody debris and fallen logs but would still represent potential foraging habitat for these species.

The proposal would not isolate any areas of habitat or cause habitat fragmentation that would affect the breeding, foraging or dispersive movements of these mobile species. The proposal would therefore remove up to 13.65 hectares of vegetation, containing suitable foraging habitat for these species. There are extensive areas of alternative foraging habitat available for locally occurring individuals of these species, in vegetation under secure tenure in conservation reserves around the proposal site. In this context, the removal of up to 13.65 hectares of potential foraging habitat is unlikely to impact the lifecycle of these highly mobile species such that a viable local population would be placed at risk of extinction.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposal would remove up to 13.65 hectares of potential foraging (and 3.6 hectares of marginal breeding habitat for some of these species) habitat for these species. This represents a small proportion of available habitat in the locality of which a large proportion is protected in conservation reserves. Habitats of highest quality for these species within the proposal site would be retained as discussed above.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Clearing for the proposal would not isolate any areas of native vegetation. The proposal would, however, widen existing gaps in vegetation by approximately 3 m. Habitat connectivity would be retained around the edges of the indicative footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile, aerial species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposal would remove up to 13.65 hectares of potential foraging and marginal breeding habitat for some of these species. As discussed above, habitats likely to have the highest value for these species would be retained. There are extensive areas of similar vegetation in adjoining areas and in the broader locality, including large areas under secure tenure within conservation reserves. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of these species in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs of relevance to these species as follows:

- Clearing of vegetation – the proposal would remove about 13.65 hectares of regrowth native vegetation and exotic grassland that represents potential foraging habitat for these species.
- Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood. Fallen timber would be salvaged from disturbance footprint and relocated in adjoining areas. Areas with the highest densities of fallen logs and woody debris would not be directly impacted by the proposal.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and areas with the highest densities of dead wood and trees within the proposal site would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on threatened woodland and forest birds pursuant to section 7.3 of the BC Act, given that:

- The proposal would not affect potential breeding habitat for the species, and would remove a negligible proportion of foraging habitat.
- Areas likely to have the highest value for these species within the proposal site would not be affected by the proposal.
- The vegetation to be removed comprises a negligible proportion of similar vegetation present in surrounding areas and the broader locality.
- Habitat connectivity would be retained for these mobile species.

Grey-headed Flying-Fox

Habitat was identified within the proposal site for Grey-headed Flying Fox (*Pteropus poliocephalus*). Given that this species manly forages in vegetation containing myrtaceous species such as dry and wet sclerophyll forests, this assessment has been prepared for the direct removal of 3.6 hectares of habitat, and indirect impacts to habitat adjacent to the disturbance footprint.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposal would remove up to 3.6 hectares of vegetation containing myrtaceous species which may be utilised as foraging habitat for the Grey-headed Flying Fox. The vegetation removal represents a very small proportion of native vegetation present within the locality, which includes extensive areas which are protected within conservation reserves.

The proposal would lead to an increase in visitation to the area mainly during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any flying foxes roosting in these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any locally occurring Grey-headed Flying Fox individuals.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

As discussed above, the proposal would remove up to 3.6 hectares of potential foraging habitat for the Grey-headed Flying Fox. The area of habitat to be removed represents a small proportion of mapped native vegetation in the locality, of which a large proportion is protected within conservation reserves.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Up to 3.6 hectares of potential foraging habitat for the Grey-headed Flying Fox would be removed. The area of habitat to be removed represents a small proportion of mapped native vegetation in the locality, of which extensive areas are currently protected within conservation reserves. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of any of the Grey-headed Flying Fox in the locality.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Vegetation clearing for the proposal would widen existing gaps by 3 meters in vegetation in some areas of the proposal site. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by this highly mobile species.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity.

On the basis of current knowledge, foraging habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey headed Flying-foxes. Natural foraging habitat that is:

- Productive during winter and spring, when food bottlenecks have been identified (Parry-Jones and Augee, 1991; Eby, 1999)
- Known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult)
- Productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May)
- Productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions)
- Known to support a continuously occupied camp

Given that no roost sites were identified in near proximity to the proposal site, the habitat within the proposal site is unlikely to represent critical habitat for the Grey-headed Flying Fox.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs of relevance to this species as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents potential foraging habitat for this species.
- Removal of dead wood and dead trees – the proposal would remove few dead trees and may disturb dead wood within the disturbance footprint.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and better quality habitat occurs adjacent to the proposal site that would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on the Grey-headed Flying Fox, pursuant to section 7.3 of the BC Act, given that:

- The proposal would be unlikely to remove any breeding habitat for the species.
- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of species which may be present within vegetation to be removed.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for this species would be isolated as a result of the proposal.

Arboreal Mammals

Habitat was identified within the proposal site for the following arboreal mammals:

- Petaurus norfolcensis (Squirrel Glider)
- *Petaurus australis* (Yellow-bellied Glider)

Given that these species manly forage in vegetation containing myrtaceous species such as dry and wet sclerophyll forests, this assessment has been prepared for the direct removal of 3.6 hectares of habitat, and indirect impacts to habitat adjacent to the disturbance footprint.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposal would remove up to 3.6 hectares of vegetation containing myrtaceous species which may be utilised as foraging habitat for glider species. No suitable hollow-bearing trees were identified within the disturbance footprint and it is therefore unlikely that the proposal would remove potential denning or breeding habitat for gliders. The vegetation removal represents a very small proportion of native vegetation present within the locality, which includes extensive areas which are protected within conservation reserves. Additionally, these areas would contain a greater density of hollows.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any mammals denning in these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any locally occurring individuals.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

As discussed above, the proposal would remove up to 3.6 hectares of potential foraging habitat for these glider species. No suitable hollows were identified within the disturbance footprint and therefore no denning habitat is likely to be removed. Hollows are also likely to occur in higher densities in habitats to be retained within the proposal site adjacent to the disturbance footprint. The area of habitat to be removed represents a small proportion of mapped native vegetation in the locality, of which a large proportion is protected within conservation reserves.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Vegetation clearing for the proposal would widen existing gaps by 3 m in vegetation in some areas of the proposal site. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

Up to 3.6 hectares of potential foraging habitat for these species would be removed. The area of habitat to be removed represents a small proportion of mapped native vegetation in the locality, of which extensive areas are currently protected within conservation reserves. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of any of these threatened mammals in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity to the proposal site.

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs of relevance to these species as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents potential foraging habitat for these species.
- Removal of dead wood and dead trees – the proposal would remove few dead trees and may disturb dead wood within the disturbance footprint.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and areas with the highest densities of dead wood and trees within hollows within the adjacent proposal site would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs. Mitigation measures are recommended to reduce the likelihood of mortality of hollow-dependent fauna.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on the Yellow-bellied Glider, or Squirrel Glider, pursuant to section 7.3 of the BC Act, given that:

- The proposal would be unlikely to remove any breeding habitat for the species.
- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of hollow-dependent species which may be present within vegetation to be removed.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for these species would be isolated as a result of the proposal.

Terrestrial Mammals

Habitat was identified within the proposal site for the following terrestrial mammals:

- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Long-nosed Potoroo (*Potorous tridactylus*)
- New Holland Mouse (Pseudomys novaehollandiae)

Given that these species may forage in a range of habitats, this assessment has been prepared for the direct removal of 3.6 hectares of potential habitat (excluding exotic grassland), and indirect impacts to habitat adjacent to the disturbance footprint.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The proposal would remove up to 3.6 hectares of potentially suitable habitat for these species. Habitats with the highest densities of potential shelter sites for these species (including fallen logs and large woody debris, as well as larger tree hollows for the Spotted-tailed Quoll) generally occur along the drainage lines and lower slopes outside the proposal site which will not be directly impacted by the proposal. Given these habitat characteristics, these areas are also likely to contain the highest densities of shelter sites for prey species of the Spotted-tailed Quoll.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any mammals roosting in these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any locally occurring individuals.

The proposal would therefore remove up to 3.6 hectares of foraging habitat containing limited potential shelter sites for these species. This would represent a small proportion of the home range of any locally occurring Spotted-tailed Quolls, which have home ranges between 180 – 5000 hectares depending on sex. The proposal would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of these mobile species.

The vegetation to be removed represents a small proportion of the mapped native vegetation within the locality, which includes extensive areas protected within conservation reserves. In the context of the landscape position of the site, adjacent to extensive areas of native vegetation, the removal of up to 3.6 hectares of foraging habitat would therefore be unlikely to threaten the persistence of these species in the locality.

(b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

– (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

Not applicable to these threatened species.

– (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable to these threatened species.

(c) In relation to the habitat of a threatened species or ecological community:

- (i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposal would be unlikely to remove any areas of breeding habitat for these species: as previously discussed. The drainage lines and lower slopes, which contain the most suitable habitats and highest densities of potential shelters for these species will not be removed by the proposal. The proposal would remove up to 3.6 hectares of potential foraging habitat containing limited potential shelter sites.

The habitat to be removed represents a small proportion of available habitat in the locality which includes extensive areas which are protected in conservation reserves.

- (ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

Clearing for the proposal would not isolate any areas of native vegetation. The proposal would widen existing gaps in vegetation in the proposal site by approximately 3 meters. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile species.

– (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality

The proposal would remove up to 3.6 hectares of potential foraging habitat for these species, containing low densities of potential shelter sites. This would represent a minor proportion of the home ranges of locally occurring Spotted-tailed Quolls. There are extensive areas of similar vegetation in adjoining areas and in the broader locality. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of these species in the locality.

(d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)

No areas of outstanding biodiversity value are located within or in close proximity to the proposal site. It is therefore unlikely that the proposal will adversely affect any declared area/s of outstanding biodiversity value

(e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The proposed action would contribute to the operation of two KTPs of relevance to these species as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents potential foraging habitat for these species.
- Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood, which would provide potential shelters for prey species.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and areas with the highest densities of dead wood and trees within the proposal site would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs.

Conclusion of Assessment of Significance

The proposal is unlikely to have a significant impact on the Spotted-tailed Quoll, Long-Nosed Potoroo and New Holland Mouse, pursuant to section 7.3 of the BC Act, given that:

- Species are considered unlikely to breed within the areas of habitat to be removed.
- Vegetation to be removed is subject to historic and ongoing disturbances which would limit its value as foraging habitat for both species.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality.
- Habitat connectivity would be retained around the proposal site.

Appendix D– Assessments of significance (EPBC Act)

Threatened flora species

- *Acacia bynoeana* (Bynoe's Wattle) - Vulnerable
- Eucalyptus parramattensis subsp. decadens (Earp's Gum) – Vulnerable
- *Angophora inopina* (Charmhaven Apple)- Vulnerable
- *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea) - Vulnerable
- *Rutidosis heterogama* (Heath Wrinklewort) - Vulnerable
- *Tetratheca juncea* (Black-eyed Susan) – Vulnerable
- *Pterostylis gibbosa* (Illawarra Greenhood) – Endangered

Threatened fauna species

Koala (Phascolarctos cinereus) – Vulnerable

Large-eared Pied Bat (*Chalinolobus dwyeri*) – Vulnerable

Terrestrial Mammals

- Spotted-tailed Quoll (*Dasyurus maculatus*) – Vulnerable
- Long-nosed Potoroo (*Potorous tridactylus*) – Vulnerable
- New Holland Mouse (*Pseudomys novaehollandiae*) – Vulnerable

Wetland Birds

- Painted Snipe (*Rostratula benghalensis*) – Endangered
- Australasian Bittern (*Botaurus poiciloptilus*) – Endangered

Woodland birds

- Painted honeyeater (*Grantiella picta)* – Vulnerable
- Regent honeyeater (*Anthochaera phrygia*) – Critically Endangered
- Swift parrot (*Lathamus discolor*) – Critically Endangered

Striped legless lizard (*Delma impar*) – Vulnerable

Migratory Species

- White-bellied Sea-Eagle (*Haliaeetus leucogaster*
- Rainbow Bee-eater (Merops ornatus)
- Cattle Egret (*Ardea ibis*)
- White-throated Needletail (*Hirundapus caudacutus*)

Acacia bynoeana (Bynoes Wattle)

Acacia bynoeana is an erect or spreading shrub which grows in heath and dry sclerophyll forest (Orchard and Wilson, 2001). Broadly, *Acacia bynoeana* is recorded in open woodland with a heath understorey or open woodland with a sparse shrub cover and a grass/sedge ground cover (Driscoll, 2006). It is also found in open and sometimes slightly disturbed sites (Benson and McDougall, 1996) such as trail margins, edges of roadsides, grading spoil mounds and in recently burnt patches (DoE, 2020a). *Acacia bynoeana* is often associated with road/trail edges and disturbed ground. This association could be due to a preference for flat topography.

Acacia bynoeana is found in central eastern NSW, from the Hunter District (Morisset) 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.

The flowers are borne in the summer from September to March, and the pods occur from November to January (Benson and McDougall, 1996; DoE, 2020a). *Acacia bynoeana* is likely to be pollinated by small native bees and wasps. The species is clonal and is capable of spreading vegetatively via underground stems. The species is currently known from about 30 locations. The size of populations where known is very small (1-5 plants) with only a few sites with 30-50 individuals.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of dry sclerophyll forest within the proposal and study area.

Grevillea parviflora subsp. *parviflora* (Small-flower Grevillea)

Grevillea parviflora subsp. *parviflora* is a low open to erect shrub, which suckers readily from rhizomes. The species occurs on ridge crests, upper slopes or flat plains in both low-lying areas between 30–70 m above sea level and can occur in exposed slightly disturbed sites close to roads and tracks (OEH, 2019d).

Grevillea parviflora subsp. *parviflora* occurs in a range of vegetation types from heath and scrubby woodland to open forest (OEH, 2019d). It occurs in Kurri Sand Swamp Woodland, open forest of *Corymbia maculata* (Spotted Gum) - *Angophora costata* (Smooth-barked Apple) at Dooralong, Sydney Sandstone Ridgetop Woodland at Wedderburn and Castlereagh Ironbark Woodland at Kemps Creek (NSW NPWS 2002g). *Grevillea parviflora* subsp. *parviflora* has been recorded growing with several threatened species including *Acacia bynoeana* (Bynoe's Wattle) at Heddon Greta, the *Persoonia bargoensis* (Bargo Geebung) south of Appin and at Bargo, and *Eucalyptus parramattensis* subsp. *decadens* (Earp's Gum) (DoE, 2020d). *Grevillea parviflora* subsp. *parviflora* flowers in April, May and between July and December (OEH, 2019d). Flowers are insect pollinated and one to two seeds are produced (Benson and McDougall, 2000) but have limited seed dispersal, probably of less than 2 m (DoE, 2020d).

There are at least 21 known populations, of which, three are thought to be extinct and several need to be confirmed (DoE, 2020d). In more urbanised areas closer to Sydney, the isolation of populations is likely to be increasing and perhaps reflected in the smaller population sizes in these areas (DoE, 2020d). The subspecies is known from sizeable populations in the Hunter Valley in the Cessnock - Kurri Kurri area (particularly Werakata NP), with a northern limit of Heddon Greta in the Lower Hunter Valley (OEH, 2019d), in addition to a number of other locations within the Sydney Basin (Putty to Wyong; Liverpool, Prospect to Woronora Plateau, western shores of Lake Macquarie, Picton to Bargo). The population within the Cessnock LGA has previously been estimated at least 94 individuals (Ecovision Consulting, 2006), with 49 of those plants on roadside verges that were planned for development.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of wet sclerophyll forest within the proposal and study area including Kurri Sand Swamp Woodland.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	*Acacia bynoeana* (Bynoes Wattle)	*Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)
Lead to a long-term decrease in the size of an important population of a species	No individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat within the proposal site. Due to the high number of records within the locality, and the location of the proposal site, the species is likely to conform to an important population in the Hunter district. The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. Considering the above, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.	Two individuals were recorded on the edge of the proposal site during field surveys of the wet sclerophyll forest habitat. The species was also found within the study area. Large patches of wet sclerophyll forest also occur outside of the study area, and are likely to provide habitat for the species. Due to the high number of records within the locality, and the location of the proposal site, the species is likely to conform to an important population in the Cessnock - Kurri Kurri area. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. Two individual species within this important population will be removed as a result of the proposal. Due to an estimated population size of 94 individuals within the Cessnock LGA, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.
Reduce the area of occupancy of an important population	The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. Considering the above, the proposal would remove potential areas of occupancy for the species as opposed to the current area of occupancy within the study area. As such, the proposal is unlikely to significantly reduce the area of occupancy of an important population.	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. Two individual species will be removed as a result of the proposal. Considering the above, the proposal would remove known and potential areas of occupancy for the species. The removal of 0.59 ha however, is unlikely to significantly reduce the area of occupancy of 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 will:	*Acacia bynoeana* (Bynoes Wattle)	*Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)
Fragment an existing important population into two or more populations	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat. The Hunter population occurs over an expansive area within the locality and is already fragmented by the cleared rail track in addition to roads and infrastructure. The proposal is unlikely to further fragment this existing important population into two or more populations.	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat. The Cessnock - Kurri Kurri population occurs over an expansive area within the locality and is already fragmented by the cleared rail track in addition to roads and infrastructure. The proposal is unlikely to further fragment this existing important population into two or more populations.
Adversely affect habitat critical to the survival of the species	No critical habitat has been identified for *Acacia bynoeana*. The proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As such, the proposal site is unlikely to be commensurate to habitat critical to the survival of the species	No critical habitat has been identified for *Grevillea parviflora* subsp. *parviflora*. The proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As such, the proposal site is unlikely to be commensurate to habitat critical to the survival of the species
Disrupt the breeding cycle of an important population	The proposal would impact on the edge of the patch of potential dry sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 29.1 ha habitat within the study area is in better condition. As pollination occurs by highly mobile insect species such as small native bees and wasps, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the breeding cycle of the species due to the mobile nature of the species pollinators.	The proposal would impact on the edge of the patch of potential wet sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As pollination occurs by highly mobile insect species, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the breeding cycle of the species due to the mobile nature of the species pollinators.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	*Acacia bynoeana* (Bynoes Wattle)	*Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat. The proposal would remove up to 3.41 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. As a result, the proposal would remove 12% of potential habitat for the species. It is however, unlikely to remove potential habitat to the extent that the species is likely to decline.	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat. The proposal would remove up to 0.59 hectares of potential habitat for this species in addition to two known individual species. As a result, the proposal would remove less than 7.5% of potential habitat for the species. It is however, unlikely to remove potential habitat to the extent that the species is likely to decline due to large patches of wet sclerophyll forest also occurring outside of the study area, which are likely to provide habitat for the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposal has the potential to increase exotic flora species within the proposal site and adjacent intact vegetation within the study area. This includes the WoNs • *Lantana camara* (Lantana) • *Anredera cordifolia* (Madeira Vine) • *Rubus fruticosus* agg. • *Senecio madagascariensis* (Fireweed) As these WoNs already occur within the proposal site the proposal may further allow for these species to further encroach into proposal site and adjacent vegetation within the study area. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction or further encroachment of exotic species.	The proposal has the potential to increase exotic flora species within the proposal site and adjacent intact vegetation within the study area. This includes the WoNs • *Lantana camara* (Lantana) • *Anredera cordifolia* (Madeira Vine) • *Rubus fruticosus* agg. • *Senecio madagascariensis* (Fireweed) As these WoNs already occur within the proposal site the proposal may further allow for these species to further encroach into proposal site and adjacent vegetation within the study area. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction or further encroachment of exotic species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	*Acacia bynoeana* (Bynoes Wattle)	*Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)
Introduce disease that may cause the species to decline, or	The proposal has the potential to cause or increase dieback caused by the root-rot fungus (*Phytophthora cinnamomi*). The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction of disease. As mitigation measures will be in place prior to construction and operation, the proposal is unlikely to introduce disease that may cause the species to decline.	The proposal has the potential to cause or increase dieback caused by the root-rot fungus (*Phytophthora cinnamomi*). The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction of disease. As mitigation measures will be in place prior to construction and operation, the proposal is unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	A recovery plan for *Acacia bynoeana* has not commenced. Despite this, the conservation advice (DoE, 2013a) for the species identifies a number of threats to the species including: • Land clearing, leading to habitat loss and fragmentation • Inappropriate habitat disturbance • Fragmentation of populations • Inappropriate fire regimes The proposal would remove up to 3.41 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. The removal of a small area of potential habitat as a result of the proposal is unlikely to interfere with the recovery of these species.	A recovery plan for *Grevillea parviflora* subsp. *parviflora* has not commenced. Despite this, the conservation advice (DEWHA, 2008b) for the species identifies a number of threats to the species including: • Habitat loss and fragmentation through clearing for urban development • Agriculture • Road maintenance • Weed invasion • Rubbish dumping • Recreational activities • Inappropriate fire regimes The proposal would remove up to 0.59 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. The removal of a small area of potential habitat as a result of the proposal is unlikely to interfere with the recovery of these species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	*Acacia bynoeana* (Bynoes Wattle)	*Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea)
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Acacia bynoeana* as: • Less than 12% of potential habitat would be removed • No known populations or individual records would be removed as a result of the proposal • The proposal is unlikely to fragment existing populations • Habitat critical to the survival of the species is unlikely to occur within the proposal site • The breeding cycle of the species is unlikely to be affected • Invasive species encroachment and disease mitigation would occur prior to construction The removal of 3.41 ha of potential habitat is unlikely to interfere with the recovery of these species.	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Grevillea parviflora* subsp. *parviflora* as: • Less than 7.5% of potential habitat would be removed • Only two individual species would be removed as a result of the proposal • The proposal is unlikely to fragment existing populations • Habitat critical to the survival of the species is unlikely to occur within the proposal site • The breeding cycle of the species is unlikely to be affected • Invasive species encroachment and disease mitigation would occur prior to construction The removal of 0.59 ha of potential habitat is unlikely to interfere with the recovery of these species.

Rutidosis heterogama (Heath Wrinklewort)

Rutidosis heterogama is a small perennial herb which grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides (OEH, 2017).

It has been recorded from near Cessnock to Kurri Kurri with an outlying occurrence at Howes Valley. On the Central Coast it is located north from Wyong to Newcastle (DoE, 2020f). There are north coast populations between Wooli and Evans Head in Yuraygir and Bundjalung National Parks. It also occurs on the New England Tablelands from Torrington and Ashford south to Wandsworth south-west of Glen Innes (OEH, 2017).

Rutidosis heterogama flowers from March to Autumn or November to January (DEWHA, 2008c). Seeds are dispersed by wind (Clarke *et al.*, 1998) and the species appears to require soil disturbance for successful recruitment (Clarke *et al.*, 1998).

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of wet sclerophyll forest within the proposal and study area including Kurri Sand Swamp Woodland.

Tetratheca juncea (Black-eyed Susan)

Tetratheca juncea is a low shrub that grows in clumps of single or multiple stems (OEH, 2019a). The species is confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock (OEH, 2019a).

The current extent of occurrence is estimated to be between 1594 and 1861 km² (DoE, 2020g), whilst the current area of occupancy is estimated at 46 km². In 2006, 28 *Tetratheca juncea* plants were recorded by Ecovision Consulting (2006) in the Cessnock LGA between Cessnock and Kurri Kurri, on land rezoned for development. The number of plant clumps within Cessnock and Lake Macquarie LGAs is estimated at around 190 and 15 000 respectively.

The seeds of *Tetratheca juncea* are produced in late spring and mature from November to February. However, seeds have very low viability (Bellairs *et al.*, 2006) and the longevity of the soil seed bank is short (Bartier *et al.*, 2001; Bellairs *et al.*, 2006) indicating that *Tetratheca juncea* is dependent on annual seed set for seedling recruitment.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of dry sclerophyll forest within the proposal and study area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Rutidosis heterogama (Heath Wrinklewort)	*Tetratheca juncea (Black-eyed Susan)*
Lead to a long-term decrease in the size of an important population of a species	No individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat. The species was found within the study area however, which indicates increasingly suitable habitat within the dry sclerophyll vegetation adjacent to the proposal site. Due to the moderate number of records within the locality, the species limited known range and the location of the proposal site, the occurrence of the species within the study area is likely to conform to an important population in the Cessnock/Kurri Kurri area. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. Considering the above, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.	Two individuals were recorded within the proposal site during field surveys of the dry sclerophyll forest habitat. Large patches of dry sclerophyll forest also occur outside of the study area, and are likely to provide habitat for the species. Due to the moderate number of records within the locality, the species limited known range and the location of the proposal site, the occurrence of the species within the study area is likely to conform to an important population in the Cessnock and Lake Macquarie LGAs. The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. Two individual species will be removed as a result of the proposal. Although marginal, the proposal is likely to lead to a long-term decrease in the size of an important population of a species.
Reduce the area of occupancy of an important population	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. Considering the above, the proposal would remove potential areas of occupancy for the species as opposed to the current area of occupancy within the study area. As such, the proposal is unlikely to significantly reduce the area of occupancy of an important population.	The proposal would remove 3.41 ha of potential habitat for this species. The remainder of the 29.1 ha occurrence within the study area will not be removed as a result of the proposal. This results in less than 12% of potential habitat within the study area being removed as a result of the proposal. Two individual species will be removed as a result of the proposal. Considering the above, the proposal would remove known and potential areas of occupancy for the species. Despite this, the proposal is unlikely to significantly reduce the area of occupancy of 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 will:	Rutidosis heterogama (Heath Wrinklewort)	*Tetratheca juncea (Black-eyed Susan)*
Fragment an existing important population into two or more populations	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat. The Cessnock/Kurri Kurri population occurs over a regionally small area within the locality and is already fragmented by the cleared rail track in addition to roads and infrastructure. The proposal is unlikely to further fragment this existing important population into two or more populations.	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat. Despite the current extent of occurrence of the species being small, the species is unlikely to occur within the proposal site and is already fragmented by the cleared rail track in addition to roads and infrastructure. The proposal is unlikely to further fragment this existing important population into two or more populations.
Adversely affect habitat critical to the survival of the species	No critical habitat has been identified for *Rutidosis heterogama*. The proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As such, the proposal site is unlikely to be commensurate to habitat critical to the survival of the species.	No critical habitat has been identified for *Tetratheca juncea*. The proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As such, the proposal site is unlikely to be commensurate to habitat critical to the survival of the species.
Disrupt the breeding cycle of an important population proposed development or activity, and	The proposal would impact on the edge of the patch of potential dry sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As seeds are dispersed by wind, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect dispersal or the breeding cycle of the species.	The proposal would impact on the edge of the patch of potential dry sclerophyll forest habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 29.1 ha habitat within the study area is in better condition. The removal of two individual species which are estimated to occur at a population between 190 and 15 000 individuals, indicates that whilst the soil seed bank may not be further enriched by these two individuals, the breeding cycle of the species is unlikely to be significantly disrupted.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Rutidosis heterogama (Heath Wrinklewort)	*Tetratheca juncea (Black-eyed Susan)*
	The proposal would remove up to 0.59 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. As a result, the proposal would remove less than 7.5% of potential habitat for the species. It is however, unlikely to remove potential habitat to the extent that the species is likely to decline.	The proposal would remove up to 3.41 hectares of potential habitat for this species. As a result, the proposal would remove less than 12% of potential habitat for the species. It is however, unlikely to remove potential habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposal has the potential to increase exotic flora species within the proposal site and adjacent intact vegetation within the study area. This includes the WoNs • *Lantana camara* (Lantana) • *Anredera cordifolia* (Madeira Vine) • *Rubus fruticosus* agg. • *Senecio madagascariensis* (Fireweed) As these WoNs already occur within the proposal site the proposal may further allow for these species to further encroach into proposal site and adjacent vegetation within the study area. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction or further encroachment of exotic species.	The proposal has the potential to increase exotic flora species within the proposal site and adjacent intact vegetation within the study area. This includes the WoNs • *Lantana camara* (Lantana) • *Anredera cordifolia* (Madeira Vine) • *Rubus fruticosus* agg. • *Senecio madagascariensis* (Fireweed) As these WoNs already occur within the proposal site the proposal may further allow for these species to further encroach into proposal site and adjacent vegetation within the study area. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction or further encroachment of exotic species.
Introduce disease that may cause the species to decline, or	The proposal has the potential to cause or increase dieback caused by the root-rot fungus (*Phytophthora cinnamomi*). The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction of disease. As mitigation measures will be in place prior to construction and operation, the proposal is unlikely to introduce disease that may cause the species to decline.	The proposal has the potential to cause or increase dieback caused by the root-rot fungus (*Phytophthora cinnamomi*). The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction of disease. As mitigation measures will be in place prior to construction and operation, the proposal is unlikely to introduce disease that may cause the species to decline.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Rutidosis heterogama (Heath Wrinklewort)	*Tetratheca juncea (Black-eyed Susan)*
Interfere substantially with the recovery of the species	A recovery plan for *Rutidosis heterogama* has not commenced. Despite this, the conservation advice (DEWHA, 2008c) for the species identifies a number of threats to the species including: • Habitat loss and fragmentation • Trampling or picking by visitors • Grazing by domestic stock and rabbits • Competition from introduced pasture plants • Road side management • Urban development and fire The proposal would remove up to 0.59 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. The removal of a small area of potential habitat as a result of the proposal is unlikely to interfere with the recovery of these species.	A recovery plan for *Tetratheca juncea* has not commenced. Despite this, the conservation advice (DEWHA, 2008d) for the species identifies a number of threats to the species including: • Habitat loss due to clearing for urban development • Inappropriate fire regimes • Weed invasion • Stormwater runoff • Dieback associated with the plant pathogen *Phytophthora cinnamomi* The proposal would remove up to 3.41 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. The removal of a small area of potential habitat as a result of the proposal is unlikely to interfere with the recovery of these species.
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Rutidosis heterogama* as: • Less than 7.5% of potential habitat would be removed • No known populations or individual records would be removed as a result of the proposal • The proposal is unlikely to fragment existing populations • Habitat critical to the survival of the species is unlikely to occur within the proposal site • The breeding cycle of the species is unlikely to be affected • Invasive species encroachment and disease mitigation would occur prior to construction • The removal of 0.59 ha of potential habitat is unlikely to interfere with the recovery of these species.	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Tetratheca juncea* as: • Less than 12% of potential habitat would be removed • Only two individual records would be removed as a result of the proposal • The proposal is unlikely to fragment existing populations • Habitat critical to the survival of the species is unlikely to occur within the proposal site • The breeding cycle of the species is unlikely to be affected • Invasive species encroachment and disease mitigation would occur prior to construction • The removal of 3.41 ha of potential habitat is unlikely to interfere with the recovery of these species.

Eucalyptus parramattensis subsp. *decadens* (Earp's Gum)

Eucalyptus parramattensis subsp. *decadens* is a woodland tree which occurs in two separate meta-populations. The Kurri Kurri meta-population is bordered by Cessnock—Kurri Kurri in the north and Mulbring—Abedare in the south. Large aggregations of the subspecies are located in the Tomalpin area. The Tomago Sandbeds meta-population is bounded by Salt Ash and Tanilba Bay in the north and Williamtown and Tomago in the south. The population within the Cessnock area has been estimated at 2500 to more than 8000 individuals (Bell, 2006).

Eucalyptus parramattensis subsp. *decadens* occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland (DoE, 2014a). *Eucalyptus parramattensis* subsp. *decadens* often occurs as a community dominant. *Eucalyptus parramattensis* subsp. *decadens* is also a characteristic species of Kurri Sand Swamp Woodland in the Sydney Basin Bioregion.

Eucalyptus parramattensis subsp. *decadens* is a long-lived species which flowers and fruits profusely throughout its range. Flowering usually occurs from November to January and seed dispersal is mainly by wind. Pollination is mostly likely to occur by the foraging activities of bats, birds and insects (DoE, 2020c). Earp's Gum germinates easily and readily re-sprouts after bushfire or other disturbance (Bell, 2006).

Seed maturation takes several months. Mature seed is largely retained in woody capsules in the canopy, and is released by the disturbance of fire in hot, dry conditions (DoE, 2020c).

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact dry sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off.

Angophora inopina (Charmhaven Apple)

Angophora inopina is small to large tree which is endemic to the Central Coast region of NSW (NSW Threatened Species Scientific Committee, 2019a). The known northern limit is near Karuah where a disjunct population occurs; to the south populations extend from Toronto to Charmhaven with the main population occurring between Charmhaven and Morisset (Bell, 2004). There is an unconfirmed record of the species near Bulahdelah. Approximately 1250 ha of occupied habitat has been mapped in the Wyong–southern Lake Macquarie area.

Angophora inopina is found in open dry sclerophyll woodland of *Eucalyptus haemastoma* and *Corymbia gummifera* with a dense shrub understorey (OEH, 2019b). The woodland occurs on deep white sandy soils over sandstone, often with some gravelly laterite.

The species flowers from mid-December to mid-January, and is most likely insect-pollinated (Benson and McDougall, 1998). Flowering is generally poor and sporadic (DoE, 2020b). Population numbers for *Angophora inopina* is not well known.

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact wet sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off. Habitat extents for this species have been based off the occurrence of wet sclerophyll forest within the proposal and study area.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	Angophora inopina (Charmhaven Apple)
Lead to a long-term decrease in the size of an important population of a species	No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat. The species was found within the study area however, which indicates increasingly suitable habitat within the wet sclerophyll vegetation adjacent to the proposal site. Due to the high number of records within the locality, and the location of the proposal site, the species is likely to conform to the Kurri Kurri/Cessnock important population. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. Considering the above, the proposal is unlikely to lead to a long-term decrease in the size of an important population of a species.	One individual was recorded within the proposal site during field surveys of the wet sclerophyll forest habitat. Large patches of wet sclerophyll forest also occur outside of the study area, and are likely to provide habitat for the species. Due to the absence of previous records within the locality, and the location of the proposal site away from known populations, the known occurrence of this species is likely to occur on the western edge of the species range. As such, the occurrence of the species within the proposal site may conform to an important population. The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. One individual species will be removed as a result of the proposal. Despite not occurring within the known populations of the Wyee-Charmhaven or Buladelah and the mid-north coast, the occurrence of this one individual is not likely to be solitary. As the species is insect pollinated, the one individual record is likely to be supported by a greater population within the locality. Considering the above, the proposal is marginally likely to lead to a long-term decrease in the size of an important population of a species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	Angophora inopina (Charmhaven Apple)
Reduce the area of occupancy of an important population	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individual occurrences or populations of the species will be removed as a result of the proposal. Considering the above, the proposal would remove potential areas of occupancy for the species as opposed to the current area of occupancy within the study area. As such, the proposal is unlikely to significantly reduce the area of occupancy of an important population.	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. This results in less than 7.5% of potential habitat within the study area being removed as a result of the proposal. One individual species will be removed as a result of the proposal. Considering the above, the proposal would remove known and potential areas of occupancy for the species. Despite this, the proposal is unlikely to significantly reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat. The Kurri Kurri population occurs over an expansive area within the locality and is already fragmented by the cleared rail track in addition to roads and infrastructure. The proposal is unlikely to further fragment this existing important population into two or more populations.	The proposal site runs through large patches of expansively vegetated areas to the north and south of the proposal site. The proposal site is also already fragmented by the existing cleared railway trail. The proposal would utilise this already cleared trail for the bike pathway. The proposal site would impact on the already impacted edges of the habitat for this species and is unlikely to fragment this habitat or further isolate it from other patches of habitat in the locality. The proposal is unlikely to further fragment this existing important population into two or more populations.
Adversely affect habitat critical to the survival of the species	No critical habitat has been identified for *Eucalyptus parramattensis* subsp. *decadens*. The proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As such, the proposal site is unlikely to be commensurate to habitat critical to the survival of the species	No critical habitat has been identified for *Angophora inopina*. The proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As such, the proposal site is unlikely to be commensurate to habitat critical to the survival of the species.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	Angophora inopina (Charmhaven Apple)
Disrupt the breeding cycle of an important population	The proposal would impact on the edge of the patch of potential habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As pollination occurs by highly mobile fauna species such as bats and birds, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the breeding cycle of the species due to the ranges of the species pollinators.	The proposal would impact on the edge of the patch of potential habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As pollination likely occurs by highly mobile insect species, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the life cycle of the species due to the range of the species pollinators.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat. The proposal would remove up to 0.59 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. As a result, the proposal would remove less than 12% of potential habitat for the species. It is however, unlikely to remove potential habitat to the extent that the species is likely to decline.	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat. The proposal would remove up to 0.59 hectares of potential habitat for this species, and one known record of *Angophora inopina*. It is however, unlikely to remove potential habitat to the extent that the species is likely to significantly decline.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	Angophora inopina (Charmhaven Apple)
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposal has the potential to increase exotic flora species within the proposal site and adjacent intact vegetation within the study area. This includes the WoNs • *Lantana camara* (Lantana) • *Anredera cordifolia* (Madeira Vine) • *Rubus fruticosus* agg. • *Senecio madagascariensis* (Fireweed) As these WoNs already occur within the proposal site the proposal may further allow for these species to further encroach into proposal site and adjacent vegetation within the study area. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction or further encroachment of exotic species.	The proposal has the potential to increase exotic flora species within the proposal site and adjacent intact vegetation within the study area. This includes the WoNs • *Lantana camara* (Lantana) • *Anredera cordifolia* (Madeira Vine) • *Rubus fruticosus* agg. • *Senecio madagascariensis* (Fireweed) As these WoNs already occur within the proposal site the proposal may further allow for these species to further encroach into proposal site and adjacent vegetation within the study area. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction or further encroachment of exotic species.
Introduce disease that may cause the species to decline, or	The proposal has the potential to cause or increase dieback caused by the root-rot fungus (*Phytophthora cinnamomi*). The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction of disease. As mitigation measures will be in place prior to construction and operation, the proposal is unlikely to introduce disease that may cause the species to decline.	The proposal has the potential to cause or increase dieback caused by the root-rot fungus (*Phytophthora cinnamomi*). The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction of disease. As mitigation measures will be in place prior to construction and operation, the proposal is unlikely to introduce disease that may cause the species to decline.
Interfere substantially with the recovery of the species	A recovery plan for *Eucalyptus parramattensis subsp. decadens* has not commenced. Despite this, the conservation advice (DoE, 2014a) for the species identifies a number of threats to the species including: • Habitat loss and fragmentation resulting from land clearing development, particularly sand mining, road construction and residential/industrial developments	A recovery plan for *Angophora inopina* has not commenced. Despite this, the conservation advice (DEWHA, 2008a) for the species identifies a number of threats to the species including: • Habitat loss, fragmentation and water table alteration from residential, agricultural and industrial developments • Frequent fire • Grazing and trampling by animals

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Eucalyptus parramattensis subsp. decadens (Earp's Gum)	Angophora inopina (Charmhaven Apple)
	• Weed invasion, in particular *Lantana camara* (Lantana) and *Chrysanthemoides monilifera* ssp. R*otundata* (Bitou Bush) • Modifications of drainage regimes in deep, low nutrient sands through draining or filling • Inappropriate fire regimes • Dryland salinity The proposal would remove up to 0.59 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. The removal of a small area of potential habitat as a result of the proposal is unlikely to interfere with the recovery of these species.	• Competition from weeds, in particular *Andropogon virginicus* (Whiskey Grass) The proposal would remove up to 0.59 hectares of potential habitat for this species. The removal of one individual in addition to a small area of potential habitat as a result of the proposal is unlikely to interfere with the recovery of these species.
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Eucalyptus parramattensis subsp. decadens* as: • Less than 7.5% of potential habitat would be removed • No known populations or individual records would be removed as a result of the proposal • The proposal is unlikely to fragment existing populations • Habitat critical to the survival of the species is unlikely to occur within the proposal site • The breeding cycle of the species is unlikely to be affected • Invasive species encroachment and disease mitigation would occur prior to construction • The removal of 0.59 ha of potential habitat is unlikely to interfere with the recovery of these species.	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Angophora inopina* as: • Less than 7.5% of potential habitat would be removed • One individual record would be removed as a result of the proposal • The proposal is unlikely to fragment existing populations • Habitat critical to the survival of the species is unlikely to occur within the proposal site • The breeding cycle of the species is unlikely to be affected • Invasive species encroachment and disease mitigation would occur prior to construction The removal of 0.59 ha of potential habitat is unlikely to interfere with the recovery of these species.

Pterostylis gibbosa (Illawarra Greenhood)

Pterostylis gibbosa is a ground-dwelling orchid 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) (OEH, 2018). In the Hunter region, the species grows in open woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus tereticornis* (Forest Red Gum) and *Callitris endlicheri* (Black Cypress Pine). Total population numbers are estimated at around 4200 plants (DoE, 2020e).

Pterostylis gibbosa is a deciduous, perennial plant that dies back to an underground tuberoid during the summer season (NPWS, 2002). The species flowers from late August and can last until early December in favourable seasons and is generally pollinated by male gnats of the genus Mycomya or 'fungus gnats' (NPWS, 2002).

The proposal site occurs through highly vegetated habitat to the north and south within the locality. The proposal is located within highly modified areas consisting of cleared dirt track, exotic vegetation and minor extents of intact wet sclerophyll forest which has been edge-effected by exotic flora species encroachment and run-off.

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 will:	*Pterostylis gibbosa* (Illawarra Greenhood)
Lead to a long-term decrease in the size of a population	No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site. The species has potential habitat which occurs marginally within the proposal site (0.59 ha). No records of the species have previously been recorded within 10 km of the proposal site, indicating that the known population in the Hunter region does not occur within the locality. Considering the above, the proposal is unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species	The proposal would remove 0.59 ha of potential habitat for this species. The remainder of the 7.87 ha occurrence within the study area will not be removed as a result of the proposal. No individuals were recorded within the proposal site during field surveys of the wet sclerophyll forest habitat within the proposal site. For this reason, it is unlikely that the proposal will reduce the area of occupancy of the species.
Fragment an existing population into two or more populations	No existing population occurs within the 10 km of the proposal site; only potential habitat. The proposal site also runs through a cleared rail trail which has historically fragmented vegetation from the north to south. For these reasons, the proposal is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of the species	No critical habitat has been identified for *Pterostylis gibbosa* within the recovery plan (NPWS, 2002). The proposal is located on a previously cleared rail trail which already fragments and has modified the potential habitat for the species. As such, the proposal site is unlikely to be commensurate to habitat critical to the survival of the species
Disrupt the breeding cycle of a population	The proposal would impact on the edge of the patch of potential habitat, which is currently edge-affected and is unlikely to be critical to the long-term survival of the local population. The remainder of the 7.87 ha habitat within the study area is in better condition. As pollination occurs by gnats, a minor increase in the already existing fragmentation through the proposal site is unlikely to affect the breeding cycle of the species due to the mobile nature of the pollinator.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Habitat for the species is fragmented by the existing cleared railway trail, which is edge effected from exotic species and increased run-off. As part of the proposal, a new bike pathway would continue to result in edge-effects and increased runoff. As such, the proposal is unlikely to substantially modify the habitat. As no known populations or individual records occur within the locality, the proposal is also unlikely to destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

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 will:	*Pterostylis gibbosa* (Illawarra Greenhood)
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the a critically endangered or endangered species' habitat	The proposal has the potential to increase exotic flora species within the proposal site and adjacent intact vegetation within the study area. This includes the WoNs • *Lantana camara* (Lantana) • *Anredera cordifolia* (Madeira Vine) • *Rubus fruticosus* agg. • *Senecio madagascariensis* (Fireweed) As these WoNs already occur within the proposal site the proposal may further allow for these species to further encroach into proposal site and adjacent vegetation within the study area. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction or further encroachment of exotic species.
Introduce disease that may cause the species to decline, or	The proposal has the potential to cause or increase dieback caused by the root-rot fungus (*Phytophthora cinnamomi*). The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the introduction of disease. As mitigation measures will be in place prior to construction and operation, the proposal is unlikely to Introduce disease that may cause the species to decline.
Interfere with the recovery of the species	The recovery plan for *Pterostylis gibbosa* (NPWS, 2002) outlines a number of threatening processes to the species including: • Habitat loss • Habitat degradation (including grazing, inappropriate fire regimes, weed invasion and wild collection The proposal would remove up to 0.59 hectares of potential habitat for this species, however, no direct removal of known individuals or populations will occur. The removal of a small area of potential habitat as a result of the proposal is unlikely to interfere with the recovery of these species.
Conclusion	Considering the above, the proposal is considered unlikely to have a significant impact on the threatened *Pterostylis gibbosa* as: • Less than 7.5% of potential habitat would be removed • No known populations or individual records have been recorded in the proposal site or locality • The proposal is unlikely to fragment existing populations • Habitat critical to the survival of the species is unlikely to occur within the proposal site • The breeding cycle of the species is unlikely to be affected • Invasive species encroachment and disease mitigation would occur prior to construction • The removal of 0.59 ha of potential habitat is unlikely to interfere with the recovery of these species.

Threatened fauna species EPBC Act - Assessments of Significance

*Koala (*Phascolarctos cinereus*)*

Habitat was identified within the proposal site for Phascolarctos cinereus (Koala) in areas containing suitable feed tree species. This assessment has been prepared for the direct removal of 3.6 hectares of habitat, and indirect impacts to habitat adjacent to the disturbance footprint.

According to the DotE (2013) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

Koala spot assessments revealed no evidence of Koalas within the proposal site. However Koala faecal droppings were observed in one location during 2020 field surveys.

The proposal would remove up to 3.6 hectares of Potential Koala Habitat: vegetation containing feed tree species that comprise >15% of the canopy. In accordance with the EPBC Act referral guidelines for the Vulnerable Koala (DoE, 2014b), the habitat is considered to be critical to the survival of the Koala.

The vegetation removal represents a very small proportion of native vegetation present within the locality, which includes extensive areas, which are protected within conservation reserves.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any Koalas in these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would decrease the size of the Koala population long-term.

Reduce the area of occupancy of an important population

No important populations of Koala are known to occur within the locality. The removal of 3.6 hectares of marginal foraging habitat is not likely to cause any reduction in the area of occupancy for this mobile species. The approximate 3 metre wide trail constructed as a result of this proposal would not form a barrier for this species.

Fragment an existing important population into two or more populations

As mentioned above the clearing of 3.6 hectares of regrowth in a linear nature will not create a barrier or fragment habitat for this species. The proposal will result in the widening of an existing gap in rather than novel impacts. Therefore the proposal will not fragment any existing populations of Koala.

Disrupt the breeding cycle of an important population

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any arboreal mammal species in these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any Koala populations within the locality.

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

The 3.6 hectares of habitat to be removed as a result of the proposal provides a negligible amount of foraging resources in comparison to the vegetation contained in larger remnants adjacent to the proposal site. These remnants will be retained and this species will not be become isolated from them as a result of the proposal. Therefore it is unlikely that any populations of locally occurring Koalas will decrease as a result of the proposal.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

As discussed above, it is possible that the proposed action would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat for this species.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Introduce disease that may cause the species to decline

The proposal would be unlikely to result in the introduction of a disease that would directly impact the Koala. However, the Construction Environmental Management Plan for the proposal would include measures to prevent the spread of pathogens, including hygiene procedures for equipment, footwear and clothing, and disposal protocols

Interfere substantially with the recovery of the species.

The proposed action would contribute to the operation of one KTP of relevance to this species as follows:

- Clearing of native vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents potential foraging habitat for this species.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and better quality habitat occurs adjacent to the proposal site that would be retained. The proposal would therefore represent a minor increase in the operation of this KTP.

Conclusion

The proposal is unlikely to have a significant impact on the Koala, given that:

- Mitigation measures, including having a suitably qualified fauna-spotter-catcher present during vegetation clearing to minimise the risk of mortality of arboreal species which may be present within vegetation to be removed.
- Vegetation to be removed comprises a negligible proportion of the habitat for the Koala present in the locality, which includes large areas within conservation reserves.
- No areas of habitat for this species would be isolated as a result of the proposal.

*Large-eared Pied Bat (*Chalinolobus dwyeri*)*

According to the DotE (2013) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

Nocturnal surveys revealed no evidence of microbats roosting in the tunnels within the proposed disturbance area. a number of microbats were observed foraging outside tunnel entrances, and some microbats were observed entering tunnels to forage.

Several rock cuttings were constructed as part of the former Richmond Vale railway. These cuttings through sandstone contain large fissures that may provide roosting habitat for cave-roosting microbat species, although the majority of fissures appear to be too shallow to sustain microbat roosts. Approximately ten cuttings will require minor stabilisation works as part of the proposal to prevent rock falls.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the rail trail. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, is already subject to relatively high levels of noise disturbance. It is therefore assumed that any bats roosting in this areas would therefore be habituated to some level of noise disturbance.

In consideration of the fact that no microbat roosts have been identified, the minor scale of rock stabilisation proposed, it is unlikely that these works would cause significant impacts upon the breeding, foraging or dispersive movements of this species.

The proposal site is likely to make up a small proportion of the home ranges of this highly mobile species. Given the extent of rock cuttings in the proposal site that would not be affected by the proposal, it is unlikely that the lifecycle of this species would be adversely affected such that viable local populations would lead to a long-term decrease in any populations.

Reduce the area of occupancy of an important population

The proposal would result in the removal of 3.6 hectares of marginal foraging habitat for this species. Large areas of higher quality foraging and breeding habitat exist around the proposal site and will be retained (for example Sugarloaf Sate Conservation Area). Considering the amount of quality habitat surrounding the proposal site and how readily this species can move throughout the locality, the proposal is unlikely to reduce the area of occupancy for this species.

Fragment an existing important population into two or more populations

As mentioned above the removal of 3.6 hectares of regenerating forest vegetation to create an approximate three metre wide gap in vegetation will not result in any areas of habitat becoming fragmented for this species. No tunnels will be removed as part of the proposal.

Therefore it is unlikely that the proposal will result in the fragmentation of important populations of this species.

Adversely affect habitat critical to the survival of the species

Rock cuttings occur throughout the proposal site in a number of locations. Mitigation measures are recommended to reduce the likelihood of mortality of cave roosting microbats, and include the presence of a suitably qualified fauna-spotter-catcher who will supervise stabilisation works (see Section 7.2).

It is therefore considered that the modification of habitats as described above would be unlikely to threaten the long-term persistence of any of this threatened microbat species in the locality. **Disrupt the breeding cycle of an important population**

As mentioned previously the habitat within the proposal site does not contain suitable breeding habitat for this species. Additionally this highly mobile species could readily fly across the resulting gap in vegetation (approximately 3 metres). Therefore it is unlikely that the proposal will result in disruptions to the breeding cycle of any populations of this threatened bat species.

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

The tunnels and rock cuttings constructed as part of the former Richmond rail corridor may be being utilised by this species as diurnal roosting habitat. The removal of loose rock for stabilisation works is proposed in a limited number of areas and stable rock cuttings will be unaffected by the proposal. Lighting is also proposed in the tunnel locations.

Upon completion of the proposal, flyways will be maintained above the proposed recreational trail and it is therefore likely that many of this species will continue to forage within the proposal site.

The area of habitat to be modified represents a small proportion of that likely to be present in the locality, of which large unaffected areas are also present in the proposal site.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

It is possible that the proposed action would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat for this species.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Introduce disease that may cause the species to decline

This species is likely to forage within the proposal site during night and is unlikely to come in contact with construction workers or the public during the operational phase of the proposal. It is also unlikely that diseases that may impact this species will be introduced into the proposal site as a result of this proposal.

Interfere substantially with the recovery of the species

A national recovery plan has been prepared for the Large-eared Pied Bat (*Chalinolobus dwyeri*). Priority actions mainly relate to research and habitat management and protection. The proposal would modify potential habitat for this species and is therefore not consistent with the recovery actions. The small area of potential habitat that would be affected is unlikely to interfere with the recovery of this species.

The proposed action would contribute to the operation of one KTP of relevance to this species:

- Clearing of vegetation – the proposal would remove about 10.84 hectares of regrowth native vegetation that represents potential foraging habitat for this species.

As previously discussed, vegetation clearing is minor in scale and the majority of the foraging habitat within the proposal site are likely to be unaffected by the proposal. The proposal would therefore represent a minor increase in the operation of this KTP. Mitigation measures are recommended to reduce the likelihood of mortality of cave microbats (see Section 7.2).

Conclusion

The proposal is unlikely to have a significant impact on this cave-roosting microbat, pursuant to section 5A of the EP&A Act, given that:

- Minor rock stabilisation works are proposed as a result of the proposal and the majority of rock cuttings will be unaffected.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality, which includes extensive areas within conservation reserves.
- Mitigation measures, including having a suitable qualified fauna-spotter-catcher present during rock stabilisation works to minimise the risk of mortality of cave-roosting species.
- Habitat connectivity would be retained for this mobile species.
- Further surveys for microbats are proposed prior to the construction phase.
- A microbat management plan will be prepared as part of the Flora and Fauna Management.

Wetland Birds

Habitat was identified within the proposal site for the following threatened wetland birds:

- Painted Snipe (*Rostratula benghalensis*)
- Australasian Bittern (*Botaurus poiciloptilus*)

Given that these species manly forage in freshwater wetland complex and coastal saltmarsh habitat, this assessment has been prepared for indirect impacts to wetland habitat adjacent to the most eastern end of proposal site near Pambalong Nature Reserve.

According to the DotE (2013) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

There is potential for indirect impacts on wetland birds during the construction phase such as increase in, noise, visitation of people and vehicle movements during daylight hours. Targeted mitigation measures including limitations on timing of construction have been proposed to limit these impacts.

The proposal also has the potential to indirectly impact on aquatic habitats through alterations to hydrology including changes to surface flows. These impacts have been considered during the design of the Richmond Rail Trial and design features such as the construction of bridges over wetland areas have been proposed to maintain the current natural hydrology and reduce potential impacts.

The potential for hydrocarbon contamination or increased nutrient or sediment inputs would be avoided or minimised through the implementation of appropriate mitigation measures as outlined in Section 7.

Given the minor nature of indirect impacts on aquatic habitats, it is unlikely the proposal would result in the long-term decrease of any populations of these species.

Reduce the area of occupancy of an important population

These species are unlikely to occur within the proposal site and therefore the proposal would be unlikely to reduce the area of occupancy for these wetland bird species. These species have been assessed due to the potential for indirect impacts to occur to potential habitat adjacent to the proposal site.

Fragment an existing important population into two or more populations

The area through which the former Richmond railway traverses the wetlands has already been elevated and separates large portions of the wetland habitat near Pambalong Nature Reserve. Clearing exotic grassland along this elevated area is unlikely to fragment habitat for these species.

The proposal would, however, widen existing gaps in vegetation by 3 m in areas where regrowth vegetation occurs. Habitat connectivity would be retained around the edges of the indicative footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation are likely to be readily traversed by these highly mobile, aerial species.

Adversely affect habitat critical to the survival of the species

No critical habitat is contained within the proposal site. The proposal site consist mainly of exotic grassland (10.05 hectares) and some (3.6 hectares) regenerating forest. Both of these habitats have been significantly degraded by previous land use as a railway and would not be consider significantly important for either of these species.

Disrupt the breeding cycle of an important population

As mentioned previously the habitat within the proposal site does not contain suitable breeding habitat for these species. There is potential for indirect impacts on wetland birds during the construction phase such as increase in, noise, visitation of people and vehicle movements during daylight hours.

Targeted mitigation measures including limitations on timing of construction have been proposed to limit these impacts.

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

The proposal would not any suitable foraging or breeding habitat for these species. The proposal has the potential to indirectly impact on aquatic habitats through alterations to hydrology in outside the proposal site. With appropriate surface water, erosion and fuel handling procedures detailed in the Construction Environmental Management Plan indirect impacts will be mitigated and therefore have significant effects on this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

It is possible that the proposal would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Introduce disease that may cause the species to decline

These species are not likely to occur within the proposal and may only be potentially impacted indirectly. The indirect impacts that these species may be subject to would not result in the introduction of disease. It is therefore unlikely that the proposal will introduce a disease that will cause a decline in any of these species.

Interfere substantially with the recovery of the species

The proposed action would contribute to the operation of one KTP of relevance to these species as follows:

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

As previously discussed, alterations to surface water flows would be mitigated by design measures.

Conclusion

The proposal is unlikely to have a significant impact on these wetland species, pursuant to section 5A of the EP&A Act, given that:

- No wetland habitat will be removed
- Mitigation measures are to be implemented to reduce the potential for disturbance to wetland species during the construction phase.
- Provided that adequate water quality management is undertaken, changes to hydrology would be relatively minor in the context of the existing and historic modifications to hydrology in the proposal site.

The proposal would not isolate any areas of habitat for these species, and habitat connectivity would not be affected throughout the wetland habitats.

*Green and Golden Bell Frog (*Litoria aurea*)*

Habitat was identified within the proposal site for one amphibian species; the Green and Golden Bell Frog. This assessment has been prepared due to potential foraging habitat for this species being located adjacent to the proposal site. The assessment also considers indirect impacts of the proposal on adjacent habitat.

According to the DotE (2013) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

There is some potential for indirect impacts on foraging habitat for this species habitats through altered surface flows and impacts to water quality, however, provided appropriate water quality management is undertaken these impacts are likely to be minor.

The proposal site lacks many of the microhabitat features to support a significant population of any of this species. Given the low quality habitat within the impacted former Richmond Vale rail line it is unlikely that impacts to the habitat within the proposal site will result in a long-term decrease in this threatened amphibian species.

Reduce the area of occupancy of an important population

The proposal would result in the removal of 3.6 hectares of marginal foraging habitat for this species. Large areas of higher quality habitat exist around the proposal site and will be retained. Considering the amount of quality habitat surrounding the proposal site and how readily this species could traverse the cleared area the proposal is unlikely to reduce the area of occupancy for this species.

Fragment an existing important population into two or more populations

As mentioned above the removal of 3.6 hectares of regenerating forest vegetation to create an approximate three metre wide gap in vegetation will not result in any areas of habitat becoming fragmented for this species.

Therefore it is unlikely that the proposal will result in the fragmentation of important populations of this species.

Adversely affect habitat critical to the survival of the species

No critical habitat is contained within the proposal site. The proposal site consist mainly of exotic grassland (10.05 hectares) and some (3.6 hectares) regenerating forest. Both of these habitats have been significantly degraded by previous land use as a railway.

Disrupt the breeding cycle of an important population

As mentioned previously the habitat within the proposal site does not contain suitable breeding habitat for this species. Additionally this highly mobile species could readily traverse the resulting gap in vegetation (approximately 3 metres). Therefore it is unlikely that the proposal will result in disruptions to the breeding cycle of any populations of this threatened amphibian species.

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

The proposal would not remove 3.6 hectares of marginal foraging habitat for this species. The proposal has the potential to indirectly impact on aquatic habitats through alterations to hydrology in outside the proposal site.

With appropriate surface water, erosion and fuel handling procedures detailed in the Construction Environmental Management Plan indirect impacts will be mitigated and therefore have significant effects on this species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

It is possible that the proposed action would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat for this species.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Introduce disease that may cause the species to decline

Chytrid fungus is known to occur in Australia and is most often fatal if contracted by amphibian species. It is unknown the status of Cytrid fungus within the proposal site however strict hygiene protocols would be included in the Construction Environmental Management Plan to deal with the mitigation of the spread of environmental pathogens such as Cytrid fungus.

It is therefore unlikely that the proposal will introduce a disease that will cause a decline in any of this species.

Interfere substantially with the recovery of the species

The habitats within the proposal site do not contain many of the microhabitat features needed by this species for breeding. No important populations of this species are known to occur with the study area. Therefore, it is unlikely that the proposal will substantially interfere with the recovery of this species.

Conclusion

The proposal is unlikely to have a significant impact on this amphibian species given that:

- Potential impacts on habitats through altered hydrology would be minor.
- Vegetation to be removed represents only marginally suitable foraging and shelter habitat.
- The proposal would not isolate any areas of habitat for the species, and habitat connectivity would not be affected throughout the most suitable habitats.

Grey-headed Flying-fox (Pteropus poliocephalus)

According to the DotE (2013) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

The Grey-headed Flying-fox feeds on nectar and pollen from flowers of canopy trees and fleshy fruits from rainforest trees and vines. The species generally moves through the landscape feeding on suitable trees when they come into flower/fruit. The proposal would involve the removal of 3.6 hectares of foraging habitat for this species. This habitat includes a number of tree species that would provide food for this species at certain times of the year when in fruit/flower including; *Eucalyptus teriticornis* (Forest Red Gum), *Corymbia maculata* (Spotted Gum) and *Corymbia gummifera* (Red Bloodwood), which have been identified as significant feed species (Eby and Law, 2008).

The Grey-headed Flying-fox has been recorded foraging within the locality, however this population is not separate to the national population of Grey-headed Flying-fox.

Given the high mobility of this species and the proximity of large areas of native vegetation containing foraging habitat in the locality (including Sugarloaf Sate Conservation Area , Lower Hunter National Park, Cessnock State Forrest and Werakata National Park), impacts from the proposal site are very unlikely to lead to a long-term decrease in the size of the population.

The proposal would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of this highly mobile species.

Given that the proposal would not impact on any roosting or breeding sites for this species and the large areas of native vegetation in the locality that would provide foraging habitat for this species, the removal of 3.6 hectares of potential foraging habitat for the proposal would be unlikely to lead to a long-term decrease in the size of the population.

Reduce the area of occupancy of an important population

The proposal would not reduce the area of occupancy of this highly mobile species. The 3.6 hectares of potential foraging habitat that would be impacted would constitute a negligible proportion of the available foraging habitat within the locality and would not create any barriers to movement or isolate any areas of habitat for this mobile species.

Fragment an existing important population into two or more populations

The Grey-headed Flying-fox is a highly mobile species that is capable of accessing isolated patches of foraging habitat within urban areas. The species is known to regularly travel distances of 50 kilometres from roost sites to access seasonal foraging resources (Eby, 1996). At a site scale, the proposal would result in the clearing of regrowth vegetation in a disturbed landscape resulting in a 3 metre wide gap that would be easily traversed by this species.

On the basis of the above, the proposal would not result in the fragmentation of the population of the Grey-headed Flying-fox into two or more populations.

Adversely affect habitat critical to the survival of the species

The Grey-headed Flying fox requires a temporal sequence of productive foraging habitats linked by migration corridors or stopover habitats combined with suitable roosting habitat in close proximity to foraging areas (DEE, 2017).

The draft recovery plan for Grey-headed Flying-fox, identifies important winter and spring habitats and include vegetation communities containing Spotted Gum (*Corymbia maculata*) (DEE, 2017). Habitats within the study area contain winter flowering myrtaceous species including: Spotted Gum (*Corymbia maculata*) and Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*).

The resources present in the study area, however, are minor in comparison to available similar foraging resources in nearby areas, including Werakata and Sugarloaf Sate Conservation Area located to the west and south west, respectively. In this context the removal of 3.6 hectares of foraging habitat is unlikely to adversely affect habitat critical to the survival of this species.

Disrupt the breeding cycle of an important population

Grey-headed Flying-foxes are seasonal breeders with a single breeding event per-year. Females generally reach sexual maturity in their second year and pregnant females will give birth to a single pup generally between October to December (DEE, 2017). Flying –foxes have been known to abort foetuses and have premature births in response to environmental stress (DEE, 2017).

There is one Grey-headed Flying-fox camp known within the locality at Black Hill, however this camp is not listed as nationally significant and has been used on occasion by a small number of individuals. It is unlikely that the proposal will have any impacts on this or other Grey-headed Flying-fox camps.

As mentioned above the removal of 3.6 ha of marginal foraging habitat for this species is unlikely to significantly impact this species, including any impacts to their breeding cycle.

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

The proposal would remove 3.6 hectares of potential foraging habitat for the Grey Headed Flying-fox. The proposal would not isolate any areas of habitat for this highly mobile species. Due to the area of foraging habitat within the locality the removal of 3.6 hectares of potential foraging habitat it is considered unlikely to result in the decline of the species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Slight increases in the incidence of weeds in adjacent vegetation may occur as a result of vegetation clearing. Weed control measures would be implemented as part of the Construction Environmental Management Plan to mitigate this risk. The introduction and/or spread of weeds is not likely to decrease the value of potential foraging habitat for this species as there is already a high abundance of weeds within the area and the introduction on new infestations is not likely to impact on the foraging resources available to Grey-headed Flying-fox.

Invasive fauna species, including predators such as cats and foxes, are already present within the study area and locality. The proposed action is unlikely to result in changes that would favour feral animals, nor is the proposed action likely to increase the incidence of invasive predators, or introduce new invasive species in the area.

Introduce disease that may cause the species to decline

Grey-headed Flying-foxes are reservoirs of a number of diseases including Australian bat lyssavirus, Hendra virus and Menangle virus. Although lyssavirus can cause clinical disease and mortality in Grey-headed Flying-foxes the incidence of disease in populations is generally low (<1%) and the virus is thought to be generally in equilibrium with the population (DECCW, 2009). It has however been noted that when flying-foxes are exposed to significant ecological stress the incident of lyssavirus can increase and the population can be impacted (DECCW, 2009). There are no clinical disease or mortality in flying-foxes associated with Hendra or Menagle virus. The proposed action is unlikely to result in ecological stresses to any of the nearby flying-fox populations such that the instances of lyssavirus would significantly increase.

Construction activities have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*) and Myrtle Rust (*Uredo rangelii*) into areas of adjacent foraging habitat for this species. These pathogens could result in a decline in health and/or mortality of flying fox feed trees. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Mitigation measures, including strict hygiene protocols for plant and machinery, and restrictions on imported fill would be implemented to prevent the introduction of Phytophthora and/or Myrtle Rust.

No diseases that may cause the species to decline are likely to become established in the study area as a result of the proposal.

Interfere substantially with the recovery of the species

The proposal is inconsistent with one of the stated objectives of the draft recovery plan (DEE, 2017), which is to 'identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range' with clearing of vegetation containing winter flowering feed trees of particular concern. Although the study site contains winter flowering species Spotted Gum (*Corymbia maculata*) and Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*) that could be utilised by Grey-headed Flying-fox the 3.6 hectares of potential foraging habitat within the study site is minor in proportion of available foraging habitat for this highly mobile species within the locality. It is considered unlikely, therefore, that the proposal would substantially interfere with the recovery of the species.

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposed action is unlikely to have a significant effect on the Grey-headed Flying-fox given that:

- Vegetation to be removed comprises a negligible proportion of potential foraging habitat present in surrounding areas and the broader locality.
- The proposed action would not form a barrier to the movement of this highly mobile species
- The proposed action would not affect movements between nearby campsites and foraging habitat that occurs within the locality.
- No known breeding or roosting habitat would be removed or adversely affected by the proposed action.
- -This species is highly mobile and the proposed action would not isolate any areas of habitat.

Striped legless lizard (*Delma impar*)

According to the DotE (2013) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

The striped legless lizard is known to inhabit native and exotic grasslands with a continuous relatively dense structure such as tussock grasslands. No records of this species occur within the locality.

The proposal may have some minor impacts on this species if they were to occur within the proposal site. Although given the minor amount of clearing required for the proposal (10.05 hectares of low quality foraging habitat) and no known important populations within the locality it is unlikely that the proposal will have any direct or indirect impacts on this species such that it would result in a decrease of an important population.

Reduce the area of occupancy of an important population

This species is not known from the locality. The nearest records lie 70 km to the north west of the proposal site near Muswellbrook. This species is unlikely to occur within or adjacent to the proposal site. Considering the above it is unlikely that the proposal would reduce the area of occupancy for this species.

Fragment an existing important population into two or more populations

As mentioned above it is unlikely that this species would occur within the study area. However, if it were to occur the proposal would result in the widening of an existing gap of vegetation (3 metres) that could easily be traversed by the relatively mobile species. It is unlikely that the proposal would cause two or more populations to become fragmented.

Adversely affect habitat critical to the survival of the species

No habitat critical to the survival of this species occurs within the study area. The proposal will therefore not result in adverse effects on habitat critical to the species' survival.

Disrupt the breeding cycle of an important population

As mentioned above it is unlikely that this species would occur within the study area. However, if it were to occur the removal of 10.05 hectares of low quality foraging habitat would not disrupt the breeding cycle of any populations of this species within the locality. More suitable habitat occurs adjacent to the proposal site, it is therefore unlikely that the proposal will result in disruptions to the breeding cycle of this species.

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

The habitat within the proposal site represents low quality foraging habitat for this species. The proposal will result in the removal of 10.05 hectares of exotic grassland and the creation of a 3 metre wide gap once constructed. The resulting vegetation gap would be easily traversed by this species. More suitable foraging and potential breeding habitat occurs adjacent to the proposal site. Therefore it is unlikely that the proposal will result in a decrease in habitat values to the extent the species will decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

It is possible that the proposed action would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat for these species.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Introduce disease that may cause the species to decline

The proposal would be unlikely to result in the introduction of a disease to this species. Apart from the species being unlikely to occur within the proposal site, it is unlikely that any diseases that would affect this species could be passed on to wild populations as part of the proposal.

Interfere substantially with the recovery of the species

As discussed above, the habitat within the proposal site contains only a small portion of the available habitat within the locality. The proposal will result in a trail approximately 3 metres wide that would be easily traverse by this mobile species.

Conclusion

On consideration of the above criteria, the proposed action is unlikely to have a significant effect on the Striped legless lizard given that:

- Vegetation to be removed comprises a negligible proportion of potential habitat within the locality
- The proposed action would not form a barrier to the movement of this mobile species
- The species is not known to occur in the locality.

Woodland birds

A total of 3.6 hectares of forest within the proposal site was identified as potential foraging habitat for the following woodland species:

- Painted Honeyeater (*Grantiella picta)*
- Regent Honeyeater (*Anthochaera phrygia*)
- Swift Parrot (*Lathamus discolor*)

The proposal site contains only marginal foraging habitat for these species due to historic disturbances associated with the Richmond Vale rail line. Regent Honeyeaters and Painted Honeyeaters are unlikely to use the proposal site for breeding due to the disturbed nature of the habitat and would most likely choose to breed within the more intact, large remnants either side of the proposal site if they were to occur within the study area.

The Swift Parrot is known only to breed in Tasmania and therefore breeding habitat does not occur within the locality of the proposal site. These points have been considered whilst completing the below assessment of significance for these species.

According to the DotE (2013) 'significant impact criteria' for critically endangered species, an action is likely to have a significant impact on a critically endangered species if there is a real chance or possibility that it will:

Lead to a long-term decrease in the size of an important population of a species

The EPBC Act defines a 'population of a species' as an occurrence of the species in a particular area which includes but is not limited to geographically distinct regional populations or collections of local populations or a population, or collection of populations, that occur within a particular bioregion (DotE, 2013).

The proposal site represents 3.6 hectares of potentially foraging habitat for these species within regenerating forest. The proposal site is bordered by large areas of higher quality foraging habitat for these species and will be retained.

No known important populations of these species are known from within the study area, considering this and the minor amount of vegetation to be removed that will not isolate any areas of potential habitat for these species it is unlikely that the proposal would have a significant impact on the population of these species causing a long-term decrease.

Reduce the area of occupancy of an important population

The proposal would result in the removal of 3.6 ha of potential foraging and breeding habitat which includes known feed species such as Spotted Gum (*Corymbia maculata*) and Bloodwood (*Corymbia gummifera*) and Forest Red Gum (*Eucalyptus tereticornis*).

The Painted honeyeater is not known from the locality and few records exist (two since 2009) of the Regent honeyeater within the locality. The Swift parrot has been observed recorded within the locality 11 times since 2009. All three of these species are highly mobile and would easily be able to cross the approximately three metre wide gap in vegetation that would be a result of the proposal. Therefore it is unlikely that the proposal will reduce the area of occupancy for these species.

Fragment an existing important population into two or more populations

Clearing for the proposal would not isolate any areas of native vegetation. The proposal would, however, widen existing gaps in vegetation by approximately 3 m. Habitat connectivity would be retained around the edges of the indicative footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile, aerial species.

Disrupt the breeding cycle of an important population

No breeding habitat for these species occurs within the proposal site. However, as mentioned above removal of 3.6 hectares of potential foraging is unlikely to disrupt the breeding cycle of these species within the locality, or in the case of the Swift Parrot the breeding migration or grounds located in Tasmania.

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

The proposal would remove up to 3.6 hectares of potential foraging habitat for these species. As discussed above, habitats likely to have the highest value for these species would be retained. There are extensive areas of similar vegetation in adjoining areas and in the broader locality, including large areas under secure tenure within conservation reserves. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of these species in the locality.

Result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat

It is possible that the proposed action would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat for these species.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Introduce disease that may cause the species to decline

The proposal would be unlikely to result in the introduction of a disease to any of these woodland bird species. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of pathogens, including hygiene procedures for equipment, footwear and clothing, and disposal protocols

Conclusion

On consideration of the above criteria, the proposal does not have the potential to have a significant impact on these woodland bird species given that:

- The proposal will result in the clearing of 3.6 hectares of marginal foraging habitat for these species and other large areas of higher quality habitat will be retained.
- Disease and pest mitigation protocols outlined in the Construction Environmental Management Plan are followed.

Terrestrial Mammals

Habitat was identified within the proposal site for the following terrestrial mammals:

- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Long-nosed Potoroo (*Potorous tridactylus*)
- New Holland Mouse (Pseudomys novaehollandiae)

Given that these species may forage in a range of habitats, this assessment has been prepared for the direct removal of 3.6 hectares of potential habitat (excluding exotic grassland), and indirect impacts to habitat adjacent to the disturbance footprint.

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

Lead to a long-term decrease in the size of an important population of a species

The proposal would remove up to 3.6 hectares of potentially suitable habitat for these species. Habitats with the highest densities of potential shelter sites for these species (including fallen logs and large woody debris, as well as larger tree hollows for the Spotted-tailed Quoll) generally occur along the drainage lines and lower slopes outside the proposal site which will not be directly impacted by the proposal. Given these habitat characteristics, these areas are also likely to contain the highest densities of shelter sites for prey species of the Spotted-tailed Quoll.

The proposal would lead to an increase in visitation to the area during daylight hours during the construction phase and upon completion of the proposal. It is noted that the proposal site, in particular the areas adjacent to major roads and residential areas, are already subject to relatively high levels of noise disturbance. Any mammals within these areas would therefore be habituated to some level of noise and vibration disturbances. It is therefore considered unlikely that the proposal would disrupt the breeding cycle of any locally occurring individuals.

The proposal would therefore remove up to 3.6 hectares of foraging habitat containing limited potential shelter sites for these species. This would represent a small proportion of the home range of any locally occurring Spotted-tailed Quolls, which have home ranges between 180 – 5000 hectares depending on sex. The proposal would not isolate any areas of habitat or cause significant habitat fragmentation that would affect the breeding, foraging or dispersive movements of these mobile species.

The vegetation to be removed represents a small proportion of the mapped native vegetation within the locality, which includes extensive areas protected within conservation reserves. In the context of the landscape position of the site, adjacent to extensive areas of native vegetation, the removal of up to 3.6 hectares of foraging habitat would therefore be unlikely to threaten the persistence of any populations of these species in the locality.

Reduce the area of occupancy of an important population

No important populations of these species are known to occur within the locality. If a population of these species were to occur within the proposal site, the site would only contribute to part of their home range and would not be of high importance to these species due to the lack of microhabitats (e.g. hollow logs and ground litter). Therefore it is unlikely that the proposal will result in these species reducing their area of occupancy.

Fragment an existing important population into two or more populations

Clearing for the proposal would not isolate any areas of native vegetation. The proposal would widen existing gaps in vegetation in the proposal site by approximately 3 metres. Habitat connectivity would be retained adjacent to the disturbance footprint. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation would be readily traversed by these highly mobile species.

Adversely affect habitat critical to the survival of the species

The proposal would remove up to 3.6 hectares of potential foraging habitat for these species, containing low densities of potential shelter sites. This would represent a minor proportion of the home ranges of locally occurring Spotted-tailed Quolls. There are extensive areas of similar vegetation in adjoining areas and in the broader locality. It is therefore considered that the removal of habitats as described above would be unlikely to threaten the long-term persistence of these species in the locality.

Disrupt the breeding cycle of an important population

The proposal would be unlikely to remove any areas of breeding habitat for these species: as previously discussed. The drainage lines and lower slopes, which contain the most suitable habitats and highest densities of potential shelters for these species will not be removed by the proposal. The proposal would remove up to 3.6 hectares of potential foraging habitat containing limited potential shelter sites. The habitat to be removed represents a small proportion of available habitat in the locality which includes extensive areas which are protected in conservation reserves.

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

The proposal would remove 3.6 hectares of potential foraging habitat for these species. The proposal would not isolate any areas of habitat for these highly mobile species. Due to the area of foraging and breeding habitat within the locality the removal of 3.6 hectares of potential foraging habitat it is considered unlikely to result in the decline of the species.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

As discussed above, it is possible that the proposed action would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat for these species.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Introduce disease that may cause the species to decline, or

The proposal would be unlikely to result in the introduction of a disease to any of these terrestrial mammal species. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of pathogens, including hygiene procedures for equipment, footwear and clothing, and disposal protocols

Interfere substantially with the recovery of the species

No recovery plan has been prepared for these species. Targeted management strategies for these species are currently being developed under the Saving our Species program. The proposal would remove habitat for this species and is therefore not consistent with the overall objectives of the recovery strategies. The small area of marginal habitat to be removed would be unlikely to interfere with the recovery of this species.

The proposed action would contribute to the operation of two KTPs of relevance to these species as follows:

- Clearing of vegetation – the proposal would remove about 3.6 hectares of regrowth native vegetation that represents potential foraging habitat for these species.
- Removal of dead wood and dead trees – the proposal would remove dead trees and may disturb dead wood, which would provide potential shelters for prey species.

As previously discussed, the vegetation to be removed represents a minor proportion of vegetation within the locality, and areas with the highest densities of dead wood and trees within the proposal site would be retained. The proposal would therefore represent a minor increase in the operation of these KTPs.

Conclusion

The proposal is unlikely to have a significant impact on the Spotted-tailed Quoll, Long-Nosed Potoroo and New Holland Mouse, given that:

- Species are considered unlikely to breed within the areas of habitat to be removed.
- Vegetation to be removed is subject to historic and ongoing disturbances which would limit its value as foraging habitat for both species.
- Vegetation to be removed comprises a negligible proportion of native vegetation present in the locality.
- Habitat connectivity would be retained around the proposal site.

Migratory Species

- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Rainbow Bee-eater (Merops ornatus)
- Cattle Egret (*Ardea ibis*)
- White-throated Needletail (*Hirundapus caudacutus*)

The Significant Impact Guidelines 1.1 (DotE, 2013) lists criteria which are used to determine whether an action is likely to have a significant impact on migratory species. An action is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

Substantially modify and/or destroy an area of important habitat for a migratory species

Section 209 of the EPBC Act lists Cattle Egret, White-throated Needletail, White-bellied Sea-eagle and Rainbow Bee-eater as migratory species. These species were identified to have potential habitat within the proposal site. The Cattle Egret, White-bellied Sea-Eagle and Rainbow Bee-eater have potential foraging and marginal breeding habitat within the proposal site. The proposal is unlikely to affect White-throated Needletail breeding for foraging habitat as this species is known to breed in the northern hemisphere and only forage aerially whilst in Australia.

The proposal would remove 10.6 hectares of exotic grassland and 3.6 hectares of forest habitat along the former Richmond Vale rail line. The proposal would, widen existing gaps in vegetation by 3 metres in areas where regrowth vegetation occurs. Habitat connectivity would be retained around the edges of the proposal site. These impacts represent an increase in existing gaps and disturbances rather than novel impacts, and the resulting gaps in vegetation are likely to be readily traversed by these highly mobile, aerial species.

The proposal also has the potential to indirectly impact on aquatic habitats through alterations to hydrology, including changes to surface flows. These impacts have been considered during the design of the Richmond Vale Rail Trail and design features such as the construction of bridges over creeks to allows pedestrian access and maintain the current natural hydrology and reduce potential impacts. However, these species would unlikely to be effected by such indirect impacts.

Considering the above, it is unlikely that the removal of 13.65 hectares of habitat within the proposal site will lead to a significant impact on any population of these species given the large remaining patches of habitat within the locality.

Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species

It is possible that the proposed action would result in slight increases in the occurrence of weeds in vegetation immediately surrounding the proposal site. The Construction Environmental Management Plan for the proposal would include measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing, and weed disposal protocols. This would minimise the potential for invasive species to establish in potential foraging habitat for these species.

Invasive fauna species such as foxes and wild dogs are already likely to occur within the proposal site. The proposal is unlikely to result in any new incursions of invasive species.

Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species

It is unlikely that an ecologically significant proportion of these species exist within the proposal site. However if a significant number of these species were to occur the removal of 10.6 hectares of exotic grassland and 3.6 hectares in a linear nature is unlikely to disrupt the lifecycle of these species.

There is potential for indirect impacts such as noise and visitation of people and vehicle movements, however the majority of these indirect impacts will be temporary and reside once construction is complete. As these species are highly mobile these indirect impacts are unlikely to have cause significant disruption to these species.

Conclusion of Assessment of Significance

Consideration of the DotE (2013) 'significant impact criteria' indicates that the proposed action is unlikely to impose a significant impact on the Cattle Egret, White-throated Needletail, White-bellied Sea-eagle and Rainbow Bee-eater due to:

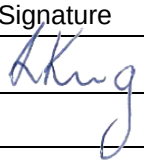
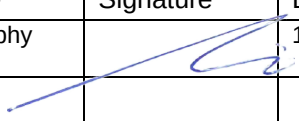
- The proposal not substantially modifying and/or destroying an area of important habitat for these species.
- The study area is not considered to be important habitat for these species
- Vegetation within the study area is only likely to represent potential foraging habitat for these species and marginal breeding habitat for Cattle Egret, White-bellied Sea-eagle and Rainbow Bee-eater. Given the extensive other areas of habitat in the locality it is unlikely that impacts from the proposal would be significant to this species.
- The proposal would not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of these species.
- The proposal is unlikely to result in an invasive species becoming established in an area of important habitat.

GHD

Level 3
24 Honeysuckle Drive
Newcastle NSW 2300
T: 02 4979 9999 F: 02 4979 9988 E: ntlmail@ghd.com

12529257-15779-10/https://projectsportal.ghd.com/sites/pp01_04/richmondvalerailtrai/ProjectDocs/12529257_REP_RVRT FFA.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	B. Seal L. O'Brien	C. Phu L King		S Murphy		11/09/2020

www.ghd.com